

**Scene Processing**  
**Grand Ballroom, Friday Morning, 8:00–9:35**

*Chaired by Carrick C. Williams, Mississippi State University*

**8:00–8:15 (1)**

**Encoding and Visual Memory: Is Task Always Irrelevant?** CAR-RICK C. WILLIAMS, *Mississippi State University*—Although some aspects of encoding (e.g., presentation time) appear to have an effect on visual memories, viewing task (incidental or intentional encoding) does not. The present study investigated whether different encoding manipulations would impact visual memories equally for all objects in a conjunction search (e.g., targets, color distractors, object category distractors, or distractors unrelated to the target). Participants were presented sequences of 12 real-world pictures for 637 msec each and were asked to search for prespecified targets (e.g., green apple), memorize all objects, search for specified targets while memorizing all objects, search for postidentified targets (e.g., *How many green apples were there?*), or memorize all objects with one object prespecified. Encoding task significantly affected visual memory, but only for targets and unrelated distractors, indicating differences in the encoding processes of visual memories. Finally, confidence ratings indicated that participants were able to accurately judge the veracity of their visual memories.

**8:20–8:35 (2)**

**When Does Memory Facilitate Perception (of a Scene's Layout)? After One or Two Episodes.** THOMAS SANOCKI & NOAH SUL-MAN, *University of South Florida*—Four experiments indicate that prior memory of a scene is necessary for a top-down spatial priming effect. We measured spatial processing within scenes that were immediately preceded by either a (same) scene prime or a control prime. The scene was either new or repeated on a trial. When new, scenes primes did not cause more accurate processing than did the control prime. However, after one or two repetitions, scene primes increased accuracy (sensitivity) of spatial processing of the briefly presented scene target, relative to the control prime. Thus, facilitation of scene layout processing was not immediate (first primed trial) but required memory for at least one prior episode with the scene. In a fifth experiment, reaction time methods suggested that scene primes can cause a bias effect on the first trial with a new scene.

**8:40–8:55 (3)**

**The Influence of Scene Context on Parafoveal Processing of Objects.** MONICA S. CASTELHANO, *Queen's University*—Does scene context influence object recognition before the object is directly fixated? We examined this question using a modified boundary paradigm (Rayner, 1975). The participants' task was to indicate whether a target object matched an object name presented earlier. Critically, objects were presented on either a scene or a gray background. On each trial, a cue appeared, and, once fixated, an object preview would onset 4° or 10° away. The preview object could be identical to the target, of the same category (but with the same or a different shape), of a different category (but with the same or a different shape), or a control (rectangle). During the saccade toward it, the target object replaced the preview. The results revealed that, although there was no effect of preview category, same-shape previews presented at 4° produced a greater benefit on a scene than on a gray background. Two possible influences of scene context on parafoveal preview benefit will be discussed.

**9:00–9:15 (4)**

**The Role of Semantic Memory in Learning Contextual Regularities in Real-World Scenes.** JAMES R. BROCKMOLE, *University of Notre Dame*, & MELISSA L.-H. VO, *University of Edinburgh*—When encountering familiar scenes, observers can use episodic memory to facilitate the guidance of attention to objects appearing in known locations or configurations. We investigated whether and how memory for semantic contingencies that exist across different scenes is used to guide attention. Observers searched for letter targets embedded in different bedrooms. In a between-subjects manipulation, targets were always on bed pillows or

randomly positioned. When targets were systematically located within scenes, search for them became progressively more efficient. Learning was abstracted away from bedrooms and transferred to a living room, where the target was on a sofa pillow. These contingencies were explicit and led to central tendency biases in memory for precise target positions. These results broaden the scope of conditions under which contextual cuing operates and demonstrate for the first time that semantic memory plays a causal and independent role in the learning of associations between objects in real-world scenes.

**9:20–9:35 (5)**

**Visual Memory: Confidence, Accuracy, and Recollection of Specific Details.** GEOFFREY R. LOFTUS, *University of Washington*, MARK T. REINITZ, *University of Puget Sound*, WILLIAM PERIA, *University of Washington*, & JULIE SEGUIN, *University of Victoria, Wellington*—How does the confidence/accuracy relationship differ when picture recognition is based on general familiarity versus specific features? Pictures were presented for varying exposure durations, followed by an old–new recognition test. Observers provided a confidence rating for each old–new response and also indicated whether each response was based on the picture's general familiarity or on one or more specific features in the picture. Feature-based responses produced higher confidence and higher accuracy. However, holding confidence constant, a feature-based response was less accurate than a familiarity-based response. The scientific conclusion is that confidence and accuracy are not based on the same internal events. The practical conclusion is that, contrary to common sense and to normal behavior (see Bell & Loftus, 1988), an eyewitness's accuracy in a legal setting should be discounted more when his or her recognition responses are based on memories for specific features than when they are based on general familiarity.

**Selective Attention I**

**Constitution Ballroom, Friday Morning, 8:00–9:35**

*Chaired by Jeremy M. Wolfe*

*Brigham and Women's Hospital and Harvard Medical School*

**8:00–8:15 (6)**

**Two Dissociable Decision Criteria in Visual Search Revealed by Varying Target Prevalence.** JEREMY M. WOLFE, *Brigham and Women's Hospital and Harvard Medical School*, & MICHAEL J. VAN WERT, *Boston University*—The frequency of targets in visual search (*target prevalence*) shapes search behavior. When targets are rare (1%–2% prevalence), observers use conservative response criteria, producing high miss rates. This might be just a version of a speed–accuracy trade-off, since low prevalence yields fast absent responses. We disprove this hypothesis by showing that very high target prevalence (98%) shifts response criteria in the opposite direction, leading to elevated false alarms, without leading to fast target-present responses. Rather, the rare target-absent responses are greatly slowed. In a second experiment, prevalence was varied sinusoidally over 1,000 trials. Observers' criterion and target-absent RTs tracked prevalence, whereas sensitivity ( $d'$ ) and target-present RTs did not. The results support a model with two criteria, both influenced by prevalence. One criterion governs perceptual decisions about each attended item. The other influences a quitting threshold that modulates RTs for target-absent responses.

**8:20–8:35 (7)**

**Reward-Induced Attentional Amnesia in Visual Search.** BRIAN R. LEVINTHAL, *Northwestern University*, & ALEJANDRO LLERAS, *University of Illinois, Urbana-Champaign* (read by Alejandro Lleras)—Intertrial effects in visual search have been demonstrated in a wide variety of paradigms and are known to be remarkably robust. The distractor previewing effect (DPE) is a particularly robust intertrial effect that emerges during oddball feature searches and reflects purely inhibitory attentional biases against one specific visual feature (or category). Previously, we have argued that these inhibitory biases reflect an implicit assessment of the usefulness of the information encountered in recent

trials, specific to the current task. Here, we explored whether an externally adjudicated reward–loss schedule linked to specific visual features modulates these intertrial attentional biases. Somewhat surprisingly, the DPE was entirely eliminated when this external reward–loss schedule was put in place. Instead, we observed a very strong within-trial attentional bias that was consistent with the reward schedule (attention moved toward rewarded features and away from penalized features) and totally amnesic of recent experience.

8:40–8:55 (8)

**Task-Based Working Memory Guidance of Visual Attention.** ZHE CHEN, *University of Canterbury*—Recent research has shown a close link between attention and working memory (WM), such that the content of WM facilitates the deployment of visual attention to stimuli that are identical or related to the object representations held in WM. So far, prior studies have focused on memory-based attentional guidance when the remembered item is a specific stimulus. The present study examined whether holding a specific task in memory would also influence participants' deployment of visual attention in favor of the stimuli associated with the task in memory and whether the effect of WM was caused primarily by early attentional capture or by delayed attentional disengagement. The results support task-based WM guidance of visual attention. Furthermore, participants showed evidence that was consistent with both early attentional capture and delayed attentional disengagement.

9:00–9:15 (9)

**Cross-Modal Distraction by Auditory Oddball Stimuli: The Course and Aftermath of Novelty and Semantic Effects.** FABRICE B. R. PARMENTIER, *University of the Balearic Islands*, & JACQUELINE TURNER & JANE V. ELSLEY, *University of Plymouth*—The unexpected occurrence of an oddball auditory stimulus (novel) among an otherwise repeated stream of sounds (standards) is known to negatively affect participants' performance in an unrelated visual task. Here, participants categorized the direction of visual arrows preceded by a task-irrelevant sound. Rare auditory novels consisted of the words *left* or *right*, which were either congruent or incongruent with the upcoming target. The data confirmed the slowing of response in the face of a novel (novelty distraction), as well as on incongruent trials, a further delay due to cross-talk interference between distractor and target (semantic effect). The semantic effect, but not novelty distraction, increased with the time interval between distractor and target. Furthermore, the production of a response on the first standard trial following a novel trial was slowed if that response required the activation of a recently inhibited network (postnovelty semantic effect).

9:20–9:35 (10)

**Oculomotor Inhibition of Return.** RAYMOND M. KLEIN & MATTHEW HILCHEY, *Dalhousie University*, ANA CHICA, *University of Granada*, JASON IVANOFF, *Saint Mary's University*, & TRACY L. TAYLOR, *Dalhousie University*—Although inhibition of return (IOR) was first demonstrated as an aftermath of covert, exogenously controlled orienting (a shift of attention in the absence of an eye movement) having effects on the processing of nearby targets calling for a speeded manual detection response (also in the absence of an eye movement), it was recognized very early on that there was a profound relation between IOR and the oculomotor system. Research will be presented on the role of oculomotor processes in causing IOR, on the different flavors of IOR that are generated when oculomotor processes are or are not inhibited, and on the effects of IOR on oculomotor behavior.

**Reasoning and Problem Solving  
Republic Ballroom, Friday Morning, 8:00–9:55**

*Chaired by Sam Glucksberg, Princeton University*

8:00–8:15 (11)

**Implicit Generics Underlie Inferences From the General to the Particular.** SANGEET KHEMLANI, SAM GLUCKSBERG, & SARAH-JANE LESLIE, *Princeton University* (read by Sam Glucksberg)—People

readily assent to generic assertions, such as *dogs have tails*, *ducks lay eggs*, and *ticks carry Lyme disease*, even though the numbers of category members that display the relevant property in each of these cases vary widely. Virtually all normal dogs have tails, a minority of ducks lay eggs, and only a tiny minority of ticks actually carry Lyme disease. To what extent do people attribute a property of the generic category to an arbitrary member of the kind? People were given examples of a kind—for example, *Jumpy is a tick*. They were then asked whether Jumpy carries Lyme disease. People were prone to judge that Jumpy carried the disease, even though the underlying generic about ticks and Lyme disease had not been made explicit. We conclude that agreement with a generic disposes people to infer, by default, that a given member of a kind has the relevant property.

8:20–8:35 (12)

**Assessing the Belief Bias Effect With ROCs: It's a Response Bias Effect.** CHAD DUBE & CAREN M. ROTELLO, *University of Massachusetts, Amherst*, & EVAN HEIT, *University of California, Merced* (read by Caren M. Rotello)—A belief bias effect in syllogistic reasoning (Evans, Barston, & Pollard, 1983) is observed when subjects accept more valid than invalid arguments, accept more believable than unbelievable conclusions, and show greater overall accuracy judging arguments with unbelievable conclusions. The effect is measured with a contrast of contrasts, comparing the acceptance rates for valid and invalid arguments with believable and unbelievable conclusions. This measure entails the assumption of a threshold model, which predicts linear receiver operating characteristics (ROCs). In three experiments, subjects made valid/invalid responses to syllogisms, followed by confidence ratings that allowed the construction of empirical ROCs. The form of those ROCs is inconsistent with the predictions of Klauer, Musch, and Naumer's (2000) multinomial model of belief bias. More appropriate, signal-detection-based measures of decision accuracy and response bias demonstrate that the belief bias effect is simply a response bias effect; unjustified use of the contrast-of-contrast measure produces the apparent accuracy difference.

8:40–8:55 (13)

**The Origins of Insight in Resting-State Brain Activity.** JOHN KOUNIOS, *Drexel University*, & MARK BEEMAN, *Northwestern University*—People can solve problems in more than one way. Two general strategies involve (1) methodical, conscious search of problem-state transformations and (2) sudden insight, with abrupt emergence of the solution into consciousness. This study elucidated the influence of initial resting brain state on subjects' subsequent strategy choices. High-density electroencephalograms (EEGs) were recorded from subjects at rest who were subsequently directed to solve a series of anagrams. Subjects were divided into two groups on the basis of the proportion of anagram solutions derived with self-reported insight versus search. Reaction time and accuracy results were consistent with insight different cognitive problem-solving strategies used for solving anagrams with insight versus without insight. Spectral analyses yielded group differences in resting-state EEG, supporting hypotheses concerning insight-related attentional diffusion and right-lateralized hemispheric asymmetry. These results reveal a relationship between resting-state brain activity and problem-solving strategy and, more generally, a dependence of event-related neural computations on the preceding resting state.

9:00–9:15 (14)

**Strategy Selection and Executive Function: Study in Arithmetic Problem Solving.** PATRICK LEMAIRE & MIREILLE LECACHEUR, *CNRS and University of Provence*—One hundred twenty participants ranging in age from 20 to 90 years were asked to do computational estimation tasks on two-digit multiplication problems (e.g., give approximate answers to  $38 \times 74$ ). On each problem, participants were asked to choose the best of two strategies, rounding down (doing  $30 \times 70 = 2,100$ ) or rounding up (doing  $40 \times 80 = 3,200$ ). Participants' executive functions were assessed with Stroop, Wisconsin Card Sorting, Trail Making, and Excluded Letter Fluency tests. The most important results showed (1) age-related changes in measures of executive functions and of skills involved in selecting

the best strategy on each problem, (2) significant correlations between individuals' executive functions and percentage of use of the best strategy on each problem, and (3) age-related changes in these correlations. Implications of these findings for strategy selection models and for our understanding of aging effects on strategy selection are discussed.

#### 9:20–9:35 (15)

**Individual Differences in the “Myside Bias” in Reasoning and Argumentation.** CHRISTOPHER R. WOLFE, *Miami University*, & M. ANNE BRITT, *Northern Illinois University*—The “myside” bias is the failure to produce statements contradicting one's position. In written argumentation, it is the failure to include other side arguments in essays. In the first study ( $N = 63$ ), we tested a Likert instrument assessing the extent to which individuals exhibit a “fact-based argumentation schema” (Cronbach's  $\alpha = .82$ ) and a “balanced reasoning schema” ( $\alpha = .80$ ). In the second study, 85 participants wrote essays under laboratory conditions, did two reason generation tasks, and responded to the schema instrument. Both the fact-based and balanced schema scores significantly predicted the myside bias in essays. Fact-based schema scores also predicted the myside bias on a reason generation task. In the third study, 100 participants engaged in six reason generation tasks, used the argumentation and reasoning schema instrument, and answered LSAT questions. Participants exhibited the myside bias. The results were explained by individual differences in reasoning and argumentation schema.

#### 9:40–9:55 (16)

**Relationships Among Beliefs About Evolution, Creation, Nationalism, Theism, and Global Warming.** MICHAEL A. RANNEY, LUKE W. MIRATRIX, & CALIDA A. MARTINEZ, *University of California, Berkeley*—U.S. beliefs about evolution and global warming share some noteworthy similarities. For instance, relative skepticism about the two scientific realms is hypothesized to be related to political positioning (e.g., for global warming: “drill, baby, drill” conservatives vs. “greenhouse gases are pollutants” liberals). Reinforced theistic manifest destiny (RTMD; Ranney, in press) is a theory that seeks to extend a commonly received view about why Americans seem to accept evolution less than do residents of peer nations. It suggests that the U.S.'s past and current military prowess reinforces an implicit, afterlife-related, national narrative that the country is divinely destined toward greatness. Evolution and global warming conflict with several Abrahamic religious notions—most obviously, evolution, with respect to creationism, but also global warming, with respect to the concept of a benevolently protective deity. The results from several studies, including one with Canadian participants, cohere with a number of RTMD predictions, as will be discussed.

#### Bilinguals Reveal the Role of Control in Language Processing Independence Ballroom, Friday Morning, 8:00–9:35

*Chaired by Judith F. Kroll, Pennsylvania State University*

#### 8:00–8:15 (17)

**On the Factors That Contribute to the Bilingual Advantage.** JUDITH F. KROLL, CARIA BOGULSKI, & RHONDA MCCLAIN, *Pennsylvania State University*—Although there is now a great deal of evidence suggesting that proficient bilingualism confers a set of cognitive advantages, there is less agreement about its scope and about a mechanism that might provide a causal account that maps aspects of language processing to domain-general cognitive changes. We review the evidence that suggests that the process of selecting the language to use, in both comprehension and production, requires the resolution of competition among activated alternatives in both languages that may enhance not only the cognitive skills associated with the resolution of conflict but also with those that facilitate new learning. Because the locus of cross-language activation may be highly variable, proficient bilinguals may be required to adjust language selection procedures in ways that create increased cognitive skill. A critical question is whether the resulting skill is constrained by the learning history of the bilingual and/or by the context of language use.

#### 8:20–8:35 (18)

**The Implications of Bilingual Advantages and Disadvantages: Separate Mechanisms.** TAMAR H. GOLLAN, *University of California, San Diego*, & ANAT PRIOR, *University of Haifa*—When proficient bilinguals converse, nothing obvious suggests they contend with a greater processing load than that monolinguals contend with. However, accumulating evidence suggests that maintaining two languages in a single cognitive system leads to disadvantages on language tasks but advantages in executive control. To investigate the relationship between executive control and language processing, we correlated verbal fluency scores in the dominant and nondominant languages with performance on a flanker task (Study 1) and correlated language-switching and mixing costs with nonlinguistic task switching and mixing costs (Study 2) in Chinese–English and Spanish–English bilinguals. The results reveal limited relationships between single-language production and executive control and yield some data suggesting that bilinguals develop special control mechanisms to support language mixing. These findings demonstrate a circumscribed role for control in bilingual language processing that arises outside the domain of lexical selection and also imply that separate mechanisms underlie bilingual advantages and disadvantages.

#### 8:40–8:55 (19)

**Changes in Representation and Control Lead to Processing Differences in Bilinguals.** ELLEN BIALYSTOK, *York University*—Across the life span, bilinguals have been shown to have poorer lexical processing than do monolinguals but better control of nonverbal executive functioning. Two features of bilingual language processing are proposed to account for these outcomes. First, bilinguals typically have weaker mental representations of each language than do comparable monolinguals. Manifestations of this deficit include the smaller vocabulary typically reported for bilingual children in each language and the poorer performance on picture naming, such as on the Boston naming task for bilingual adults. Second, language processing in bilinguals involves the joint activation of both languages, creating competition for selection between the systems, making lexical access more effortful, even when representations are equivalent. This competition is resolved by domain-general executive functions, which enhances the effectiveness of those functions for all applications, including nonverbal ones. Thus, bilingualism alters mental representations and, therefore, compromises linguistic outcomes and modifies control processes that both compromise linguistic outcomes and enhance nonlinguistic ones.

#### 9:00–9:15 (20)

**Bilingual Advantage in Nonlinguistic Task Switching.** ALBERT COSTA, *Pompeu Fabra University*, MIREIA HERNÁNDEZ, *University of Barcelona*, CLARA MARTIN, *Pompeu Fabra University*, & FRANCISCO BARCELÓ, *University of the Balearic Islands*—Bilingual speakers are able to switch back and forth between their two languages with remarkable speed and precision. Researchers have often speculated that this ability may have consequences for the switching skills of bilinguals in general, as compared with those of monolinguals. However, the results up to date are not clear enough to draw a safe conclusion about the impact of bilingualism on task-switching performance. Part of the contradictory results may stem from the fact that task switching involves several effects that are often mixed together, obscuring the potential effects of bilingualism. Switching costs include restart costs (higher RTs after any cue, regardless of whether the cue prompts a switch or not), and local costs (higher RTs after a switch cue than after a repeat cue). In this presentation, we will bring new data suggesting that, whereas restart costs are affected by bilingualism, local costs are not.

#### 9:20–9:35 (21)

**Language Learning and Inhibition in Bilinguals and Monolinguals.** VIORICA MARIAN, *Northwestern University*, MARGARITA KAUSHANSKAYA, *University of Wisconsin, Madison*, JAMES BARTOLOTTI, *Northwestern University*, & HENRIKE K. BLUMENFELD, *San Diego State University*—In a series of recent studies, we examined the consequences of bilingualism on cognitive and linguistic function.



We present research that focuses on language learning and inhibition in English monolinguals and English–Spanish bilinguals. First, monolinguals and bilinguals were taught artificially constructed words that overlapped with English orthographically but diverged phonologically. Native-language orthographic information presented during learning interfered with encoding of novel words in monolinguals but not in bilinguals. Next, monolinguals and bilinguals learned artificially constructed words that shared English phonology. While using the newly learned vocabulary, coactivation and inhibition of English were tested via eyetracking and mousetracking. The results suggest that bilinguals outperform monolinguals on novel word learning and recruit inhibitory control differently while processing language. These findings extend research on coactivation and inhibition in fluent bilinguals to new language learners and suggest that bilingualism changes how the cognitive system responds to linguistic input.

#### Discourse Processing

**Back Bay Ballroom C, Friday Morning, 8:00–9:15**

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

#### 8:00–8:15 (22)

**Aging and Mind Wandering.** GABRIEL A. RADVANSKY, SABINE A. KRAWIETZ, & ANDREA K. TAMPLIN, *University of Notre Dame*—Younger and older adults were asked to read the first five chapters of Leo Tolstoy's *War and Peace*. At various intervals (randomly sampled every 2–4 min), the participants were probed to assess whether they were mind wandering and to assess whether they could answer recognition questions. The results of this paradigm revealed that older adults mind wandered less often than the younger adults and were more accurate at answering the questions. These results are interpreted in light of current theories of mind wandering and situation model processing and aging. Specifically, older adults have less working memory capacity and, therefore, have fewer resources to allow mind wandering to occur. Also, superior processing at the situation model level allows older adults to better engage in what they are reading, leading to less mind wandering.

#### 8:20–8:35 (23)

**Establishing Global and Local Coherence in Discourse Processing: Evidence From fMRI.** PAUL VAN DEN BROEK, *Leiden University*, BEN SEIPEL & VIRGINIA CLINTON, *University of Minnesota*, EDWARD J. O'BRIEN, *University of New Hampshire*, PHILIP BURTON, *University of Minnesota*, & NICOLE LANDI, *Yale University and Haskins Laboratories*—Maintaining both global and local text coherence is critical for successful reading comprehension. The present study used event-related fMRI to compare patterns of brain activation associated with reading narrative texts that were consistent relative to those that were inconsistent at either the global or the local level. Global inconsistencies evoked increased activation in the prefrontal cortex along the midline, an area associated in prior research with monitoring character motivation and action, as well as with conflict resolution. Local inconsistencies evoked increased activation in the precuneus. These results indicate that reading inconsistent (as compared with consistent) texts elicits unique neural patterns and, moreover, that these neural activations are distinct for global versus local inconsistencies. The results also suggest that readers engage in different cognitive processes for building a mental representation at the local and global text levels, respectively.

#### 8:40–8:55 (24)

**Regulatory Focus and the Accessibility of Goals During Reading.** DAVID B. MIELE, *Columbia University*, & DAVID N. RAPP, *Northwestern University* (read by David N. Rapp)—A large body of work has demonstrated that information about a protagonist's goals is highly accessible to readers while those goals remain unsatisfied; in contrast, this information becomes less accessible once the goals have been satisfied (perhaps as a function of the decreased importance or relevance of satisfied goals). Notably, the accessibility of everyday goal information appears to depend on whether an individual is predominantly focused on promotion or prevention concerns (i.e., seeking opportunities for gain vs.

protecting against losses). The present project examined whether these regulatory concerns impact the accessibility of goals during text experiences. Participants read stories in which protagonists satisfied goals or postponed their completion. After each story, participants indicated whether a test statement matched the protagonist's goal. Promotion-focused participants exhibited the standard pattern, with slower judgments to goal statements when the goal was satisfied than when it was unsatisfied; however, prevention-focused participants did not exhibit similar declines in judgment latencies for satisfied goals.

#### 9:00–9:15 (25)

**Does Rapid Talk Impose a Cost or a Benefit in the Referential Communication Task?** CLAUDE G. ČECH & KYLE E. ALBARADO, *University of Louisiana, Lafayette*—In one version of the referential communication task, directors describe tangram figures with the goal of enabling matchers to select and arrange their figures in the same order. Fox Tree (1999) found that overhearers listening to tapes of interactive directors and matchers placed more figures correctly, despite the fact that rate of speech was slower in the monologue condition, thereby presumably facilitating comprehension. She thus concluded that better performance was moderated by factors (e.g., multiple perspectives, discourse markers) other than speech rate. We explored an alternative claim that faster (but still normal) rates of speech may engage enhanced attentional processing, thereby partly accounting for the dialogue superiority effect. To test this claim, we looked at the effect of speech rate on accuracy within monologue and dialogue conditions.

#### Associative Learning

**Back Bay Ballroom D, Friday Morning, 8:00–9:35**

*Chaired by Russell M. Church, Brown University*

#### 8:00–8:15 (26)

**Memorization or Rapid Rereading in a Multiple-Cued-Interval Task.** PAULO GUILHARDI, *Brown University and New England Center for Children*, MARCELO S. CAETANO, *Brown University and The John B. Pierce Laboratory*, & RUSSELL M. CHURCH, *Brown University* (read by Russell M. Church)—The problem was to identify training conditions under which temporal intervals, signaled by different stimuli, are memorized (i.e., under stimulus control) or rapidly reread. The task was a simple computer game in which a participant shot at a moving target, with feedback regarding hits and misses; this was a relatively engaging multiple-cued-interval task. The conditions were variations in the speed of the target, the discriminability of the stimuli, whether or not the target was visible, and the order of presentation of the types of trials. The participants readily learned the multiple-cued-interval task. The results were generally consistent with the principles of scalar timing and with a modular process model of timing. Although responding was similar across conditions at the end of training, transfer tests demonstrated that the resulting intervening processes differed. The results with human participants were similar to those observed with rats.

#### 8:20–8:35 (27)

**Putting Names to Unfamiliar Faces: Similarity in Face–Name Associative Learning.** ROBERT SEKULER & JIE HUANG, *Brandeis University*, & MICHAEL J. KAHANA, *University of Pennsylvania*—How does perceptual similarity influence the learning of face–name associations? For answers, we used realistic synthetic faces and monosyllabic Chinese names. The stimuli's perceptual similarity spaces were defined by multidimensional scaling. Then associative recognition was measured with stimulus sets whose similarities were manipulated parametrically. In alternating study and test blocks, subjects studied a fixed set of face–name pairs and were tested with preserved and rearranged pairs. Over successive trial blocks, correct recognitions of preserved face–name pairs increased, whereas false recognitions of rearranged pairs decreased. Face and name similarity each strongly influenced associative recognition. These similarity effects were accommodated within a novel, hybrid model in which an interactive activation and competition

network was integrated with NEMo, our global matching framework for recognition. Learning of face–name associations reflects both an increasingly precise representation of individual stimuli and a sharpening of activation within the associative network.

8:40–8:55 (28)

**The Elements of Configural Learning: Common, Unique, or Replaced?** JESSE W. WHITLOW, JR., *Rutgers University, Camden*—Associative learning theories have proposed several solutions to the problem of learning complex discriminations that involve configural cues. This paper describes several studies in which people learned relations between food items and health outcomes through the use of negative patterning and biconditional discrimination tasks. The results are presented for tests of the possible roles of common cues (Harris; McLaren & Macintosh), unique cues (Rescorla & Wagner), and replaced elements (Wagner). Some general observations on elemental approaches to configural cue learning are also considered.

9:00–9:15 (29)

**Rules and Associations: Dissociating Different Processes in Retrospective Revaluation.** IAN P. L. MCLAREN, *University of Exeter*—Retrospective revaluation (RR) can be demonstrated in an allergy prediction paradigm, but the challenge is to determine which processes are responsible for the effect. First-order RR can be explained in terms of either rule-based cognitive inference (e.g., De Houwer & Beckers, 2002), associative learning (e.g., Dickinson & Burke, 1996), or memory (e.g., Le Pelley & McLaren, 2001), but second-order RR designs provide a basis for distinguishing among these mechanisms. The inferential account applied to second-order effects predicts that the direction of effect should be opposite to that observed in first-order RR, whereas associative accounts predict that the direction of effect should be the same. I present evidence that shows that, under conditions of low memory load, second-order RR is observed in line with the predictions made by the inferential account, but that, under high memory load, a pattern of results that supports associative processing is obtained.

9:20–9:35 (30)

**The Effect of Outcome Expectation on Operant and Pavlovian Variability in Pigeons and Rats.** W. DAVID STAHLMAN & AARON P. BLAISDELL, *UCLA* (read by Aaron P. Blaisdell)—Behavior typically becomes more variable in the face of a drop in the expectation of a motivating outcome, such as food. We review converging lines of evidence for this relationship from studies in our lab. We establish the relationship between outcome probability and both temporal and spatial aspects of behavioral variability in both operant (Experiment 1) and autoshaping (Experiment 2) tasks with pigeons. Within-trial variability decreased with the approach of the time of a possible appetitive outcome in both operant and Pavlovian procedures and even in a negative automaintenance procedure (Experiment 3). Behavioral variability was also inversely related to outcome magnitude (Experiment 4) and in the more ecologically valid context of an open field with rats (Experiment 5). Outcome expectation therefore drove robust effects on many aspects and a wide variety of conditioned behaviors.

## SYMPOSIUM I

### Darwinian Themes in Contemporary Psychology Grand Ballroom, Friday Morning, 9:45–11:55

Chaired by Sara J. Shettleworth, *University of Toronto*

9:45–10:05 (31)

**Darwin and Beyond Darwin in Comparative Psychology.** SARA J. SHETTLEWORTH, *University of Toronto*—In *On the Origin of Species*, published 150 years ago this weekend, Darwin only briefly alluded to the implications of his theory for psychology, but he developed them in later books. *The Descent of Man* proposed a list of cognitive processes humans share with other species. *The Expression of the Emotions* similarly analyzed human emotions. Darwin's influence is evident in much contemporary research. This presentation introduces the themes

explored in the symposium and discusses ways in which current research in comparative cognition both supports Darwin's hypotheses and goes "beyond Darwin." Darwin stimulated studies of human-like cognitive processes in other animals. Some current comparative research turns the tables and reveals simple nonverbal processes in animals that have unexpected importance in human behavior. Contemporary research is also revealing limits to how much species are only "different in degree" and providing evidence for processes in humans "different in kind" from those in other animals.

10:05–10:25 (32)

**Shared and Unique Processes in Spatial Development.** NORA S. NEWCOMBE, FRANCES BALCOMB, & ALEXANDRA TWYMAN, *Temple University*—Because all mobile species face navigational challenges that determine adaptation, spatial cognition is a domain in which a comparative approach to understanding development is essential. In this presentation, we will discuss two lines of research: the development of place learning and the development of a balance between the use of geometric and featural cues for reorientation. In both lines of research, we see fundamental cross-species commonalities, as well as a few phenomena specific to humans. For place learning, development occurs during an early juvenile period across mammalian species and correlates with hippocampal change. For reorientation, geometric cues often predominate, but use of featural cues depends on factors that are common across mammalian and nonmammalian species. In addition, for human children, there is a role for language in each line of development. However, there is no evidence (so far) that language is either sufficient or necessary for development.

10:25–10:45 (33)

**Basic Math . . . in Monkeys.** JESSICA CANTLON, *University of Rochester*, & ELIZABETH BRANNON, *Duke University*—Nonhuman animal species as divergent as pigeons and primates possess a capacity for numerical representation. For example, when adult humans are tested on the same numerical comparison task as nonhuman primates and prevented from verbally counting, the discrimination performance of the two species is virtually identical. Reports such as these provide compelling evidence that humans are not unique in their ability to extract numerical information from objects or events in the world. One issue left unresolved by prior research, however, has been the extent to which nonhuman animals can compute arithmetic-like operations. Arithmetic operations, such as addition, subtraction, and multiplication, require mental transformations over numerical values. Here, we report that monkeys can solve addition and subtraction problems and exhibit a set of cognitive signatures that adult humans display during simple arithmetic. Overall, our findings support the claim that mental arithmetic is a fundamental, evolutionarily widespread cognitive process.

10:45–11:05 (34)

**Darwin's Best Friend.** CLIVE D. L. WYNNE & MONIQUE A. UDELL, *University of Florida*—"The barbarians of Tierra del Fuego, . . . [kill] and [devour] their old women, in times of dearth, as of less value than their dogs" (Darwin, 1859, p. 36). Darwin's writings are packed with observations on the relationship between humans and dogs, and dogs provide a fascinating window into Darwin's thinking about the relationship between human and nonhuman minds. Data will be presented from studies of dogs living under varied conditions and hand-reared wolves in two tasks. In the object-choice paradigm, the canids had to follow human gestures to find food. In the begging-choice experiment, the canids selected whether to beg from a seeing or a vision-occluded human. The results show Darwin to have been mistaken about the value of anthropomorphic interpretations of animal minds. Nonetheless, dogs remain an excellent species in which to study the interplay of phylogeny and ontogeny in the development of complex forms of interspecies social behavior.

11:05–11:25 (35)

**Evolving the Ingredients for Reciprocity and Spite.** MARC HAUSER, *Harvard University*—Darwin never provided a satisfactory account of

altruism. Hamilton, Williams, and Trivers delivered the necessary satisfaction. But none of these authors considered in sufficient detail how proximate constraints may constrain the evolution of particular forms of altruism, despite their ultimate function. Here, I explore two forms of social interaction that are evolutionarily plausible but that are either extremely rare or absent in the animal kingdom: reciprocity and spite. I argue that the weak comparative evidence is predicted once we consider the requisite socioecological pressures and psychological mechanisms. In particular, reciprocity and spite evolved in humans because of adaptive demands on cooperation among unrelated individuals living in large groups and because of the integrative capacities of inequity detection, future-oriented decision making, and inhibitory control. I support these arguments with new experiments on cotton-top tamarins and human children.

11:25–11:45 (36)

**Form and Function in Facial Expression of Emotion.** ADAM K. ANDERSON, *University of Toronto*—Facial expressions are instrumental in externalizing one's internal emotional state and, thus, in regulating social interactions. Over 130 years ago, Darwin hypothesized that emotional expressions originated in a less appreciated functional role to modify preparedness for perception and action. We provide evidence for two of Darwin's evolutionarily derived principles of emotional expressive behavior in humans: (1) The principle of "serviceable associated habits" expressions serve adaptive functions for the sender, and (2) the principle of "antithesis" expressions with opposite functions are opposites in form. Specifically, we show that facial expressions afford a primitive sensory regulatory opposition to increase or decrease sensory intake. We next examine the exaptation or co-opting of expressions for the purposes of social communication, demonstrating how facial expression opposition is mirrored in neural representations supporting expression recognition. These convergent sources of evidence suggest facial expressions are not arbitrarily shaped social signals but may have differentiated from an underlying sensory origin.

11:45–11:55

**General Discussion.** SARA J. SHETTLWORTH, *University of Toronto*.

#### Automatic Processing

Constitution Ballroom, Friday Morning, 10:00–11:55

Chaired by Philip A. Allen, *University of Akron*

10:00–10:15 (37)

**Influence of Adult Age and Training on Dual-Task Crosswalk Performance.** PHILIP A. ALLEN, *University of Akron*, MEI-CHING LIEN, *Oregon State University*, & ERIC RUTHRUFF, *University of New Mexico*—We simulated a crosswalk within a psychological refractory period (PRP) paradigm to determine whether attentional factors might predispose older adults to have more pedestrian accidents. Task 1 was a walk/wait discrimination based on signal color (green/red), and Task 2 was a pure-tone/car-horn discrimination. After a dual-task pretest, participants received single-task training sessions on Task 1 for 6 weeks. Finally, there was a dual-task posttest. In both the pre- and post-dual-task test, we found larger PRP effects for older adults than for younger adults. Also, younger adults responded "wait" faster than "walk" (Task 1) for the first session but showed similar response speed for both stimulus types in the second session, whereas older adults showed faster "walk" responses for both sessions. These results suggest that older adults may have been biased to "walk," whereas younger adults were biased to "wait."

10:20–10:35 (38)

**Mind Wandering During Reading.** CHRISTOPHER T. BALL & K. ANDREW DESOTO, *College of William & Mary*—Mind wandering involves a shift in attention from a conscious focus on externally directed cognitive tasks to an unfocused, internally directed series of thoughts and mental images. Mind wandering regularly occurs during reading, although the reasons why mind wandering happens when it does and what effect it can have on the reading process are relatively

unknown. We report the results of two experiments where participants were prompted to provide their state of awareness while reading. In the first experiment, we compared the reader's linguistic (verbatim recall of sentence) and semantic (author's purpose for sentence) processing of sentences, and in the second experiment, we examined changes in eye movements while sentences were read. Mind wandering during reading resulted in significant decrements in sentence recall and comprehension. Mind wandering also elicited significant changes in eye movements (fixations, saccades, and regressions) during reading. The implications of this research for understanding mind wandering and reading are discussed.

10:40–10:55 (39)

**On the Role of Spatial Attention in Visual Word Recognition.** DEREK BESNER, STEPHANIE WAECHTER, & JENNIFER A. STOLZ, *University of Waterloo*—Many researchers appear to believe that attention plays no necessary role when visually presented words are processed (e.g., Lachter, Ruthruff, Lien, & McCann, 2008, among others). The results of four new experiments (1) shed new light on why different laboratories produce different results and (2) suggest that spatial attention is a necessary preliminary to lexical processing when one reads aloud.

11:00–11:15 (40)

**A Vector Model of the Simon Effect.** ROBERT W. PROCTOR & MOTONORI YAMAGUCHI, *Purdue University*—Choice performance is affected by the properties of stimulus and response sets, and effects of these factors are not always independent. When interdependent, a joint representation of the stimulus/response properties must be constructed. An example of interdependence between stimulus and response properties is the phenomenon known as the Simon effect. We propose that the response selection processes underlying the Simon effect can be represented by a vector model. In the model, stimuli and responses are represented, respectively, by points in a psychological space and regions that partition a vector. A stimulus representation is orthogonally projected onto the vector, and a response is selected when the projected point falls in the region corresponding to that response. We discuss relationships between the vector model, signal detection theory, and associative network models.

11:20–11:35 (41)

**Reaching Trajectories and the Temporal Dynamics of Masked Congruence Priming.** MATTHEW S. FINKBEINER, *Macquarie University*—The masked congruence priming effect (MCE) has proven valuable in the investigation of nonconscious cognitive processes. Typically, studies of the MCE use mean reaction times (RTs) as the dependent measure. Although mean RTs certainly reveal an MCE, they are relatively insensitive to the temporal properties of this effect. To investigate the temporal dynamics of the MCE, we had participants perform a reaching-to-touch response, and we sampled the position of their hand multiple times during their response. The advantage of this continuous measure was that it revealed the MCE as it emerged during the response. In this presentation, I will report the time course of the MCE from three experiments in which we manipulated the prime type (repeated primes [also appeared as targets] vs. novel primes [did not appear as targets]), spatial attention (prime attended vs. prime unattended), and prime duration (~16.7 to ~66.7 msec).

11:40–11:55 (42)

**A Polarity Correspondence Account of Comparative Number Magnitude Judgments.** ROLF REBER, *University of Bergen*, PASCAL WURTZ, *University of Bern*, & LINN V. LERVIK & MARIT KNAPSTAD, *University of Bergen*—When asked which number is greater, participants respond faster when physical size corresponds to number magnitude, such as in 3 7, than when the two attributes contradict each other, such as in 3 7. This size congruence effect in comparative number judgments is a well-documented phenomenon. We extend existing findings by showing that this effect does not depend on physical size of the number but can be observed with number symmetry. In addition, we observed that symmetric numbers are judged as being smaller than asymmetric numbers, which renders an interpretation of the number



symmetry congruence effect in terms of physical size implausible. We refer to the polarity correspondence principle (Proctor & Cho, 2006) to explain the present findings.

### Decision Making I

Republic Ballroom, Friday Morning, 10:20–11:55

Chaired by Charles R. Gallistel, Rutgers University, Piscataway

#### 10:20–10:35 (43)

**The Perception of Probability.** MONIKA KRISHAN, *Rutgers University, Piscataway*, YE LIU, *Institute of Psychology, CAS, Beijing*, & CHARLES R. GALLISTEL, *Rutgers University, Piscataway* (read by Charles R. Gallistel)—Subjects watched red or green circles emerge from behind an occluder one by one. After each emergence, the subjects were asked to position a slider to indicate their estimate of the currently operative value for the relative frequency of the green circles. The slider controlled the proportion of small green versus red circles inside a display rectangle. Subjects were told that the probability might change from time to time and were asked to press a key when they thought it had changed. The data were modeled with a Bayesian ideal observer with “second thoughts” (i.e., the ability to retroactively revise its estimate of whether there had been a change in a given stretch of trials). Subjects tracked the probability with great accuracy, detecting changes as quickly as an ideal observer, and very rapidly adjusting their estimates to the new probability. Can these results be explained by computationally simple heuristics?

#### 10:40–10:55 (44)

**Benford’s Law: An Example of Sensitivity to Environmental Regularities?** BRUCE D. BURNS & JONATHAN R. KRYGIER, *University of Sydney*—Recent decision-making research suggests that people are sensitive to statistical relationships in the environment even when they have little awareness of them. Benford (1938) showed that the first digits of many quantities have a logarithmic rather than flat distribution. This little-known fact is being used to detect financial fraud on the assumption that people will not spontaneously conform to Benford’s law. In a series of experiments, participants estimated quantities (e.g., length of the Indus River in kilometers), and we found that people can fit to Benford’s law, especially when estimating quantities about which they lack precise knowledge but about which they know something. However, when generating quantities was replaced with selecting from options, there was less evidence of Benford’s law. Overall, the results suggest that Benford’s law is a product of the way people estimate quantities on the basis of other information, rather than sensitivity to Benford’s law itself.

#### 11:00–11:15 (45)

**Deliberate Versus Automatic Processes for Classification With Probabilistic Cues.** DAVID J. BRYANT, *Defence R&D Canada, Toronto*—Both compensatory decision rules and fast and frugal heuristics have been found to be valid models of human judgment in a threat classification task. Glöckner and Betsch (2008) have suggested that fast and frugal heuristics are associated with deliberate processing, whereas others (e.g., Waldron & Ashby, 2001) have suggested that a countervailing automatic processing system can support compensatory integration of cues in classification. Employing a dual-task methodology, we examined whether heuristic classification is mediated by deliberate processing and compensatory procedures by automatic processing and whether the requirement to perform a secondary task would affect participants’ propensity to employ one or the other decision strategy. The results suggest that the deliberate/automatic distinction does underlie the use of heuristic versus compensatory decision strategies and can affect an individual’s choice of strategy under some circumstances.

#### 11:20–11:35 (46)

**The Symbolic Distance Effect: Evidence for a Magnitude Comparison Process.** NORMAN R. BROWN, SHAWN TAN, & PETER J. LEE, *University of Alberta*—The present study examined the processes underlying paired comparison judgments. First, RTs were measured as participants decided which of two vehicles was more expensive (e.g.,

BMW 323i sedan or Toyota 4Runner SUV). The vehicles were drawn from four categories defined by crossing two features: brand status (luxury vs. nonluxury) and product class (SUV vs. sedan). Second, participants estimated the base price of the 16 vehicles used in the comparison task. RTs displayed a classic symbolic distance effect (Bank, 1977; Moyers & Dumais, 1978): RTs were inversely related to the difference between the subjective prices of the compared vehicles, and subjective price was predicted by a weight combination of the two defining features (Murray & Brown, in press). These findings indicate that a magnitude comparison process plays a central role in the binary decision task. At the same time, specific patterns in the data disconfirmed predictions made by two one-reason decision models.

#### 11:40–11:55 (47)

**Assessing Joint Distributions With Isoprobability Contours.** DAVID V. BUDESCU, *Fordham University*, & ALI E. ABBAS & YUHONG GU, *University of Illinois, Urbana-Champaign*—We present a new method for constructing joint probability distributions of continuous random variables, using isoprobability contours—the set of all of the points with the same joint cumulative probability. This approach reduces the joint probability assessment to a sequence of binary choices between various combinations of the variables of interest and eliminates the need to assess directly the dependence or association between them. We discuss properties of isoprobability contours, describe methods for their assessment, and illustrate their use to infer the correlations between the variables. We report results of an experiment involving 25 judges who assessed the 50th percentile isoprobability contour of the joint distribution of height and weight in a population of students. The subjects provided meaningful, consistent, and reliable judgments that can be used to infer indirectly the correlation between the two variables. We discuss possible applications, extensions, and directions of future research.

### Metamemory

Independence Ballroom, Friday Morning, 10:00–11:55

Chaired by Elizabeth J. Marsh, Duke University

#### 10:00–10:15 (48)

**Prior Knowledge Does Not Protect Against Illusory Truth Effects.** LISA K. FAZIO & ELIZABETH J. MARSH, *Duke University* (read by Elizabeth J. Marsh)—How do people judge the truth of statements like “Helsinki is the capital of Finland” (true) and “Louisville is the capital of Kentucky” (false)? Prior research suggests that people rely on processing fluency as a cue for truth (e.g., Unkelbach, 2007). Statements are judged to be truer if they had been read previously, appear in an easy-to-read font, or contain a rhyme. Our question is whether people rely on fluency in cases where truth ratings could be based on prior knowledge. Subjects were exposed to true and false statements in an initial phase of each experiment and then rated the truth of the statements in a second phase. Half of the facts were well known, as determined by norms (Experiment 1) or by each individual’s ability to recognize the correct answer at another time (Experiment 2). Repetition increased truth ratings of both obscure and well-known facts, even when the statements contradicted prior knowledge.

#### 10:20–10:35 (49)

**Recollective Mental Imagery and Memory Confidence.** WILLIAM F. BREWER, *University of Illinois, Urbana-Champaign*, & CRISTINA SAMPALIO, *Western Washington University*—Bartlett (1921) and Brewer (1996) have argued that recollective memory imagery leads to strong memory confidence; however, neither theorist provided direct, convincing data for this proposal. Data from two experiments are presented that support this hypothesis. Experiment 1 involved simple recognition memory for sentences. Nondeceptive items that the participants classified as *recalled* showed very high confidence and accuracy. Experiment 2 involved verbal recognition tests for a set of viewed 3-D objects. Items called *old* with recollective imagery showed high confidence, whereas items called *old* without recollective imagery showed low confidence, showing that participants have a metamemory belief that recollective imagery is associated with high accuracy. For actual old items,

the occurrence of imagery was, in fact, associated with high accuracy, whereas the nonoccurrence of imagery was associated with low accuracy. The results provide support for Bartlett's and Brewer's proposals that recollective mental imagery leads to high memory confidence.

10:40–10:55 (50)

**Misinformation Impairs Metacognitive Monitoring Only If People Are Not Warned.** PHILIP A. HIGHAM, *University of Southampton*, KARLOS LUNA, *University of Minho*, & HARTMUT BLANK, *University of Portsmouth*—The received wisdom for eyewitness memory is that postevent misinformation produces false memories that are quickly accessed and confidently held (see, e.g., Loftus et al., 1989). If so, and all other things are equal, metacognitive monitoring (MM; the degree to which subjective confidence discriminates between accurate and inaccurate responses) will be detrimentally affected by misinformation. Surprisingly, very little research has directly tested this hypothesis, but results from a few studies do indeed support it. However, we have found that MM impairment occurs only when participants have no reason to question the veracity of retrieved memories. If, instead, participants are given clear warnings that they have been misled, all measures of MM (gamma, mean confidence, and  $d'$  from Type 2 signal detection theory) indicate that MM is good and unaffected by misinformation, despite the fact that misinformation worsens memory retrieval. The results are discussed in terms of current metacognitive models.

11:00–11:15 (51)

**Metacognition of Agency: Brain Monitoring of Control.** JANET METCALFE & DAVID B. MIELE, *Columbia University*—People's metacognitions of agency—of being in control or out of control—and the attendant brain processes were studied while people engaged in a computer task, in the scanner, in which they attempted to catch downward scrolling Xs without touching Os. Control was experimentally manipulated by applying “turbulence” (statistical noise) to the computer cursor. After each trial, participants made either a judgment of performance (JOP; i.e., how well they had done) or a judgment of agency (JOA; i.e., how in control they had felt). The fMRI analyses revealed increased activation in the temporoparietal junction and other locations during task performance in the turbulence trials, when participants felt out of control, as compared with during the control trials, when they (appropriately) felt more in control. Differences in activations during the judgment phase were also found and were associated with the two different types of metacognitive judgments—JOAs and JOPs.

11:20–11:35 (52)

**Metacognitively Guided Retrieval and Report (META-RAR): Quality Control Processes in Recall.** MORRIS GOLDSMITH, *University of Haifa*, LARRY L. JACOBY, *Washington University*, VERED HALAMISH, *University of Haifa*, & CHRISTOPHER N. WAHLHEIM, *Washington University*—Quality control in recall can be achieved either by postretrieval monitoring and control processes that identify and screen out false retrieved information before it is reported or by constraining retrieval, such that false information is less likely to be retrieved in the first place. Here, we present an integrative framework—metacognitively guided retrieval and report (META-RAR)—which is useful for studying the “front-end” and “back-end” components of recall quality control. Using the framework and an accompanying assessment methodology, we have begun to examine the separate contributions of metacognitively constrained retrieval and postretrieval monitoring to recall accuracy and the division of labor between them. The results of several experiments manipulating factors such as encoding depth and information about encoding depth, cue–target associative strength and information about cue–target associative strength, and proactive interference and experience with proactive interference, illustrate the utility of the approach.

11:40–11:55 (53)

**Reflecting Upon a Victim's Feelings.** MAKIKO NAKA, CHIKAGE ISHIZAKI, & YUKO YAMASAKI, *Hokkaido University*, & SARAH J. BARBER & NANCY FRANKLIN, *Stony Brook University*—Thinking

about a victim is considered to help rehabilitation of offenders. The deeper an offender reflects upon the victim's feelings, the more he/she will regret the offense, which may prevent him/her from committing the crime again. This study investigated how profoundly one could think about a victim's feelings and damage, as well as examining whether the ability to do so has any relationship with interpersonal intelligence. Seventy-nine undergraduates were given a context (shoplifting, blackmail, or assault) and were asked a range of questions about the victim's feelings and how to compensate for the damage. The number, amount, and contents of the descriptions were analyzed. The results showed that the definition of “victim” is not limited to the target of offense but may include the offender's family, society, and even the offender him/herself. The amount and number of descriptions changed according to the seriousness of the crime, and some showed correlations with social intelligence scores.

**New Insights Into Perceptual Organization**  
**Back Bay Ballroom C, Friday Morning, 9:40–11:55**

*Chaired by Johan Wagemans, Katholieke Universiteit Leuven*

9:40–9:55 (54)

**Laws of Auditory Perceptual Organization.** MICHAEL KUBOVY, *University of Virginia*—Perceptual organization in vision and audition are linked through a duality: The visual system detects and identifies surfaces, and the auditory system detects and identifies sources. Surfaces are illuminated by sources of light, and sound is reflected off surfaces. However, the visual system discounts sources, and the auditory system discounts surfaces. These insights tell us where one might expect analogies between visual and auditory perceptual organization. I will discuss two types of empirical work. (1) The Garner problem consists of predicting the perceived starting note of cyclic tone sequences (called “necklaces”). I will describe generalizations of Garner's run and gap principles and will discuss the effect of stressing preferred and non-preferred starting notes. (2) The second type is grouping by proximity in pitch and time. We create two types of sequences of two pitches—... B\_AAB\_BAA\_BBA\_A ... or ... BB\_AA\_AB\_BB\_AA\_A ... (where “\_” is a longer gap)—in which two perceptual organizations compete. We develop laws of grouping by proximity in pitch and time.

10:00–10:15 (55)

**Perceptual Organization Influences Automatic Deployment of Attention.** RUTH KIMCHI, YAFFA YESHURUN, & GUY SHA'SHOUA, *University of Haifa*—We examined whether perceptual organization influences automatic deployment of attention. Participants were presented with a matrix of  $L$  black elements in various orientations. The task was to identify the color of one element changing its color or to discriminate a Vernier target that was added to the matrix or appeared after its offset. On some trials, a subset of elements became grouped, by collinearity and closure, into a square-like object. No abrupt onset or any other unique transient was associated with the object, and it did not predict the target or the target's location. Performance on trials with an object was faster than performance on no-object trials for targets in the object area but was slower for targets in a nonobject area, even when the target appeared after the matrix offset. These results demonstrate that the mere organization of some elements in the visual scene into a coherent perceptual unit captures attention automatically.

10:20–10:35 (56)

**Bilateral Mirror Symmetry as a Cue for Figure–Ground Segregation.** BART MACHILSEN & JOHAN WAGEMANS, *Katholieke Universiteit Leuven* (read by Johan Wagemans)—Since the early observations by Ernst Mach (1886), vertical mirror symmetry has been assumed to play a key role in perceptual organization. However, no empirical studies have reported a benefit of symmetry in figure–ground organization. In a two-alternative forced choice design, we asked participants to indicate which of two Gabor arrays contained a visual shape. The shape, defined by a subset of Gabor patches aligned with the shape outline, was either symmetric or asymmetric, but no symmetry judgment was



required. The saliency of the embedded shape was reduced by adding orientation noise to the Gabor patches. Across different noise levels, symmetric shapes were more detectable than asymmetric shapes. This suggests that symmetry does act as a cue in figure–ground segregation. A posteriori analyses on the amount of symmetry in our stimuli further support this finding.

10:40–10:55 (57)

**Between-Shape Inhibitory Competition in Figure–Ground Perception: Measurements at Multiple Levels.** MARY A. PETERSON, *University of Arizona*—We proposed that figure–ground perception entails inhibitory competition between candidate configurations identified on opposite sides of edges. The winning configuration is perceived as the figure; the losing configuration is suppressed and perceived as the ground. We tested this view with closed silhouettes in which classic configural cues favored seeing the figure on the inside, but portions of familiar objects were suggested on the outside. The familiar configurations were expected to lose the figure–ground competition. Indeed, the outsides were perceived as unshaped grounds to the silhouette figures. Object-decision RTs showed that the shapes of the losing familiar configurations were suppressed. Target discrimination RTs showed that competition-induced suppression extends to lower levels (e.g., location) via feedback. Lexical decision RTs showed that the familiar configurations were processed, but not suppressed, at semantic levels. The results indicate that figure–ground perception entails inhibitory cross-edge competition between configurations identified in an initial fast processing pass.

11:00–11:15 (58)

**The Role of Spatial Short-Term Memory in the Maintenance of Occluded Objects.** HYUN KYU LEE, *University of Illinois, Urbana-Champaign*, & SHAUN P. VECERA, *University of Iowa* (read by Shaun P. Vecera)—We examined the role of spatial short-term memory (SSTM) in maintaining the hidden portions of occluded objects. We measured the degree of visual completion by asking participants to perform an object-based attention task on occluded objects while maintaining four locations in SSTM. SSTM did not interfere with object-based selection generally (Experiment 1). Maintenance of occluded objects was prevented when four locations were rehearsed in SSTM and did not overlap with the locations of occluded objects (Experiment 2). Importantly, when observers remembered and rehearsed locations that overlapped with the occluded regions of objects, the occluded objects were maintained behind the occluder (Experiment 3). These results suggest that SSTM is a working memory system that is involved in maintaining and completing occluded objects.

11:20–11:35 (59)

**Exploring Object Correspondence in Dynamic Displays.** CATHLEEN M. MOORE, TERESA STEPHENS, & ELISABETH HEIN, *University of Iowa*—How does the visual system “decide” whether a stimulus that is perceived at one time and place is the same object as a stimulus perceived at a different time and place? This is one variation of the correspondence problem, which has been studied in many different incarnations since at least the early 20th century. We revisited this problem from the point of view of modern constructs, such as object files, fingers-of-instantiation, and proto-objects, by investigating three different phenomena: object previewing, the perception of causality, and a form of ambiguous motion known as *Ternus motion*. We contrast the relative roles of spatiotemporal information and object-feature information (e.g., color, size, and contrast polarity) in resolving object correspondence. One of the primary conclusions is that, contrary to textbook accounts of object correspondence, object features do play a role in resolving correspondence and can even overwhelm spatiotemporal information under some conditions.

11:40–11:55 (60)

**Simple Gestalts: Emergent Features in Two-Line Stimulus Space.** JAMES R. POMERANTZ & ANNA I. STUPINA, *Rice University*—The speed with which a line segment of one orientation can be found in

a field of segments with other orientations can change dramatically when a second, identical context line is added to each of the originals to form two-line configurations (such as T, L, //, —, ||, or V.) We systematically sampled a portion of the infinite space of all possible configurations of two-line segments falling in plane to determine what emergent features (EFs) they possess—that is, what novel and salient features emerge from two-line configurations that are not possessed by either line segment alone but that are responsible for making the configurations discriminable. The results suggest that salient EFs from two lines include parallelism, connectivity, and intersections. These results add to a growing list of EFs—gestalts—that are more salient to the visual system than are the components from which they are constructed.

### Categories and Concepts I

Back Bay Ballroom D, Friday Morning, 10:00–11:55

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

10:00–10:15 (61)

**The Dimensionality of Perceptual Category Learning: A State-Trace Analysis.** BEN R. NEWELL, *University of New South Wales*, JOHN C. DUNN, *University of Adelaide*, & MICHAEL KALISH, *University of Louisiana, Lafayette*—State-trace analysis was used to investigate the effect of concurrent working memory load on perceptual category learning. Initial reanalysis of Zeithamova and Maddox (2006, Experiment 1) revealed an apparently two-dimensional state-trace plot consistent with a dual-system interpretation of category learning. Follow-up analyses restricted to only those participants who had learned the category task and performed the concurrent working memory task adequately revealed a one-dimensional plot consistent with a single-system interpretation. Three modified replications of the original experiment showed evidence of a single resource underlying the learning of both rule-based and information integration category structures. The results challenge the notion that separate cognitive systems are responsible for learning different category structures and highlight the potential of state-trace analysis in furthering our understanding of the mechanisms underlying category learning.

10:20–10:35 (62)

**Integrating Conceptual Knowledge Within and Across Representational Modalities.** CHRIS McNORGAN, JACKIE REID, & KEN McRAE, *University of Western Ontario* (read by Ken McRae)—Research suggests that concepts are distributed across brain regions specialized for processing information from sensorimotor modalities. Multimodal semantic models fall into one of two broad classes differentiated by the assumed hierarchy of convergence zones over which information is integrated. In shallow models, communication within and between modalities is accomplished using direct connectivity, or a central semantic hub. In deep models, modalities are connected by cascading integration sites with successively wider receptive fields. Two experiments directly tested these models using speeded behavioral tasks involving feature inference and concept activation. Shallow models predict no within- versus cross-modal difference in either task, whereas deep models predict a within-modal advantage for feature inference but a cross-modal advantage for feature verification. Experiment 1 used relatedness judgments to tap participants’ knowledge of relations for within- and cross-modal feature pairs. Experiment 2 used a dual-feature verification task. The results are consistent with a deep integration hierarchy.

10:40–10:55 (63)

**The Unidimensionality of Category Extension and Intension.** STEVEN VERHEYEN & GERT STORMS, *Katholieke Universiteit Leuven* (read by Gert Storms)—The answer to the question of what constitutes a category generally comes in two guises. The first refers to the set of items in the world that is delineated by the category (category extension). The second refers to the set of characteristic features associated with the category (category intension). Although extension and intension are two complementary depictions of what a category is, they are not always treated accordingly. They are often studied as if they were two independent subject

matters. We will present a theory of semantic categories that assumes both exemplars and features to vary along a common, latent scale. Evidence for this theory will be provided through an analysis of exemplar by feature applicability matrices with the two-parameter logistic model. This item response model for unidimensional data not only fits the applicability matrices, its parameters naturally account for the varying representativeness of the constituting exemplars and features.

**11:00–11:15 (64)**

**Mechanistic and Teleological Explanations in Inference.** TANIA LOMBROZO, *University of California, Berkeley*—Many objects and events can be explained either mechanistically, by appeal to preceding causal mechanisms, or teleologically, by appeal to functions and goals. For example, a tiger's stripes can be explained mechanistically by appeal to gene–environment interactions or teleologically by appeal to camouflage. What are the cognitive consequences of these distinct kinds of explanation? In particular, do mechanistic and teleological explanations reflect or influence basic cognitive processes, such as categorization and inference? Building on recent work documenting the effects of different kinds of explanations on categorization (Lombrozo, 2009, *Cognition*, **110**, 248–253), I will present a series of experiments exploring the roles of functional properties and explanations in inference, focusing on property generalization in category-based induction.

**11:20–11:35 (65)**

**Logical Rule Models of Classification Response Times.** ROBERT M. NOSOFSKY, *Indiana University, Bloomington*, & MARIO FIFIC, *Max Planck Institute for Human Development*—A classic idea in cognitive

psychology is that, in many situations involving concept learning and categorization, people develop and test logical rules as a basis for classification. What response time (RT) predictions are made by logical rule models? There is currently a major gap in answering this question. We develop a set of logical rule models of classification RTs by synthesizing mental-architecture and random-walk approaches. In initial validation tests that involve explicit instructions for the use of logical rule strategies, the logical rule models compare favorably with major alternatives in the field, including exemplar, distance-from-boundary, and diffusion-like models. Ongoing work tests the extent to which logical rules are indeed used as a basis for classification by examining RTs in free-strategy situations.

**11:40–11:55 (66)**

**Levels of Abstraction: A Bird's-Eye View.** ROBERT G. COOK, *Tufts University*—Because of birds' and mammals' shared status as highly mobile, visual animals that interact with the world at similar spatial scales, the examination of discrimination and categorization across birds and mammals is a critical part of any complete psychology of cognition. Focusing primarily on research with pigeons, studies are reviewed that highlight some of the similarities and differences we have found at different levels of abstraction across these classes of animals. These studies include examinations of exemplar and category learning across different tasks, the learning of same/different relations across different modalities, and the classification of actions. In particular, the theoretical relations of exemplar memorization and generalized abstraction and their respective roles in comparative intelligence and the evolution of cognition are considered.

## SYMPOSIUM II

**What Are We Learning From fMRI About the Neural Mechanisms of Source Memory?**  
**Grand Ballroom, Friday Afternoon, 1:35–3:45**

*Chaired by Karen J. Mitchell, Yale University*

**1:35–1:45 (67)**

**Introduction to the Symposium: What Are We Learning From fMRI About the Neural Mechanisms of Source Memory?** KAREN J. MITCHELL, *Yale University*—The systematic study of source memory provides a useful approach to investigating the features that give memories their episodic character; the associative, organizational, or binding processes that connect features; and access and evaluation processes involved in identifying current mental experiences as memories of past events. It can also help clarify the locus of many types of memory errors, and some of the cognitive deficits associated with psychopathology. The talks in this symposium provide cutting-edge examples of how fMRI is advancing our understanding of the brain mechanisms involved in source memory. As suggested by these talks, continued dialogue between cognitive theory and evidence from fMRI studies, including studies of populations exhibiting source memory deficits, should further clarify our conceptualization of cognitive processes (e.g., feature binding, retrieval, monitoring), prior knowledge (e.g., semantics, schemas), and features (e.g., perceptual and emotional information), and of how they combine to create true and false memories.

**1:45–2:05 (68)**

**Medial Temporal Lobe Contributions to Source Encoding.** LILA DA-VACHI, *New York University*—Remembering the source of a past experience requires the ability to bring back to mind the associated details linked with that experience, and is dependent on successful encoding of episodic details. Since there are arguably innumerable details to encode during any experience, the brain must be able to support fast and flexible binding. I will present functional imaging data aimed at elucidating how the medial temporal lobe (MTL) supports the binding of event features into a unified memory trace. Emerging findings demonstrate that the perirhinal cortex differentially participates in the encoding of items and item-related features, whereas the hippocampus, on the other hand, supports the binding of all episodic details regardless of their domain. These data contribute to a working model of how the MTL participates in episodic memory formation with domain-general relational binding mechanisms supported by the hippocampus and emerging evidence for domain-specificity within the perirhinal and parahippocampal cortices.

**2:05–2:25 (69)**

**Cognitive Control Versus Retrieval Success Accounts of Prefrontal and Parietal Activation During Source and Item Recognition.** IAN G. DOBBINS, *Washington University*—A strikingly similar cortical network is implicated in fMRI research examining simple item recognition and source memory attribution, including areas in left lateral parietal and frontopolar prefrontal cortices. I will present data suggesting that this network supports the countermanding of expectations on the basis of the quality of recovered memory evidence. The first experiment used a memory-cuing task in which observers received precues indicating the likely status of upcoming memoranda. Cue validity and not memory status (studied or novel) governed the response of the critical network. The second experiment examined whether network activation tracked observer differences in accuracy or criterion during standard recognition. Greater differential network activation to old versus new items was linked to more conservative, not more accurate responding across observers, again suggesting a core role in cognitive control. Both findings suggest that so-called “retrieval success” effects in this network reflect the mismatch between memory expectations and actual retrieval outcomes.

**2:25–2:45 (70)**

**Decoding Source Memory Processes Using Multivoxel Pattern Analysis.** KENNETH A. NORMAN, *Princeton University*—For the

past several years, my lab has been using multivoxel pattern analysis (MVPA) to study memory retrieval. MVPA involves applying pattern classifiers to spatially distributed (multivoxel) patterns of fMRI activity. These pattern classifiers are trained to detect the neural signatures of specific cognitive states. Once a classifier has been trained to detect a particular cognitive state, the classifier can be used to covertly measure fluctuations in that cognitive state over time. We can use this time-varying readout of the subject’s cognitive state to test hypotheses about how cognitive state variables relate to behavior and to each other. I will discuss how we have used MVPA to gain insight into how subjects probe memory, what subjects retrieve from memory, and how subjects make decisions on the basis of retrieved information. I will also discuss methodological challenges that we have faced (and continue to face) in getting MVPA to reach its full potential.

**2:45–3:05 (71)**

**How Emotion Affects Memory for Source Information.** ELIZABETH A. KENSINGER, *Boston College*—There has been debate about whether emotion enhances the accuracy with which details of an experience are remembered. In the present talk, I will present evidence that emotion’s effects on memory for detail vary as a function of both the type of detail that is being encoded and the valence of emotion (positive or negative) elicited by an event. Source memory appears to be particularly enhanced when a stimulus elicits a negative emotion and when memory is queried for “intrinsic” features that are directly tied to the stimulus that elicited the emotion. This enhancement appears to result from enhanced amygdala engagement during encoding and from increased connectivity among the amygdala, the hippocampus, and the fusiform gyrus.

**3:05–3:25 (72)**

**Self As “Source”: What Behavioral, Neural, and Cognitive Training Experiments Tell Us About Impaired Reality Monitoring in Schizophrenia.** SOPHIA VINOGRADOV, *University of California, San Francisco*—Schizophrenia patients are impaired at identifying themselves as the source of self-generated information (abnormal reality monitoring), and show relatively decreased activation within dorsal medial prefrontal cortex compared with healthy subjects when engaged in this process. Behavioral evidence indicates that, for both schizophrenia patients and healthy subjects, memory for self-generated information shows unique associations with social cognition, compared with memory for externally presented information. In other words, the ability to remember that “self was source” on an earlier sentence completion task strongly relates to basic social cognitive performance on face recognition and emotion identification tasks. However, in schizophrenia, this relationship is attenuated and is also influenced by attention and executive functions. Fourteen weeks of intensive computerized cognitive training of general and social cognitive functions results in significant behavioral improvement in self-referential source memory in schizophrenia, as well as “normalization” of the neural correlates of this process observed in fMRI experiments.

**3:25–3:45 (73)**

**Commentary.** MARCIA K. JOHNSON, *Yale University*—fMRI studies are beginning to identify brain regions, and networks of regions, associated with encoding and remembering specific types of information that give rise to the phenomenal experience of remembering, and to characterize neural activity associated with variations in the subjective qualities of these characteristics. Such studies are also beginning to identify regions associated with component cognitive processes and how they combine under different agendas to remember. The possibility that such component processes serve more general cognitive functions is of growing interest. fMRI findings are helping elucidate changes in source memory accompanying normal development and pathologies. They also are prompting investigators to articulate theoretical assumptions with greater specificity; for example, to move beyond broad concepts such as encoding or monitoring and toward isolating component processes and specific features involved in remembering. Such dialogue between cognitive theory and fMRI studies is enriching our understanding of source memory.



**Selective Attention II****Constitution Ballroom, Friday Afternoon, 1:30–2:45***Chaired by Steven L. Franconeri, Northwestern University***1:30–1:45 (74)**

**Tracking Multiple Objects Is Limited Only by Interobject Crowding, and Not Object Speed.** STEVEN L. FRANCONERI, SUMEETH V. JONATHAN, & JASON M. SCIMECA, *Northwestern University*—We have the ability to dynamically track the locations of up to eight moving objects. Because tracking capacity is reduced as objects move more quickly, one class of potential mechanism specifies that increased speed depletes some limited processing resource. In contrast, we suggest that object speed only affects tracking performance to the degree that it creates more instances of crowding per trial. Greater speed brings greater distance traveled per object, leading to a larger number of “close calls” with other objects. To eliminate this confound, we equated distance traveled across speeds by shortening trials with greater object speed (i.e., playing the same trial using “fast forward”). When distance was controlled, speed had little influence on tracking ability. These data suggest that within the limits of interobject crowding, if you can track one object at a given speed, independent tracking mechanisms allow you to track an unlimited number of objects at that speed.

**1:50–2:05 (75)**

**It's Hard to Represent Two Search Targets As a Single Range.** MICHAEL J. STROUD & KYLE R. CAVE, *University of Massachusetts, Amherst*, & TAMARYN MENNEER & NICK DONNELLY, *University of Southampton* (read by Kyle R. Cave)—Previous dual-color search experiments have revealed a split-target cost: a drop in search efficiency as a function of the dissimilarity between the two target colors. When the target colors are similar, fixations show the target representation driving search to be a single continuous range of colors that includes both targets and a color in between. When the targets are dissimilar, they are instead represented as two discrete colors. Are these discrete representations used because it is difficult to represent such a large range of different colors, or because they prevent fixations to in-between colors? We tested whether the presence of in-between distractor colors affected the target representation. The intervening colors have, at best, a minimal influence on shaping the guiding target representation. There is apparently a fundamental difficulty in representing the search targets as a large range of colors, even when that range would not select distractors.

**2:10–2:25 (76)**

**Do Distractors Disrupt Prediction in Multiple Object Tracking?** TODD S. HOROWITZ, *Harvard Medical School*, & MICHAEL A. COHEN, *Harvard University*—Additional distractors are known to disrupt multiple object tracking (MOT) performance. Our previous work with motion-defined stimuli argues that increased errors cannot be entirely due to confusions between targets and distractors. Since distractors are known to disrupt motion extrapolation in a variety of tasks, from smooth pursuit to time-to-contact judgments, we suggest that distractors degrade the ability to predict target motion in MOT. We tested this hypothesis by measuring information about target trajectories. Observers tracked four targets either alone or among four distractors. When probed, observers had to report a randomly selected target's direction of motion by adjusting an arrow. We analyzed the angular errors with a mixture model in order to remove the influence of trials on which the probed target was not tracked. In accord with the motion extrapolation hypothesis, we found that adding distractors reduced directional precision.

**2:30–2:45 (77)**

**Attention Transfers Perceptual Learning to New Locations.** MARISA CARRASCO, *New York University*—Perceptual learning is the improvement in performance resulting from practice with simple tasks, which is highly specific to basic stimulus attributes, including spatial location. We investigated whether exogenous (involuntary) attention would help perceptual learning transfer to new spatial locations. Observers trained for 5 consecutive days with an orientation discrimination task. For different observers each trial began with a cue: (1) neutral, (2) valid or invalid,

(3) valid. Performance improved throughout the training task for all conditions, and was higher at validly cued and lower at invalidly cued conditions than in the neutral condition. In the transfer task, observers reported the orientation of stimuli appearing either at the original locations (horizontal meridian) or above and below them. At these new locations, nearly all learning was lost for the neutral and invalid cue conditions. However, for the valid cues conditions, the transfer cost disappeared, indicating that attention transfers learning to new stimulus locations.

**Speech Perception I****Republic Ballroom, Friday Afternoon, 1:30–3:25***Chaired by Laura C. Dilley, Michigan State University***1:30–1:45 (78)**

**What Information in Speech Conveys Speaking-Rate Effects on Lexical Perception?** LAURA C. DILLEY, *Michigan State University*, & MARK A. PITT, *Ohio State University*—In casual speech, pronunciation of function words can be highly reduced. We have found that perception of reduced function words can be strongly affected by the speaking rate of surrounding context, with the functor perceptually disappearing when the context is slowed (Dilley & Pitt, 2008). Here, we asked what types of rate-carrying information in the surrounding context cause the effect. In a series of experiments, we gradually reduced the intelligibility of surrounding context from clear speech to a tone sequence. If listeners entrain to gross temporal modulation conveyed by the amplitude envelopes of syllables, then the speaking-rate effect should be found with tone sequences. If listeners require the temporal precision and fine-grained spectral cues conveyed by subtle articulatory movements to encode speaking rate, then only intelligible speech or speechlike sounds should produce the speaking-rate effect. The results will be discussed in the context of oscillator-based models of speech timing.

**1:50–2:05 (79)**

**Identical Speech Acoustics, Different Perceptual Learning: Faces Matter.** ARTHUR G. SAMUEL, *Stony Brook University*, & TANYA KRALJIC, *University of Pennsylvania*—Listeners dynamically adjust their phonetic categorization space. For example, if they hear words with variant /s/ sounds (e.g., “embashy”), they expand the /s/ category to include sounds like the variant. However, if a listener is first exposed to words that have normal pronunciations of the critical sound (e.g., “Tennessee”), hearing variants afterward does not produce perceptual learning. Here, we test whether this inoculation effect attaches to a particular voice, or to a particular person. We first replicated the inoculation effect, using audiovisual presentation. Listeners in a second condition heard exactly the same stimuli, but halfway through, the person in the video changed from one female to another. In a third condition, the video switch was from a female to a male. Despite the identical audio, the latter two conditions produced robust perceptual learning. Thus, the inoculation is person specific (not voice specific), or alternatively, perceptual learning is sensitive to the audiovisual configuration.

**2:10–2:25 (80)**

**Phonological Universals Constrain the Processing of Nonspeech Stimuli.** IRIS BERENT, *Northeastern University*, EVAN BALABAN, *McGill University*, TRACY LENNERTZ, *Northeastern University*, & VERED VAKNIN-NUSBAUM, *University of Haifa*—Speakers of various languages are sensitive to universal phonological restrictions concerning structures that are unattested in their language. For example, English speakers are more likely to misidentify universally ill-formed onsets (e.g., mɔɪf → mɔɪf) in comparison with better formed ones (e.g., mlɪf), whereas speakers of Russian (a language allowing both onset types) perceive such onsets accurately. Does universal and language-particular phonological knowledge also extend to auditory stimuli that are unambiguously identified as nonspeech? Two experiments compared the perceptions of English and Russian speakers using nonspeech stimuli generated from the first formant frequency contours of the original speech stimuli, and “speech-like” control sounds that retained attenuated higher frequency formant information. The results showed that responses to nonspeech stimuli were similar to speech, and

were likewise modulated by linguistic experience. This convergence suggests either that phonological universals only reflect domain-general properties of human audition, or that linguistic brain circuits participate in processing nonspeech stimuli without conscious awareness.

2:30–2:45 (81)

**Is One Accent As Good As Another: Specificity and Generalization in Perceptual Learning of Accented Speech.** JESSICA E. D. ALEXANDER & LYNNE C. NYGAARD, *Emory University* (read by Lynne C. Nygaard)—The present study investigated the process of perceptual learning of specific properties of foreign-accented speech. Native English-speaking listeners were trained with Spanish-accented speech, with Korean-accented speech, or with a group of speakers from six different first-language backgrounds. During training, all listeners transcribed accented words and received feedback. At test, listeners transcribed novel words produced by unfamiliar Korean- or Spanish-accented speakers and were not given feedback. Overall, there was evidence of specificity of learning, with listeners who were trained and tested on the same variety of accented speech showing better transcription at test than untrained controls. However, patterns of transcription accuracy differed for listeners tested with Korean-accented speech and those tested with Spanish-accented speech, suggesting that accent-specific learning may be dependent on characteristics such as linguistic similarity, previous experience, or overall intelligibility. These results have implications for how listeners perceptually adapt to categories of accented speech.

2:50–3:05 (82)

**Listeners' Adjustment to a Talker's Vowel Space.** DELPHINE DAHAN, *University of Pennsylvania*, & ANNELIE TUINMAN, *Max Planck Institute for Psycholinguistics*—Participants followed instructions to move one of four printed words on a computer display. Utterances originated from the speaker of a dialect in which the realization of the vowel /o/ approaches that of /ae/ in standard American English, in effect making “bottle” sound like a rendition of “battle.” Critical trials referred to an /o/ word, displayed with its /ae/ counterpart and another pair (e.g., *bottle*, *battle*, *gravy*, *groovy*). The rate at which participants interpreted the targets as /o/ words indicated participants' adjustment to the talker's vowel space. When the instruction contained a verb with a shifted /o/ (e.g., “drop the word bottle . . .”), listeners interpreted “battle” as “bottle” almost 50% of the time. When the verb contained a nonshifted vowel (e.g., *put*), the rate dropped to about 15%, whether or not a shifted-verb instruction had just been heard. Talker adjustment, thus, involves a short-lived perceptual shift, in addition to a longer lasting adaptation.

3:10–3:25 (83)

**Effects of Perceptual and Cognitive Loads on Speech Segmentation by Native and Nonnative Speakers.** SVEN L. MATTYS, *University of Bristol*—This study investigated whether native and nonnative speakers of English use a similar balance of lexical and acoustic cues to segment English, and whether both groups are equally affected by a perceptual load (background babble noise) or a cognitive load (simultaneous visual search task). In both intact speech and load conditions, nonnative speakers were less accurate than native speakers and, independently, they gave more weight to acoustic cues; for example, juncture-specific allophones. Under cognitive load, as expected from prior research, the visual search task caused the English speakers to rely more heavily on lexical information and pay less attention to the acoustic cues. This lexical shift was not observed in the nonnative group, however. These results show that nonnative speakers pay less attention to lexical information and more attention to acoustic details than was previously believed. Furthermore, attention to acoustic details is robust and shows little penetrability by cognitive factors.

#### Picture Processing

**Independence Ballroom, Friday Afternoon, 1:30–3:05**

*Chaired by William G. Hayward, University of Hong Kong*

1:30–1:45 (84)

**Repetition Blindness for Rotated Objects: Influence of Object Coherency.** WILLIAM G. HAYWARD, *University of Hong Kong*, GUOMEI

ZHOU, *Sun Yat-Sen University*, & IRINA M. HARRIS, *University of Sydney*—Repetition blindness (RB) is the finding that the repetition of an item within a rapid visual stream is often missed. Previous research has shown that RB is reduced for small (0°) and large (180°) rotations of an object between presentations, relative to intermediate rotations (e.g., Hayward et al., 2007; Kanwisher et al., 1999). In the present experiment, we investigated the effect of object coherency on RB for rotated objects. When an object image was split vertically or horizontally, breaking the holistic coherence of the object, modulations of RB across viewpoint were eliminated and it was completely viewpoint invariant. These findings suggest that RB is due mainly to the activation of object representations from local diagnostic features, but can be modulated by priming on the basis of view similarity.

1:50–2:05 (85)

**The Evolution of Shot Structure in Hollywood Film.** JAMES E. CUTTING & JORDAN E. DELONG, *Cornell University*, & CHRISTINE E. NOTHELFER, *University of California, Berkeley*—1/f spectra can be found in reaction times, and these patterns reflect time-varying changes in attention. We investigated film structure to determine whether these same patterns occur in film. We parsed 150 films with release dates between 1935 and 2005 into their sequences of shots, and then analyzed the pattern of shot lengths in each film. Autoregressive and power analyses showed that, across that span of 70 years, shots became increasingly more correlated in length with their neighbors, and created power spectra approaching 1/f. We suggest that, as in other domains, 1/f patterns reflect world structure and mental process. Moreover, a 1/f temporal shot structure may help harness our attention to the narrative of the film.

2:10–2:25 (86)

**The Effects of Object–Scene Association in Natural Scenes on Change Detection.** GARY CHON-WEN SHYI & YA-TING CHAN, *National Chung Cheng University*—In three experiments, we manipulated object–scene association (OSA) and examined the extent to which OSA affects change detection. In Experiment 1, we demonstrated that change detection was better for objects that were rated with high OSA than for those with low OSA. In Experiment 2, we found that change detection of objects with high OSA increased as more time was available for scene scanning, whereas change detection of those with low OSA was not affected by scene duration. In Experiment 3, we recorded eye movements during scene scanning and found evidence suggesting that objects with high OSA enjoyed better encoding and consequently resulted in better retention. These results together suggest that with sufficient exposure, the OSA between an object and its scene context may guide attention and eye movement to those with high OSA, which helps to corroborate the scene schema initially activated.

2:30–2:45 (87)

**Picture Detection in RSVP: Features or Identity?** MARY C. POTTER, *MIT*, BRAD WYBLE, *University of Syracuse*, & RIJUTA PANDAV & JENNIFER OLEJARCZYK, *MIT*—A pictured object can be readily detected in an RSVP sequence when the target is specified by a superordinate category name, such as *animal* or *vehicle*. Are category features the initial basis for detection, with basic-level identification of the specific object occurring in a second stage (Evans & Treisman, 2005), or does basic-level identification of the object occur in the first stage, enabling detection? When two targets in the same superordinate category are presented successively (lag 1), only the identification-first hypothesis predicts lag 1 sparing of the second target. The results of two experiments with novel pictures of objects and a wide range of categories supported the identification-first hypothesis. The results are consistent with a location-specific transient attention model of lag 1 sparing and the attentional blink (Wyble, Bowman, & Potter, 2009).

2:50–3:05 (88)

**The Role of Gaze Direction in Face Processing in Autism Spectrum Disorders.** SAFAR. ZAKI, *Williams College*, & SHANNON A. JOHNSON, *Dalhousie University*—We tested the hypothesis that aversion to eye contact in ASD may play a role in reported ASD face recognition deficits. In previous studies, typically developing children and adults

better remembered faces in which the eyes were gazing directly at them, compared with faces in which the eyes were averted. High-functioning children and adolescents with an ASD, and age- and IQ-matched typically developing controls were shown a series of faces. The gaze of the eyes of the study faces was either direct or averted. We tested memory for these faces shown with their eyes closed in a recognition task. The typically developing group better remembered the direct-gaze faces, whereas the ASD participants showed the opposite effect. These results imply that there may be an important link between gaze aversion in ASD and face recognition abilities.

### Working Memory

Back Bay Ballroom C, Friday Afternoon, 1:30–3:25

Chaired by Klaus Oberauer, University of Zurich

1:30–1:45 (89)

**No Evidence for Decay in Verbal Working Memory.** KLAUS OBERAUER, *University of Zurich*, & STEPHAN LEWANDOWSKY, *University of Western Australia*—Why is working memory capacity limited? One idea is that representations in working memory quickly decay over time unless rehearsed. Support for this assumption comes from Portrat, Barrouillet, and Camos (2008, *JEP:LMC*), who varied the difficulty (and thereby duration) of a choice task inserted in between memoranda in a complex-span paradigm, holding the time for rehearsal between choice-task trials constant. They found better memory with easier choice tasks. We show through reanalysis of their data that the effect was not due to the duration of people's choices but to their errors, which engendered posterror processing, thus reducing rehearsal time. We present two experiments using the same design as Portrat et al., but with a choice task that generates no posterror slowing. The manipulation of choice-task difficulty, despite having a substantial effect on processing duration, had no effect on memory. The results provide evidence against time-based decay in working memory.

1:50–2:05 (90)

**After 50 Years, the Fate of Attention and Working Memory Theories.** NELSON COWAN, *University of Missouri, Columbia*—Around the start of the Psychonomic Society, George Miller, Donald Broadbent, and George Sperling profoundly inspired experimental psychologists. Where do their ideas stand now? I will review basic conclusions of their works in light of subsequent research. Miller (1956) wrote of the "magical number seven" in immediate memory and Miller, Galanter, and Pribram (1960) described a working memory faculty that maintains the goals of cognitive tasks. Broadbent (1958) proposed a simple model of information processing including automatic short-lived storage and limited-capacity attention, and Sperling (1960) provided stronger evidence of pre- and postattentive memory. I argue that these researchers established principles that were fundamentally correct, but that they missed several boundary conditions that must be met to observe three phenomena: (1) a fixed number of chunks in working memory, (2) loss of memory as a function of time, and (3) filtering out of irrelevant stimuli at an early stage of processing.

2:10–2:25 (91)

**Strategic Elimination of Objects From Visual Working Memory.** ASHLEIGH M. RICHARD & ANDREW HOLLINGWORTH, *University of Iowa* (read by Andrew Hollingworth)—The completion of many real-world visual tasks requires control over the content of visual working memory (VWM). Previously, we reported that participants can strategically prioritize a task-relevant object in VWM, protecting it from interference caused by fixations on other objects. Here, we examined a second form of control: the elimination of no-longer-relevant items from VWM. Participants were cued to prioritize one object within a set of objects presented serially in a natural scene. On some trials, a second cue indicated that the cued object should be deprioritized, because it would now be the object least likely to be tested. Memory for the deprioritized object was reduced to levels near floor, despite its active maintenance in VWM for multiple seconds between the first and second cue. These results demonstrate close top-down management of the content of VWM

and the ability to strategically eliminate information that is no longer task relevant.

2:30–2:45 (92)

**To Bind or Not To Bind in Visual Short-Term Memory: It Depends on the Question.** SHRIRADHA SENGUPTA & PAUL VERHAEGHEN, *Georgia Institute of Technology* (read by Paul Verhaeghen)—We examined time–accuracy functions for encoding into visual short-term memory (VSTM). Participants saw a memory set of three objects built from two features (shape and color) and indicated whether either the color or the shape of a probe object, or the whole object itself, had been present in the memory set. In a disjunctive condition, in which the negative targets were built from features absent in the memory set, all three time–accuracy functions were identical, showing no binding costs. Large binding costs were observed in a conjunctive condition, in which the negative targets consisted of recombined features from the display. VSTM might then be flexible in how it stores elements—as features or as objects. This position is strengthened by the results of a third (conjunctive) experiment: The cumulative distribution for whole-object retrieval times fit the expectation for an independent race of features. (Data collection for the corresponding disjunction experiment is under way.)

2:50–3:05 (93)

**Update on the TODAM Working Memory Model.** BENNET B. MURDOCK, *University of Toronto*—The TODAM working memory model is a simulation version of the Lewandowsky and Murdock (1989) chaining model for serial-order effects in short-term memory. It deals with recall, probe tests, item recognition, and serial learning and has been applied to a variety of empirical effects. It uses the standard TODAM system architecture and a four-item working memory buffer in which the storage and retrieval operations (convolution and correlation) are carried out. After a brief review of the model, I will present some recent results.

3:10–3:25 (94)

**Quantity Not Quality: The Relationship Between Working Memory Capacity and Fluid Intelligence.** EDWARD AWH, KEISUKE FUKUDA, EDWARD VOGEL, & ULRICH MAYR, *University of Oregon*—A central motivation for understanding capacity in working memory (WM) is its robust covariance with fluid intelligence (*g*). Motivated by recent evidence that the number and resolution of representations in WM represent distinct aspects of memory ability, we sought to determine which of these factors mediate the link with *g* (measured using Raven's and Culture Fair). We carried out an exploratory factor analysis that included multiple measures of number and resolution in visual WM ( $n = 79$ ). Consistent with the two-factor model, two orthogonal factors (with no significant cross-loadings) emerged to account for individual differences in number and resolution. Moreover, although the number of items stored showed a robust correlation with *g* ( $r = .66$ ), no reliable relationship was observed between mnemonic resolution and *g* ( $r = -.05$ ). Thus, although both number and resolution are crucial aspects of WM capacity, only number mediates the link with standard measures of fluid intelligence.

### Models of Decision Making

Back Bay Ballroom D, Friday Afternoon, 1:30–3:25

Chaired by Douglas H. Wedell, University of South Carolina

1:30–1:45 (95)

**Modeling Contextual Dependence of Choice in Individuals.** DOUGLAS H. WEDELL, *University of South Carolina*, & SYLVIA FITTING, *Virginia Commonwealth University*—Participants made 150 trinary choices in simulated grocery shopping, with each product described by price and quality rating. Each set included a decoy alternative designed to alter the preference relationship between the other two alternatives in the set. Each participant's choices were fit by a series of models using a common response function and weighted additive integration of dimensional values along with contextual valuation parameters that captured (1) rank valuing, (2) dominance valuing, (3) tied dominance valuing, (4) loss valuing, and (5) compromise valuing. These value processes



were combined in higher order models that allowed for nested testing of the relative explanatory power of the different models. Contextual shifts in preference were robust within and across individuals. The patterns of contextual preferences and the modeling of these patterns demonstrated clear individual differences in the contextual valuation across individuals, implicating multiple bases for these effects.

1:50–2:05 (96)

**Using Time-Varying Motion Stimuli to Explore Decision Dynamics.** MARIUS USHER, *Tel Aviv University*, & JUAN GAO, REBECCA K. TORTELL, & JAMES L. MCCLELLAND, *Stanford University* (read by James L. McClelland)—Dynamical models of decision making assume that participants in speeded reaction time tasks respond when a decision variable reaches a bound, but what happens when an external signal indicates when it is time to respond? In some theories, the decision is still based on bounded integration, but in others, decision variables remain continuous and subject to change until the stimulus ends or the response signal occurs. Some existing findings support the idea that decision states can remain fluid until a response is required, and the leaky, competing accumulator model can account for evidence some take as supporting bounded integration. We present evidence from new experiments in which the direction and coherence of random dot motion signals vary within the observation period. The duration of the observation period also varies. We then present simulations and theoretical analysis assessing bounded integration and leaky, competing accumulator models of the process underlying the data.

2:10–2:25 (97)

**A Unified Model of Conservatism, Base-Rate Neglect, and Bayesian Inference.** JONATHAN D. NELSON, *Max Planck Institute for Human Development*, REZA SHAHBAZI, *Cornell University*, & TERRENCE J. SEJNOWSKI, *Salk Institute Computational Neurobiology Laboratory and Howard Hughes Medical Institute*—Bayes's theorem provides a potential descriptive account of human belief updating. Edwards suggested that people are qualitatively Bayesian, but conservative, making too much use of base rates and neglecting likelihoods. Several recent Bayesian models of cognitive and perceptual tasks incorporate conservatism. Kahneman and Tversky suggested that people are not conservative, but rather too aggressive in belief updating, exhibiting base-rate neglect. Some accounts attempt to explain base-rate neglect, yet themselves neglect conservatism. Scant research has attempted to unify these perspectives. We introduce a concise, unified Bayesian model. Our model illustrates how beliefs about noise in the data, imperfect memory, or communicative pragmatics could lead optimal Bayesians to falsely appear to exhibit either base-rate neglect or conservatism.

2:30–2:45 (98)

**Comparing Learning Models of Sequential Decision Making.** JÖRG RIESKAMP, *University of Basel*, & JEROME R. BUSEMEYER, *Indiana University, Bloomington*—Decisions are frequently made on the basis of past experience. The present work examines how people make decisions in situations in which decisions' outcomes depend on previous decisions, so that people have to find the best decision path. In the experiment, the participants faced a situation in which they made three decisions and the outcome of the last two decisions depended on their previous decisions. The experimental results show that most participants learned the optimum sequence of decisions. This learning process was modeled with two learning models. The first reinforcement learning model assumes that the complete paths that can be taken are the object of reinforcement. The second temporal difference learning model assumes that the possible decisions that can be made given the state of previous decisions are the object of reinforcement. When testing the models against each other, the temporal difference model predicted the observed learning process best.

2:50–3:05 (99)

**New Mechanisms for the Less-Is-More Effect: A Signal Detection Approach.** KONSTANTINOS V. KATSIKOPOULOS, *Max Planck Institute for Human Development*—A strong prediction of the theory of heuristics is that less information leads, under some conditions, to

more accuracy. Pleskac (2007) argued that the condition  $A \text{ (validity of the experience cue)} > B \text{ (accuracy of knowledge used for comparing two experienced objects)}$  is necessary and jointly sufficient with high sensitivity. For Goldstein and Gigerenzer (2002) and Pleskac (2007), the mechanism for the less-is-more effect is that as more objects are recognized or experienced, knowledge is used instead of recognition or experience. I propose two new mechanisms. Surprisingly, they include the condition  $A \leq B$ . The effect is predicted if, additionally, (1) hit rate is medium and false alarm rate is low, or (2) false alarm rate is high and hit rate is low. As more objects are experienced, in (1) guessing is used instead of experience or knowledge, and in (2) erroneous recognition is used instead of guessing or experience.

3:10–3:25 (100)

**Disjunction Fallacies in Episodic Memory: Integrating Fuzzy Trace Theory and Support Theory.** VALERIE F. REYNA & CHARLES J. BRAINERD, *Cornell University*—Disjunction fallacies have been extensively studied in probability judgment because they are core predictions of a leading theory, support theory. However, fuzzy trace theory predicts that disjunction fallacies arise at the deeper level of episodic memory. These episodic disjunction fallacies fall directly out of the equations of fuzzy trace theory's retrieval model. In a series of experiments, disjunction fallacies were consistently detected in episodic memory, for individuals as well as groups, and the model's quantitative predictions about those effects were quite accurate. Episodic disjunction fallacies varied reliably as functions of four theoretically specified manipulations (type of memory probe, immediate vs. delayed testing, word frequency, and emotional valence), and as predicted, memory retrieval and response bias jointly determined the magnitudes of these effects. The two accounts of disjunction fallacies can be reconciled by using fuzzy trace theory's retrieval equations to parameterize support theory's support function.

Faces of Familiarity

Grand Ballroom, Friday Afternoon, 4:10–5:25

Chaired by Lisa K. Son, *Barnard College, Columbia University*

4:10–4:25 (101)

**Knowledge of One's Lack of Knowledge.** LISA K. SON & MARIA EVANS, *Barnard College, Columbia University*—How do you know that you do not know? In the past, metacognitive research has focused on people's know judgments. The issue of judging one's lack of knowledge, however, has typically been clustered together with knowing, or simply disregarded. We present a study that investigated the don't-know judgment, and its relation to category familiarity. Participants first memorized the sizes and names of nonsense categories, and also a variable number of exemplars that belonged to those categories. Then, they were given trials in which a category was presented along with an item that did or did not belong to the category. Their task was to say yes, no, or that they didn't know whether the item belonged. Reaction times for saying that they didn't know were of particular interest. The results show that know and don't-know judgments are driven by different types of knowledge, and contribute to our understanding of familiarity structures.

4:30–4:45 (102)

**The Role of Answer Familiarity in the Multiple-Choice Testing Effect.** YOONHEE JANG, DAVID E. HUBER, & HAL PASHLER, *University of California, San Diego* (read by David E. Huber)—Previous research has found no testing effect advantage in multiple-choice testing when "none of the above" (NOTA) was the correct choice during retrieval practice, but there was a robust testing effect when NOTA was incorrect. However, in the latter situation, the correct answer was the only answer of high familiarity. Across three experiments, we examined the role of answer familiarity in the multiple-choice testing effect. We found that the distribution of answer familiarity matters, producing no advantage when the alternative answers are uniformly novel or uniformly familiar. However, there was a testing effect when NOTA was the correct choice, provided that just one alternative answer was familiar. Thus, the testing effect in multiple-choice testing exists when there is just one familiar

answer, regardless of whether that answer is correct or incorrect. This suggests that familiarity serves to focus attention on potential answers to guide retrieval attempts.

#### 4:50–5:05 (103)

**On the Resilience of the Standard Interpretation of Processing Fluency.** DEANNE L. WESTERMAN, JUSTIN M. OLDS, & BRIAN P. KURILLA, *Binghamton University*—Stimuli that are processed fluently tend to be regarded as familiar and are more likely to be classified as *old* on a recognition test. Recently, it has been shown that the relationship between fluency and positive recognition judgments can be easily reversed (Unkelbach, 2006, 2007). When participants are given a brief training phase in which previously studied stimuli are associated with lower levels of fluency, and feedback is given during training, there is a reversal of the standard fluency effect, and fluent stimuli are more likely to be classified as *new*. The present study investigated the resilience of the reversed fluency effect by determining whether it persists across a delay between training and test or a change in context. The results show that the reversal of the fluency heuristic is short-lived, and that participants revert to the standard interpretation of enhanced fluency as familiarity quite readily.

#### 5:10–5:25 (104)

**Context Effects in Episodic Recognition of Famous Versus Nonfamous Faces.** LYNNE M. REDER, *Carnegie Mellon University*—Subjects viewed celebrities and unfamiliar faces that were superimposed on identifiable scenic locations (e.g., Mount Rushmore) and judged the likelihood of the person actually visiting the location. Backgrounds were randomly assigned to be seen (1) with famous or unfamiliar faces and (2) with many faces (“Hi Fan”) or only one (“Low Fan”) during encoding. The surprise posttest asked subjects to recognize whether the face was rated earlier, regardless of whether or not the background was the same as before. Half of the backgrounds were reinstated and half were swapped with another face’s background. Recognition was better when the background was a reinstatement, but this advantage was modulated by the fan of the background and by the fame of the face. An explanation for this pattern is offered on the basis of the thesis that familiarity stimuli are easier to associate with context. Supporting evidence is also provided.

#### Selective Attention III

#### Constitution Ballroom, Friday Afternoon, 3:10–5:25

*Chaired by Stephen R. Mitroff, Duke University*

#### 3:10–3:25 (105)

**Generalized “Satisfaction of Search”: Adverse Influences on Dual-Target Search Accuracy.** MATHIAS S. FLECK, EHSAN SAMEI, & STEPHEN R. MITROFF, *Duke University* (read by Stephen R. Mitroff)—The successful detection of a target in a radiological search can reduce the detectability of a second target, a phenomenon termed “satisfaction of search” (SOS). Here, we investigate the generality of SOS to simultaneously inform radiology, cognitive psychology, and non-medical, real-world searches. Our experiments, utilizing nonmedical searches and untrained searchers, suggest that SOS is affected by several factors, including (1) relative salience and frequency of different target types, (2) time pressure, (3) perceptual set, (4) search instructions, and (5) reward pressure. Collectively, SOS arises when searchers have an expectation about the likelihood of a target type and when they are under pressure to perform quickly. This first demonstration of SOS outside of radiology might implicate a default heuristic that could affect search broadly. For example, the present data suggest that the detection of easy-to-spot targets in baggage screening (e.g., water bottles) might reduce detection of hard-to-spot targets (e.g., box cutters).

#### 3:30–3:45 (106)

**Perceptual Load Theory: Much Ado About Nothing.** YEHOASHUA TSAL & HANNA BENONI, *Tel Aviv University*—In a critical discussion of the theory, we conclude that perceptual load is not a major factor in attentional selection. We will focus on the following problems:

(1) “Perceptual load” has never been defined and its manipulations have been guided by intuitions. (2) The hypothetical construct “perceptual load” and its operationalization, “display size,” have often been confused, leading to puzzling interpretations. (3) The major tenets of the theory are based on incoherent assumptions rather than testable hypotheses. (4) The theory makes opposite predictions for perceptual load manipulations and sensory (or cognitive) load manipulations. Given that the distinctions between the above concepts are often fuzzy, any possible result could “support” the theory by assigning a particular load to a particular pattern of results obtained. (5) In the major manipulation, display size, perceptual load is completely confounded with dilution. The latter factor is responsible for the effects traditionally attributed to perceptual load.

#### 3:50–4:05 (107)

**Target–Distractor Competition Influences the Compatibility Effect Under Low Perceptual Load.** YEI-YU YEH, YEN-HO CHEN, & CHENG-TA YANG, *National Taiwan University*—Three experiments were conducted to investigate the context in which a task-irrelevant distractor is processed to the late stage of response selection under low perceptual load. The results of Experiment 1 showed that the compatibility effect was reduced with an increasing number of redundant targets and was eliminated with five targets. The results of Experiments 2 and 3 showed that four redundant targets eliminated the compatibility effect caused by three redundant distractors only when the distractors were not perceptually grouped and the focus of attention could hence be widened. A hierarchical diffusion modeling approach provided converging evidence, showing that distractor compatibility influenced how fast information accumulated toward a correct decision. This compatibility effect was eliminated when five redundant targets won over a singleton distractor or when four redundant targets won over three grouped redundant distractors. The results suggested that target–distractor competition for recognition and selection in visual short-term memory underlies the compatibility effect.

#### 4:10–4:25 (108)

**Stimulus-Driven Capture by Abrupt Onsets: Evidence Against Nonspatial Filtering.** JAN THEEUWES, DANIEL SCHREIJ, & CHRISTIAN N. L. OLIVERS, *Vrije Universiteit Amsterdam*—Whether attentional capture is contingent on top-down control settings or is involuntarily driven by salient stimuli is still widely debated. Schreij, Owens, and Theeuwes (2008) demonstrated that an onset distractor caused a response delay even when participants adopted an attentional set for a color feature. This contradicts the contingent capture hypothesis and is consistent with stimulus-driven attentional capture. However, Folk, Remington, and Wu (2009) claimed that this delay does not reflect capture, but rather nonspatial filtering costs. The present study shows that the effect of abrupt onsets is in fact spatially modulated, in that the onset (1) interferes more when presented close to a target, (2) generates inhibition of return specific for its location, and (3) speeds up performance when coinciding with the target location. Moreover, adding onsets to the display has similar effects as does adding attentional-set-contingent distractors. We conclude that onsets capture attention independently of attentional set.

#### 4:30–4:45 (109)

**Does Feature Detection Require Focal Attention?** HOWARD E. EGETH & JEFFREY MOHER, *Johns Hopkins University*—Feature integration theory suggests that a feature can be detected preattentively on the basis of activity in a hypothetical feature map. Subjects responded to the presence or absence of a single red letter in a circle of gray letters surrounding fixation. Subjects were faster to indicate the presence of a red letter when that letter’s identity was repeated from the previous trial, even though identity was task irrelevant. This suggests that focal attention was directed to the letter, even in a simple feature detection task (cf. Theeuwes, Van der Burg, & Belopolsky, 2008). However, we found no repetition priming in a similar task with unfamiliar characters instead of English letters, or with heterogeneous displays in which the target color was not a singleton. These and related data suggest that a simple

feature target can be reported as present without first being selected by focal attention.

4:50–5:05 (110)

**Suppression of Salient-but-Irrelevant Objects in Visual Search Overcomes Distraction: An ERP Study.** JOHN J. McDONALD, JESSICA J. GREEN, ALI JANNATI, & VINCENT DI LOLLO, *Simon Fraser University*—To find an object of interest in the visual field, observers must often overcome distraction by more salient, but irrelevant, objects. It remains unclear how—and at what processing stage—this is accomplished. According to one theory, the most salient item in the display captures attention automatically, delaying voluntary shifts of attention to a less salient target. According to other theories, the capture of attention by salient distractors can be prevented, possibly by suppressing distractor processing. Using an ERP component called the distractor positivity, we show that information arising from a salient distractor is suppressed early or late, depending on advance knowledge of the distractor's defining feature. Suppression of a predictable distractor occurred early (100–200 msec) and prevented the distractor from capturing attention. Suppression of an unpredictable distractor occurred late (350–400 msec) and prevented further processing of the distractor after it had captured attention.

5:10–5:25 (111)

**Neural Predictors of Within-Subjects Fluctuations in Attention Capture Over Time.** ANDREW B. LEBER, *University of New Hampshire*—Whether salient objects automatically capture attention has long been the subject of considerable controversy. A possible resolution, investigated in this fMRI study, is that observers vacillate between periods when attention capture is high and when it is negligible. Observers searched static displays for a target circle among nontarget squares; an irrelevant color singleton distractor appeared on 50% of trials. A whole-brain data-driven analysis was designed to determine whether fluctuations in the fMRI signal predicted RT on a trial-by-trial basis; results revealed several regions in frontal and parietal cortices from which the momentary degree of distractor interference (distractor-present – distractor-absent RT) could be predicted. Thus, these data confirm that within single sessions, individuals do indeed vacillate between susceptibility and resistance to attention capture. Additional analyses characterized how fluctuations in frontoparietal signal predict (1) evoked response in early visual regions and (2) behavioral performance at various display set sizes.

#### Collaborative Cognition

Republic Ballroom, Friday Afternoon, 3:50–5:25

*Chaired by Michael F. Schober, New School for Social Research*

3:50–4:05 (112)

**Copresence and Improvisation Quality in Jazz Musicians' Performance.** MICHAEL F. SCHOBBER & MICHELLE F. LEVINE, *New School for Social Research*—When musical duos perform together live, they coordinate by relying on combinations of auditory and visual cues that are not yet fully understood. The present study analyzes a corpus of 90 performances of the same piece by 30 experienced jazz piano and saxophone duos. Each duo (in different counterbalanced orders) played the same piece in the same physical space, in separate spaces mediated by video and audio, and in separate spaces mediated only by audio. The piece, specially composed for the study, included notated sections and improvised sax and piano solos. All 90 performances were blindly rated by experts—jazz musicians with substantial experience as academic and competition jurors—on various aspects of quality of coordination and ensemble playing, as well as on improvisation quality. Discrepancies between musicians' self-reported feelings of copresence and the rated quality of collaboration have implications for the role of visual and auditory cues in successful musical coordination.

4:10–4:25 (113)

**Lighten Your Load: Social Processes Constrain the Visual Perception of Weight.** ADAM DOERRFELD, *Rutgers University, Newark*, NATALIE SEBANZ, *Radboud University Nijmegen*, & MAGGIE

SHIFFRAR, *Rutgers University, Newark* (read by Maggie Shiffrar)—Visual percepts reflect the observer's ability to act (e.g., Gibson, 1979; Proffitt, 2006). As inherently social beings, observers frequently act in concert with others. We investigated whether the visual perception of weight depends upon the presence and action capabilities of other people. Observers judged the weights of boxes of potatoes or golf balls that weighted between 1 and 20 pounds in the presence of a co-actor who did or did not help lift. Boxes appeared lighter whenever the observer expected lifting help from the co-actor, unless the co-actor was physically injured. This effect extended to the perceived weights of boxes in photographs that were held by one or two people. Volume perception was unaffected by co-lifters. These results support the hypothesis that the ability to act in conjunction with other people influences observers' percepts of the physical world.

4:30–4:45 (114)

**Effects of Multiple Speakers (Copresent or Not) on Dialogue Context.** GREGORY A. PERRYMAN & SUSAN E. BRENNAN, *Stony Brook University* (read by Susan E. Brennan)—In dialogue contexts with lexical competitors, listeners tend to interpret deaccented words as anaphoric and accented words as nonanaphoric (Dahan, Tanenhaus, & Chambers, 2002; Ito & Speer, 2008). Is dialogue context tracked in a speaker-specific way? We had listeners follow instructions produced by two speakers in a visual context to select colored shape targets ("Click on the green circle"); on critical trials, the speaker changed and the target was a different color but the same shape as the previous target. Listeners identified targets more quickly relative to same-color competitors when speakers used contrastive accents (L+H\*) on the adjective (e.g., "Click on the BLUE circle"), but only when the second speaker was copresent with the first speaker during the previous instruction. This suggests that listeners can use contrastive stress as a cue across utterances from different speakers, and that they are sensitive to the presumed knowledge of speakers when interpreting spoken discourse.

4:50–5:05 (115)

**Referential Communication, Not Labeling Alone, Affects Categorization.** JOHN K. VOIKLIS, *Stevens Institute of Technology*, & JAMES E. CORTER, *Teachers College, Columbia University* (read by James E. Corter)—We compared how the public versus private use of referential labels affects the discovery of category structure defined on novel objects. Ninety participants learned to predict functional features, <nutritive> and <destructive>, that implicitly defined four unlabeled categories of fictional aliens. A one-dimensional rule predicted one function, whereas a family resemblance predicted the other. In one learning condition, participants communicated with a remote partner. In another condition, participants recorded audio descriptions for their own later use. In a third condition, participants worked silently. Before and after learning, each participant worked individually to sort exemplars; a posttest yielded data on selective attention to features. By every measure examined, dyadic learning was better and more efficient than individual learning, even in comparison with individuals who self-described exemplars. We conclude that negotiating conventions of reference with another person may enhance attention to and memory for relationships among perceptual features and their associations with functional significance.

5:10–5:25 (116)

**The Power of Three: Why the Third Person Matters.** JENNIFER WILEY, ANDREW F. JAROSZ, & PATRICK J. CUSHEN, *University of Illinois, Chicago*, MELINDA S. JENSEN, *University of Illinois, Urbana-Champaign*, & THOMAS D. GRIFFIN, *University of Illinois, Chicago*—How and when does collaboration improve problem solving, reasoning, and learning? Although intuitively, many people believe that two heads working together should be better than one, the literature has in fact shown that the opposite result is more likely, and that working with others does not generally or naturally seem to improve performance over individual contexts. Nevertheless, across several studies, we have found a robust advantage of working in triads versus working in dyads or alone on several problem-solving and learning outcomes. The mechanisms by which group size may exert its influence on performance



is explored through examination of the composition of the groups, the discourse from the group interactions, and associated learning products. Further, some specific alternative hypotheses about why the third person may matter will be discussed.

### Psycholinguistics I

#### Independence Ballroom, Friday Afternoon, 3:30–5:25

*Chaired by Matthew J. Traxler, University of California, Davis*

#### 3:30–3:45 (117)

**Syntactic Priming in Comprehension: Residual Activation or Implicit Learning (or Both)?** KRISTEN M. TOOLEY & MATTHEW J. TRAXLER, *University of California, Davis* (read by Matthew J. Traxler)—Speakers and comprehenders are sensitive to syntactic structure information in preceding sentences. Syntactic priming effects may reflect residual activation of the primed structure, implicit learning, or both. Three eyetracking experiments investigated the sources of syntactic priming. In the first experiment, participants completed five separate sessions. In each session, participants read 24 pairs of syntactically complex prime and target sentences. Fixation time data showed a linear decrease in reading time for prime sentences across the five sessions, and significant savings in target sentence reading time over and above the linear decrease in prime sentence RT. These results suggest that both residual activation and implicit learning contribute to syntactic priming effects. Experiments 2 and 3 investigated whether priming occurs when unrelated sentences intervene between the prime and the target. Equivalent syntactic priming was observed when no, one, or three unrelated sentences intervened between primes and targets.

#### 3:50–4:05 (118)

**Eye Movements During Mindless Reading.** ERIK D. REICHLER & ANDREW E. REINEBERG, *University of Pittsburgh*, & JONATHAN W. SCHOOLER, *University of California, Santa Barbara*—Mindless reading occurs when a reader's comprehension has ceased but his/her eyes continue to move across the page. Despite the ubiquity of this phenomenon, very little is known about what happens in the mind during mindless reading. The present eye-movement study compared eye movements collected during intervals of normal versus mindless reading. Comparisons indicated gross differences between the two types of eye movements (e.g., more erratic scan paths during mindless reading). And relative to normal reading, fixations during mindless reading were longer in duration and were largely affected by linguistic variables (e.g., word frequency). The latter finding suggests that whatever cognitive processes normally guide eye movements during reading exert less control during mindless reading. The results are also consistent with cognitive-control models of eye-movement control during reading and provide support for the distinction between awareness and meta-awareness.

#### 4:10–4:25 (119)

**Repetition Facilitates Eyetracking Measures of Early Word Recognition.** PETER C. GORDON, *University of North Carolina, Chapel Hill*—A number of studies have shown that recognition of words that are repeated in experimental materials show facilitation on eyetracking measures of word recognition during reading. However, current models of eye-movement control during reading either do not incorporate mechanisms whereby repetition could prime word recognition independently of predictability or do not accord a major role to word recognition in the control of eye movements. The experiments reported here show that lexical repetition has an effect on word recognition that is independent of predictability and of the extent to which the repeated word is easily integrated into the meaning of the sentence. The facilitative effect of word recognition is seen on eyetracking measures of early processing—skipping rate, first-fixation duration, and gaze duration. These findings provide evidence that recognition is strongly influenced by recent lexical exposure and provide a challenge to current models of eye-movement control during reading.

#### 4:30–4:45 (120)

**Generating “Joints” in Cognitive Dynamics: The Effects of Negation on Mouse-Movement Trajectories in a Sentence Verification Task.**

RICK DALE & NICHOLAS D. DURAN, *University of Memphis*—A growing strand of research has employed semicontinuous tracking of arm movements (e.g., through the computer mouse, or Nintendo Wii remote) as a dynamic signature of unfolding cognitive processes. These studies have demonstrated a systematic covariation between cognitive processes and response execution. Often this work seeks smooth or nearly smooth trajectories in analysis, discarding any data showing “changes of mind”—rapid shifting of the arm dynamics within a trial—as noise. We present a new analysis that embraces these rapid shifts in cognitive dynamics as signal rather than noise. In two experiments, the effects of negation on sentence verification are explored and, in particular, discrete-like shifts in sentence processing. We discuss the results in terms of an integrative, plural perspective on cognition: Dynamic and symbolic accounts of the mind may be usefully integrated in explaining real-time cognition.

#### 4:50–5:05 (121)

**Context Affects Semantic Priming of Number Names.** JAMIE I. D. CAMPBELL, *University of Saskatchewan*, & BERT REYNVOET, *Katholieke Universiteit Leuven*—Campbell and Metcalfe (2008) found that naming single-digit Arabic numbers was about 15 msec slower when performed in the context of number-fact retrieval (multiplication) than in the context of a task requiring semantic processing (magnitude comparison). They proposed that the comparison context enabled both semantic and asemanic pathways for number naming, but number-fact retrieval ( $2 \times 3 = ?$ ) inhibited the semantic route. To pursue this hypothesis, we adapted their paradigm by introducing a semantic priming manipulation. In comparison blocks, digit naming was 8 msec faster immediately after naming near digit primes ( $\pm 1$ ) in comparison with far primes ( $\geq 3$ ), but there was no evidence for priming in multiplication blocks. The results reinforce the theory that number-fact retrieval can inhibit the semantic route for digit naming.

#### 5:10–5:25 (122)

**Instruments Are Not Automatically Primed by Verbs.** CHUNG-I SU & GAIL MAUNER, *University at Buffalo* (read by Gail Mauner)—Ferretti et al. (2001) argued that some verbs automatically prime noun instrument role fillers. We investigated whether their results were due to an instrument expectation strategy that would lead to both inhibition for unrelated targets when the expectation is violated and facilitation for related targets when it is met. After replicating their study and results, we used a neutral (blank screen) rather than an unrelated (verb) baseline to eliminate expectation violations. Instrument priming was not significant and effect size was reduced. We then used continuous priming to eliminate all instrument expectations. No priming was observed and effect size was further reduced. These results demonstrate that instrument priming obtained with paired-word presentation, lexical decision, and short SOA is strategic rather than automatic. Whether other participant role-filler priming effects are strategic or automatic remains to be clarified by replication using continuous priming procedures that do not encourage strategy formation.

### Explicit Memory I

#### Back Bay Ballroom C, Friday Afternoon, 3:50–5:25

*Chaired by Aude Oliva, MIT*

#### 3:50–4:05 (123)

**Remembering Thousands of Images With High Fidelity.** AUDE OLIVA, TIMOTHY F. BRADY, & TALIA KONKLE, *MIT*, & GEORGE A. ALVAREZ, *Harvard University*—Although it is known that human long-term memory capacity for images is massive, the fidelity with which human memory can represent such a large number of images is an outstanding question. We conducted three large-scale memory experiments to determine the details remembered per image in both objects and natural scenes, by varying the amount of detail required to succeed in subsequent memory tests. Our results show that contrary to the commonly accepted view that long-term memory representations contain only the gist of what was seen, long-term memory can store thousands of items with a large amount of detail per item. Further analyses reveal that memory for an item depends on the extent to which

it is conceptually distinct from other items in the memory set, suggesting that a “conceptual hook” is necessary for maintaining a large number of high-fidelity representations of objects and scenes in visual long-term memory.

4:10–4:25 (124)

**Memory and Domain-Specific Expertise: Knowledge Affords Distinctive Processing.** KATHERINE A. RAWSON, *Kent State University*, & R. REED HUNT, *University of Texas, San Antonio* (read by R. Reed Hunt)—The domain-specific memory advantage of experts traditionally is attributed to enhanced organizational processing. In earlier work, we revised this interpretation by proposing that knowledge allows a distinctive processing advantage, which better describes the expert’s memory. Distinctive processing is the processing of difference in the context of similarity, a definition that entails organizational processing supplemented by item-specific processing. We report three experiments requiring difficult recognition memory decisions about the prior occurrence of (American) football terms. Participants had either higher or lower levels of knowledge about football. Through manipulation of materials and orienting tasks, the results variously showed expertise advantages on hits but not false alarms, on hits and false alarms, and on hits but with disadvantages on false alarms. All results were predicted by the distinctive processing account of expert memory.

4:30–4:45 (125)

**The Effects of Experience on Memory and Perception.** ANGELA B. NELSON & RICHARD M. SHIFFRIN, *Indiana University, Bloomington* (read by Richard M. Shiffrin)—Frequency effects are found in explicit memory, knowledge retrieval, and perception. We train observers to form knowledge about Chinese characters, the number of presentations varying widely across characters. Training in Study 1 uses visual search, allowing high-frequency characters to become more similar to each other (context effects); training in Study 2 uses character matching, eliminating context effects and frequency-dependent similarity effects. Frequency effects were found in both studies in subsequent tests of recognition memory, “lexical decision,” and perceptual identification, demonstrating separate roles for absolute frequency and for context-based similarity. In Study 2, a 6-week delayed set of tests showed unchanged lexical decision effects, but greatly reduced recognition effects, suggesting that better performance for low-frequency items in Study 2 were due not to confusions of test items with similar list traces, but to confusions with traces of the test item in the training sessions.

4:50–5:05 (126)

**Effects of Emotional Arousal on Memory: Why Sometimes Retrograde Amnesia and Sometimes Retrograde Enhancement?** MARISA KNIGHT, *University of San Francisco*, & MARA MATHER, *University of Southern California* (read by Mara Mather)—Previous research reveals contradictory effects of emotional events on memory for neutral events that precede or follow them: In some studies, emotionally arousing items impair memory for immediately preceding or following items, and in others, arousing items enhance memory for preceding items. By demonstrating both emotion-induced enhancement and impairment, Experiments 1 and 2 clarified the conditions under which these effects are likely to occur. The results suggest that emotion-induced enhancement is most likely to occur for neutral items that (1) precede (and so are poised to predict the onset of) emotionally arousing items, (2) have high attentional weights at encoding, and (3) are tested after a delay period of a week rather than within the same experimental session. In contrast, emotion-induced impairment is most likely to occur for neutral items near the onset of emotional arousal that are overshadowed by highly activated competing items during encoding.

5:10–5:25 (127)

**Linking Emotional Items: When Is the Whole Less Than the Sum of Its Parts?** CARISSA ZIMMERMAN & COLLEEN M. KELLEY, *Florida State University* (read by Colleen M. Kelley)—Memory for emotional words is often better than memory for neutral words in tests of free recall. However, little is known about the intentional formation of relations in memory between emotional words. In a series of

experiments, we find that although free recall of positive and negative words is enhanced relative to neutral words, the pattern is surprisingly different for cued recall of positive, negative, and neutral word pairs. We discuss the possibility that differential cognitive processing during certain emotional states may produce variations in the way that emotional words can enter into relations in memory.

## Animal Cognition I

Back Bay Ballroom D, Friday Afternoon, 3:50–5:25

Chaired by David A. Washburn, *Georgia State University*

3:50–4:05 (128)

**Simians in the Shape School: A Comparative Study of Executive Function.** DAVID A. WASHBURN, MICHAEL J. BERAN, & THEODORE A. EVANS, *Georgia State University*, & KIMBERLY A. ESPY, *University of Nebraska, Lincoln*—Shape School was designed by Espy (1997) to assess development of children’s executive function. For this study, a computerized Shape School task was administered to 9 rhesus monkeys, which were trained to sort animated characters on the basis of shape or color, and to switch between the rules. Infrequently, an inhibition stimulus indicated that the monkeys should not respond. Monkeys that reached training criteria performed highly accurately (>90%) across trial types. Average accuracy on trials in which the response rule switched (e.g., sort on color when the previous trial required sorting on shape) was comparable with accuracy levels on no-switch trials. However, performance did vary reliably as a function of the number of consecutive trials of the same rule. These findings from monkeys will be compared with published Shape School data from normally and atypically developing children.

4:10–4:25 (129)

**Gray Parrot Number Acquisition: Parallels With and Differences From Young Children.** IRENE M. PEPPERBERG, SUSAN CAREY, & ELIZABETH S. SPELKE, *Harvard University*—A Gray parrot (*Psittacus erithacus*) had been taught, in ways that differed considerably from those used for children, to use English labels to quantify ≤6-item sets (including heterogeneous subsets; Pepperberg, 1994) and to label the corresponding Arabic numerals appropriately; without training, he inferred the relationship between the numerals and the sets of objects (Pepperberg, 2006). He was then trained to label vocally the Arabic numerals 7 and 8 and to order these Arabic numerals with respect to the numeral 6. He was subsequently tested as to whether he, like children, could infer the ordinality of the numerals 7 and 8 with respect to untrained numerals and the appropriate label use for collections of 7 and 8 items. His results demonstrate his capacity to build an exact symbolic integer system.

4:30–4:45 (130)

**Object Permanence in Dogs.** THOMAS R. ZENTALL, HOLLY C. MILLER, REBECCA RAYBURN-REEVES, & KRISTINA L. PATTISON, *University of Kentucky*—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. We also find that a perceptual (or higher order conditioning) solution is probably not sufficient to account for this performance. 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.

4:50–5:05 (131)

**Spatial and Nonspatial Information in Rats’ Working Memory for Object-Cued Food Site Locations.** JEROME COHEN & JOSEPH BARKHO, *University of Windsor*—We report a series of experiments in which rats have to remember the location of a marked food site that varies within a rectangular array of six object-cued ( $2 \times 3$ ) food sites

over trials. On some trials, an array will consist of identical objects, whereas on other trials it will consist of different objects arranged in a fixed configuration. The major question we ask is whether rats' accuracy for locating the position of a selected food site requires any specific combination of three possible types of information: the marked food site's global position within the foraging arena, its local position within the rectangular array, and its nonspatial representation of the "missing" object within the array consisting of different objects. To answer this question, we eliminate the relevance of each of the two types of spatial information during probe test trial segments.

**5:10–5:25 (132)**

**Do Pigeons Have Metamemory for Temporal Intervals?** ANGELO SANTI & ALLISON ADAMS, *Wilfrid Laurier University*—Whereas

a previous temporal duration discrimination study found evidence for metacognition in rats (Foote & Crystal, 2007), several visual discrimination studies have failed to obtain evidence of metamemory in pigeons (Inman & Shettleworth, 1999; Roberts et al., 2009; Sutton & Shettleworth, 2008). In the present study, pigeons were trained in a temporal discrimination task and then allowed to choose between stimuli that led to a memory test or to escape before the memory test was presented. In different test phases, the effects of sample omission, increases in retention interval, and variation in trial spacing on selection of the escape option and accuracy were studied. Overall, neither the frequency with which the escape option was selected, nor the accuracy on forced memory tests versus chosen memory tests varied in a way consistent with metamemory. However, some individual pigeons occasionally did show a pattern of results suggestive of metamemory.



### Perception

Grand Ballroom, Saturday Morning, 8:00–9:35

Chaired by J. Devin McAuley, Michigan State University

#### 8:00–8:15 (133)

**Prior Exposure to Auditory Rhythms Alters Responses to Visual Rhythms.** J. DEVIN MCAULEY, *Michigan State University*, MOLLY J. HENRY, *Bowling Green State University*, & JESSICA A. GRAHN, *MRC Cognition and Brain Sciences Unit*—Functional magnetic resonance imaging (fMRI) was used to characterize brain activity during perception of auditory and visual rhythms. In separate fMRI sessions, participants judged whether auditory and visual rhythms were “speeding up” or “slowing down.” Of interest were test rhythms, which implied a periodic beat that was not explicitly marked. Consistent with previous work, implied beat perception was weaker for visual rhythms than for auditory rhythms. However, responses to visual rhythms depended on prior exposure to auditory rhythms. Visual rhythms produced a stronger sense of beat when they were preceded by exposure to auditory rhythms than when they were presented first. Moreover, fMRI results revealed that visual rhythms with prior auditory exposure produced greater brain activity in the basal ganglia, right inferior operculum, supramarginal gyrus, and bilateral cerebellum in comparison with visual rhythms without prior auditory exposure. No such behavioral or neural order-dependent differences were found for auditory rhythms.

#### 8:20–8:35 (134)

**A Frequency-Range Discrimination Test of Absolute Pitch.** RONALD G. WEISMAN & LAURA-LEE BALKWILL, *Queen's University*, MARISA HOESCHELE & MICHELE K. MOSCICKI, *University of Alberta*, LAURIE L. BLOOMFIELD, *Algoma University*, & CHRISTOPHER B. STURDY, *University of Alberta*—Most researchers measure absolute pitch (AP) using pitch-naming tasks, which presume fluency with the names and positions of notes on the semitone scale of western music. Here, we report on an accurate test of AP that does not require note naming. The task requires subjects to solve a go/no-go discrimination, simply responding to positive tones and not to negative tones. To establish the validity of the discrimination, we tested subjects who scored high and low on a well-known note-naming test. We also tested the subjects on two measures of autism spectrum disorder.

#### 8:40–8:55 (135)

**What's Up With Slope?** FRANK H. DURGIN, *Swarthmore College*, ALEN HAJNAL, *University of Southern Mississippi*, & ZHI LI, *Swarthmore College*—The perception of geographic slope (surface slant relative to the horizontal plane) is greatly exaggerated, but so too are many of the theoretical claims made about slope perception. In fact, nearly everything you think you know about slope perception may be wrong. For example, palm boards, which are normally employed in the geographic slope literature, are wildly inaccurate measures of perceived slope that can accidentally seem correct. This is because the haptic perception of surface slope is distorted in ways that can sometimes match visual distortions. True proprioceptive measures (hand orientation without contact with a surface) can be quite accurate for near (small) surfaces in reaching space, but show systematic errors for farther ones, suggesting no special “dorsal” access to geographic slope. Here, we describe how biases in slope estimation are much more general and much more complex than has previously been appreciated. We consider coding theories that emphasize perceptual discrimination.

#### 9:00–9:15 (136)

**Correlation Versus Causation in Audiovisual Perception.** HOLGER MITTERER & ALEXANDRA JESSE, *Max Planck Institute for Psycholinguistics*—Perception benefits when an auditory and a visual source are available; for instance, when perceiving speech in noise. Multisensory information could be linked by learning an association between co-occurring sensory sources or by directly perceiving their common causative source (i.e., articulatory gestures). Testing these accounts is difficult, because association and causation are usually confounded. Piano tones, however, are caused by rarely observed hammers but are

associated with keystrokes. We examined the influence of seeing the hammer and the keystroke on auditory temporal order judgments (TOJs). Participants judged the temporal order of a dog bark and a piano tone, while seeing the piano stroke shifted temporally relative to its audio signal. Visual lead increased “piano-first” responses in auditory TOJs, but more so if only the associated (keystroke) as opposed to the causative (hammer) source was visible. This provides evidence for a learning account of audiovisual perception.

#### 9:20–9:35 (137)

**Perception of Synchrony Between Heard and Lipread Speech Is Not Special.** JEAN VROOMEN & JEROEN STEKELENBURG, *Tilburg University*—The perception of synchrony between the senses of a multisensory event is not straightforward. It has been suggested that stimuli that naturally belong together—such as heard and lipread speech—are more likely paired into a single multimodal event, and this tendency would make the relative temporal order of the components become lost so that paired stimuli are “ventriloquized” in time. We examined this idea using an audiovisual temporal order judgment (TOJ) task in which participants decided whether a sine-wave speech token or the corresponding lipread information was presented first. In contrast with the idea of intersensory pairing, sensitivity for temporal order was not worse if listeners were in “speech” rather than “nonspeech mode,” whereas control experiments showed that only listeners in speech mode integrated the two information sources. Perception of audiovisual synchrony thus does not depend on a high-level interpretation of the information sources.

### Attentional Blink

Constitution Ballroom, Saturday Morning, 8:00–9:15

Chaired by Shui-I Shih, University of Southampton

#### 8:00–8:15 (138)

**Searching for Multiple Targets Without an Attentional Blink.** SHUI-I SHIH, *University of Southampton*—Participants searched for four red target letters in rapid serial visual presentation (RSVP). On each trial, targets were consecutive or interleaved with distractors, and RSVP speed was slow or fast (7.5 or 12 Hz). Green distractors were also letters in one experiment, but digits in another. More targets were reported when distractors were digits as opposed to letters; when speed was slow as opposed to fast; and when targets were consecutive as opposed to interleaved. More important, an attentional blink (AB; a sharp reduction in report probability from the first to subsequent targets) was absent in all but one condition—fast RSVP, interleaved targets, and letter distractors—and its occurrence was attributed to intrusions from interleaved distractors. Conclusions: An attention window is much wider in the present task than in a conventional AB task; attention-gated distractors affect target processing in working memory only if they share target-defining features (e.g., category membership).

#### 8:20–8:35 (139)

**Attention Blinks for Recognition but Not for Judging Expected Value.** JANE E. RAYMOND, JENNIFER L. O'BRIEN, & YOSHIHIKO YAGI, *Bangor University*—Interacting with objects leads to their recognition and allows them to acquire expected value; that is, to become predictive of positive or negative outcomes. We previously showed that learning to associate monetary wins or losses with specific face stimuli (value learning) subsequently determined recognition performance when these stimuli were presented as the second of two targets in an attentional blink (AB) procedure. Although recognition of loss- or no-outcome-associated stimuli showed typical AB effects, recognition of win-associated stimuli produced no AB effect. Here, we asked whether the valence of expected value codes (win/loss) for previously learned stimuli is accessible during the AB and whether accessibility depends on motivational salience (i.e., probability of outcome during value learning)? After win/loss value learning, we found no AB effects for valence judgments although performance was high, albeit only for motivationally salient stimuli. An object's expected value can sometimes be readily accessed even when attention is divided.

**8:40–8:55 (140)**

**Where Does Attention Go When You Blink?** DAVID E. IRWIN, *University of Illinois, Urbana-Champaign*—Many studies have found that covert visual attention precedes saccadic eye movements to locations in space. The present research investigated whether the allocation of attention is similarly affected by eyeblinks. Participants completed a partial-report task under blink and no-blink conditions. Experiment 1 showed that blinking facilitated report of the bottom row of the stimulus array: Accuracy for the bottom row increased and mislocation errors decreased under blink in comparison with no-blink conditions, indicating that blinking influenced the allocation of spatial attention. Experiment 2 showed that this was true even when participants were biased to attend elsewhere. These results suggest that attention moves downward before a blink in an involuntary fashion.

**9:00–9:15 (141)**

**Shifting the Sparing: Novel Distractors Produce Lag 2 Sparing in a Contingent Attentional Blink Task.** CHARLES L. FOLK, *Villanova University*, ANDREW B. LEBER, *University of New Hampshire*, & HOWARD E. EGETH, *Johns Hopkins University*—Recent studies have shown that when subjects are required to report a letter of a particular color in a stream of multicolored letters appearing inside a fixation box, briefly changing the color of the box to the target color produces an attentional blink (Folk, Leber, & Egeth, 2008). The present experiments varied the categorical similarity between the target letter and the item occurring simultaneously with the change in the distractor box (i.e., the “distractor item” could be a letter, a digit, a random dot pattern, or a blank). Relative to letter distractor items, the other three item types produced an enhancement in target identification that was specific to lag 2. Subsequent experiments showed that this effect is sensitive to the categorical heterogeneity of the stream items, and is specific to the ordinal (rather than temporal) position of the distractor item. The results suggest that novelty can influence the dynamics of attentional gating.

**Psycholinguistics II****Republic Ballroom, Saturday Morning, 8:00–9:55**

*Chaired by Padraig G. O’Seaghdha, Lehigh University*

**8:00–8:15 (142)**

**Setting Boundaries: Tests of Structural Priming in Word Production.** PADRAIG G. O’SEAGHDHA, *Lehigh University*, JULIO SANTIAGO & ANTONIO ROMÁN, *University of Granada*, & JORDAN L. KNICELY, *Lehigh University*—Word shape and syllable position influences on speech errors suggest that structural priming occurs between whole words. Alternatively, structure is represented sublexically in syllabic fragments that facilitate corresponding or adjacent components (Sevold, Dell, & Cole, 1995). To test the first idea, we implemented a production version of a classic design in which speakers recited disyllable pairs sharing or differing in first syllable structure and/or content. In parallel English and Spanish experiments, we found tongue-twister-like effects of shared content but little effect of structural alignment. Recitation of word-initial fragments with disyllabic words provided only limited support for the sublexical fragment idea. Our findings are most consistent with the conclusion that word shape is only coarsely preserved across productions; for example, aligning onsets with word and syllable boundaries but not preserving syllable internal structure.

**8:20–8:35 (143)**

**Number Sense and Number Syntax: The Magical \* \* \*** KATHRYN BOCK, *University of Illinois, Urbana-Champaign*, & JASON KAHN, *University of North Carolina, Chapel Hill*—The fast, accurate ability to individuate small numerosities and the range of grammatical number systems in languages converge provocatively at a limit of three. To explore whether the convergence is a coincidence or an important cognitive confluence, we undertook two experiments to test the relationship between enumerating objects in simple arrays and naming objects in the same arrays. The arrays contained one to six objects. For arrays of the same objects at all numerosities between two and six, the naming task always elicited the same plural word (e.g., *forks*). Naming latencies revealed a

function that tracked enumeration latencies for the same arrays, with a discontinuity in plural naming times for arrays between three and four objects. There was no evidence for a grammar-constrained discontinuity between singular and plural. The results suggest that limitations on individuation that exist well before the onset of language acquisition continue to operate during adult language use.

**8:40–8:55 (144)**

**Cascaded Processing in Written Naming: Evidence From the Picture–Picture Interference Paradigm.** PATRICK BONIN & SÉBASTIEN ROUX, *LAPSCO/CNRS and Blaise Pascal University*—In three experiments, we investigated the issue of how information flows within the lexical system in written naming. In Experiment 1, participants named target pictures that were accompanied by distractor pictures having phonologically and orthographically related (e.g., a picture of a ball superimposed on a picture of a bed) or unrelated names. In Experiment 2, the related condition consisted of a target and distractor pictures that shared the initial letter but not the initial sound. Again, a facilitatory effect was observed on the latencies. In Experiment 3, a categorization task was used to rule out a perceptual account of the facilitation effects found in the naming experiments. The findings suggest that the activation within the lexical system in written naming flows in a cascaded manner, and thus, that the recognition of an object leads to the activation of its name.

**9:00–9:15 (145)**

**Interjections in the Performance of Jane Austen’s *Pride and Prejudice*.** DANIEL C. O’CONNELL, *Georgetown University*, & SABINE KOWAL, *Berlin University of Technology*—Three sets of primary and secondary interjections were compared: those in the text of Austen’s (1813/1994) *Pride and Prejudice*; those read aloud by six professional readers of the text; and those spoken in a film performance. Occurrences of interjections were, respectively 136 < 141 < 398. An astonishing 96% of the textual interjections were attributable to women characters. The findings are in accord with Nübling’s (2004, 2005) hypothesis of a spectrum of interjectional expressivity and with our own (2008) theory of spontaneous spoken discourse, particularly with respect to the development of the romantic relationship between Elizabeth Bennett and Fitzwilliam Darcy.

**9:20–9:35 (146)**

**Solving Drug Name Confusions Can Create New Problems.** RUTH S. DAY, *Duke University*—Drug name confusions are responsible for many medication errors. Names that are visually and/or phonetically similar are especially problematic. When a prescription drug is intended for a given patient, one with a similar name may be given instead. Recently, many pharmacies began using “Tallman” lettering to visually differentiate confusable names (e.g., the pair Chlorpromazine–Chlorpropamide is written as ChlorproMAZINE–ChlorproPAMIDE). However, there is no behavioral evidence that Tallman lettering works. Our visual search experiments asked participants to go get a particular drug bottle from pharmacy shelves. Tallman lettering increased—rather than decreased—medication errors overall, by as much as 30%, in some cases. Capitalizing subsets of letters can change the phonetic encoding of drug names, which interferes with many tasks, including prescribing, dispensing, and administering intended drugs. Problem solving in the real world, without sufficient knowledge of language perception and production, can lead to unfortunate consequences.

**9:40–9:55 (147)**

**Text Messaging As a Predictor of Spelling Ability.** DAVID S. KREINER & DANIELLE L. DAVIS, *University of Central Missouri*—We investigated the idea that individuals who make more use of text messaging have decreased spelling ability. The participants included 64 college students. In addition to providing self-reports of text messaging frequency, students completed a Text Abbreviations Test (TAT) as an indirect measure of their use of text messaging. On the basis of responses to the TAT, we computed two measures of text messaging knowledge for each participant: the difference between the number of real abbreviations and the number of fake abbreviations reported as having been

seen (sensitivity–seen) and used (sensitivity–used). Participants also completed the spelling section of the Wide Range Achievement Test–3. Spelling scores were not significantly correlated with self-report measures of text messaging frequency, but there was a significant positive correlation between sensitivity–seen from the TAT and spelling scores. The results do not support the hypothesis that increased knowledge of text abbreviations is related to lower spelling ability.

#### Explicit Memory II

**Independence Ballroom, Saturday Morning, 8:00–9:55**

*Chaired by Natalie Sebanz, Radboud University Nijmegen*

#### 8:00–8:15 (148)

**Your Words in My Memory: How Coaction Affects Recall.** NATALIE SEBANZ & TERRY ESKENAZI, *Radboud University Nijmegen*, ADAM DOERRFELD, *Rutgers University, Newark*, & GÜNTHER KNOBLICH, *Radboud University Nijmegen*—Individuals acting together have a tendency to take into account each others' tasks, even when this is not required. The present study investigated whether such "task sharing" leads to improved memory for information relevant to another person. Participants performed a categorization task alone and together. In a subsequent surprise recall test, they reported as many items as possible from the previous task. Our results demonstrate that participants recalled more of the items that were relevant to the other's task, compared with items of the same category encountered during individual task performance, or items of a control category irrelevant to both actors. Further experiments show that this effect of joint task performance on encoding occurs even when participants receive financial incentives to focus on encoding the items relevant to their own task performance. It is concluded that acting together may improve memory performance by affecting depth of processing.

#### 8:20–8:35 (149)

**Reconstructing Past Events by Averaging Retrieved Memories Across Individuals.** MARK STEYVERS, BRENT MILLER, PERNILLE HEMMER, & MICHAEL LEE, *University of California, Irvine*—When individuals independently recollect events or retrieve facts from memory, how can we average these retrieved memories to best reconstruct the actual set of events or facts? In this research, we report the performance of individuals in a series of general knowledge tasks, where the goal is to reconstruct from memory the order of historic events (e.g., the order of the U.S. presidents), or the magnitude along some physical dimension (e.g., the order of the largest U.S. cities). We also report performance of individuals in serial recall tasks in which the goal is to reconstruct the original order of episodic events. We aggregate the retrieved orders with several rank-order models, including a Thurstonian model and a Mallows model, as well as several probabilistic versions of serial recall models. We demonstrate a *wisdom of crowds* effect, whereby the memories aggregated across individuals come surprisingly close to the true answer.

#### 8:40–8:55 (150)

**Adaptive Memory: Ancestral Priorities and the Power of Survival Processing.** JAMES S. NAIRNE, *Purdue University*, & JOSEFA N. S. PANDEIRADA, *University of Aveiro*—Evolutionary psychologists often argue that we continue to carry around stone-age brains, along with a toolkit of cognitive adaptations designed originally to solve hunter-gatherer problems. This perspective makes the interesting prediction that optimal cognitive performance may sometimes be induced by ancestrally based problems, those present in ancestral environments, rather than by adaptive problems faced more commonly in modern environments. This prediction was examined in three experiments using the survival processing paradigm, in which retention is tested after participants process information in terms of its relevance to fitness-based scenarios. In all three experiments, participants remembered information better after processing its relevance in ancestral environments (grasslands) as opposed to modern urban environments (cities), despite the fact that all scenarios described similar fitness-relevant problems. These data suggest that our memory systems may be tuned to ancestral priorities.

#### 9:00–9:15 (151)

**Retrieval-Induced Forgetting and Executive Control.** M. TERESA BAJO, PATRICIA ROMAN, & MARIA F. SORIANO, *University of Granada*, & CARLOS J. GÓMEZ-ARIZA, *University of Jaen*—Retrieving information from long-term memory can lead people to forget previously irrelevant related information. Some have proposed that this retrieval-induced forgetting (RIF) effect is mediated by inhibitory executive control mechanisms recruited to overcome interference. In this study, we assessed whether inhibition in RIF depends on executive processes. The effect RIF obtained in a standard retrieval-practice condition was compared with that obtained from two different conditions in which participants had to perform two concurrent updating tasks demanding executive attention. Whereas the usual RIF effect was observed when retrieval practice was performed singly, no evidence of forgetting was found in the dual-task conditions. The results strongly suggest that inhibition involved in RIF is the result of executive control processes.

#### 9:20–9:35 (152)

**Exploring the Sequential Lineup Advantage Using WITNESS.** SCOTT D. GRONLUND & CHARLES A. GOODSELL, *University of Oklahoma*, & CURT A. CARLSON, *Texas A&M University, Commerce*—The sequential lineup has been advocated as an improvement over simultaneous lineup procedures; however, no formal explanation exists for why it is sometimes better. We used the computational model WITNESS (Clark, 2003) to explore theoretical explanations of the sequential lineup advantage. An exploration of WITNESS's parameter space revealed that the model could produce a sequential advantage by pairing conservative sequential choosing with more liberal simultaneous choosing. The model was fit to 10 published experiments that directly compared sequential with simultaneous lineup formats. WITNESS poorly approximated the 5 experiments that exhibited a large sequential advantage. Both decision-based and memory-based modifications were proposed as to how the model could better handle sequential lineups. The next step will be to undertake empirical research to test among these proposed explanations for the sequential lineup advantage.

#### 9:40–9:55 (153)

**Impact of Learning History on Collaborative and Individual Recall.** ADAM CONGLETON & SUPARNA RAJARAM, *Stony Brook University* (read by Suparna Rajaram)—Collaboration during retrieval lowers group recall in comparison with the group's potential. This counterintuitive phenomenon of collaborative inhibition has important implications for the common educational practice of group study. Previous findings show that repeated study reduces collaborative inhibition and increases organization (Pereira-Pasarin & Rajaram, 2007) and repeated recall in the context of collaboration can improve later individual memory (Blumen & Rajaram, 2008). In light of the testing effect literature that shows contrasting consequences of these two learning histories on individual memory, their relative impact on collaboration and on the collaboration cascade on later individual memory was tested. The repeated study advantage that occurs in individual recall at short delay was replicated. Repeated testing prior to collaboration abolished collaborative inhibition and enabled positive collaboration cascade on later individual memory. Findings are evaluated in terms of how learning history and collaboration together impact the organization, gains, losses, and recovery of studied information.

#### Spatial Cognition

**Back Bay Ballroom C, Saturday Morning, 8:00–9:55**

*Chaired by Timothy L. Hubbard, Texas Christian University*

#### 8:00–8:15 (154)

**Displacement of Location in Illusory Motion.** TIMOTHY L. HUBBARD, *Texas Christian University*, & SUSAN E. RUPPEL, *University of South Carolina, Upstate*—We examined whether displacement in the remembered location of a target typically found with actual motion is found with illusory line motion. In Experiments 1 and 2, a cue appeared



left or right of a subsequently presented stationary target line. In Experiment 3, either a single cue appeared or one of two cues vanished before the target appeared. In all experiments, the (remaining) cue and target then vanished, a probe line appeared, and participants judged whether the probe was at the same location as the previously viewed target. When a cue appeared, memory for the target was displaced toward the cue; displacement increased during the first 250 msec after the target vanished and when the cue was closest to the target. When a cue vanished, memory for the target was displaced in the opposite direction. Displacement from illusory motion is similar to displacement from actual motion and reflects high-level (top-down) mechanisms.

#### 8:20–8:35 (155)

**Right or North? Category and Perspective Effects on Spatial Memory.** QI WANG, *Tufts University*, TAD T. BRUNYÉ & CAROLINE R. MAHONEY, *US Army NSRDEC and Tufts University*, & HOLLY A. TAYLOR, *Tufts University* (read by Holly A. Taylor)—People integrate spatial and nonspatial information to structure their memory for an environment. Maddox, Rapp, Brion, and Taylor (2008) found that spatial and racial categories interacted in straight-line distance estimations. The present study extends this work by exploring spatial and nonspatial category effects on memory as a function of the spatial perspective required by the memory task. After studying a map and associated information about business locations, including the proprietor's race, participants performed a Euclidean distance estimation task and drew route maps, in counterbalanced order. The results suggest that categories differentially affect spatial judgments as a function of the task's spatial perspective requirement. People overestimated distances across categories for the survey perspective task, but overestimated within category for the route perspective task. Additionally, the perspective undertaken first (task order) and the preferred perspective affected responses. Taken together, the results suggest that there are perspective-based retrieval effects on spatial memory.

#### 8:40–8:55 (156)

**The Role of Immersion in Three-Dimensional Mental Rotation.** MARIA KOZHEVNIKOV, *George Mason University*—The majority of experimental studies on 3-D visuospatial processing have been conducted using traditional 2-D displays. We were interested in the contribution of immersion to 3-D image transformations and compared subjects' performance on spatial transformation tasks within traditional 2-D, 3-D-nonimmersive (3-DNI; stereo glasses), and 3-D-immersive (3-DI; head-mounted display with position tracking) environments. Twenty-five participants completed a Shepard and Metzler Mental Rotation Task (MRT), in which they mentally rotated 3-D objects along the picture (x), vertical (y), or depth (z) axes. Whereas the patterns of subjects' responses were not significantly different in 2-D and 3-DNI environments, we found a unique pattern of responses in the 3-DI environment, suggesting that immersion triggered significantly greater use of viewer-centered frame of reference than the two other nonimmersive environments. Overall, our findings suggest that 3-DI environments are different from 3-DNI and 2-D ones, and that immersion is necessary to provide adequate information for building the spatial reference frame crucial for high-order motor planning and egocentric encoding.

#### 9:00–9:15 (157)

**Estimation by Proxy: Size Judgments of Common Objects From Perception, Memory, and As Proxies for Food Portions.** ALINDA FRIEDMAN & GEOFF D. C. BALL, *University of Alberta*—Participants estimated the size of objects (e.g., a tennis ball) commonly used as proxies for portions of various foods. Their task was always to adjust the size of an image of a nonfood object displayed on a computer screen to match its actual real-world size. The nonfood objects were either (1) directly in front of the participants; (2) sized from memory; or (3) sized from memory while participants were thinking of them as representing portions of specific foods. The largest absolute errors occurred while participants were thinking about the objects as proxies for food portions, even when the food condition followed the perception condition. In addition, body mass index predicted error rates and all conditions

were well fit by power functions. The data extend a metrics and mapping model to portion size estimation and implicate embodied cognition as a mechanism in volumetric size estimates.

#### 9:20–9:35 (158)

**Expertise in Spatial Visualization: Can Geologists Reverse Time?** THOMAS F. SHIPLEY, *Temple University*, CATHRYN A. MANDUCA, *Carleton College*, & ILYSE RESNICK & CHRISTOPHER SCHILLING, *Temple University*—Geologists report being able to look at an outcrop and mentally animate the sequence of geologic transformations back to the original horizontal sedimentary layers. Previous research on expertise suggests that expert abilities may be domain specific (e.g., memory for locations in chess; Chase & Simon, 1973). We have found that for geologists, mental animation appears to be a general ability. A group of geologists and a group of age-, education-level-, and gender-matched controls attempted to reconstruct multiply faulted words (pieces were translated in opposite directions on either side of a diagonal cut through the words). The geologists performed substantially better than the controls. This ability is not restricted to ecologically plausible transformation. The geologists' performance with a second set of words, transformed by moving letter fragments in random directions, was comparable to the levels for the transformations based on geological fault movement. Visual routines that might subserve this mental transformation ability will be discussed.

#### 9:40–9:55 (159)

**Should Miss Congeniality Have Good Spatial Skills? Social and Spatial Skill Interactions.** AMY L. SHELTON, WAI YIM LAM, DIANA M. PAK, AMY M. CLEMENTS-STEPHENS, & ALEXANDRA J. MURRAY, *Johns Hopkins University*—Although we intuitively expect cognitive domains to interact, we often study them in relative isolation. However, neurological disorders often show patterns of impairment and sparing across domains. While investigating the relationship between spatial skills and traits associated with autism, we observed a robust correlation between social/communication skills and spatial perspective taking in healthy adults. By contrast, only attentional traits correlated with other mental spatial transformations. To understand the social/spatial relationship, we manipulated the “agency” of the to-be-imagined perspective in the perspective-taking task. We observed that taking the perspective of a doll (a person) was mediated by social skills, whereas taking the perspective of a block (an object) was not, suggesting an important interaction between one's social prowess and the spatial problem at hand. This interaction has practical implications for experimentation but also highlights the need to consider the nature of the everyday psychological phenomena that motivate our studies.

#### Decision Making II

Back Bay Ballroom D, Saturday Morning, 8:00–9:35

Chaired by Ruthanna Gordon, *Illinois Institute of Technology*

#### 8:00–8:15 (160)

**The Influence of Past Accuracy and Desirability on Source Credibility Judgments.** RUTHANNA GORDON & KRISTIN BRYANT, *Illinois Institute of Technology*—This study compared behavioral and explicit measures of source credibility judgment on the basis of two factors: a source's past record of accuracy, and its production of desirable statements. Whereas the former is a rational basis for predicting a source's future accuracy, the latter leads to optimistic but error-prone judgments. Participants read predictions from two sources varying in one of the two factors (in Experiments 1 and 2), or from one high-accuracy source and one high-desirability source (in Experiment 3). They then saw new accurate and inaccurate predictions, and were asked to say which source was most likely to produce each. Following this behavioral measure, participants made explicit judgments of credibility for both sources. When the factors were measured separately, participants showed behavioral sensitivity to both, but explicit awareness only of past accuracy. When the two factors were placed in conflict, however, both measures revealed judgments based entirely on past accuracy.



8:20–8:35 (161)

**Decisions From Experience and the Tendency to Rely on Small Samples.** IDO EREV, *Technion*—Previous studies of decisions from experience highlight four robust deviations from maximization. Decision makers tend to (1) underweight rare events; (2) explore too much when the number of alternatives is small (exhibit the payoff variability effect); (3) explore too little when the number of alternatives is large (converge to a local maximum); and (4) overreact to attractive foregone payoffs (exhibit “the big eyes effect”). These results suggest that the processes that underlay decisions from experience are closer to basic learning processes than to the processes that underlay decisions from description (the focus of mainstream behavioral decision research). The main properties of decisions from experience can be captured with a simple model assuming that decision makers rely on small samples of experiences in similar situations.

8:40–8:55 (162)

**Multicustering of Beliefs Within Societies: Correlational Inference From Small Samples.** RICHARD B. ANDERSON & JUSTIN M. GILKEY, *Bowling Green State University*—One important characteristic of human society is that individuals have intuitive beliefs about how various aspects of their environment correlate to other aspects. This research examines the hypothesis that the mathematical environment gives rise to multiple clusters of beliefs about the degree of relatedness between variables. Simulations demonstrated that when the sample size is extremely small (3), the sampling distribution of correlations is either U-shaped or W-shaped. Behavioral data indicated distributions that tended to approximate a W. Additionally, when people guessed because they felt they could not extract useful information from the sample, they were biased to guess that the population correlation was zero. Surprisingly, similar results occurred for larger samples ( $n = 25$ ). The findings suggest that a natural multicustering of sample correlations leads to a multicustering of beliefs about the population correlation, and that when given large samples, people may nevertheless base their judgments on very small subsamples.

9:00–9:15 (163)

**Big Number Effects in Direct Numerical Comparisons.** GARY L. BRASE, *Kansas State University*—People struggle with understanding very large numbers, such as millions or billions. Two contrasting results are that (1) total frequencies based on large reference classes (e.g., 2.7 million Americans) tend to exaggerate perceptions of low proportions, and (2) those same total frequencies tend to devalue perceptions of high proportions. Similar results do not occur with formats such as normalized frequencies (e.g.,  $x$  out of 100). Both evolutionary and nonevolutionary rationales exist for these patterns. To directly evaluate these results and explanations, a series of experiments used forced choice comparisons of total frequencies based on large reference classes versus normalized frequencies. Large reference class total frequencies produced the aforementioned big number effects across different-sized reference classes and different comparison sets.

9:20–9:35 (164)

**Children’s and Adults’ Number Line Estimates.** ROBERT T. DURETTE, ALEX M. MOORE, & MARK H. ASHCRAFT, *University of Nevada, Las Vegas* (read by Mark H. Ashcraft)—We tested grade school children and college undergraduates on a simple estimation task (“On a line labeled 0–100, what number corresponds to this hatch mark?”). Accuracy, reaction times, and eye movements (in adults) were analyzed to examine underlying cognitive processes involved in the estimations. Children showed the classic progression from logarithmic to linear number line representation by second (0–100 lines) and third (0–1,000) grades, and adults showed uniformly linear responding. Interestingly, third graders showed RT and error patterns similar to adults’, suggesting a “known midpoint” strategy of fast and accurate performance when the hatch mark was near the midpoint of “easy” lines (e.g., 48 on 0–100). This strategy disappeared on the 0–723 lines where the midpoint is not already known. Errors and eye movements further revealed the processes of estimation; for hatch marks away from the midpoint, adults scan from the nearest endpoint, and consistently overestimate as they do so.

## SYMPOSIUM III

**Visual Knowledge: Emergence of a New Discipline That Synthesizes Vision and Memory Theory**  
Grand Ballroom, Saturday Morning, 9:45–11:55

*Chaired by Haline E. Schendan, Tufts University, Boston University, and Athinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School*

How can people interact appropriately with and understand the world they see around them? Prior knowledge about the world influences visual perception, cognition, and task performance at conscious and nonconscious levels. Emerging research on visual knowledge synthesizes ideas regarding vision and memory, two important areas of psychology that have proceeded largely in parallel. By its integrative nature, the science of visual knowledge can also provide new insights to improve theories of vision and memory. This symposium features cognitive psychologists and cognitive neuroscientists using diverse perspectives and methods to study human visual knowledge and its brain basis. The talks will present ideas and findings that can facilitate stronger connections between research in cognitive psychology using sophisticated behavioral measures and cognitive neuroscience using brain measures. The research presented can facilitate cross-pollination of ideas across vision and memory science and promote integrative inquiry into the brain basis of human visual knowledge.

9:45–10:10 (165)

**Visual Simulation in Conceptual Processing.** LAWRENCE W. BARSALOU, *Emory University*—The conceptual system in the brain contains categorical knowledge that supports online processing (perception, categorization, inference, action) and offline processing (memory, language, thought). Semantic memory, the dominant theory of the conceptual system, typically portrays it as modular and amodal. According to this approach, amodal symbols represent category knowledge in a modular system, separate from the brain’s modal systems for perception, action, and introspection (e.g., affect, mental states, bodily states). Alternatively, the conceptual system can be viewed as nonmodular and modal, sharing representational mechanisms with the brain’s modal systems for perception, action, and introspection. On a given occasion, multimodal information about a category’s members is reenacted (simulated) across relevant modalities to represent it conceptually. Behavioral and neural evidence is presented showing that visual simulations contribute to the representation of categories during conceptual processing.

10:10–10:35 (166)

**A Multisource Model of Visual Scene Perception.** HELENE INTRAUB, *University of Delaware*—Scene perception cycles between visual sensory input and memory when fixations are interspersed with saccades. Intraub and Dickinson (2008) demonstrated that boundary extension (memory beyond the physical limits of a view) occurs when vision is interrupted for as little as 42 msec (commensurate with a saccade). In other research (with Dickinson & Michod), viewers were forewarned, fixated the boundary regions of photographs, and yet failed to eliminate boundary extension. I will suggest that scene representation is not *visual*; instead, even for pictures, it reflects a concatenation of multiple sources of knowledge. The primary structure is an egocentric representation of space that surrounds the viewer. This is “filled in” (in the case of a picture) by vision, amodal perception, and contextual knowledge. The goal is *not* to retain the spurious boundaries of each “snapshot,” but to provide a continuous representation of a continuous world that can never be viewed all at once.

10:35–11:00 (167)

**Categorical Visual Search.** GREGORY J. ZELINSKY, HYEJIN YANG, & JOSEPH SCHMIDT, *Stony Brook University*—Many real-world tasks require using general knowledge of visual objects, such as searching for any tablet to jot down a note. In one study aimed at understanding this form of categorical representation, subjects searched through random objects for either a specifically defined teddy bear (from a target preview) or a categorically defined bear. In another study, we manipulated

the availability of target information in three preview conditions: a picture of the target (an orange), a visually precise target label (the word *orange*), and a visually imprecise label (the word *fruit*). In both studies we found that gaze was guided most efficiently to the pictorially previewed target. However, we also found above-chance search guidance to categorical targets, with the degree of guidance decreasing as the target category became increasingly abstract. This evidence for categorical guidance challenges search theories, which have traditionally assumed the construction of target templates from specific visual features rather than general visual knowledge.

11:00–11:25 (168)

**Training Generalized Spatial Skills: Behavioral and Neuroimaging Evidence.** GIORGIO GANIS, *Athinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School, and Harvard University*—Spatial skills, critical for cognition, can be improved by training. Importantly, recent work shows that long-term training leads to generalizable knowledge representations—that is, change transcending stimulus and task parameters. Participants were tested on two spatial imagery tasks, mental rotation and mental paper folding, and on a nonspatial control task. Each individual participated in daily training sessions with one of the spatial tasks over 21 days. The results showed transfer to novel stimuli for the trained task, as well as transfer to the other, nontrained, spatial task. Improvement was not merely due to general factors because it was greater for the spatial tasks than for the control task. Similar effects, albeit smaller, were found with a shorter training session, indicating that the underlying processes and representations change rapidly. The results from a neuroimaging study with this paradigm suggest that both spatial and shape-based processes and knowledge representations are affected, but with different time courses.

11:25–11:50 (169)

**Brain Dynamics for Visual Object Knowledge.** HALINE E. SCHENDAN, *Tufts University, Boston University, and Athinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School*—Visual object cognition typically depends upon knowledge and improves with experience. Little is known about how knowledge is retrieved in neural circuits, especially during higher cognitive tasks and when viewing is more visually impoverished. In such cases, performance remains accurate at a cost of time and, according to perceptual hypothesis testing theories, depends more on top-down processing. A series of event-related potential and functional magnetic resonance imaging experiments investigated the timing and brain structures supporting knowledge retrieval while people categorized or recognized objects under various visual conditions. Findings motivated a two-state interactive framework of the brain dynamics for visual object knowledge. First, between 120 and ~170 msec, a bottom-up pass activates knowledge in occipitotemporal cortex for perceptual categorization. Second, between ~200 and 500 msec, bottom-up, top-down, and recurrent interactions among occipitotemporal and inferior lateral prefrontal cortex activate the object knowledge necessary for facilitating cognitive decisions about objects under diverse conditions.

11:50–11:55 (170)

**Commentary and Overview on Visual Knowledge.** HELENE INTRAUB, *University of Delaware*—The symposium will end with a summary of the central themes of the talks and an overview of the field of visual knowledge.

### Cognitive Control I

Constitution Ballroom, Saturday Morning, 9:40–11:55

Chaired by Ulrich Mayr, *University of Oregon*

9:40–9:55 (171)

**Eye Movements Reveal Task Selection Dynamics.** ULRICH MAYR, MIRANDA RIETER, & DAVID KUHN, *University of Oregon*—Some models of task switching assume a “special switch process,” such as loading rules into working memory, whereas others posit that switch trials simply contain more of the same processes as no-switch trials. We used eyetracking to assess the precise point in time at which task-set

information begins to control fixations toward task-relevant and away from task-irrelevant aspects. For switch frequencies of 25% or 50% and a short cue–stimulus interval (CSI) we find a sharp onset of fixation control, which is delayed for switch trials. For long CSIs, the delay is eliminated, indicating that the special process is absorbed into the preparatory interval. When switch frequency is high (75%), the delay is present whenever the CSI is short, even on no-switch trials. This pattern is consistent with the special-process account, but also suggests that when switch expectancy is high, even no-switch trials are treated like switch trials.

10:00–10:15 (172)

**The Difficulty Law of Motivation: fMRI (Noise) Increases Cognitive Control.** BERNHARD HOMMEL & LORENZA S. COLZATO, *Leiden Institute for Brain and Cognition, WERY P. M. VAN DEN WILDENBERG, Amsterdam Center for the Study of Adaptive Control in Brain and Behavior, & CRISTIANO CELLINI, Leiden Institute for Brain and Cognition*—Hillgruber’s (1912) “Difficulty Law of Motivation” states that people respond to increasing task demands by automatically increasing the amount of cognitive control exerted. Consistent with this law, we found that participants were more effective in controlling episodic retrieval of previous stimulus–response bindings, switching to a new task, and mastering conflict in a Simon task if they were exposed to 70-dB echo planar imaging noise sampled from an fMRI scanner. These findings have considerable theoretical implications, in questioning the widespread assumption that people are equally devoted to easy and more challenging tasks (thus undermining capacity models), and methodological implications, in suggesting that experiments carried out in fMRI scanners systematically overestimate contributions from cognitive control processes.

10:20–10:35 (173)

**Dissociating Neurocognitive Components Underlying Response Inhibition Using Transcranial Stimulation of Prefrontal Cortex.** FREDERICK VERBRUGGEN, *Ghent University, CHRISTOPHER D. CHAMBERS, Cardiff University, & ADAM R. ARON, University of California, San Diego*—Response inhibition supports flexible behavior in a constantly changing environment: When actions are no longer relevant, they can be stopped completely. Recent work shows that successful stopping depends on both inhibitory and noninhibitory attentional processes. In this study, we used the context-cuing paradigm (Verbruggen & Logan, 2009) to further examine the neurocognitive mechanisms of successful inhibition. We found that go latencies decreased but stopping latencies increased after delivery of theta-burst stimulation (TBS) of right inferior frontal gyrus (rIFG). Furthermore, TBS of rIFG tended to influence dual-task performance in general, as demonstrated by slower performance on trials on which two responses had to be executed. Combined, these findings suggest that rIFG may play a more general role in stopping than was initially assumed. Implications for current theories on neurocognitive mechanisms of response inhibition will be discussed.

10:40–10:55 (174)

**Unconscious Priming of Conscious Will: Subliminal Action Effects Modulate Experienced Agency and Control.** THOMAS GOSCHKE & KATRIN LINSE, *Dresden University of Technology*—Recent evidence indicates that the experience of agency and conscious control rests on comparisons between anticipated and actual action effects: If the representation of an event following an action is activated before the action, it is experienced as self-caused, whereas in case of a mismatch it is attributed to an external cause. Here, we show that subliminally priming alleged (but objectively uncontrollable) action effects before free-choice actions increased participants’ judged control over the alleged effects. This prime-induced control illusion was obtained even when primes were not consciously perceived. Experiment 2 showed that under conditions of reversed priming, prime-induced modulation of experienced control reversed accordingly. In Experiment 3, alleged action effects, which were objectively unpredictable, were perceived as being more predictable when they had been primed subliminally before the action. The results indicate that experienced control is modulated by unconsciously activated action–effect representations, presumably due to sensory attenuation of subsequent alleged effect stimuli.

11:00–11:15 (175)

**All Stopping Is Not the Same: The Role of Inhibition in Action Control.** CHELAN WEAVER, *University of Cambridge*, & MICHAEL C. ANDERSON, *MRC Cognition and Brain Sciences Unit* (read by Michael C. Anderson)—Stop-signal and go/no-go paradigms are widely used to measure motor stopping ability across populations and species. Although both tasks quantify aspects of stopping performance, it is unclear to what degree they share constituent processes. Moreover, it has not been shown that either task necessitates inhibition at the computational level, in which stopping is accomplished by attenuating response activation. To ascertain the involvement of inhibition, we adapted each task to incorporate the independent probe method, a technique developed to isolate the aftereffects of inhibition from other sources of impairment. In both paradigms, novel stimuli cued recently stopped motor responses, enabling the measurement of aftereffects localized to the response. This revealed a dissociation between the two types of stopping, suggesting that inhibition may be selectively recruited to revoke, but not prevent actions. These findings establish a novel measure of inhibitory control in motor stopping, allowing the assessment of the functional consequences of inhibition.

11:20–11:35 (176)

**Lag-2 Repetition Cost in Task Switching: Backward Inhibition or Gambler's Fallacy?** MICHAEL E. J. MASSON, *University of Victoria*—Some models of cognitive control postulate that task switching is supported by inhibition of a just completed task set. Thus, when switching between three tasks (designated A, B, and C), performing the third task in the sequence ABA takes longer than performing the third task in the control sequence CBA (lag-2 repetition cost) because in the former case, Task A has more recently been completed and inhibited. I report eyetracking data showing that in the lag-2 repetition condition, fixation duration on the stimulus associated with the least recently performed task (Task C, in the sample sequences above) is elevated relative to the control condition. No such effects were seen for any other task stimulus or the task cue. These results suggest that in the lag-2 repetition condition, response time increases because attention is preferentially drawn to a task that has not recently occurred—a form of gambler's fallacy.

11:40–11:55 (177)

**Polychlorinated Biphenyls May Contribute to ADHD in Males and Alcoholism in Females.** DAVID F. BERGER, JOHN P. LOMBARDO, & PETER M. JEFFERS, *SUNY Cortland*—We have investigated sex differences in the effects of exposure to environmental levels of polychlorinated biphenyls (PCBs) on an animal model of attention deficit hyperactivity disorder (ADHD). Exposing male Sprague Dawley (SD) rats to PCBs during different developmental stages produces operant behavior that can be characterized as hyperactive and impulsive, in comparison with unexposed controls. The PCB-exposed males behave like genetically hyperactive, spontaneously hypertensive rats (SHRs), and more importantly, like ADHD boys. The PCB-exposed females become hypoactive in comparison with controls. People with ADHD are likely to abuse drugs. We observed increased voluntary ethanol consumption by PCB-exposed SD female rats in comparison with PCB-exposed males and unexposed male and female SDs. Consumption by PCB-exposed SD females is similar to consumption by SHR females. Our collaborators from SUNY Upstate Medical University found altered gene expression in the male offspring of SD dams exposed to PCBs during gestation. Environmental toxins may be involved in the etiology of ADHD.

#### Word Processing

Republic Ballroom, Saturday Morning, 10:20–11:55

Chaired by Brenda C. Rapp, *Johns Hopkins University*

10:20–10:35 (178)

**Vowel-Specific Synesthesia: Evidence for Orthographic Consonants and Vowels.** BRENDA C. RAPP, MICHAEL MCCLOSKEY, DAVID ROTHLEIN, KATE LIPKA, & MANUEL VINDIOLA, *Johns Hopkins University*—We describe an adult who reports vivid color

experiences when she processes written vowels. The synesthetic experience is limited to vowels and is experienced whether words, letter strings, or individual letters are presented visually or are mentally recalled. The specific vowel-color assignments are highly specific, stable over time, and produce interference in font-color naming for incongruently colored letters in a Stroop paradigm. We show that it is the orthographic and not the phonological identity of letters that determines the color experience. The behavioral evidence provides novel support for the claims that (1) orthographic consonants and vowels are representationally distinct and (2) they are represented independently of phonological consonants and vowels. We carried out an fMRI evaluation of the synesthetic individual and normal control participants. We will discuss the neural bases of the representation of orthographic consonants and vowels, as well as of the grapheme-color synesthetic experience.

10:40–10:55 (179)

**Danger and Usefulness Effects As a Function of Concept Ancientness.** LEE H. WURM, DEVON WITHERELL, SEAN SEAMAN, NIKKI A. BRUGNONE, & EVAN T. FULFORD, *Wayne State University*—Perceived danger and usefulness affect the speed of word recognition, and along with these effects an interesting danger  $\times$  useful interaction is seen (e.g., Wurm, 2007). We tested hypotheses about differential effects of these dimensions, based on the relevance of concepts relative to the time perceptual systems underwent selective pressures. Auditory lexical decisions were made for nouns rated on danger, usefulness, and the "ancientness" of each concept. For RTs, the typical danger  $\times$  useful interaction was seen, as was an interaction between danger and ancientness. Increasing danger led to faster RTs for ancient words and slower RTs for modern words. The error analysis revealed a similar danger  $\times$  ancientness interaction, and some interactions with participant gender. Consistent with Wurm et al. (2004), men's but not women's performance improved with increasing danger. The beneficial effect of usefulness on accuracy was greater for women than for men.

11:00–11:15 (180)

**A New Model of Lexical Decision: MROM+.** JONATHAN GRAINGER, STÉPHANE DUFAU, & JOHANNES C. ZIEGLER, *CNRS and University of Provence*—Grainger and Jacobs's (1996) multiple read-out model (MROM) provided an influential account of performance in the lexical decision task. In MROM, nonword responses are generated by a temporal deadline mechanism (T-criterion), and recent work has pointed to several deficiencies with this specific mechanism (Ratcliff et al., 2004; Wagenmakers et al., 2008). Our new model maintains the core structure of MROM while replacing the deficient T-criterion. As in MROM, time from stimulus onset plays a key role in generating "non-word" responses, but time is used in an active manner as opposed to the passive deadline mechanism of MROM. Time from stimulus onset activates the negative response node in a competitive binary decision network, whereas lexical activity provides the input to the positive response node. Evidence for a nonword is therefore a function of time from stimulus onset modulated by lexical activity.

11:20–11:35 (181)

**What Letters, Numbers, and Symbols Tell Us About Dyslexia.** JOHANNES C. ZIEGLER & JONATHAN GRAINGER, *CNRS and University of Provence*—We used a Reicher-Wheeler 2AFC paradigm with strings of letters, digits, and symbols to adjudicate between competing theories of dyslexia. A comparison of performance in dyslexics and normally developing readers revealed global deficits for letters and numbers but not for symbols, which rules out low-level visual and/or attentional explanations of dyslexia. Moreover, the serial position functions of dyslexics for letters and numbers were identical to those of controls, which rules out theories that attribute dyslexia to increased crowding or lateral masking. The fact that numbers showed the same deficit as letters rules out backward causality whereby lack of reading would cause poor letter processing, rather than the other way around. Our results suggest that dyslexia is the consequence of deficits in basic mechanisms involved in processing alphanumeric stimuli, such as the mapping of position-coded elements onto componential phonology.



11:40–11:55 (182)

**The Role of Physical Similarity Versus Numerical Distance in Numerical Judgment Tasks.** DALE J. COHEN, *University of North Carolina, Wilmington*—For decades, researchers have been studying how people perceive numbers. Researchers have generally come to the conclusion that, when people are presented a number (such as 2, 3, etc.), they will automatically perceive the quantity symbolized by that number. I present and test an alternative hypothesis.

**Implicit Memory****Independence Ballroom, Saturday Morning, 10:20–11:55***Chaired by Eric-Jan Wagenmakers, University of Amsterdam*

10:20–10:35 (183)

**Are Researchers Egoistic When They Write an Abstract? A Bayesian Hierarchical Test of the Name Letter Effect.** ERIC-JAN WAGENMAKERS, *University of Amsterdam*, OLIVER DYJAS, *University of Tübingen*, & RAOUL GRASMAN & RUUD WETZELS, *University of Amsterdam*—People prefer their initials to the other letters of the alphabet, a phenomenon known as the name letter effect. This effect, researchers have argued, makes Angela move to Los Angeles, makes Phil buy a Philips TV, and influences Dennis to become a dentist. In order to establish such associations between people's initials and their behavior, researchers typically carry out statistical analyses of large databases. Unfortunately, the standard *p*-value procedures ignore the hierarchical structure of the data and do not allow one to confirm the null hypothesis. Here, we propose a Bayesian hierarchical hypothesis test that avoids these limitations. We illustrate the method with examples that involve the use of author initials in scientific abstracts. The conclusions from our Bayesian hypothesis test are sometimes in radical opposition to those based on *p*-value procedures.

10:40–10:55 (184)

**Sequential Effects Reflect Learning of Temporal Structure.** MATT JONES, TIM CURRAN, MICHAEL C. MOZER, & MATTHEW H. WILDER, *University of Colorado, Boulder*—Binary choice tasks such as two-alternative forced choice tasks show a remarkably consistent pattern of sequential effects, whereby choices and response times depend on the detailed pattern of prior stimuli going back at least five trials. We show that existing data are well explained by a combination of two priming mechanisms, reflecting incremental learning of the base rate and of the repetition rate in the sequence. EEG and other types of evidence indicate that the base rate mechanism resides in response preparation (i.e., response priming) and that the repetition mechanism resides in stimulus identification (i.e., learning the rate of stimulus repetitions vs. alternations). However, results from a new experiment that manipulated the repetition rate between subjects show that the learning mechanism is more sophisticated than simple priming. The findings highlight a tension between the two broad and well-established classes of trace-based memory models and error-driven learning models. Attempts at reconciling these approaches will be discussed.

11:00–11:15 (185)

**Knowledge Representation in a New Perceptual–Motor Sequence Learning Task.** PAUL J. REBER, DANIEL J. SANCHEZ, & ERIC W. GOBEL, *Northwestern University*—A new experimental paradigm is described for studying perceptual–motor sequence learning that combines the well-studied serial reaction time (SRT) task with a novel interface derived from several popular video games. The new task naturally incorporates timing information into motor sequence learning. In Experiment 1, timing is shown to be integrated with sequence knowledge so that minimal transfer is observed when participants attempt to execute a familiar sequence of actions with unfamiliar interitem timing demands. The level of cognitive challenge can be easily manipulated to increase the difficulty of the task. In Experiment 2, we show that making the task challenging produces an unusually strong dissociation between performance and awareness in healthy participants. Following learning a randomly selected sequence, participants' error rates can be used to identify which sequence was learned even though their ability to recognize the trained sequence is approximately at chance.

11:20–11:35 (186)

**Different Musical Features Predict Implicit and Explicit Memory for Melodies.** ANDREA R. HALPERN, *Bucknell University*, & DANIEL MÜLLENSIEFEN & GERAINT WIGGINS, *Goldsmiths College*—Evidence for the separation of implicit and explicit memory systems has come from experimental dissociations as well as patient and activation studies. A completely different kind of evidence may be gleaned from discovery-driven approaches. We presented a set of melodies from 40 unfamiliar pop tunes, followed by 40 old and 40 new melodies for explicit recognition, and for rating on pleasantness. A set of musical features was selected to represent first-order characteristics relating to pitches, durations, and so on, of the melodies, as well as second-order information about the frequencies of melodic patterns relative to both the 80-item test set, and the parent corpus of 14,000 tunes. Regression models were quite successful in predicting which tunes elicited better explicit and implicit performance. However, the actual features retained in the models differed considerably. This dissociation between implicit and explicit memory measures was thus based entirely on sensitivity to different stimulus features.

11:40–11:55 (187)

**Breaking Miller's 7±2 Limit: Practice Effects in Absolute Identification ("Dead Reckoning").** PENNIE DODDS, CHRIS DONKIN, SCOTT D. BROWN, & ANDREW HEATHCOTE, *University of Newcastle, Australia* (read by Scott D. Brown)—Miller's (1956) review of a series of absolute identification experiments suggested a fundamental limit to human processing capacity. This limit has been confirmed by 50 years of subsequent research, and is thought to be highly resistant to practice. Following work from Rouder and colleagues, we outline an extensive series of experiments that show that people can learn to increase their information capacity. We discuss effects of stimulus manipulations (including modality and set size) as well as individual differences between participants. We also provide a framework in which our results (and Rouder et al.'s) can be reconciled with 50 years of prior research—which appears incongruent.

**Human Learning and Instruction I****Back Bay Ballroom C, Saturday Morning, 10:20–11:55***Chaired by John B. Black, Teachers College, Columbia University*

10:20–10:35 (188)

**Haptic and Immediate Visual Feedback Increases Learning of Mental Models.** INSOOK HAN, JOHN B. BLACK, IRINA PALEY, & GREG HALLMAN, *Teachers College, Columbia University* (read by John B. Black)—In two studies, students learned mental models of simple systems such as gear and pulley configurations through interactive visual simulations of the systems. These were direct manipulation animations in which the students directly manipulated one variable and got immediate feedback on the other variables. Providing haptic feedback using a force-feedback joystick, so that the students could feel how hard it was to move the gears or pulleys, increased learning over just providing visual feedback. A narrative voice-over also provided better learning than an expository voice-over. These results are consistent with a perceptually grounded approach to mental models of systems.

10:40–10:55 (189)

**Learning at Study Versus Learning at Test: Does Familiarity Matter?** KERRY A. CHALMERS & BEATRICE BORA, *University of Newcastle, Australia*—Learning during study and test was examined in a three-phase (i.e., study, Test 1, Test 2) recognition memory paradigm. In Experiment 1, 32 undergraduate psychology students studied a list consisting of familiar (high- and low-frequency) and unfamiliar (very low-frequency) words prior to completing two yes/no recognition memory tests. Items from the study list served as targets for Test 1. Test List 1 served as the target list for Test 2. Significant interactions between familiarity and testing were observed. High-frequency words were recognized more accurately at Test 2 than at Test 1, whereas very low-frequency words were recognized more accurately at Test 1 than at Test 2. In Experiment 2, using the same paradigm but different stimuli (words and



nonwords), recognition of nonwords was more accurate at Test 1 than at Test 2. Implications of the different pattern of results for familiar and unfamiliar stimuli for theories of memory will be discussed.

#### 11:00–11:15 (190)

**Educational Psychology: A Vanishing Relevance?** PHILIP LANGER, *University of Colorado, Boulder*—Findings in psychology are being superseded by a drift toward cultural anthropology in education. It appears that the content and findings covered in educational psychology seem to be of little concern in subsequent methodology and policy courses. In general, questions of why have been replaced by questions of how. Rothkopf (2008) alluded to this when he argued that research in education today seems focused on measures of the general efficiency of a given methodology, rather than on an analysis of the specific classroom activities involved; that is, “tactical level.” Not only that, but such approaches as behaviorism no longer appear in the lexicon of classroom methodology. In fact, for some favorite classroom methodologies, psychological concerns are seemingly ignored. To the student, the educational psychology course seems to be an academic hurdle to be overcome, and subsequently an outlier in his/her training.

#### 11:20–11:35 (191)

**Schooling and Growth of Literacy Skills: The Causal Contribution of Instruction.** FREDERICK J. MORRISON, *University of Michigan*, & CAROL M. CONNOR, *Florida State University*—Utilizing a natural experiment (school cutoff), previous research revealed that early schooling influences some skills (short-term memory, reading, math) but not others (vocabulary, conservation). Recent within-grade correlational analyses established that reading growth is predicted by amounts and types of instruction. The present study examined the causal status of instruction in the pattern of effects found in the between-subjects design. Two groups of children, who just made or missed the cutoff for school entry, were compared in a pre–post design on growth of word reading and vocabulary skills. Videotaped observations permitted coding of the instruction that children received. Preliminary analyses revealed that types and amounts of instruction alone did not predict patterns of schooling effects. However, when instructional content was added to the model, the schooling effects were completely predicted by the instructional variables.

#### 11:40–11:55 (192)

**Change in Confusion Matrices for Nine Chest Pain Diagnoses During Instruction.** ROBERT M. HAMM, *University of Oklahoma Health Sciences Center*, & FRANK J. PAPA, *University of North Texas College of Osteopathic Medicine*—We analyzed confusion matrices from a chest pain diagnosis task, comparing multiple-choice responses with nine correct diagnoses before, after, and 2 weeks after participants studied a computerized tutor (KBIT). For each diagnosis, two close competitors were identified, and the tutorial presented cases in which each competitor was plausible. We calculated the proportion of answers that was correct, for close competitors, for less similar alternatives, or for very dissimilar alternatives. Correct diagnoses increased from 51% pretest to 69% posttest, but retreated to 57% at 2 weeks. The proportion of close competitor responses showed the inverse pattern: 23%, 15%, and 21%; and similarly for the proportion of choices of the least similar alternatives: 17%, 9%, and 14%. We will compare these proportions to predictions based on cases’ similarities to prototypes, indexed by correlation and by the matching measure in KBIT’s foundational theory. The results are applicable to case selection for diagnosis tutorial programs.

#### Categories and Concepts II

Back Bay Ballroom D, Saturday Morning, 10:00–11:55

Chaired by Alan W. Kersten, *Florida Atlantic University*

#### 10:00–10:15 (193)

**Classification of Novel Manners of Motion by Monolingual English and Spanish Speakers.** ALAN W. KERSTEN, *Florida Atlantic University*, CHRISTIAN A. MEISSNER, *University of Texas, El Paso*, JULIA LECHUGA, *Medical College of Wisconsin*, BENNETT L. SCHWARTZ, *Florida International University*, JUSTIN S.

ALBRECHTSEN, *University of Texas, El Paso*, & ADAM IGLESIAS, *Florida Atlantic University*—English verbs (e.g., *skip*, *hop*) mark subtle differences in the manner in which an object moves, whereas Spanish manner-of-motion verbs (e.g., *saltar*) carry more general meanings. The present research tested whether these differences cause English speakers to be more sensitive to manner-of-motion differences when learning new categories. Monolingual English and Spanish speakers learned to differentiate four species of Martian creatures in a supervised classification task. The species were distinguished either by the manner in which a creature moved its legs, or by the path taken with respect to a second creature. The two groups performed similarly when path was relevant, but English speakers performed better than Spanish speakers when manner of motion distinguished the categories. These results are consistent with linguistic relativity, suggesting that frequent use of English verbs causes English speakers to habitually attend to manner of motion, even when overt speech is not required.

#### 10:20–10:35 (194)

**Individual Differences in Learning and Transfer: Exemplar Versus Rule Learners.** MARK A. MCDANIEL, *Washington University*, DAVID L. TRUMPOWER, *University of Ottawa*, & MATTHEW ROBBINS, *Washington University*—We hypothesize that during training, some learners focus on acquiring the particular exemplars and responses associated with the exemplars, whereas other learners attempt to abstract underlying regularities reflected in the particular exemplars linked to an appropriate response (termed “rule learners”). We further posit that an individual’s tendency to either focus on exemplars during learning versus focusing on extracting some abstraction of the concept or problem solution might be a relatively stable characteristic of the individual. Supporting this individual-differences distinction, we report experiments that demonstrate that the learners indexed a priori as rule learners (through function-learning extrapolation profiles) were more likely to exhibit transfer to novel instances in a domain than were exemplar learners. These individual tendencies were not reliably associated with working memory capacity, achievement test scores, or fluid intelligence, nor did these standard individual-difference measures predict performance in analogical problem solving or acquisition of abstract coherent categories.

#### 10:40–10:55 (195)

**Exploring the Relationship Between Inductive Reasoning and Recognition Memory.** BRETT K. HAYES, *University of New South Wales*, & EVAN HEIT, *University of California, Merced*—Two studies examined the relationship between induction and recognition memory using a paradigm that makes these two tasks as comparable as possible. During study, participants were asked to memorize or learn about a novel property of a common set of study items (pictures of dogs). At test, old and new pictures were presented and participants made recognition decisions or inferences about property generalization. People doing induction were more likely to make positive responses to old and new test stimuli than were those doing recognition. However, there was a strong positive correlation between the probability of making a positive response to test items in induction and recognition conditions. Manipulations of frequency of exposure (Experiment 1) and diversity (Experiment 2) of study items had parallel effects on recognition and induction. A model assuming a common generalization process based on exemplar similarity produced a good fit to both recognition and induction data.

#### 11:00–11:15 (196)

**Continuity Across Species and Development: The Case of Relational Learning.** BRADLEY C. LOVE & MARC T. TOMLINSON, *University of Texas, Austin*—We present a cognitive model that bridges work in analogy and category learning. The model, Building Relations through Instance Driven Gradient Error Shifting (BRIDGES), extends ALCOVE, an exemplar-based connectionist model of human category learning (Kruschke, 1992). Unlike ALCOVE, which is limited to featural or spatial representations, BRIDGES can appreciate analogical relationships between stimuli and stored predicate representations of exemplars. Like ALCOVE, BRIDGES learns to shift attention over the course of learning to reduce error and, in the process, alters its notion of similarity. A shift toward relational sources of similarity allows BRIDGES to

display what appears to be an understanding of abstract domains, when in fact performance is driven by similarity-based structural alignment (i.e., analogy) to stored exemplars. Supportive simulations of animal, infant, and adult learning are provided. We suggest that there is a high degree of continuity across species and development in terms of learning processes and representations.

11:20–11:35 (197)

**Categorical Versus Trait-Based Dimensional Classification Systems for Personality Disorders.** BENJAMIN M. ROTTMAN & WOO-KYOUNG AHN, *Yale University*, NANCY S. KIM, *Northeastern University*, & CHARLES A. SANISLOW, *Yale University* (read by Woo-Kyoung Ahn)—Features are inherently ambiguous in that their meanings depend on the categories they describe (e.g., *small* for PLANETS vs. MOLECULES; Murphy, 1988). However, a new proposal for the upcoming revision of the *Diagnostic and Statistical Manual of Mental Disorders (DSM)* advocates eliminating personality disorder categories, instead describing patients using only dimensions with the well-known five-factor model (FFM). In a series of studies, we investigated whether practicing clinicians ( $N = 378$ ) and experts in personality pathology ( $N = 73$ ) are able to translate dimensional, FFM-based patient descriptions into their corresponding *DSM* diagnostic categories. The results showed that both practicing clinicians and experts (personality disorder

researchers) had considerable difficulty disambiguating the meaning of the dimensions to determine correct diagnoses. Participants also found the dimensional system to be less useful for making prognoses and devising treatment plans. Implications for categorization research are discussed.

11:40–11:55 (198)

**Are Jungle Ravens Birds? How Atypical Modifiers Create Doubt in Generic Sentences.** JAMES A. HAMPTON, *City University London*, ALESSIA PASSANISI, *University of Catania*, & MARTIN L. JÖNSSON, *University of Lund*—When a generic statement (“Ravens are black”) has its subject modified (“Jungle ravens are black”), confidence in the truth of the statement goes down in proportion to the atypicality of the modifier (Connolly et al., 2007). In a series of studies, we first replicated the effect and its interaction with modifier typicality. Curiously, we then found that the modifier effect did not interact with the centrality of the property. Both central (“Ravens are birds”) and mutable (“Ravens are black”) sentences were equally affected by an atypical modifier. Finally, when a story context was provided to give credibility to the modified concept, the effect was greatly reduced. We conclude that the effect results from general uncertainty about the existence and reference of unfamiliar noun phrases. Jungle ravens may be a subset of ravens, but they may equally be a type of helicopter or the name of a rock band.

**Memory**  
**Grand Ballroom, Saturday Afternoon, 1:30–3:25**

*Chaired by Sami Gülgöz, Koç University*

**1:30–1:45 (199)**

**Vulnerability of Earliest Memories.** SAMI GÜLGÖZ, *Koç University*, & BURCU DEMIRAY, *University of Florida*—We investigated vulnerability of earliest memory characteristics to experimental context. Participants ( $N = 550$ ) responded to an online questionnaire about earliest, most recent, and an in-between memory. Half the participants answered questions on the earliest event, and others about the most recent event. All participants answered questions about the event in-between last. The results showed that earliest memory was from significantly younger ages when questions about an earliest memory were presented first. In this condition, earliest memories were rated as real and as earliest with more confidence. They were rated as more positive and vivid than when the section on recent memory was presented first. Although the manipulation did not influence number of field/observer memories, the ages of memories from each category were affected. We observed similar effects on ratings of the in-between event according to which type of memory preceded it. We discuss whether such vulnerability is explicable by current approaches, such as the self-memory system.

**1:50–2:05 (200)**

**Implications of Self-Terminated Memory Search for Understanding Retrieval Dynamics.** MICHAEL R. DOUGHERTY, ERIKA K. HUSSEY, & J. ISAAH HARBISON, *University of Maryland, College Park*—Almost all free-recall experiments utilize an experimental paradigm in which participants are given a preset amount of time to retrieve a set of items (e.g., 30 sec). Although much has been learned using this paradigm, it masks an important component of most real-world retrieval tasks—namely, the decision to terminate memory search. In this paper, we describe a novel experimental task that allows for the examination of the time course of search termination. Data from three experiments illustrate that search termination decisions are highly systematic across different memory tasks and across participants and are correlated with individual differences in decisiveness. Additionally, we illustrate that interretrieval times obtained in our self-terminated free-recall paradigm do not follow the hyperbolic function typically found when using the standard free-recall paradigm. We argue that providing participants with a preset retrieval interval masks important components of the retrieval process and fundamentally alters the natural retrieval dynamics.

**2:10–2:25 (201)**

**Serial Position Effects in a Singer's Long-Term Recall Reflect Attention During Practice.** ROGER CHAFFIN, *University of Connecticut*, JANE GINSBORG, *Royal Northern College of Music*, & JAMES A. DIXON, *University of Connecticut*—An experienced singer recorded her practice as she prepared Stravinsky's *Ricercar* for public performance and then wrote out melody and text from memory six times, after 0, 18, 32, 42, 47, and 59 months. We examined effects of serial position on the probability of correct recall at points in the music that the singer identified as musically significant. Sharp increases in recall probability at beginnings of sections and phrases indicated that starting at these places during practice provided the singer with content-addressable access to these locations in memory, whereas gradual decreases in succeeding bars suggested that these were retrieved by serial cuing. U-shaped serial position curves surrounding places where the singer had to attend to other musicians probably reflected decreased attention to the music. Similarly, S-shaped curves at expressive turning points probably reflected the focus of the singer's attention on the upcoming change at the expense of the preceding bars.

**2:30–2:45 (202)**

**Encoding Strength: Differentiation or Criterion Shift?** AMY H. CRISS, *Syracuse University*—In differentiation models, the processes of encoding and retrieval produce an increase in the target distribution and a decrease in the foil distribution as the amount of encoding increases. The result is an increase in the hit rate and a decrease in the false alarm rate for a strongly encoded list, as compared with a weakly encoded list,

consistent with empirical data. Other models assume either that the foil distribution is unaffected by encoding manipulations or that the foil distribution increases as a function of target strength. Such models account for empirical data by assuming a stricter criterion for strongly encoded lists, relative to weakly encoded lists. In a series of experiments, empirical distributions of memory strength and reaction distributions were collected. The data support the differentiation models.

**2:50–3:05 (203)**

**Prospective Memory Offers Some Protection Against Forgetting Associated Items.** LYLE E. BOURNE, JR., & ALICE F. HEALY, *University of Colorado, Boulder*, WILLIAM J. BONK, *Colorado Department of Education*, & CAROLYN J. BUCK-GENGLER, *University of Colorado, Boulder* (read by Alice F. Healy)—Two experiments compared prospective and retrospective memory tasks under both short and long retention intervals, using a continuous memory-updating paradigm with and without time pressure to respond. Two separate measures were examined in both tasks, one involving memory for the intention to respond in a particular way and the other involving memory for associations paired with the intentions. Time pressure had an adverse effect that was statistically significant on both measures only when it was manipulated within participants. Association memory was better, overall, with short than with long retention intervals and was better for prospective than for retrospective memory, especially at the long retention interval. These results imply that prospective memory protects associations from loss due to forgetting. Holding in working memory an intention to respond in a special way not only preserves that intention, but also sustains the associated information.

**3:10–3:25 (204)**

**Effective Priming of Involuntary Autobiographical Memories.** GIULIANA MAZZONI & VICTORIA PEARCE, *University of Hull*, & NATALIE WYER, *University of Plymouth*—The attempt to elicit involuntary autobiographical memories (ABMs) in the lab is problematic, since the explicit request to produce an involuntary memory seems to defy the very aim of these studies. In two experiments, we adopted a subliminal priming procedure with the request to report mental contents during a mind-wandering task that could be either visual (Experiment 1) or auditory (Experiment 2). Only at the end of each experiment did participants mark which mental content was a memory. In a subsequent phase, participants were asked to report voluntary ABMs elicited by presenting the primes supraliminally. The results showed that subliminal priming had an effect on involuntary ABMs. Prime-related memories were activated subliminally when the mind-wandering task was visual but were inhibited when the mind-wandering task was auditory. No effect of priming was obtained for voluntary ABMs. These results for the first time show an effect of subliminal priming on genuinely involuntary ABMs.

**Attention and the Brain**  
**Constitution Ballroom, Saturday Afternoon, 1:30–3:25**

*Chaired by Geoffrey F. Woodman, Vanderbilt University*

**1:30–1:45 (205)**

**Covert Attentional Selection in Monkey and Man: Bridging the Gap Reveals Underlying Neural Circuitry.** GEOFFREY F. WOODMAN, RICHARD P. HEITZ, JEREMIAH Y. COHEN, JASON T. ARITA, MIN-SUK KANG, & JEFFREY D. SCHALL, *Vanderbilt University*—Event-related potentials (ERPs) recorded from humans and single-unit recordings from macaque monkeys have long been vital tools for studying normally unobservable aspects of cognition. We will describe a technique for recording ERPs from macaque monkeys that we are using to bridge the gap between electrophysiological studies of the cognitive processing of human and nonhuman primates. This technique and parallel experiments with human subjects have shown that primates have homologous ERP components related to covert visual selection. We have used simultaneous recordings of ERPs, intracranial local-field potentials, single units, and microstimulation to show that a common ERP index of visual attention is generated by feedback from the frontal cortex. This new combination of techniques provides a way of linking the literatures

that use electrophysiology to study cognition in human and nonhuman primates and potentially solve the inverse problem of ERP component localization that has vexed cognitive scientists for nearly a century.

1:50–2:05 (206)

**Two Distinct Systems for Spatial Attention: Evidence From Trait Impulsivity and Neuropsychology.** WILLIAM PRINZMETAL, AYELET N. LANDAU, ARIEL ROKEM, & MICHAEL A. SILVER, *University of California, Berkeley*—It has been proposed that there are separate neural and psychological mechanisms underlying voluntary (endogenous) and involuntary (exogenous) attention. To examine this proposal, we tested both individual differences and a pharmacological manipulation in the spatial-cuing task (Posner, 1980). The magnitudes of voluntary and involuntary cuing effects varied with trait impulsivity as assessed with the Barratt Impulsivity Scale. Participants with high impulsivity scores had larger involuntary attention effects than did participants with low impulsivity scores. On the other hand, low-impulsive participants had larger voluntary attention effects than did high-impulsive participants. In a second set of experiments, we administered the cholinesterase inhibitor donepezil (Aricept) to increase synaptic levels of the neurotransmitter acetylcholine. This cholinergic enhancement selectively increased voluntary attention but had no influence on involuntary attention. In addition to previous behavioral, EEG, and fMRI research, voluntary and involuntary attention can be dissociated with individual differences and neuropsychology.

2:10–2:25 (207)

**Neuropsychological fMRI Reveals the Neural Circuits for Visual Selection by Saliency.** GLYN W. HUMPHREYS, CARMEL MEVORACH, & JANE RIDDOCH, *University of Birmingham*, & LILACH SHALEV, *Hebrew University of Jerusalem*—We examine how interactions between parietal and extrastriate cortex modulate the ability to select targets on the basis of their relative saliency in the visual field. Activation patterns in the left IPS and in the extrastriate visual cortex were examined in two patients exhibiting distinct extrastriate visual cortex damage and a group of healthy controls. In healthy controls, there was attenuation of activation in the visual cortex, along with increased activity in the left intraparietal sulcus, when there was high distractor saliency and low target saliency. In the patients, these patterns of activation were pronounced only when distractor processing was intact. We conclude that the left IPS acts to bias the competition for selection against salient distracting information by modulating activity in the extrastriate cortex, but it does not modulate the processing of low-salient targets per se.

2:30–2:45 (208)

**Distinct Bases for Auditory and Visual Stroop Interference in Monolinguals and Bilinguals.** WENDY S. FRANCIS, CRISTIAN ACOSTA, ARLENE LUEVANO, & LAURA ZAMBRANO-VAZQUEZ, *University of Texas, El Paso*—Auditory, or cross-modal, Stroop interference in color naming is an established effect, but its locus of interference has not been compared with that of visual Stroop interference. A series of monolingual and bilingual Stroop experiments was conducted to clarify the mechanisms of interference and their level of interdependence. Experiment 1 with monolinguals compared auditory and visual effects and examined their combined effects. Experiment 2 with bilinguals replicated Experiment 1 and added language manipulations as a way to separate semantic and phonological identity. The results of these experiments suggested that the stages of color identification and production affected differ across stimulus word modalities. Further monolingual and bilingual experiments incorporated color-related words and manipulations of acoustic properties to further isolate and identify the affected stages. The results of these experiments converge on the conclusion that auditory interference is primarily phonological and has less semantic involvement than does visual interference.

2:50–3:05 (209)

**Aging and Early-Stage Alzheimer's Disease: Beyond the Mean in Attentional Selection Tasks.** DAVID A. BALOTA & JANET M. DUCHEK, *Washington University*, CHI-SHING TSE, *Chinese University of Hong Kong*, & MELVIN J. YAP, *National University of*

*Singapore*—Accumulating evidence suggests that there are age-related changes in reaction time (RT) variability above and beyond mean performance in both healthy aging and in the earliest stages of dementia of the Alzheimer's type (DAT). We explored this possibility in a large sample of participants (32 young, 246 healthy old, and 74 very mild DAT) in three standard selective attention tasks (Stroop, Simon, and a switching task). There were reliable increases in variability above and beyond mean performance across groups. RT distributional analyses indicated that age was more likely to produce changes in all components of the underlying RT distribution, whereas early-stage DAT primarily produced a change in the tail of the RT distributions. The slow tail of the RT distribution was primarily related to working and episodic memory measures, whereas the modal portion of the RT distribution was also related to other speeded measures.

3:10–3:25 (210)

**Simon Reversals With Accessory Peripheral Signals in Visual and Auditory Tasks.** ERIC L. SOETENS & KATHLEEN MAETENS, *Vrije Universiteit Brussel*—In visual two-choice reaction time tasks, Simon-like effects occur when a peripheral accessory signal is presented shortly before or together with the response signal. However, the effect reverses when the peripheral signal appears shortly after the response signal. This pattern also occurs when the peripheral signal appears relative to a go (no-go) signal, with the relevant signal presented in advance. The reversal is explained as the inhibition of exogenous response-code activation when an action plan has been developed. In two experiments, we investigated whether the inhibition would also occur with auditory stimuli and whether it would concern a general or modality-specific inhibitory process. A Simon effect appeared in both experiments, but the reversal occurred only when the peripheral and relevant response signals were auditory, and not when the relevant signal was visual with auditory accessory signals. We suggest that planned actions are protected against exogenous interference by a modality-specific inhibitory process.

Metacognition

Republic Ballroom, Saturday Afternoon, 1:30–3:05

Chaired by Ayanna K. Thomas, *Tufts University*

1:30–1:45 (211)

**When Contextual Information Matters: Consequences of Semantic Knowledge in the Feeling of Knowing.** AYANNA K. THOMAS, *Tufts University*, JOHN B. BULEVICH, *Rhode Island College*, & STACEY DUBOIS, *Tufts University*—In feeling-of-knowing (FOK) studies, participants are asked to predict subsequent recognition performance on items that were initially encoded but that cannot presently be recalled. The accessibility model suggests that the amount of contextual cues associated with a target and the ease with which those cues come to mind contribute to FOK judgments, regardless of the quality of that information (Koriat, 1993). The present study examined conditions under which quality, or correctness, of contextual information influenced episodic FOK judgments. We presented subjects with letter string pairs, word pairs, and namable and abstract picture pairs. Quality of contextual information was not important when semantic content was not evident. When meaning of the stimuli was evident, average FOKs were higher when retrieved contextual information was correct, as compared with when it was incorrect. These data suggest that when meaningful material is processed, participants may more carefully evaluate accessible contextual information.

1:50–2:05 (212)

**The Influence of Top-Down and Bottom-Up Control of Self-Regulated Study.** JOHN DUNLOSKY & ROBERT ARIEL, *Kent State University*—Recent research on self-regulated study has largely focused on the top-down control of allocation decisions, such as whether people select items for study that are in their region of proximal learning. We directly contrast such top-down control with stimulus-driven control. Participants selected pairs for study from an array that included relatively easy-to-learn, moderately difficult, and difficult-to-learn pairs. In some arrays, pairs were ordered by ease of learning from left to right



(easy, moderate, difficult), and in other arrays, they were presented in the reverse order (difficult, moderate, easy). Across multiple experiments, we replicated previous research showing that people select items within their region of proximal learning (i.e., select the easy items first) but also demonstrate that such allocation decisions partially arise from stimulus-driven control.

#### 2:10–2:25 (213)

**The Effects of Emotion on Tip-of-the-Tongue States.** BENNETT L. SCHWARTZ, *Florida International University*—Tip-of-the-tongue states (TOTs) are judgments of the likelihood of imminent retrieval for items currently not recalled. This study explored the relation of emotion to the experience of TOTs. In the experiment, emotion-inducing questions (e.g., “What is the term for ritual suicide in Japan?”) were embedded among emotionally neutral questions (e.g., “What is the capital of Denmark?”). Participants attempted to recall the answers and, if unsuccessful, were asked if they were in a TOT and given a recognition test. For unrecalled items, there were significantly more TOTs for the emotional items than for the neutral items (36% vs. 28%), even though the recognition performance was identical (46% for each). The results also showed that items given TOTs were given higher emotion ratings. These findings suggest that emotional cues increase the likelihood that a TOT will occur. These data are consistent with a metacognitive view of TOTs.

#### 2:30–2:45 (214)

**Attributing Effort to Data-Driven and Goal-Driven Effects: Implications for Metacognitive Judgments.** ASHER KORIAT, *University of Haifa*—The monitoring-affects-control model predicts that metacognitive judgments should increase with the amount of effort invested in the task, whereas the control-affects-monitoring model predicts that they should decrease. Judgments of learning as well as subjective confidence yielded evidence for both types of effects, the former occurring when the regulation of effort is goal driven and the latter when it is data driven. Because the amount of effort invested in a task is conjointly determined by both types of regulation, an attribution process was postulated in which variations in effort are attributed to data-driven or goal-driven regulation in different proportions before the implications for metacognitive judgments are determined. Experiments are reported that substantiate the reality of the attribution process underlying metacognitive judgments and examine the development of the ability to respond differentially and simultaneously to both types of regulation.

#### 2:50–3:05 (215)

**Younger and Older Adults Exhibit Theory of Mind Errors on a Continuous False Belief Task.** DANIEL M. BERNSTEIN, *Kwantlen Polytechnic University and University of Washington*, WENDY L. THORNTON, *Simon Fraser University*, & JESSICA A. SOMMERVILLE, *University of Washington*—Theory of mind (ToM) refers to the ability to infer one's own or another's mental states. ToM improves dramatically from ages three to five, then stabilizes until young adulthood, and declines in old age. We developed a novel task to measure ToM ability across the life span. In the present study, older and younger adults watched a character (Sally) place an object in a 5-foot-long box, and then leave the room. Subsequently, another character (Anne) moved the object to another location within the same box. Subjects estimated where Sally would look for the object upon her return. Both younger and older adults were significantly biased by the second location, although older adults showed greater bias. These effects were unaffected by memory, executive functioning, and vocabulary scores. We conclude that ToM errors persist throughout the life span but are enhanced in later life. This is consistent with weaker ToM abilities in older adults.

#### Language Acquisition

**Independence Ballroom, Saturday Afternoon, 1:30–3:25**

*Chaired by Curt Burgess, University of California, Riverside*

#### 1:30–1:45 (216)

**A High-Dimensional Analysis of Semantic Language Representation in Autistic Children.** CURT BURGESS, *University of California,*

*Riverside*, & DAPHNE ZACHY, *San Diego State University*—Autism presents a complex array of language processing for a theoretical account of the disorder. Skyles (2001) argues that autism can be seen as a deficit in encoding context during the comprehension process. It follows, he argues, that context-based memory models such as LSA or HAL might provide an account of this context problem. The literature suggests that autistic children have difficulty with higher level comprehension (ambiguity resolution) and are relatively unimpaired with basic word recognition and lexical-semantic priming. An autistic memory model was constructed using the HAL model and a language corpus from 6 autistic children. A control model was built from language from unimpaired children. Semantic priming was mimicked by comparing the distance of related word pairs to unrelated word pairs. The results suggest that (1) a coherent low-level semantic system was learned with impoverished language and (2) the priming with the model was consistent with the empirical literature.

#### 1:50–2:05 (217)

**Individual Differences in Adult Foreign Language Learning.** PATRICIA J. BROOKS, *City University of New York*, VERA KEMPE, *University of Abertay Dundee*, & ANNEMARIE DONACHIE, *College of Staten Island, CUNY*—This paper explores cognitive mediators of individual differences in foreign language learning. Adults ( $N = 77$ ) learned Russian vocabulary and grammar (adjective–noun gender agreement and case-marking noun inflections) over six 1-h sessions. They completed tasks (listen/repeat, comprehension, production) that encouraged correct pronunciation without explicitly teaching them grammar. Whereas verbal working memory and nonword repetition predicted vocabulary retention, nonverbal IQ and artificial grammar learning (AGL) predicted grammar learning (with AGL more strongly linked to performance on familiar items from the training set, and nonverbal IQ to generalization of grammatical patterns to new items). Nonverbal IQ and AGL correlated strongly with explicit awareness of the grammatical patterns. However, in support of Robinson's (1995) “noticing hypothesis,” nonverbal IQ and AGL failed to predict any unique variance in grammar learning, over and above their effects on explicit awareness. Hence, even under conditions emphasizing implicit learning, individual differences in grammar learning stem from differences in conscious awareness.

#### 2:10–2:25 (218)

**Crosslinguistic Variation in Children's Sensitivity to Word Order.** LETITIA R. NAIGLES, *University of Connecticut*, AYSE CANDAN & AYLIN KÜNTAY, *Koç University*, MEGAN KRAVITZ, *University of Connecticut*, & LAURA WAGNER, *Ohio State University*—Some languages (e.g., English) use word order to indicate the doer and the undergoer of an action. Other languages (e.g., Turkish) employ case markers for the same purpose. Both types of cues must be learned; our question concerns the relative strength of the word order cue in these different languages. We compare 18- to 36-month-old English and Turkish learners listening to simple transitive sentences in the basic word order of their respective languages (SVO and SOV, respectively), using intermodal preferential looking (IPL). The videos show reversible familiar actions performed by people in horse and bird costumes (horse pushes bird, bird pushes horse), paired with the test audio (“The bird is pushing the horse!”). Even the 18-month-olds in each language showed significant preferences for the matching screen, although the effect sizes were larger for the English learners than for the Turkish learners. Canonical word order seems to be acquired early in both languages.

#### 2:30–2:45 (219)

**Factor Analysis of Reading Skills in Middle and High School Students.** GLORIA S. WATERS, *Boston University*, & DAVID N. CAPLAN & JENNIFER MICHAUD, *Massachusetts General Hospital*—This study investigated the relationship between component reading skills in 1,356 students in Grades 6–10. Participants were tested on a battery of 12 tasks that assessed language at the sublexical, lexical, morphological, sentential, and discourse levels. Stimuli were presented on a computer screen, and participants' reaction times and accuracy in responding were recorded. The linguistic properties of the stimuli were manipulated within each task in order to provide a range of difficulty of

stimulus items on each task and to allow for the determination of the effects of different aspects of linguistic complexity on performance. Factor analysis revealed three factors—one involved in recognizing the form of items (pseudohomophone judgment, lexical decision for simple and complex words, grammaticality judgment), one involved in accessing meaning from complex forms (affixed words, sentences, and discourse), and one involved in accessing meaning from simple words.

### 2:50–3:05 (220)

**Learning a Hierarchical Embedded Structure With Semantics, in AGL.** FENNA H. POLETIEK, *Leiden University*, & PADRAIC MONAGHAN, *Lancaster University*—Center embedded hierarchical structures are a crucial property of natural languages. The learnability of such structures is highly debated. Recent studies investigated hierarchical structures learning in the artificial grammar learning (AGL) paradigm, with mixed results. Bahlmann and Friederici (2006) report learning. De Vries et al. (2008) failed to replicate any learning in a similar study. In two AGL experiments, we explored the possibility that learning hierarchical structures is facilitated when learners are presented examples of the artificial language and their “meaning.” In Experiment 1, a setup without semantics, no learning was found. When semantic referents (rows of shapes and colors) were added at training, and the test task was to “parse” semantically new grammatical items—rather than to give grammaticality judgments—significant learning was found. We claim that semantics is one of the cues that help learners to acquire complex structures from exemplars.

### 3:10–3:25 (221)

**Statistical Learning Skill Predicts Language Performance: Online Data From Nonadjacency Learning and Relative Clause Processing.** JENNIFER B. MISYAK & MORTEN H. CHRISTIANSEN, *Cornell University*, & J. BRUCE TOMBLIN, *University of Iowa* (read by Morten H. Christiansen)—We developed a novel cross-modal paradigm implementing artificial grammar learning within a serial reaction time framework and applied it toward examining statistical learning in Gómez’s (2002) a × b nonadjacency language with “high-variability” of intervening elements. Data from 50 participants demonstrated group-level sensitivity to the artificial nonadjacencies, with substantial variation in learning score indices. The same participants also completed a word-by-word self-paced reading task involving subject- and object-relative clause sentences. Statistical learning skill predicted performance for both subject and object relatives, with better nonadjacency learning corresponding to faster reading times. Statistical learners who did not improve across training blocks showed a reading time pattern previously associated with individuals with low verbal working memory span: slower reading times overall, especially at the main verb in object-relative clauses. These findings provide empirical support for Wells et al.’s (2009) hypothesis that statistical learning mechanisms are involved in mediating effects of experience-based learning on relative clause processing.

### Action I

Back Bay Ballroom C, Saturday Afternoon, 1:30–3:45

Chaired by Sarah H. Creem-Regehr, *University of Utah*

### 1:30–1:45 (222)

**Visual Body Representations Influence Judgments of Object Extent.** BENJAMIN R. KUNZ, SARAH H. CREEM-REGEHR, & WILLIAM B. THOMPSON, *University of Utah* (read by Sarah H. Creem-Regehr)—When visual and proprioceptive information for hand position are in conflict, the felt position of the hand is dominated by the visual information and the observer experiences “visual capture.” Although this visual dominance effect has been shown to influence pointing to egocentric locations that are inherently performed within the body’s own reachable space, little is known about the role of the visual body in body-based scaling of spatial dimensions outside of egocentrically referenced location. After experiencing visual capture through a mirror box, observers made judgments of the exocentric extent of a block by adjusting an interval between their two hands. Judgments were influenced by the visual location of the hand, regardless of whether the block was

near, far, or laterally displaced from the observer. We suggest that visual representation of the body has effects that generalize beyond egocentric localization tasks to exocentric judgments directed outside of the body’s personal space.

### 1:50–2:05 (223)

**What Is the Moment of Decision in the Libet Paradigm?** WILLIAM P. BANKS, *Pomona College*, & EVE A. ISHAM, *Claremont Graduate University*—A deceptive response cue delayed 5–60 msec after an action causes the reported time of the decision to act (Libet’s *W*) to move forward in time proportionally to the delay of the deceptive cue. The reported time of response (Libet’s *M*) also moved forward with the deceptive cue. Viewing one’s own hand through a delayed video image caused the reported time of decision for *W* to be delayed. Judgments of responses of others seen on video were also shifted in time by the deceptive cue. These findings support the hypothesis that the reported time of decision is not simply a report on brain activity leading to the response. Rather, the apparent time of decision, which should be based on a volitional event prior to the response, is based largely on perception of when the response occurred.

### 2:10–2:25 (224)

**On the Specificity and Automaticity of Embodied Lexical–Semantic Representations.** HAROLD BEKKERING, CHRISTIAN PFEIFFER, WESSEL O. VAN DAM, & SHIRLEY-ANN RUESCHEMEYER, *Donders Institute for Brain, Cognition and Behaviour*—Embodied theories of language (ETLs) suggest that understanding words draws on the resources of brain areas involved in real-world experience with words’ referents. In the present series of studies, we focus on words with an action-semantic component (i.e., words denoting objects/events associated with specific actions, such as *cup*). We show that (1) the action-information activated by word comprehension is very specific, including information about putative action goals (e.g., in understanding the word *cup*, brain areas involved in supporting hand movements toward the mouth are activated), and (2) action-semantic information is automatically activated when words are presented in isolation, but that lexical-semantic representations are not inflexible (e.g., whereas *cup* facilitates hand-to-mouth actions, *cup* presented after the word *sink* does not). These studies provide new insights into ETL by illustrating how specific embodied lexical-semantic representations are, but also by demonstrating that the assumed automaticity of embodied lexical-semantic representations is limited.

### 2:30–2:45 (225)

**Automatic Action Activation in the Motor Cortex: Effects of Object Affordances and Hand Grip.** LUC BOUTSEN, *Aston University*, & SANJAY KUMAR & GLYN W. HUMPHREYS, *University of Birmingham*—The activation of action information by visually presented hand-held tools is influenced by object affordances and by hand grip information. In word–picture matching tasks involving action words, motor responses are enhanced when tools are oriented toward the observer’s dominant hand and when the grip of the hand-held object is congruent with its normal use. We studied the neural basis of the grip congruence effect in an event-related brain potential (ERP) study by measuring lateralized readiness potentials (LRPs) during word–picture matching. Twelve right-handed observers matched object names and action words to photographs of hand-held common tools, while EEG was measured. Hand orientation (left/right) and grip congruency (congruent/incongruent) modulated the amplitude and onset latency of stimulus-related LRPs in action matching. LRPs were enhanced for congruent grips and for object/hand orientations that matched the observer’s dominant hand. These results suggest that detailed visual action information influences response preparation in the motor cortex.

### 2:50–3:05 (226)

**Applications of Nonparametric Adaptive Methods for Simple Reaction Time Experiments.** YUNG-FONG HSU, *National Taiwan University*—Adaptive methods are commonly used in psychophysical research for detection and discrimination (see Leek, 2001; Treutwein, 1995, for reviews). In recent years, researchers have investigated via simulations some asymptotic and small-sample properties of two

nonparametric adaptive methods—namely, the fixed-step-size up–down method (Garcia-Perez, 1998, 2001) and the (accelerated) stochastic approximation (Faes et al., 2007). In this study, we extend both methods to the simple reaction time (RT) situation for the measure of signal intensities that elicit certain (fixed) RT percentiles. We focus on extending the following four methods: the stochastic approximation of Robbins and Monro (1951), its accelerated version of Kesten (1958), the transformed up–down of Wetherill (1963), and the “biased coin design” of Durham and Flournoy (1994, 1995). The convergences of the asymptotic and small-sample properties for different starting values, step sizes, and response criteria are systematically investigated.

### 3:10–3:25 (227)

**How Omissions Cause Events.** PHILLIP M. WOLFF, *Emory University*—This research examines how people attribute causation when an effect results from an absence (e.g., not watering the plant caused it to wilt). The phenomenon has been viewed as an insurmountable problem for mechanistic theories of causation, which specify causation in terms of forces, but not for theories that specify causation in terms of statistical or counterfactual dependencies. A new account of causation challenges this assumption. According to the force theory, absences are causal when they represent the removal or nonrealization of a force, which then leads to an effect. Evidence in support of this account was found in three experiments in which people classified complex animations depicting effects resulting from the removal of forces. The findings reconcile not only how causation by omission can be grounded in the physical world, but also how people designate which absences, among the potentially infinite number of absences, are causal.

### 3:30–3:45 (228)

**Judgments of Delayed Causation in a Video Game.** MICHAEL E. YOUNG, *Southern Illinois University, Carbondale*—A first-person shooter video game was adapted for the study of causal decision making within dynamic environments. Each of the levels of the video game included seven groups of three potential targets. Participants chose which of the three potential targets in each group was producing distal explosions. The actual source of the explosion effect varied in the delay between the firing of its weapon and its effect (from 0 to 2 sec), and these delays could be unfilled or filled with auditory events. In Experiment 1, participants' choice accuracy was highest with shorter delays and when a delay was filled with a predictably changing auditory event. These results were extended in Experiment 2, in which variable delays produced higher accuracy when the delays were long. Participants' behavior was well described by a model that assumes that choice behavior was driven by a backward inference based on relative contiguity.

### Animal Cognition II

#### Back Bay Ballroom D, Saturday Afternoon, 1:30–2:45

*Chaired by Michael F. Brown, Villanova University*

### 1:30–1:45 (229)

**Social Influences on Spatial Choice.** MICHAEL F. BROWN & MATTHEW R. KELLER, *Villanova University*—Earlier work from our laboratory on modulation of rat spatial choice in a radial-arm maze by the choices made by a foraging partner indicates both attraction to locations most recently chosen by the foraging partner and avoidance of locations chosen earlier during a trial. This complex pattern of results can be understood as an interaction between social facilitation of choice and a learned tendency to avoid locations depleted by the partner. Here, we present corresponding data from a paradigm in which two rats foraged in a matrix of baited locations. Factors affecting spatial choices included the previous choices of the foraging partner, the recency of those choices, and proximity of the foraging partner when the earlier choices were made. These data allow models of social influences on spatial choice to be compared.

### 1:50–2:05 (230)

**Choice Among Topographically Different Responses.** JAMES S. MACDONALL & JACQUELINE McMAHON, *Fordham University*—There

is a confound in standard concurrent choice procedures: The values of the schedules arranging reinforcers for staying at each alternative equal the values of the schedules arranging reinforcers for switching to the other alternative. Eliminating the confound by using four different schedules, each arranging reinforcers for one of the four responses (staying at each alternative and switching to each alternative) and setting the value of each stay schedule equal to the value of the switch schedule at the same alternative, prevented the generalized matching equation (GME) from describing data combined from standard arrangements and the new arrangement. The stay/switch model (SSM) described these data. Three rats pressed a lever or pushed a flap with their nose. The results from 11 conditions, using the original confounded arrangement or the unconfounded arrangement, were not described by the GME but were described by the SSM, which extends the applicability of the SSM.

### 2:10–2:25 (231)

**Cue Interactions: The Role of Within-Compound Associations.** RALPH R. MILLER & JAMES E. WITNAUER, *Binghamton University*—In Pavlovian situations, when multiple cues are trained in compound, animals learn associations among the cues in the compound (i.e., within-compound associations), as well as between each cue and the outcome. Most contemporary theories of associative learning assert that cue–outcome associations drive cue competition (e.g., overshadowing) because of their effects on processing of the outcome's representation. Using a computational modeling approach, we reviewed and simulated experiments that pertain to the role of within-compound associations in negative mediation, positive mediation, and counteraction. A mathematical model that attributes all cue interactions to within-compound associations was shown to provide a better fit to some negative mediation phenomena than did a model that attributes negative mediation effects to variations in outcome processing. Overall, the results of this analysis suggest that within-compound associations are important for cue competition, conditioned inhibition, counteraction effects, retrospective revaluation, and second-order conditioning.

### 2:30–2:45 (232)

**Reflexivity in Pigeons.** PETER J. URCUIOLI & MARY M. SWEENEY, *Purdue University*—Reflexivity, an emergent ability to match each stimulus to itself, is a characteristic of stimulus equivalence. A recent theory of equivalence-class formation (Urcuioli, 2008) predicts that reflexivity in pigeons should emerge after training on certain sets of successive (go/no-go) matching tasks. One group was trained on such a set; a control group was trained on another set that, theoretically, should yield the opposite effect (emergent oddity). Although there was only sparse evidence for emergent oddity in the latter group, reflexivity was clearly apparent in the former group—the first time this phenomenon has been demonstrated in any animal.

### SYMPOSIUM IV

#### Wandering Minds and Brains

#### Grand Ballroom, Saturday Afternoon, 3:15–5:25

*Chaired by Michael J. Kane, University of North Carolina, Greensboro*

### 3:15–3:20

**Introduction.** JONATHAN W. SCHOOLER, *University of California, Santa Barbara*.

### 3:20–3:45 (233)

**When Minds Wander to Distant Places and Times, We Can Forget the Present.** PETER F. DELANEY & LILI SAHAKYAN, *University of North Carolina, Greensboro*, & COLLEEN M. KELLEY & CARISSA ZIMMERMAN, *Florida State University*—Daydreaming mentally transports us to another place or time. Many daydreams are remarkably similar in content to the thoughts people generate to intentionally forget things (Sahakyan & Kelley, 2002). Although daydreams obviously impair encoding during daydreaming, they also cause forgetting of previously encoded events. Furthermore, daydreams that are more different from the current moment should produce more forgetting than should daydreams that are less different from the current moment, because they



result in greater contextual change. Two experiments tested this hypothesis by having students learn two lists of words. Between the lists, we had them retrieve autobiographical memories. In Experiment 1, recalling one's parents' home resulted in more List 1 forgetting than did recalling one's own home. In Experiment 2, remembering a vacation abroad produced more forgetting than did a domestic vacation. The results support a context-change account of the amnesic effects of daydreaming, consistent with predictions derived from recent memory models.

3:45–4:10 (234)

**Mind Wandering Contributes to Executive Control Failure and the Worst-Performance Rule.** MICHAEL J. KANE & JENNIFER C. MCVAY, *University of North Carolina, Greensboro*—Individual differences in working memory capacity (WMC) predict performance in executive control tasks, as well as mind-wandering rates in both laboratory and daily-life contexts. Moreover, much of the shared variance between WMC and executive control tasks is explained by mind-wandering rate. Here, we explore the boundary conditions of the WMC/mind-wandering association, asking whether executive control task demands are necessary to yield WMC-related differences in off-task thinking. We also consider the role of mind wandering in producing WMC-related differences in RT variability: Higher and lower WMC subjects differ more in the longest RTs they sometimes produce than in the shortest RTs they are able to produce (consistent with the “worst performance rule”). Here, we use subjects' mind-wandering reports and ex-Gaussian analyses of RT distributions to pit our executive attention view of WMC (Engle & Kane, 2004) against the proposal that attentional lapses are unnecessary to explain the WMC–RT association (Schmiedek, Oberauer, Wilhelm, Süß, & Wittmann, 2007).

4:10–4:35 (235)

**Affective Yet Effective? Is Emotional Regulation One Reason Why the Mind Wanders?** JONATHAN SMALLWOOD, *University of California, Santa Barbara*—Mind wandering is a common experience, yet we know little about the internal conditions that promote the experience or the purposes it plays in daily life. This talk reviews two distinct yet closely related lines of research, which together suggest that, perhaps, the mind wanders to regulate our affective state. One thread of research documents both cross-sectional and experimental evidence that states of negative affect lead to an increase in mind wandering. A related series of studies will be described suggesting that mind wandering is generally focused on future events, perhaps mediated by the left-hemisphere ability to generate alternative scenarios. Given that future thinking seems to be critical to successful self-regulation and that the left hemisphere is important in emotional regulation, it seems plausible that increases in mind wandering during negative affect reflects attempts to resolve the problems in daily life that make individuals unhappy in the first place.

4:35–5:00 (236)

**Mind Wandering for Predictions: Insights From the Brain's Default Activity.** MOSHE BAR, *Harvard Medical School*—The constant engagement of our brains in mind wandering and the immense neural energy that this mental theater costs imply that mind wandering has a purpose. I propose that the primary function of mind wandering, what seems like random thoughts and aimless mental simulations, is to create “memories” that subsequently improve our ability to generate better predictions. Information encoded in our memory guides and sometimes dictates our future behavior. But why should these memories only be derived from real experiences, given that our mind is powerful enough to generate simulated experiences that did not happen but could happen in the future? This perspective promotes considering imagined scenarios and mind wandering as beneficial to our learning and future behavior as much as real experiences. I will present neuroimaging data and related insights from cognitive neuroscience that together synthesize to support this proposal.

5:00–5:25 (237)

**Losing Track of One's Mind: The Intermittent Meta-Awareness of Mind Wandering.** JONATHAN W. SCHOOLER, *University of California, Santa Barbara*—Recent advances in the use of two self-report

methodologies suggest that individuals are only intermittently meta-aware of their mind wandering. In one methodology, participants are periodically probed regarding whether they were mind wandering and, if so, whether they were aware of this fact. In a second methodology, mind wandering that is self-caught (and therefore has reached meta-awareness) is compared with probe-caught mind wandering that is caught by experience sampling probes before individuals notice it themselves (and thus reflect episodes that may not have reached meta-awareness). Using these procedures we have found that (1) the occurrence versus the noticing of mind wandering are differentially influenced by a variety of factors (e.g., alcohol, craving, cognitive load, emotion), (2) mind wandering without meta-awareness has a more disruptive effect on performance than does mind wandering that individuals are aware of, and (3) mind wandering with versus without meta-awareness is associated with distinct patterns of neural recruitment.

### Word Recognition

Constitution Ballroom, Saturday Afternoon, 3:50–5:25

Chaired by Carol Whitney, *University of Maryland, College Park*

3:50–4:05 (238)

**Implications of Perceptual Patterns for Letter-Position Encoding.** CAROL WHITNEY & YUVAL MARTON, *University of Maryland, College Park*—It is now well established that transposition-priming results strongly constrain models of orthographic processing (Grainger & Whitney, 2004, *TICS*). The next frontier is the study of perceptual patterns in identification of letters in consonant strings. Last year, Grainger and Tydgat claimed hemisphere-specific receptive-field shapes for letter detectors, based on the finding that a leftward distractor letter is more detrimental than a rightward one for left visual field (LVF) target letters, whereas there is no asymmetry for right visual field targets. We present trigram identification data showing that the LVF asymmetry extends beyond adjacent letters. This result is better explained by the SERIOL model's hemisphere-specific patterns of lateral inhibition (Whitney, 2001, *PB&R*) than by receptive-field shapes. We also present Reicher–Wheeler data on five-letter strings, showing that a final-letter advantage is present at an exposure duration of 133 msec, but not 67 msec, in line with the claim of serial activation of abstract letter representations (Whitney, 2001).

4:10–4:25 (239)

**Three Puzzling Findings in Visual Word Recognition.** ALISON L. MORRIS, *Iowa State University*, & MARY L. STILL, *Missouri Western State University*—Three recent findings pose problems for models of visual word recognition: the U-shaped length effect in lexical decision, priming across an intervening item, and the complex effects of prime exposure duration and neighborhood density in orthographic priming. The competition model (Morris, Still, & Caldwell-Harris, 2009), originally designed to account for repetition blindness effects, may prove useful in explaining these findings. The model was derived from recent findings in neurophysiology concerning the effects of stimulus repetition and the neural correlates of consciousness. According to the model, an overt response to a word requires that it be identified by the recognition system and that its representation access awareness. Furthermore, the competition for access to awareness between successive items is based on the total activation of each representation. We will present simulations suggesting that competition between items presented in close temporal proximity is the common thread underlying the three problematic findings.

4:30–4:45 (240)

**Early Morphological Processing Is Morpho-Semantic and Not Simply Morpho-Orthographic: More Evidence Against a Form-Then-Meaning Account of Word Recognition.** LAURIE BETH FELDMAN, *University at Albany and Haskins Laboratories*, PATRICK A. O'CONNOR, *University at Albany*, & FERMÍN MOSCOSO DEL PRADO, *CNRS and University of Provence*—Some interpret the (null) finding that facilitation after semantically transparent and opaque morphologically related primes are comparable in early stages of morphological processing as evidence that a word's orthographic form must be



processed fully before it can provide access to meaning. A recent meta-analysis ( $N = 16$ ) suggests greater morphological facilitation after transparent than after opaque primes, even at the very early stimulus onset asynchronies (SOAs) (Feldman, O'Connor, & Moscoso del Prado, in press). We examined the time course over which semantic transparency influences parsing into stem and suffix in the forward-masked priming variant of the lexical decision paradigm and compared patterns of facilitation between semantically transparent (e.g., *dented*–*DENT*) and opaque (e.g., *dentist*–*DENT*) prime–target pairs across five SOAs (34, 50, 67, 84, and 100 msec). Morphological facilitation was significantly greater after semantically transparent pairs than after opaque pairs, and results did not vary significantly with SOA. The results limit the scope of form-then-semantics models of word recognition and demonstrate that semantic similarity can influence even early stages of morphological processing.

#### 4:50–5:05 (241)

**Are Transposition Effects Specific to Letters?** MANUEL PEREA, *University of València*, & SAMARA MUÑOZ & JAVIER GARCÍA-ORZA, *University of Málaga*—Recent research has consistently shown that pseudowords created by transposing two letters are perceptually similar to their corresponding base words (e.g., *jugde*–*judge*). In the framework of the overlap model (Gomez, Ratcliff, & Perea, 2008, *Psychological Review*), this effect is due to a noisy process in the localization of the “objects” (e.g., letters, Kana syllables). In the present study, we examined whether this effect is specific to letter strings (words, pseudowords) or whether it also occurs with other “objects” (namely, digits, symbols, and pseudoletters). To that end, we conducted a series of five masked priming experiments using the same–different task. The results showed robust effects of transposition for all objects, except for pseudoletters. This is consistent with the view that locations of familiar objects (i.e., letters, numbers, symbols) can be best understood as distributions along a dimension, rather than as precise points.

#### 5:10–5:25 (242)

**Letter Transposition Effects Across Morpheme Boundaries.** JAY G. RUECKL & ANURAG RIMZHIM, *University of Connecticut and Haskins Laboratories*—Various measures show that readers treat strings formed by transposing two letters (e.g., *JUDGE/JUGDE*) as more similar than strings formed by letter substitution (e.g., *JUDGE/JUBFE*). Several studies have reported that the transposed-letter (TL) effect is reduced or eliminated if the transposition crosses a morpheme boundary (e.g., *TEACHER/TEACEHR*), although other studies have suggested that TL effects are not constrained by morphological structure. In our experiments (using English materials, semantically transparent derivations as primes, and root-word targets), we found equivalent masked priming effects from TL forms regardless of whether the transposition crossed a morphological boundary. The theoretical implications of these results will be discussed, as well as some methodological considerations that may explain why different studies suggest different conclusions.

#### Context Memory

##### Republic Ballroom, Saturday Afternoon, 3:30–5:25

Chaired by Colin M. MacLeod, *University of Waterloo*

#### 3:30–3:45 (243)

**Source-Constrained Retrieval Influences New Encoding.** STACEY L. DANCKERT, COLIN M. MACLEOD, & MYRA A. FERNANDES, *University of Waterloo* (read by Colin M. MacLeod)—Jacoby, Shimizu, Daniels, and Rhodes (2005) demonstrated that distractors presented among a list of old words that had been deeply encoded were better remembered than distractors presented among a list of old words that had been shallowly encoded. In Experiment 1, we closely replicated this effect. In further experiments, we showed (1) that the effect is not simply a consequence of strength differences in old items created during encoding, (2) that it is insufficient to induce a processing mode at retrieval only but that the mode must bridge encoding and retrieval, and (3) that the effect is sufficiently robust to occur following a different type of encoding—deep versus shallow imagery. Overall, we provide support for the source-constrained retrieval hypothesis of Jacoby et al. (2005):

During attempts at recognition, encoding of new information can be influenced by how surrounding items are encoded and retrieved, as long as the surrounding items recruit a coherent mode of processing.

#### 3:50–4:05 (244)

**Where is Context Integrated Into Memory? Hippocampus, Parahippocampal Gyrus, and Schizophrenia.** MARTIJN MEETER, *Vrije Universiteit Amsterdam*, & LUCIA M. TALAMINI, *University of Amsterdam*—What makes memories episodic is that they are embedded in a spatial and temporal context. This raises the question of how, in the brain, context is integrated with other information into a memory. We have previously suggested that this takes place in the parahippocampal gyrus, through the convergence of inputs that occurs there. In schizophrenia, the parahippocampal gyrus is, of all brain regions, the most strongly affected. Our hypothesis suggests that schizophrenia should therefore be accompanied by a massive deficit in context integration. Here, we present data from a new paradigm in which incidental encoding of context was tested. We present findings from patients with recent-onset schizophrenia that support our hypothesis, but also data from control experiments and from other patients groups, to shed light on the specificity of the identified deficits.

#### 4:10–4:25 (245)

**The Role Context Plays in the Politics of Forgetting.** EMILY R. WALDUM & LILI SAHAKYAN, *University of North Carolina, Greensboro* (read by Lili Sahakyan)—A list-method directed-forgetting study investigated whether people can intentionally forget complex, self-relevant information. The materials involved political attitude statements reflecting conservative and liberal viewpoints. When the goal was to remember, both Democrat and Republican participants recalled more opposing-party statements than own-party statements. However, when the goal was to forget rather than remember, members of both parties forgot more opposing-party statements than own-party statements. Subsequent experiments were aimed at investigating the theoretical mechanisms of this phenomenon by using pure–mixed list designs with free recall and recognition tests. Consistent with previous research (Sahakyan, Delaney, & Waldum, 2008), the results showed yet another parallel between directed-forgetting findings and the list-strength effect, underscoring the role of context in both phenomena.

#### 4:30–4:45 (246)

**Context Matters: Thematic Salience and Test-Induced False Recognition.** DANIEL R. KIMBALL & WILLIAM J. MUNTEAN, *University of Oklahoma*—In the Deese/Roediger–McDermott (DRM) paradigm, participants often falsely recognize a critical lure that is associated to a set of studied words. Two experiments investigated boundary conditions for this effect. Each studied list incorporated three DRM sets, with word order either blocked by DRM set or randomized; this variable was manipulated between subjects in Experiment 1 and within subjects in Experiment 2. Within each list, we manipulated the number of studied associates from each set that were tested prior to the corresponding critical lure. In Experiment 1, the number of tested associates did not affect false recognition differently for blocked and random study orders. In Experiment 2, more tested associates were needed to increase false recognition for the random order than for the blocked order. The results suggest that studying some blocked lists—which have higher thematic salience—can abate test-induced false recognition in other, randomly ordered lists having lower thematic salience.

#### 4:50–5:05 (247)

**Effects of Context Similarity on Contextual Cuing.** STEVEN M. SMITH & ISABEL MANZANO, *Texas A&M University*—Two experiments investigated the influence of similarity on context reinstatement effects, using movie scenes as contexts. Words were displayed on a screen, superimposed over background video scenes at encoding. Robust reinstatement effects were found in both experiments when the video scenes were reinstated during a recall test. In Experiment 1, the original video scenes, highly similar video scenes (recorded in the original settings 10 sec after videorecording the original scenes), or new scenes were shown at test. Highly similar scenes cued recall far better than did new scenes, although neither new contexts nor similar scenes cued recall as

well as did the original scenes. In Experiment 2, however, conceptually similar scenes were found to cue recall as well as the original scenes. These experiments show that both the original contexts of events and contexts similar to the original ones can have robust cuing effects in recall.

5:10–5:25 (248)

**Remember Source Memory ROCs Indicate Recollection Is a Continuous Process.** SCOTT D. SLOTNICK, *Boston College*—The dual-process model assumes that memory is based on recollection (retrieval with specific detail) or familiarity (retrieval without specific detail). A current debate is whether recollection is a threshold (all-or-none) process or, like familiarity, is a continuous (graded) process. In the present study, two continuous models and two threshold models of recollection were evaluated using receiver operating characteristic (ROC) analysis. These models included the continuous signal detection unequal variance model and the threshold dual-process model. In the study phase of two experiments, objects were presented to the right or left of fixation. At test, participants made “remember” or “know” responses and source memory (spatial location) confidence ratings. Recollection ROCs were generated from “remember” source memory confidence ratings. Neither threshold model adequately fit the recollection ROCs. By contrast, the continuous models adequately fit one or both recollection ROCs. The present results indicate that both recollection and familiarity are continuous processes.

**Applications of Decision Making**  
**Independence Ballroom, Saturday Afternoon, 3:50–5:25**

*Chaired by Frederick V. Malmstrom, U.S. Air Force Academy*

3:50–4:05 (249)

**A Behavioral Economic Model of Addiction.** FREDERICK V. MALMSTROM & DAVID MULLIN, *U.S. Air Force Academy*, & GARY MEARS, *University of the Rockies*—Economic models of addiction behavior have traditionally emphasized rational decision making by use of intertemporal utility functions. This study modifies previous models by focusing on interactions between the rational and emotional brain centers. Our model uses an economic barter-exchange framework to describe steady state demand-side behavior. Chemical models of addiction behavior have been shown to involve a three-way interaction with the prefrontal cortex, the nucleus accumbens, and the insula. Here, we pay particular attention to the delay of gratification. This model may be simulated through Monte Carlo processes and tested through existing data from compulsory intervention processes to determine its steady state equilibrium. Finally, this model investigates why rational models of addiction treatment, such as compulsory (e.g., 12-step court ordered) and pure informational (e.g., Just-Say-No) programs, have limited effectiveness.

4:10–4:25 (250)

**Dynamics of Future Discounting and Fluctuating Blood Glucose.** X. T. WANG & ROBERT D. DVORAK, *University of South Dakota*—Little is known about how fluctuating blood glucose levels affect cognitive functions. The present study explored metabolic mechanisms of future discounting, a choice phenomenon where people value present goods over future goods. Using fluctuating blood glucose as an index of body energy budget, optimal discounting should regulate choice among rewards as a function of temporal caloric requirement. We identified this novel link between glucose levels measured in vivo and future discounting in an experiment where participants made choices between a smaller-sooner reward and a larger-later option, with possible actual monetary consequences. In contrast to the zero-sugar drink group, the sugar drink group showed a reduced future discount rate after drink, when controlling for sex, age, body mass index, and the taste rating of the drink. The blood glucose levels not only varied as a result of caloric intake, but also regulated the rate of future discounting according to body energy budget.

4:30–4:45 (251)

**A Causal Contrast Theory of Moral Intuitions in Trolley Dilemmas.** MICHAEL R. WALDMANN & ALEX WIEGMANN, *University of*

*Göttingen*—In trolley dilemmas, a train is about to kill several victims who could be saved if, instead, a different victim is harmed. A number of theories have been proposed that assume that permissibility judgments in these dilemmas are mediated by an assessment of the causal structure entailed by the proposed interventions. For example, it has been postulated that it is permissible to harm people as a side effect, but not as a means of saving others. We have developed a different causal theory, according to which reasoners primarily focus on the relevant targets of the proposed interventions (e.g., threats, victims), and contrast the moral consequences of the causal paths of these targets in the presence versus absence of the intervention. We will show that this causal contrast theory explains intuitions in various types of trolley dilemmas better than its competitors.

4:50–5:05 (252)

**Temporal Discounting and Risk: Different Strategies for Different Tasks.** MARY KAY STEVENSON, STEPHEN HONG, & SHARON ALKIRE, *California State University, East Bay*—Previous research has shown that when participants judge and define their preferences for future losses or risky losses, a slope reversal is reliably obtained. Participants’ responses are described by a steeper slope across losses for the longest delay and a steeper slope across losses for the smallest probability of losing. This study describes the impact of reversing the response scale so that the participants judged the unattractiveness of the events and the outcomes they preferred the least. Participants also evaluated the same stimuli in terms of how attractive the outcomes were or how much they preferred one of two options. Several prediction strategies for identifying individual differences were also tested. The results are discussed in terms of a theoretical framework that can be used to account for the slope reversal effect.

5:10–5:25 (253)

**Managing Exposure to Risk: Strategies and Influences.** SANDRA L. SCHNEIDER, NATHANIEL DECKER, & MOUMITA MUKHERJEE, *University of South Florida*—How decision makers deal with risk is a topic that is typically studied within the “risky choice” paradigm often associated with studies based on Kahneman and Tversky’s prospect theory. In this presentation, we provide a series of empirical and simulated results to show that risk responses are often qualitatively different from what would be expected when focusing exclusively on risky choice. In particular, we demonstrate that risk tolerance is markedly reduced when individuals take an active role in managing their risk exposure, when people feel threatened, and when people make decisions with a partner. In addition, we show that decision-making models that do not take into account context-based goals and dynamic contingencies cannot effectively meet the needs of decision makers, because there is no mechanism to protect decision makers from unnecessary exposure to catastrophic losses or to avail them of serendipitous opportunities for windfall gains.

**Cognitive Control II**  
**Back Bay Ballroom C, Saturday Afternoon, 4:10–5:25**

*Chaired by Ines Jentzsch, University of St Andrews*

4:10–4:25 (254)

**Control Adjustments After Alternation-Based Response Conflict.** INES JENTZSCH, *University of St Andrews*—Recently, we proposed that response alternations in unidimensional tasks can produce response conflict and subsequent processing adjustments (Jentzsch & Leuthold, 2005, *JEP:HPP*). The aim of the present experiments was to more clearly specify the mechanisms of such alternation-based response conflict. In four experiments the response-stimulus interval (RSI) and speed-accuracy instruction were manipulated. Emphasis on speed rather than accuracy should reduce the amount of executive control, leading to a reduced behavioral adjustment after conflict. Participants responded generally more slowly and more accurately under accuracy than under speed instructions. Alternation-based interference was reduced more under speed than under accuracy instruction and systematically decreased with increasing RSI. In sum, these findings suggest that control adjustments

after response conflict are modifiable by strategic, top-down control and are not just automatically triggered by the occurrence or size of conflict. Also, alternation-based response conflict decays over time, with the speed of decay being influenced by the overall amount of conflict.

4:30–4:45 (255)

**Error Adaptation Is Not Conflict Adaptation.** WIM NOTEBAERT, *Ghent University*—In this paper, I present three lines of support indicating that behavioral changes following errors are different in nature than behavioral changes following conflict, in contradiction to what conflict-monitoring theory suggested. First, there is converging evidence that conflict adaptation is task specific. I demonstrate that the same data that showed task specificity for conflict adaptation show error adaptation over tasks, hence demonstrating task-unspecific error adaptation. Second, in a new experiment where errors and conflict could be dissociated, I demonstrated no reduction of interference after errors (as is usually observed after conflict trials). Finally, I present new data that demonstrate that adaptation following errors is subserved by more posterior brain areas, as compared with the more frontal areas involved in conflict adaptation. The data will be discussed in terms of adaptation by binding (Verguts & Notebaert, 2008, 2009) and the orienting account (Notebaert et al., 2009).

4:50–5:05 (256)

**List-Wide Proportion Congruence Effects Are Not Always Item-Specific Effects in Disguise.** JULIE M. BUGG, *Washington University*—The item-specific proportion congruence effect refers to the finding that Stroop interference is reduced for items that are mostly incongruent (e.g., RED and BLUE), as compared with items that are mostly congruent (e.g., GREEN and WHITE). This effect occurs within a list-wide context that is 50% congruent and, thus, cannot be accounted for by list-wide control strategies. In contrast, recent evidence supports the notion that item-specific control underlies the list-wide proportion congruence effect (the finding of reduced Stroop interference in lists that are composed of mostly incongruent trials). Here, the role of response predictability in the obtainment of such evidence is considered. In doing so, it is shown that (1) the list-wide proportion congruence effect at least partially reflects the contribution of list-wide control that is independent of item-specific control and (2) list-wide and item-specific control can operate simultaneously in service of reducing interference.

5:10–5:25 (257)

**Effects of Contingency Learning and Working Memory Capacity on Stroop Proportion Congruence Effects.** KEITH A. HUTCHISON, *Montana State University*—In a series of experiments, color words were presented either mostly in their congruent colors (MC items) or mostly in incongruent colors (MI items). Importantly, MI items (e.g., *red*) were most often presented in a specific incongruent color (e.g., yellow). The results indicated a significant item-specific proportion congruence effect (i.e., smaller interference for MI items), but only for high-contingency responses (e.g., *red* presented in yellow). In follow-up experiments, MC and MI items were embedded within MC and MI lists created by adding filler items. Participants also completed the operation span task. The results demonstrated both item-specific and list-specific proportion congruence effects. These effects interacted such that list-specific effects were greatest for MC items. In addition, working memory capacity correlated negatively with estimates of word reading, especially among those in the MC list. These results support both cognitive control and contingency learning as mechanisms underlying proportion congruence effects in the Stroop task.

#### Memory Models

Back Bay Ballroom D, Saturday Afternoon, 3:10–5:25

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

3:10–3:25 (258)

**Remember-Know and Source Memory Instructions Can Qualitatively Change Old-New Recognition Accuracy: The Modality-Match Effect.** NEIL W. MULLIGAN, MIRI BESKEN, & DANIEL

PETERSON, *University of North Carolina, Chapel Hill*—The modality-match effect in recognition refers to superior memory for words presented in the same modality at study and test. Prior research demonstrates that the modality-match effect is found when modality is rendered salient at either encoding or retrieval. The present study indicates that the remember-know and source (modality) tests induce the modality-match effect under conditions in which a standard (old-new) recognition test reveals no effect. Specifically, visual and auditory study trials were presented in blocks, followed by a standard (old-new) recognition test, a remember-know recognition test, or a source (modality) memory test. For the standard recognition test, modality match produced no effect on recognition accuracy, consistent with prior research. Measures of old-new accuracy obtained from the other two tests demonstrated a significant modality-match effect. This indicates that these forms of test can qualitatively change old-new recognition, a finding at odds with the goals and typical conceptions of these tests.

3:30–3:45 (259)

**Signal Detection Versus Threshold Models of Source Memory.** ARNDT BRÖDER & JULIA SCHÜTZ, *University of Bonn*—Recently, several authors claimed that the curvilinear shape of source memory rating receiver-operating characteristics (ROCs) refutes threshold models. However, rating-based ROCs are not diagnostic to disprove threshold models. Furthermore, since source memory ROC analyses ignore influences of other processes, such as item detection and old-new response tendencies on source discrimination performance, source memory data should be analyzed using more diagnostic methods, such as direct model fitting. Five source-monitoring experiments with different bias manipulations and materials were conducted. We fitted the two high threshold multinomial model of source monitoring (2HTSM) and a multivariate signal detection model for selection to the data. Furthermore, we included conditions to replicate the typical ratings ROCs and to compare the model fits of an extended 2HTSM and the multivariate signal detection model. The results suggest that the discrete model is superior in fitting the data, and both models are at least equally well suited for measurement purposes.

3:50–4:05 (260)

**A Signal-Detection-Based, Dual-Process Interpretation of Remember/Know Judgments.** JOHN T. WIXTED & LAURA MICKES, *University of California, San Diego*—The remember/know procedure is widely used in both psychology and cognitive neuroscience to investigate recollection and familiarity. In recent years, a great deal of evidence has supported a signal detection interpretation of remember/know judgments over the common dual-process interpretation. However, a problem with the signal detection account is that the slope of the zROC derived from confidence ratings differs from the slope derived from remember/know judgments. This difference has been explained by assuming that the remember criterion exhibits trial-to-trial variability on the memory strength axis. New evidence suggests that (1) the apparent criterion variability may be an illusion, (2) old/new judgments (and confidence ratings) are based on a continuous memory signal that consists of recollection and familiarity combined (in a manner consistent with signal detection theory), and (3) remember/know judgments are based on a continuous recollection signal such that a remember judgment is made when the degree of recollection exceeds a (fixed) recollection criterion.

4:10–4:25 (261)

**Tests of a Model for Source and Item Recognition Memory.** MICHAEL J. HAUTUS, *University of Auckland*, & CAREN M. ROTELLO & NEIL A. MACMILLAN, *University of Massachusetts, Amherst* (read by Neil A. Macmillan)—Our recent signal detection model of source and item memory (Hautus et al., 2008) postulates two-dimensional correlated distributions, likelihood-based decision bounds, and partial inattention. The model, which does not incorporate a separate recollection process, provides an excellent account of previously published old-new and source receiver-operating characteristics (both overall and conditional on a particular confidence level). In a series of experiments requiring both old-new and source ratings, we tested the responsiveness of the model's parameters to the experimental situation. For example, we varied the relative strengths of the two sources

and considered whether the resulting model fit indicated that only the strength-of-evidence parameters changed. To affect the response bias parameters, we varied the probabilities of the sources and also implemented payoffs for certain responses. Attentional manipulations targeted the attention parameter. We discuss the results of these experiments and implications for the interpretation of other source recognition data.

#### 4:30–4:45 (262)

##### **Sequential Dependencies in Recognition Memory Testing.**

KENNETH J. MALMBERG & DONALD J. HAYWARD, *University of South Florida*—According to all models of recognition, adjacent decisions at test are independent of one another. However, findings that show that testing items consecutively that were studied in nearby serial positions enhances memory for the second item tested violate the independence assumption. A critical issue is whether this sequential dependency is the result of enhanced memory access (i.e., recognition priming) or due to the assimilation of adjacent responses. The results of several experiments clearly point to the assimilation account of sequential dependencies, since they were consistently observed even when the test items were not studied. The implications for models of recognition memory are discussed, and a link between models of memory and perception is proposed.

#### 4:50–5:05 (263)

##### **The Two Faces of Part-List Cuing and Part-List Retrieval.**

KARL-HEINZ BÄUML & ANUSCHEH SAMENIEH, *University of Regensburg*—Forgetting of critical material can arise through the passage of time until test (normal forgetting), the prior encoding of related material (proactive interference), a context change after study (context-dependent forgetting), or a cue to forget the material (directed forgetting). We

examined to what extent such episodic forgetting is modulated by part-list cuing (PLC) and part-list retrieval (PLR). The critical study material was divided into target and nontarget items, and target recall was examined in the presence of the nontargets serving as retrieval cues at test (PLC) and after prior guided cued recall of the nontarget items (PLR). PLC and PLR did not affect normal forgetting and proactive interference but eliminated the forgetting, or even reversed the pattern, in context-dependent forgetting and directed forgetting. The results demonstrate two different faces of cuing and retrieval, providing suggestions on when they are decremental and when they are incremental for recall.

#### 5:10–5:25 (264)

##### **Recognition of Categorized Words: Strength Effects in Rote Study.**

MURRAY SINGER, *University of Manitoba*—In signal detection analyses of recognition memory, decision criteria may shift among stimulus classes. People apply stricter criteria to strong than to weak stimuli tested in different lists. When item strength varies within list, criterion shifts appear when study is accompanied by semantic judgments (Singer, *M&C*, in press), but less so with rote study (Stretch & Wixted, 1998, *JEP:LMC*). In new experiments scrutinizing rote study, participants studied and then recognized words from category pairs (professions, countries). The experiments cumulatively presented one to five category pairs, examined item study times of 750–3,000 msec, instantiated “strength” as two to five repetitions, and administered recognition after each or all category pairs. Opposite to the pattern detected under semantic judgments, false alarms were uniformly higher (less strict) for strong than for weak categories. Hits were higher for strong categories. This concordant pattern is sometimes interpreted to reflect strengthened distributions of both targets and lures, rather than a criterion shift.



**Dual Processes in Memory Development**  
**Grand Ballroom, Sunday Morning, 8:00–9:15**

*Chaired by Mark L. Howe, Lancaster University*

**8:00–8:15 (265)**

**A New Model and Data on Early Memory Development.** MARK L. HOWE, *Lancaster University*, & CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*—We present a new model and research that addresses the scarcity of multiprocess studies of early memory development. It turns out that this problem can be resolved by using low-burden repeated recall tasks. Because recall data are inherently multidimensional, they can be well understood using a hidden Markov model whose parameters measure three component processes: direct access of memory traces (a recollective component), familiarity judgment, and reconstruction. We used this model to measure the three processes in a large corpus of developmental studies of associative, cued, and free recall. Between early childhood and adolescence, memory development was dominated by increases in direct access and reconstruction. In contrast, memory development was dominated by increases in familiarity judgment between adolescence and adulthood.

**8:20–8:35 (266)**

**Implications for False Memory Rejection.** SIMONA GHETTI, *University of California, Davis*—Previous research has documented that the recollection and familiarity processes support both true and false memory. To date, relatively little is known about the relative contribution of these processes to false-memory rejection during development. I report the results of a series of experiments showing that (1) familiarity-based rejection is a robust phenomenon present in early childhood; (2) recollection rejection, the process through which recollection of accurate memories enhances rejection of false memories that are similar in content to true memories, not only operates on spontaneous false memories but also counters misinformation effects during childhood; and (3) rejection of false memories on the basis of additional metacognitive processes becomes increasingly prominent during the course of childhood.

**8:40–8:55 (267)**

**New Modeling Procedures, With Data on Aging, Cognitive Impairment, and Psychosis.** CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*, & MARK L. HOWE, *Lancaster University*—We present a solution to the ongoing controversy over whether separate recollection and familiarity processes can be measured with recognition data and then apply it to the study of dual memory processes in healthy aging, cognitive impairment, and psychosis. The measurement problem is solved by switching to low-burden repeated recall tasks. The data of such tasks are inherently multidimensional and are easily modeled with hidden Markov chains that measure three distinct processes: direct access of verbatim traces (a recollective process), familiarity judgment, and reconstruction. We measured these processes in older and younger adults by using a large corpus of associative, cued, and free recall data. Healthy older adults displayed consistent declines in direct access, coupled with sparing of familiarity judgment and reconstruction. However, reconstructive ability was no longer spared in older adults who were cognitively impaired. Schizophrenic subjects also exhibited deficiencies in reconstruction, as compared with clinical control subjects.

**9:00–9:15 (268)**

**Elevated False Recollection of Emotional Pictures With Aging.** DAVID A. GALLO, *University of Chicago*—Current theories predict opposing effects of emotionally arousing information on false memory. If emotion enhances recollection, false recollection might be lower for emotional than for neutral pictures. However, if emotion enhances conceptual relatedness, false recollection might increase for nonstudied but emotionally related pictures. We contrasted these two factors in younger and older adults by using the International Affective Picture System (IAPS) and a memory test designed to elicit recollection-based responding. Although both age groups used recollection in our task, false

recollection was greatest for emotional pictures. A separately obtained measure of gist-based relatedness for the IAPS content provided additional support for the conceptual relatedness account. Finally, even after controlling for accuracy differences, age was related to high-confidence false recollection.

**Psycholinguistics III**

**Constitution Ballroom, Sunday Morning, 8:00–9:15**

*Chaired by Gary E. Raney, University of Illinois, Chicago*

**8:00–8:15 (269)**

**Early Language Learners Show a Reversed MLE During Letter Detection.** JOANNA C. BOVEE & GARY E. RANEY, *University of Illinois, Chicago* (read by Gary E. Raney) (sponsored by Gary E. Raney)—Research using letter detection tasks (Hatch et al., 1974; Tao et al., 1997) shows that beginning second language learners process words similarly to native language users, as evidenced by the presence of missing letter effects (MLE, which is more accurate letter detection for content words than for function words) in both groups. The MLE is smaller during initial language learning but quickly grows. To explore word processing during early language learning, we had readers who were proficient in English and not proficient in Spanish perform letter detection tasks while they read texts in English and Spanish. In English, participants demonstrated the traditional MLE. In Spanish, the opposite occurred (reverse MLE). It appears that readers were not unitizing words and/or were not affected by word class in their second language. Spanish letter detection resembled more of a letter-level feature detection task than a verbal task, with letter detection being easier in shorter function words.

**8:20–8:35 (270)**

**Comics: Language and Culture Affect Action in Depictions.** BARBARA TVERSKY, *Teachers College, Columbia University*, and *Stanford University*, & TRACY CHOW, *Teachers College, Columbia University*—Do language typology and culture affect depictions produced by a culture? To address this, we picked an inexpensive popular medium, comics for teenage boys. We chose four stories, each from four countries: two from manner (many verbs of motion) languages, Chinese and English, and two from path (few verbs of motion) languages, Japanese and Italian. Twelve U.S. and 10 Japanese adults blindly rated frames from these comics on a scale ranging from *action* to *scene-setting*. Ratings of U.S. and Japanese respondents did not differ. The degree of action was higher for manner than for path languages and higher for Eastern than for Western cultures. Describing action in manner languages is more fluent, which may facilitate thinking about action in creating stories. Eastern cultures are thought to emphasize interconnectivity among people more than do Western cultures, and actions show relations between people more than do static scenes.

**8:40–8:55 (271)**

**Does the Cognate Effect Reflect the Letter or Spirit of Cross-Language Relationships?** NATTALIA PATERSON & MATTHEW GOLDRICK, *Northwestern University* (read by Matthew Goldrick)—Bilinguals produce cognates—words that share form and meaning across languages—more quickly and accurately than they do noncognates. It is unclear whether this cognate advantage is rooted in the simultaneous overlap of both form and meaning or whether overlap in the form of cross-language neighbors is sufficient to induce the effect. To address this, we examine the English picture naming performance of Portuguese–English bilinguals. We examine naming not just of cognates (e.g., English *camel* with Portuguese translation *camelo*) but also of false cognates—words with cross-language neighbors sharing form but not meaning (e.g., English *bald* with Portuguese neighbor *balde*, meaning “bucket”). Comparison of reaction time and accuracy measures for both of these categories relative to noncognate controls will reveal whether form overlap alone is sufficient to facilitate processing. Additional phonetic analyses of speakers’ productions examine whether these cross-language lexical neighbors influence the degree to which phonetic properties of Portuguese intrude in English productions.

9:00–9:15 (272)

**Effects of Stress, Working Memory Capacity, and Inferential Complexity on Foreign Language Reading Comprehension.** LESTER C. LOSCHKY, MANPREET K. RAI, RICHARD J. HARRIS, PATRICIA C. BARROS, & LINDSAY G. COOK, *Kansas State University*—We investigated effects of stress, working memory (WM) capacity, and inferential complexity on foreign language (FL) readers' inference comprehension, in terms of accuracy (processing effectiveness) and reading speed (processing efficiency). Fifty-five intermediate-level Spanish learners' reading comprehension was measured using questions with three levels of inferential complexity: noninference, bridging-inference, and pragmatic-inference. We measured participants' WM capacity and varied their stress level using a video camera. The results showed that higher WM learners were more accurate overall. Stress decreased efficiency, with a trend toward greater effects on RTs for questions requiring greater inferential complexity. Consistent with Eysenck et al.'s (2007) attentional control theory, analyses showed that higher WM learners strategically traded efficiency for greater effectiveness, whereas lower WM learners only did so (less successfully) under stress. Thus, the results showed that stress impedes FL reading comprehension through interactions between WM capacity and inferential complexity but can be strategically compensated for by increasing processing time.

#### Divided Attention

Republic Ballroom, Sunday Morning, 8:00–9:55

Chaired by Andrew Heathcote, *University of Newcastle, Australia*

8:00–8:15 (273)

**Testing the Architecture of Cognition.** ANDREW HEATHCOTE, AMI EIDELS, & SCOTT D. BROWN, *University of Newcastle, Australia*—Psychologists have long sought ways to identify the architecture of cognition, from Donders's (1859) subtractive methodology, through Sternberg's (1969) additive factors methodology for establishing selective influence on a processing stage, and culminating in Townsend and Nozawa's (1995) system factorial technology (SFT). SFT analyzes response time distribution, rather than summaries such as mean RT, allowing it to avoid the limitations of earlier approaches and make strong inferences (Platt, 1964). SFT uses signature functions that identify architectural variations critical to the study of attention and perception, such as whether a system is serial or parallel and whether it is affected by capacity limitations. We propose a nonparametric Bayesian approach, based on Klugkist, Laudy, and Hoijtink (2005), to statistical inference for SFT. We benchmark its statistical performance for testing selective influence, where there exist alternative approaches from econometrics, and illustrate its broader application to testing SFT hypotheses where no alternative tests exist.

8:20–8:35 (274)

**Dual Task With and Without Cost: An Underlying Modular Architecture.** ASHER COHEN, MORAN ISRAEL, MAYA ZUCKERMAN, & ARIT GLICKSOHN, *Hebrew University of Jerusalem*—Dual task costs are often documented, but their underlying costs are disputed. We conducted experiments in which participants performed one or two visual tasks over eight sessions. In the first set of experiments, the input to both tasks was presented simultaneously. The two tasks either shared a module or did not share a module. Clear dual task costs were observed when the tasks shared a module, and no costs were observed when the tasks did not share a module. The very same tasks were performed in a second set of experiments, except that the SOA of the input to the two tasks varied between trials. Here, a clear cost was observed even when the tasks did not share a module. The results suggest that a modular architecture is an important factor in dual task performance and that the PRP paradigm is not adequate for examining structural dual task costs.

8:40–8:55 (275)

**Supertaskers: Extraordinary Ability in Multitasking.** DAVID L. STRAYER & JASON M. WATSON, *University of Utah*—Theory suggests that driving should be impaired for all motorists when they

concurrently talk on a cell phone. But is everybody impaired by this dual-task combination? We tested 200 participants in a high-fidelity driving simulator in both single- and dual-task conditions. The dual-task condition involved concurrently performing a very demanding auditory version of the operation span (OSPAN) task. Whereas the vast majority of participants showed significant performance decrements in dual-task conditions (compared to single-task conditions for both the driving and OSPAN tasks), 2% of the sample showed absolutely no performance decrements across the single- and dual-task conditions. In the single-task condition, these supertaskers scored in the top quartile on all dependent measures associated with driving, and OSPAN tasks and Monte Carlo simulations indicated that the frequency of supertaskers was significantly greater than chance. We suggest that, in demanding dual-task situations, supertaskers recruit from broader neural regions than do the population at large.

9:00–9:15 (276)

**Triple-Task Performance Reveals Common Codes for Spatial Information.** PAUL ATCHLEY & DAVID MARSHALL, *University of Kansas*—Multiple resource theory (Wickens, 1980, 2002) suggests attention may use separate resource pools and share common codes (such as spatial codes). This view is supported by work showing that spatial coding for verbal and visual attention information may overlap physiologically in right hemisphere regions. We examined cross-modal dual-task performance using a dichotic listening task to present verbal information and a pointing task to collect visual attention data. Participants listened to word streams of directional words and color words in each ear and responded to one ear on a block of trials by producing compatible direction (e.g., “up: north”) or color (e.g., “ruby: red”) responses while performing a visual task in which they identified a centrally presented target and then localized a target presented peripherally along the same axes as the directional words. The data showed clear code interference effects; dichotic evidence for a right lateralized effect for direction was mixed.

9:20–9:35 (277)

**Evidence Against a Unitary Central Bottleneck: Reductions of Dual-Task Costs Depend on Modality Pairings.** ELIOT HAZELTINE, *University of Iowa*, ERIC RUTHRUFF, *University of New Mexico*, & TIM WIFALL, *University of Iowa*—Practice can dramatically reduce dual-task costs, in some cases, completely eliminating them. However, dual-task costs are reduced at different rates, depending on the particular combination of tasks. We examined the role that task similarity, in terms of the input and output modalities, plays in reduction of dual-task costs with practice. Four groups of participants performed a visual-manual task that was paired with either another visual-manual task, a visual-vocal task, an auditory-manual task, or an auditory-vocal task. Although task difficulty was similar across all conditions, only the auditory-vocal group was able to eliminate dual-task costs after 16 sessions of practice. These findings suggest that dual-task costs after practice depend on crosstalk between modality-specific representations rather than on competition for amodal central operations.

9:40–9:55 (278)

**When Two Objects Are Easier Than One: Implications for Object-Based Attention.** W. TRAMMELL NEILL, YONGNA LI, & GEORGE A. SEROR, *University at Albany*—In many studies, subjects process two features of one object more easily than they do two features of two objects. Such within-object superiority suggests that attention is object based rather than merely space based. However, other studies find the opposite result: between-object superiority (e.g., Davis & Holmes, 2005; Neill, O'Connor, & Li, 2008). How can it be easier to divide attention between features of different objects than between features of the same object? We consider three explanations: (1) Processing capacity may be initially divided between objects, so that features of the same object compete for allocated capacity, but features of different objects do not. (2) Attention to two features of the same object may cause irrelevant object information to also be processed. (3) When target features are integral to object shapes, whole objects may be easier to compare than the component features. We report multiple experiments supporting the third explanation.

**Motor Control****Independence Ballroom, Sunday Morning, 8:00–9:55***Chaired by Gordon M. Redding, Illinois State University***8:00–8:15 (279)**

**Intermanual Transfer of Visual Prism Adaptation for Right- and Left-Handers.** GORDON M. REDDING, *Illinois State University*, & BENJAMIN WALLACE, *Cleveland State University*—Right- and left-handers had their dominant or nondominant hand exposed to leftward or rightward prismatic displacement under exposure conditions that produced visual realignment. Visual realignment transferred from the nondominant hand to the dominant hand, but not from the dominant hand to the nondominant hand. These results suggest that limb control is lateralized for right-handers, but not for left-handers.

**8:20–8:35 (280)**

**Bimanual Coordination in Expert Typists in RT, Speeded Tapping, and Synchronization Tasks.** MARTINA RIEGER, *Max Planck Institute for Human Cognitive and Brain Sciences*—It has previously been shown that expert pianists show improved performance in tasks requiring bimanual coordination. In the present study, it was investigated whether this is also the case in expert typists. In Experiment 1, typists and control participants performed a spatially compatible and a verbally compatible bimanual RT task. Typists showed a reduced difference between symmetric and parallel reaction times. Whereas pianists are well trained in performing alternating movements between two hands, as well as performing bimanual movements (concurrent keypresses), the task of typing only requires the former (i.e., switching between hands). Therefore, in Experiment 2, typists, pianists, and control participants performed tapping tasks, either alternating between fingers of the left and right hand or concurrently tapping with fingers of both hands. It is concluded that, in expert typists, intensive training of finger movements leads to increased efficiency in performing bimanual finger movements.

**8:40–8:55 (281)**

**Evidence for the Online Correction of Saccades From the Eye Movements of an Individual With a Scotoma.** TIMOTHY N. WELSH & SANJAY CHANDRASEKHARAN, *University of Calgary*—Saccades are generally considered to be ballistic in nature and executed without the involvement of online correction mechanisms. The results of several studies, however, suggest that the trajectories of saccades are adjusted during execution. To investigate the role of visual information in online control, we performed a detailed kinematic analysis of the voluntary saccades of an individual with a scotoma in the right eye that obscured foveal vision and the nasal half of the visual field. Movements of both the impaired and unimpaired eyes were simultaneously recorded during horizontal saccades to targets presented in and out of the scotomic area. Interestingly, evidence for online correction, including increased saccadic durations and time-after-peak decelerations, was greatest in the trajectories of the unimpaired left eye. These data suggest that a single central plan is responsible for the ballistic component of the saccade of both eyes, but that online control mechanisms correct each eye independently.

**9:00–9:15 (282)**

**The Dynamics of Disruption From Altered Auditory Feedback.** PETER Q. PFORDRESHER & JOHN D. KULPA, *University at Buffalo*—Three experiments are reported to test the proposal that perception and action are coordinated in a way that distinguishes sequencing and timing (Pfordresher, 2003). Participants produced sequences of isochronous taps (Experiment 1) or melodic sequences (Experiments 2 and 3) at a prescribed rate. Participants heard auditory feedback over headphones, which could be altered with respect to synchrony with actions (Experiments 1 and 2) or pitch contents (Experiment 3). Trials were organized in phases, during which altered feedback was presented (for varying lengths of time) and then withdrawn. Whereas asynchronous auditory feedback yielded immediate and transient effects (vanishing after removal), feedback that resulted in alterations of feedback pitch had an accumulative effect that lasted after removal of altered feedback.

**9:20–9:35 (283)**

**Expertise, Age, and Training in Rhythmic Timing: An fMRI Study.** RALF T. KRAMPE, ANN LAVRYSEN, NICOLE WENDEROTH, & STEPHAN SWINNEN, *Katholieke Universiteit Leuven*—We used fMRI to contrast performances of simple, isochronous timing tasks with complex rhythm tasks in younger (20–35 years of age) and older (60–70 years of age) expert musicians and age-matched novices. Participants produced taps with their wrists while wearing an orthosis and lying in the scanner. In addition, novices underwent a nine-session training regime with pre- and posttraining scans; experts participated in four sessions including pre-post scans. In line with earlier studies (Krampe, Mayr, & Kliegl, *JEP:HPP*, 2005), timing variability in novices was higher in rhythm, as compared with isochronous tasks, and this effect was pronounced in older novices. Experts showed much lower variability in all tasks and no task-related increases in variability. At the neural level, expertise corresponded to higher activation in a motor network (cerebellum, premotor area, SMA) activated by all participants. Increasing task complexity was reflected in more cerebellar activation in younger experts, whereas novices—particularly older adults—showed additional frontal activation.

**9:40–9:55 (284)**

**Probing Discrete Keying Sequences With a Tone Counting Task.** WILLEM B. VERWEY, *University of Twente*—Earlier research has shown that extensive practice of fixed movement sequences induces the development of memory representations (motor chunks) that allow rapid execution of these sequences. As part of the discrete sequence production task, participants in the present study first practiced two fixed sequences consisting of six (Experiment 1) or seven keypresses (Experiment 2). In the test phases, they executed these familiar, and in Experiment 1, two unfamiliar, keying sequences while, at an unpredictable moment, a low- or high-pitched tone could be presented. The results suggest that a cognitive processor is heavily involved in executing each individual keypress of the unfamiliar keying sequences. In familiar sequences, its role remained important for the first keypress, but its contribution to executing later keypresses had reduced considerably, even for the transition between successive chunks within a sequence.

**Speech Perception II****Back Bay Ballroom C, Sunday Morning, 8:00–9:55***Chaired by Rochelle S. Newman, University of Maryland, College Park***8:00–8:15 (285)**

**Lexical Access Across Talker Changes: Does His “Cap” and Her “Size” Refer to Boats?** ROCHELLE S. NEWMAN, *University of Maryland, College Park*—A long-standing issue in speech perception is how listeners decide what words a speaker intended to say. Because of potential ambiguity in word boundary locations, the brain appears to initially entertain multiple interpretations of a speech signal, including interpretations that cross a word boundary. For example, Gow and Gordon (1995) found that multiple-word sequences such as “two lips” may activate words such as “tulips,” despite the presence of acoustic cues to a word boundary in the middle of the sequence. We examine whether lexical access could similarly cross signals entirely—that is, whether lexical access could occur across a change in talkers. We find that when two different speakers produce two separate words (such as when a male says “cap” followed by a female saying “size”), lexical access for the combined item (“capsize”) continues to occur, despite the clear acoustic changes signaling a word (and talker) boundary.

**8:20–8:35 (286)**

**Individual Differences in Executive Function Affect Spoken Word Recognition.** JULIE MERCIER, IRINA PIVNEVA, CORINNE HAIGH, & DEBRA A. TITONE, *McGill University* (read by Debra A.



Titone)—We investigated whether individual differences in executive function (EF) affect the time course of spoken word processing using the visual world paradigm. Participants listened to spoken words (e.g., *bath-tub*) and looked at pictures including the target, a word onset competitor (e.g., *bagpipes*), and unrelated filler pictures, while their eye movements were monitored. One group ( $n = 23$ ) had no advance training with the picture names, whereas another group ( $n = 21$ ) did have advance training. All participants looked more at competitor pictures than at other nontarget pictures; however, EF in the two groups differentially correlated with competitor effects. With no advance training, high EF correlated with increased competition prior to target/competitor acoustic divergence and reduced competition after their divergence. With advance training, high EF skills correlated with reduced competition at early stages only. Thus, individual differences in EF affect the temporal dynamics of spoken word recognition, especially under conditions that are most reflective of natural language processing.

8:40–8:55 (287)

**Linguistic Masking in Speech Perception Under Adverse Conditions.** SUSANNE BROUWER, *Max Planck Institute for Psycholinguistics*, & KRISTIN VAN ENGEN, LAUREN CALANDRUCCIO, & ANN R. BRADLOW, *Northwestern University* (read by Ann R. Bradlow)—Speech recognition in the presence of background speech is challenged by a combination of energetic/peripheral and informational/central masking. Energetic masking is related to target audibility. Informational masking depends on linguistic, attentional, and cognitive factors (Cooke, García-Lecumberri, & Barker, 2008). We explored the linguistic component of informational masking by having English and Dutch listeners recognize English and/or Dutch sentences embedded in two-talker babble at different signal-to-noise ratios (SNRs). The babble was in either the same language (e.g., English-in-English), a typologically close language (e.g., English-in-Dutch), or a typologically distant language (e.g., English-in-Mandarin). We also compared recognition accuracy in babble consisting of either meaningful or semantically anomalous sentences. The results provide insight into how bottom-up perceptual processes (indexed by variation in energetic masking from different SNRs) interact with top-down learning and categorization mechanisms (indexed by variation in linguistic masking from different listener-, language- and content-related characteristics) for speech perception under adverse conditions.

9:00–9:15 (288)

**Cross-Linguistic Effects in the Perception of Assimilated Speech.** GARETH GASKELL & MEGHAN CLAYARDS, *University of York*, & OLIVER NIEBUHR, *University of Provence*—Models of spoken-word recognition differ on whether compensation for assimilatory changes are language specific. Through association with pictures, we taught English and French participants pseudowords that began or ended with /s/ or /ʃ/ consonants. Both languages exhibit some sibilant assimilation (e.g., /s/ becomes like /ʃ/ in “dress shop”), but the languages differ in its strength and directionality. After 2 days’ training, participants were presented with pseudoword pairs that could engender assimilation. The sequences were uttered by both French and English speakers and used a spectral continuum of sibilant sounds between the two phonemic endpoints. Listeners’ perceptions of the potential assimilations were examined using a visual-world eyetracking paradigm, in which the listener clicked on a picture associated with the perceived pseudoword. Preliminary analyses suggested that French and English participants treated the assimilatory sequences differently and that compensation for assimilation develops in response to the statistics of assimilation in the listener’s native language.

9:20–9:35 (289)

**Dissociation Between Speech and Music Processing in Preverbal Infants.** HEATHER BORTFELD, *University of Connecticut*, ESWEN FAVA, *Texas A&M University*, & DAVID A. BOAS, *Harvard Medical School*—Here, we demonstrate dissociation between processing of music and speech in preverbal infants. In a previous study (Bortfeld, Fava, & Boas, 2009), we demonstrated left lateralization for processing speech in infants. Here, we hypothesize that music processing will be right lateralized in a comparable population. Although music contains a rule-based

structure somewhat like language, music is dependent on relatively small changes in pitch, distinctions to which the right hemisphere has been demonstrated to be sensitive. Preverbal infants watched a video of animated shapes (visual stimuli) coupled with either speech (1 of 10 different stories in infant-direct speech) or music (Chopin’s *Ballade No. 3 in A Flat Major*) while we recorded hemodynamic activity in bilateral superior temporal sites using near-infrared spectroscopy. The results demonstrate that, even at this early age, processing these two different forms of structured auditory stimuli relies on distinct cortical regions.

9:40–9:55 (290)

**Speech Synthesis From Natural Models by Hand and by Algorithm.** ROBERT E. REMEZ, KATHRYN R. DUBOWSKI, MORGANA L. DAVIDS, EMILY F. THOMAS, NINA PADDU, & Yael S. GROSSMAN, *Barnard College, Columbia University*—Are automatic methods of estimation adequate for measuring the acoustic properties of speech? With the use of algorithmically derived estimates as synthesis parameters, tests of intelligibility of the resulting synthetic speech can provide one measure of adequacy. We performed new tests of intelligibility of synthetic sentences created from automatically produced estimates and compared these to synthetic items produced from estimates made by hand. Two groups of sentences were used in the test: (1) voiced continuously (e.g., *I’m merry wherever I roam*) and (2) acoustically discontinuous due to the presence of voiceless consonants and stops (e.g., *The watchdog gave a warning growl*). Because automatic methods fare most poorly when an acoustic spectrum changes rapidly or discontinuously, we predicted that intelligibility would be poorest for sentences exhibiting acoustic discontinuities that were estimated automatically. The results are instructive about the efficacy of automatic estimation in acoustic measurement and speech synthesis.

## Human Learning and Instruction II

Back Bay Ballroom D, Sunday Morning, 8:00–9:35

Chaired by Michael C. Mozer, *University of Colorado, Boulder*

8:00–8:15 (291)

**Predicting the Optimal Spacing of Study: A Multiscale Context Model.** MICHAEL C. MOZER, *University of Colorado, Boulder*, HAL PASHLER, *University of California, San Diego*, NICHOLAS J. CEPEDA, *York University*, & ROBERT LINDSEY, *University of Colorado, Boulder*—When individuals learn paired associates over multiple study sessions, the temporal spacing of study has a significant impact on memory retention. A nonmonotonic relationship is observed between intersession interval (ISI) and retention: Intermediate ISIs yield higher cued recall accuracy than do short or long ISIs, implying the existence of an optimal ISI. This optimal ISI increases with the retention interval roughly according to a power law. We introduce a model that is able to predict the optimal spacing for specific material, given only data characterizing forgetting of that material over time following a single study session. Our model is a synthesis of two existing memory models (Raaijmakers, 2003; Staddon, Chelaru, & Higa, 2002) that share key formal properties with each other, even though they are cast as very different mechanisms. The synthesis results in a model that can determine study schedules maximizing the durability of learning in educational settings.

8:20–8:35 (292)

**Reversing the Spacing Effect: Support for an Accessibility Principle.** ROBERT A. BJORK, *UCLA*, NATE KORNELL, *Williams College*, & CHI-KONG CHEUNG, *UCLA*—We argue that the spacing effect, one of the most robust and general findings from the history of experimental psychology, reflects a more fundamental accessibility principle—namely, that reducing the accessibility of information in memory fosters additional learning of that information. In this view, increasing the spacing between learning trials enhances learning because it decreases accessibility of the to-be-learned information. Using a procedure designed to eliminate the normal confounding of spacing and accessibility by inducing absolute recovery—so that accessibility increased, rather than decreased, with delay—we reversed the spacing effect, a result that supports the accessibility principle and runs counter to other explanations



of the spacing effect. The accessibility principle may be a kind of law of memory, even if the effect of spacing per se is not.

#### 8:40–8:55 (293)

**Achieving Arithmetic Fluency Through Fact-Family Study Versus Traditional Testing.** TIMOTHY C. RICKARD & DANIEL BAJIC, *University of California, San Diego*—Fact-family study involves presenting students with arithmetic number triplets (e.g., 4, 7, 28) and having them perform a study task for each triplet. Two factors suggest that this method may, relative to traditional testing (e.g.,  $28/7 = ?$ ), facilitate the onset of fluent, retrieval-based performance: (1) If triplets are encoded into memory as a unit, then the entire family of corresponding arithmetic problems can be performed by accessing that unit, whereas such encoding does not occur through testing; and (2) the need to repeatedly execute time-consuming arithmetic strategies that do not in themselves foster memory encoding may be circumvented. Thus, although testing has nearly always been found to be superior to study in other domains, the cards appear to be uniquely stacked against testing in the case of arithmetic. We report our initial effort to directly compare study and testing as methods for achieving arithmetic fluency.

#### 9:00–9:15 (294)

**Computer-Based Learning of Neuroanatomy: A Longitudinal Study of Learning, Transfer, and Retention.** JULIA H. CHARIKER, FARAH NAAZ, & JOHN R. PANI, *University of Louisville* (read by John R. Pani)—A longitudinal experiment was conducted to explore computer-based learning of neuroanatomy. Using a realistic 3-D graphical model of neuroanatomy and sections derived from the model, we integrated exploratory graphical tools into interactive computer programs to allow adaptive exploration. Seventy-two participants learned either sectional anatomy alone or learned whole anatomy followed by sectional anatomy. Sectional anatomy was explored either in perceptually continuous animation or discretely, as in the use of an anatomical atlas. Learning was measured longitudinally to a high performance criterion. After learning, transfer to biomedical images and long-term retention were tested. Learning whole anatomy prior to learning sectional anatomy led to a more efficient learning experience. Learners demonstrated high levels of transfer from whole anatomy to sectional anatomy and from sectional anatomy to complex biomedical images. All learning groups demonstrated high levels of retention at 2–3 weeks.

#### 9:20–9:35 (295)

**Guided Cognition Homework Improves Mathematics Interpretations and Calculations.** WILLIAM B. WHITTEN II, MITCHELL RABINOWITZ, & SANDRA E. WHITTEN, *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. Previous research found English literature students' quiz performance to be better after GC homework than after traditional (T) homework. Current research focuses on how GC facilitates the learning of mathematics: Does GC homework improve students' abilities to (1) interpret a story problem, (2) execute the required calculations, or (3) both? Seventh-grade students worked story problems (condition T) or worked story problems and performed a GC task for each (condition GC). An unannounced quiz included calculation-only problems and story problems. The results showed that  $GC > T$  for calculation-only problems, that  $GC > T$  for interpretations and calculations, and that the effects were about the same in each case.

#### Action II

**Grand Ballroom, Sunday Morning, 9:40–11:55**

*Chaired by Sian L. Beilock, University of Chicago*

#### 9:40–9:55 (296)

**Gesture Changes Thought By Grounding It in Action.** SIAN L. BEILOCK & SUSAN GOLDIN-MEADOW, *University of Chicago*—

People's gestures convey unspoken thoughts. We show that gesture does more: It changes gesturers' thought and affects their problem solving. Participants (1) solved the Tower-of-Hanoi problem (pretest), (2) explained how they solved it, and (3) solved it again (posttest). In Tower-of-Hanoi, the goal is to move disks, arranged largest on bottom to smallest on top, from one of three pegs to another without placing a bigger disk onto a smaller disk. For some (no-switch group,  $n = 12$ ), the biggest disk was always the heaviest and the smallest disk the lightest. For others (switch group,  $n = 14$ ), disk weights were reversed at posttest (smallest disk = heaviest). The more the switch group's gestures during explanation incorporated weight information conflicting with the movements needed to solve the Tower-of-Hanoi posttest, the worse they performed at posttest. This was not true for the no-switch group (group  $\times$  gesture type interaction:  $\beta = 1.15$ ,  $t = 2.19$ ,  $p < .04$ ). The action components of our gestures influence problem solving, and not always for the better.

#### 10:00–10:15 (297)

**Auditory–Motor Integration Affects Auditory Memory for Music.** RACHEL M. BROWN & CAROLINE PALMER, *McGill University* (read by Caroline Palmer)—Auditory–motor tasks such as speech and music require movements to be integrated with perception of auditory feedback. We examined how auditory–motor integration influences recognition memory for music. Pianists learned novel melodies in different practice conditions: auditory only (listening), motor only (performing without sound), and combined auditory and motor practice, in which their movements were either coupled with auditory feedback (normal) or uncoupled with feedback (as in lip-synching). Auditory recognition of the melodies was better after coupled auditory–motor learning than after auditory-only learning (Experiments 1 and 2) and improved in all conditions with more practice (Experiment 2). Performers with high auditory imagery skills recognized music better following motor-only learning than did performers with lower imagery skills, suggesting that auditory imagery compensated for missing auditory feedback at learning. Motor experience improved auditory recognition when movements were coupled with sound at learning, and imagery abilities modulated the impact of auditory–motor learning on later recognition memory.

#### 10:20–10:35 (298)

**Inferring Agency From Sound.** GÜNTHER KNOBLICH, *Radboud University Nijmegen*, & BRUNO H. REPP, *Haskins Laboratories*—How do people know which environmental events they control? Previous studies addressing agency have addressed proprioceptive and visual contributions to the subjective feeling of control. However, the role of sound is largely unexplored. In three experiments, we identified sensorimotor and perceptual factors that make people feel that a sequence of sounds reflects the timing of their actions. In the first experiment, participants tried to detect a switch from self-control to external control of sound and vice versa. Two further experiments assessed agency in a rhythm reproduction task. The results showed that people use sensorimotor as well as perceptual cues to infer agency: The smaller the asynchrony between actions and sounds, the more people feel in control. However, purely perceptual cues, such as the temporal variability in a tone sequence, are at least equally important. In fact, perceptual cues sometimes overruled sensorimotor cues in nonmusically trained participants.

#### 10:40–10:55 (299)

**Posture Affects Vision and Reading.** RICHARDA. ABRAMS, CHRISTOPHER C. DAVOLI, FENG DU, EMILY K. BLOESCH, & JUAN MONTANA, *Washington University*, & WILLIAM H. KNAPP III, *Quincy University*—Recent results have shown that the proximity of the hands can enhance visuospatial processing of nearby stimuli by, for example, inhibiting the disengagement of attention during a visual search task. We show here that semantic processing is adversely affected by proximity to the hands: Participants were poorer to assess the sensibleness of sentences presented near their hands, and they had reduced interference from words in a Stroop color–word task. Many of the effects of nearby hands on vision can also be produced by manipulation of the observer's posture, such as requiring them to stand during testing. The results have implications for the connections between action and perception.

11:00–11:15 (300)

**Spatiotemporal Occlusion of Biological Motion Reveals Anticipation Processes of Soccer Players.** SHUJI MORI, *Kyushu University*, & FUMIAKI YOSHITOMI, *Japan Airlines Co.*—Sport perception research has demonstrated that expert sport players anticipate forthcoming plays better than do their novice counterparts. What remains to be specified is the perceptual processes underlying their superior anticipation. To address this question about soccer goalkeepers who attempt to predict the direction of penalty kicks, we conducted a series of experiments using biological motion of a penalty kicker in temporal and spatial occlusion tasks. The results show quite different patterns of anticipatory performance between experienced players and novices. The players' anticipation accuracy increased suddenly from 250 msec to 150 msec before the kicker kicked the ball, and their anticipation relied on the kinematic information of the kicker's waist and support leg at that moment. On the other hand, the novices' accuracy increased gradually with increasing spatiotemporal information in the kicker's motion. From those results, we describe two separate time courses of anticipation for experienced players and novices.

11:20–11:35 (301)

**Forms of Underhand Throwing Fit Environmental Conditions and Personal Situations.** JOHN RIESER & GAYATHRI NARASIMHAM, *Vanderbilt University*—People vary their forms of action so there is enough force to get a job done while minimizing unnecessary movement and satisfying constraints posed by the actor and context. In this study, adults and young children tried to throw a ball with an underhanded toss into a wastebasket that was 1–30 m away. They could not see or hear the ball's trajectory. Every subject varied the form of throw by increasing the number of degrees of freedom for longer distances—swinging from the elbow alone for the 1 m target; from elbow and shoulder for the intermediate targets; elbow, shoulder, and waist for the far targets; and adding a run-up for the farthest target. We go on to ask whether the transition points optimize efficiency, are predictable from individual measures of strength and limb lengths, and vary with the ball's shape or weight, as well as target distance.

11:40–11:55 (302)

**The Role of Concepts About Agency in Perceiving Actions.** DANIEL T. LEVIN, MEGAN M. SAYLOR, & JULIE A. ADAMS, *Vanderbilt University*—In previous research, adults predicted that people would engage in more goal-directed actions that are guided by objects' categories (as opposed to their surface features) than would computers or robots. In the present experiment, we explored how these concepts affect people's memory for the observed actions of a robot that were described either in basic mechanical terms or in more intentional terms. After hearing the mechanical or intentional context, participants watched as the robot traveled among a set of objects, visiting (and "looking at") four of them. Participants were better at naming the object categories in the scene for the intentional robot but were worse at remembering small variations in the intentional robot's actions. This demonstrates that concepts about agency form an interpretive framework that guides attention in predictable ways during action perception.

Vision

Constitution Ballroom, Sunday Morning, 9:40–11:55

Chaired by Thomas A. Busey, *Indiana University, Bloomington*

9:40–9:55 (303)

**Temporal Processing Across the Senses: Individual Differences in Elders.** THOMAS A. BUSEY, LARRY E. HUMES, JAMES C. CRAIG, & DIANE KEWLEY-PORT, *Indiana University, Bloomington*—Temporal slowing associated with aging affects the auditory, visual, and tactile senses. Such slowing may lead to deficits in processing rapid speech and changing scenes, as well as in haptic object identification. Participants made four different types of temporal order judgments with visual, auditory, and tactile stimuli. These tasks involved reporting the order of two or four patterns presented sequentially to the same location or ordering two items presented to different locations. Elder ( $n = 150$ ), middle-aged

( $n = 30$ ), and younger ( $n = 50$ ) participants were tested. We varied the stimulus onset asynchrony (SOA) between the patterns to find a critical SOA. We found group differences in virtually all of our measures, suggesting a strong age-related component in each modality. Younger participants showed strong within- and across-modality correlations. Elders showed weaker correlations, especially across modalities. Factor analyses revealed that elders showed more modality independence, which contradicts common cause accounts of perceptual decline.

10:00–10:15 (304)

**The Psychological Four-Color Mapping Problem.** GREGORY FRANCIS, *Purdue University*—Mathematicians have proven that four colors are sufficient to color 2-D maps so that no neighboring regions share the same color. Here, we consider the psychological four-color problem: identifying which four colors should be used to make a map easy to use. We build a model of visual search for this design task and demonstrate how to apply it to the task of identifying the optimal colors for a map. Application and testing of the model shows that an optimally colored version of a map of English counties is searched 15% faster than the corresponding worst colored map.

10:20–10:35 (305)

**Human Color Preference: WAVES of Color, Culture, and Emotion.** STEPHEN E. PALMER & KAREN B. SCHLOSS, *University of California, Berkeley*—Color preference is an important aspect of human behavior, but little is known about why people like certain colors more than other colors, or even why they like colors at all. We report detailed measurements of preferences among 37 colors—people like blues and cool colors most and browns and olives least—and other relevant aspects of color perception. Models based on cone-opponent contrasts, colorimetric ratings, and color-emotion associations fit the results less well than do average ecological valences of color-associated objects, which account for more than 70% of the group variance: People like colors strongly associated with objects they like (e.g., blues with clear skies and clean water) and dislike colors strongly associated with objects they dislike (e.g., browns with feces and rotten fruit). Further results show that similar effects arise from social/cultural associations: People like colors strongly associated with their universities, favorite sports teams, and religions.

10:40–10:55 (306)

**Visual Adaptation: Noise or Gain?** ADAM J. REEVES & REBECCA GRAYHEM, *Northeastern University*—We offer support for both the Weber law and the Rose–DeVries square-root law by using visual detection thresholds for brief large (Weberian) or tiny (square-root) incremental spots of light presented on steady light-adapting fields in Maxwellian view. Turning off the field permits thresholds to drop almost instantaneously to a level predicted by the removal of the photon-driven noise generated by the field. We conclude that photon noise controls visual threshold not just at absolute threshold (Hecht, Schlaer, & Pirenne, 1942, *J. Gen. Physiol.*, **25**, 819), but also in the light; the effect of noise accounts for the entire square-root law and half of the Weber law.

11:00–11:15 (307)

**A.H.'s Persisting Visual Mislocalizations: Implications for Visual Updating and Visual Awareness.** MICHAEL MCCLOSKEY & EMMA GREGORY, *Johns Hopkins University*—A.H., a young woman with a developmental deficit in perceiving the location of visual stimuli, makes left–right and up–down reflection errors in a variety of tasks. For example, when an object is located on her right, A.H. often perceives it at the corresponding position on her left, or vice versa. Remarkably, A.H.'s misperceptions of location may persist when she moves her eyes. If she erroneously perceives an object to be on her left while looking straight ahead and then makes a leftward saccade in an effort to fixate the object, she may report that she is looking at the object, even though the eye movement actually shifted the target to a more peripheral position in her visual field. We argue that A.H.'s persisting visual mislocalization errors have implications for understanding how visual representations are updated over time and what levels of representation give rise to visual awareness.

## 11:20–11:35 (308)

**Why Invalid Exogenous Cues Are Beneficial Under So-Called “Simple RT” Tasks When Display Size Is Large.** J. TOBY MORDKOFF, *University of Iowa*, & PEGGY CHEN, *Kessler Foundation*—We have found that increasing the number of display locations to six or more causes the effect of exogenous spatial cues on simple target detection to become negative, with invalid cues producing faster RTs than valid cues. Here, we test a specific explanation for this pattern of results that centers on the idea that there are multiple routes to response activation in these tasks and that display size changes which route dominates.

## 11:40–11:55 (309)

**Fearful Face Cues Improve Temporal Gap Detection and Impair Spatial Gap Detection.** RENÉ ZEELLENBERG & BRUNO BOCANEGRA, *Erasmus University Rotterdam*—Neuroimaging and behavioral studies have indicated that emotionally significant stimuli facilitate early stages of visual processing. Recently, however, we showed that emotion can also impair early vision (Bocanegra & Zeelenberg, 2009). Here, we investigate the hypothesis that emotion induces a trade-off in vision that boosts temporal resolution at the expense of fine-grained spatial resolution. We tested spatial and temporal acuity with Landolt optotypes that contained either a small spatial or a brief temporal discontinuity. Our results show that the presentation of fearful faces, as compared with that of neutral faces, improves temporal but impairs spatial resolution. Additional experiments indicated that both the spatial and the temporal effects were triggered selectively by low spatial frequency components of the faces and are not due to the high spatial frequency components. Our results suggest that the pattern of temporal benefits and the spatial deficits are due to magno–parvo interchannel inhibition.

## Priming

## Republic Ballroom, Sunday Morning, 10:20–11:55

*Chaired by Stephen J. Lupker, University of Western Ontario*

## 10:20–10:35 (310)

**Sandwich Priming and Models of Orthographic Coding.** STEPHEN J. LUPKER, *University of Western Ontario*, COLIN J. DAVIS, *Royal Holloway, University of London*, KRISTOPHER BAILEY & ERIC J. STINCHCOMBE, *University of Western Ontario*, & SAM MCCORMICK, *Royal Holloway, University of London*—The conventional masked priming paradigm (Forster & Davis, 1994) is not ideal for testing orthographic coding models, because orthographic similarity effects in this paradigm are contaminated by lexical competition effects. Lupker and Davis (2009) proposed a new masked priming technique, *sandwich priming*, which they claim minimizes the impact of lexical competition, allowing orthographic similarity to be more clearly evaluated. This claim was examined in two experiments, in which we showed that sandwich priming does not modulate semantic priming effects and that sandwich priming eliminates the inhibitory effects of masked word primes that emerge in conventional masked priming. We then used both conventional and sandwich priming paradigms in order to adjudicate between two models of orthographic coding. One type of prime produced equivalent priming in the two paradigms, whereas the other produced facilitation only when using sandwich priming, just as the SOLAR model predicts.

## 10:40–10:55 (311)

**Priming Homographs for a Vocabulary Test.** DAVID S. GORFEIN, *University of Texas, Dallas*—Brief definitions were selected for the nondominant meanings of three categories of ambiguous words. These categories were nonhomophonic homographs (heterophones) and two sets of homophonic homographs. The two latter sets were matched with the heterophones for meaning dominance, but varied in *stability*, defined as the likelihood of changing meaning across responses in a continuous association task. One set of homophonic homographs was matched with the heterophones for stability; the other set was less stable. Prior to the vocabulary test, participants judged the sensibility of sentences that primed either the dominant or the nondominant meaning of half of the homographs. Performance on the vocabulary test benefited when the nondominant meaning cue at test matched the meaning in the sentence

task. There was no effect when the dominant meaning was primed in the sentence test. Further studies are under way in an attempt to explain this lack of negative transfer.

## 11:00–11:15 (312)

**Leet Priming Does Not Reflect Top-Down Feedback.** SACHIKO KINOSHITA & STEPHANIE LAGOUTARIS, *Macquarie University*—The “leet priming” (Carreiras, Duñabeitia, & Perea, 2007, *TICS*) phenomenon shows that NUMB3R5 used in place of letters produce masked priming of words. Using the same–different match task, Perea, Duñabeitia, Pollatsek, and Carreiras (in press, *QJEP*) reported that numbers produced leet priming for pseudowords (e.g., V35Z3D–VESZED), but letters did not produce leet priming for digit strings (e.g., 7ES6E8–735638). They took this result to argue that leet priming reflects top-down feedback that regularizes the shape of leet characters. We suggest that this difference between digit string and pseudoword is due to the capacity limit of visual short-term memory and that, for short strings, pseudowords and digit strings show equal leet priming effects. We also show that single letters and high-frequency words show equal-sized leet priming effects. These results fit better with an account of masked priming that does not assume top-down feedback (e.g., Norris & Kinoshita, 2008, *JEP:G*).

## 11:20–11:35 (313)

**Electrophysiological Correlates of Masked Orthographic Priming With High- and Low-Frequency Orthographic Neighbors.** MANUEL CARREIRAS & JON ANDONI DUÑABEITIA, *Basque Center on Cognition, Brain, and Language*—Behavioral research has shown that word recognition is inhibited by the prior presentation of masked high-frequency orthographic neighbors of the target. A recent study has also shown that this is the case for target words preceded by low-frequency orthographic neighbors. In the present study, a group of Spanish adults were presented with words preceded either by a masked high-frequency or by a low-frequency orthographic neighbor. Participants performed a lexical decision task and a semantic categorization task in two different blocks while event-related brain potentials were recorded. The results showed that low-frequency neighbors modulated an early component between 175 and 300 msec (N250 component), whereas high-frequency neighbors modulated later components in a very different way, with no significant differences across tasks. These results show a different time course for low- and high-frequency neighbors. The findings are discussed within the framework of mechanisms of sublexical processing followed by inhibitory competitive links among co-activated lexical forms.

## 11:40–11:55 (314)

**Asymmetries in Cross-Language Masked Translation Priming.** KENNETH I. FORSTER & NAOKO WITZEL, *University of Arizona*, & XIN WANG, *National University of Singapore*—In a lexical decision experiment, bilinguals showed strong masked cross-language translation priming from words in the native language (L1) to their translation equivalents in a second language (L2) but little or no priming in the reverse direction (L2 to L1). This might be explained in terms of lower proficiency in L2, except for the fact that L2 to L1 priming is obtained with tasks other than lexical decision—namely, a semantic categorization task, as shown by Finkbeiner, Forster, Nicol, and Nakamura (2004), and an “old/new” recognition memory task, as shown by Jiang and Forster (2001). We show that priming in a semantic task is not simply due to the fact that semantic processing is required, whereas, in lexical decision, it is not. We also report several experiments that confirmed Jiang’s finding under circumstances where the prime has only just been learned and is most unlikely to be lexically represented.

## Reading

## Independence Ballroom, Sunday Morning, 10:20–11:55

*Chaired by Mark S. Seidenberg, University of Wisconsin, Madison*

## 10:20–10:35 (315)

**Megastudies of Word Reading: What Replicates?** MARK S. SEIDENBERG & DARAGH E. SIBLEY, *University of Wisconsin*,



*Madison*—Two primary methods have been used in studies of word reading: small-scale factorial studies and larger scale “megastudies” involving thousands of words. We conducted comparisons of the two, using the frequency  $\times$  regularity interaction in word naming as a test case. Whereas the effect replicates across small-scale studies conducted in different labs with different materials, the same results were not obtained using item means from three megastudies. Correlations between the megastudies are also surprisingly low. The considerable error variance in the megastudies limits their use in creating mini (“virtual”) experiments. The megastudies yield small but more consistent results using multiple regression to examine factors such as frequency and length. We conclude that important phenomena would not have been discovered using only the megastudy methodology.

#### 10:40–10:55 (316)

**Parafoveal Preview Effects Within and Between Morphemes.** DENIS DRIEGHE, *Ghent University*, ALEXANDER POLLATSEK, *University of Massachusetts, Amherst*, BARBARA J. JUHASZ, *Wesleyan University*, & KEITH RAYNER, *University of California, San Diego*—Much emphasis has been placed on how serial versus parallel models of lexical processing during eye fixations in reading can account for observations obtained in between-word boundary change experiments. We implemented a boundary change manipulation within a monomorphemic word (e.g., “fountaom,” as a preview for “fountain”), where, given adequate visual acuity, parallel processing is uncontested. Parafoveal preview was also examined within an unspaced compound (e.g., “bathroan,” as a preview for “bathroom”), where serial processing of the constituents is likely. There was larger preview benefit on monomorphemic words than on compounds. Also, differences occurred early in the word: There was no effect of the preview manipulation on the first constituent of the compound, but there was on the corresponding letters of the monomorphemic word. The massive preview benefit observed with monomorphemic words (225 msec) casts doubts on the amount of parallel processing typically taking place between words (effects of 20–40 msec).

#### 11:00–11:15 (317)

**Effects of Word Frequency and Repetition on the Coordination of Eye Fixations and Responses in Word Sequences.** JENNIFER S. BURT, STEFANIE I. BECKER, MICHAEL CARROLL, & ROGER W. REMINGTON, *University of Queensland*—The coordination of the eyes and manual responses was examined in sequences of five 4-letter words and nonwords arrayed from the left to the right edge of a computer display. Readers fixated the items in turn and made a lexical decision to each. Replicating previous results with single letters, the eyes left each item approximately 250 msec prior to the execution of the manual response to the item. Reductions of lexical processing time brought about by repetition and high word frequency reduced both fixation durations and interresponse times for the relevant word. Frequency of the immediately preceding word affected fixation durations and the interval from the eyes leaving a word until a response to it, whereas repetition of the prior word did not consistently affect fixations or responses to the current word. These results suggest different effects of word frequency and repetition on eye movement control and responses.

#### 11:20–11:35 (318)

**Reading Spaced and Unspaced Chinese Text: Evidence From Non-native Chinese Speakers' Eye Movements.** SIMON P. LIVERSEDGE, *University of Southampton*, DELI SHEN, XUEJUN BAI, JIN TIAN, & GUOLI YAN, *Tianjin Normal University*, & KEITH RAYNER, *University of California, San Diego*—We examined spacing in relation to word segmentation for four groups of nonnative Chinese speakers (American, Korean, Japanese, and Thai) learning Chinese as a second language. We used Chinese sentences with four spacing formats: unspaced text, word-spaced text, character-spaced text, and nonword-spaced text. Native languages were spaced (English and Korean) or unspaced (Japanese and Thai), character based (Japanese and Korean), or alphabetic (English and Thai). We investigated whether spacing effects in the second language were modulated by characteristics of the native language. Reading measures all showed least disruption for word-spaced text and more for unspaced, spaced, and nonword-spaced text, respectively. Effects were

uninfluenced by native language (though Chinese reading experience did produce differences). Demarcation of word boundaries through spacing speeds lexical identification during nonnative reading. The data suggest that the word, not the character, is the primary unit of information in Chinese reading.

#### 11:40–11:55 (319)

**Words Are Spatially Indexed During Reading.** ALBRECHT W. INHOFF, SEYMOUR BRADLEY, & JASON FLEISCHER, *Binghamton University*, & RALPH RADACH, *Florida State University*—Our work examined the spatial addressability of recognized visual words during reading. Participants read text with a target word near the left (close to sentence onset) or right margin. This was followed by a recognition memory task in which participants were asked to determine whether a word (target/old or filler/new) had appeared in the previously read sentence. Word onset was accompanied by a 50-msec left- or right-side visual cue that matched or mismatched the target's original sentence location or occupied a randomly selected right/left location on filler trials. No cues were present in a baseline condition. Left-cue and no-cue trials yielded faster RTs for left- than for right-side targets. Right-side cues resulted in relatively long RTs for left-side targets and short RTs for right-side targets. Spatial cuing thus facilitated lexical retrieval when the word was not close to sentence onset.

#### Categories and Concepts III

**Back Bay Ballroom C, Sunday Morning, 10:20–11:55**

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

#### 10:20–10:35 (320)

**Visual Working Memory: Its Effects on Learning Rule-Defined and Non-Rule-Defined Categories.** JOHN PAUL MINDA & SARAH J. MILES, *University of Western Ontario*—It is intuitive that category learning involves contributions from both visual and verbal systems, and considerable research suggests that the learning of rule-defined categories depends on working memory. However, most existing research has focused on verbal working memory, so the role of visual working memory in categorization is unclear. We describe several experiments that investigated the roles of visual and verbal memory in category learning. In one experiment, both a visual and a verbal working memory task interfered with the learning of rule-defined categories, but only the visual working memory task seemed to interfere with the learning of non-rule-defined categories. In another experiment, a visual task that did not rely much on working memory disrupted the learning of non-rule-defined categories, but did not disrupt the learning of rule-defined categories. We discuss these results within a multiple systems theory of category learning.

#### 10:40–10:55 (321)

**The Development of Categorization: Category Structure, Selective Attention, and Inhibitory Control.** VLADIMIR M. SLOUTSKY, *Ohio State University*—The ability to learn categories appears early in development. Some aspects of category learning (e.g., the ability to learn statistically dense or similarity-based categories) exhibit relative phylogenetic and ontogenetic universality and can be found across a wide range of species and age groups. Other aspects of category learning are less universal, and they emerge relatively late in development. For example, human adults (but not human infants) can learn statistically sparse, similarity-free categories. What changes in the course of development? We propose that, whereas learning of dense categories could be subserved by the striatum, learning of sparse categories requires the involvement of the prefrontal cortex. If this is the case, the development of categorization is linked to the development of prefrontal functions, such as selectivity and inhibitory control. We present evidence indicating that infants and young children learn complex categories when selectivity is not required, whereas learning fails when selectivity or inhibitory control is required.

#### 11:00–11:15 (322)

**Categorization and Perception of Similarity in Pigeons.** OLGA F. LAZAREVA, *Drake University*—The ability to categorize objects and



events and to extend this categorization behavior to new instances is fundamental to many human activities. Extensive experimental evidence suggests that our abilities to categorize and conceptualize are not unique to our species. Many animal species, including birds, can be trained to sort stimuli into different, noncomplementary, basic-level categories. But do animals, as do humans, view the members of these categories as being perceptually coherent before such categorization training? We will discuss research demonstrating that birds perceive the members of one basic-level category to be more similar to each other than to the members of other categories. We will also present data that demonstrate how between-category similarity affects categorization at the basic level and at the superordinate level in both pigeons and adult humans.

#### 11:20–11:35 (323)

**Same and Different: Keel and Backbone.** EDWARDA. WASSERMAN, *University of Iowa*, & MICHAEL E. YOUNG, *Southern Illinois University, Carbondale*—The twin notions of sameness and differentness were deemed by William James to be “the very keel and backbone of our thinking” (1890, p. 459). Yet we know rather little about these foundational concepts. Recent comparative research suggests that same–different discrimination behavior is not uniquely human, does not require human language, is based on the variability of the collection of items, obeys fundamental psychophysical laws, and may be captured by quantitative models of the stimulus collection. The comparative study of same–different discrimination behavior sheds fresh light on the mechanisms and functions of abstract conceptualization. Such study has also prompted the development of a theory—the *finding differences model*—that successfully explains a wealth of findings in the comparative psychology of same–different discrimination behavior.

#### 11:40–11:55 (324)

**Inference Learning Under Uncertainty.** KENNETH J. KURTZ & KIMERY LEVERING, *Binghamton University*—Whereas classification learning (using features to predict category) leads to efficient discrimination between categories, inference learning (using all but one feature, plus the category label, to predict the missing feature) leads to sensitivity to the internal structure of categories. Existing accounts emphasize the category label in the inference task since it restricts focus to one category per trial and/or acts as a highly diagnostic cue in learning classification schemes for feature values. We studied inference learning with the category label provided only as feedback. Inference learning was successful without the presentation of the category label as a cue. Furthermore, at test, participants who had been trained under the traditional inference task effectively predicted missing features without being given the category label. The results are interpreted in terms of the DIVA model, which makes feature inferences intrinsically in its categorization process and does not depend on the category label as a cue during inference learning.

#### Task Switching

Back Bay Ballroom D, Sunday Morning, 10:00–11:55

Chaired by Robert H. Logie, *University of Edinburgh*

#### 10:00–10:15 (325)

**Multitasking for Breakfast and in the Shopping Mall.** ROBERT H. LOGIE, *University of Edinburgh*, ANNA S. LAW, *Liverpool John Moores University*, & STEVEN TRAWLEY & JACK NISSAN, *University of Edinburgh*—Multitasking refers to the ability to schedule the performance of a range of tasks that have to be completed in a limited time. Previous studies of multitasking have focused on the impact of damage to the prefrontal cortex and on high-demand multitasking, such as in aviation or military domains. Relatively little research has explored everyday multitasking in healthy aging and in domains that are important for everyday living, such as completing errands in a shopping mall or preparing a meal. We will present an experimental and a multivariate study using a virtual breakfast-making task (Craik & Bialystok, 2006) and the recently developed Edinburgh Virtual Errands Task. The results show a decline in everyday multitasking ability in middle age (45–55) and that spatial planning, retrospective memory, and spatial working memory all make independent contributions to performance.

#### 10:20–10:35 (326)

**Partitioning Task-Switch Cost With ERPs: Switching Slows Lexical Access.** HEIKE ELCHLEPP, STEPHEN MONSELL, & AURELIU LAVRIC, *University of Exeter* (read by Stephen Monsell)—Reaction times are prolonged by a task switch. Although this task-switch cost can be reduced by an opportunity for preparation, there remains a substantial “residual” cost, usually attributed to interference with response selection due to persistence or reactivation of a competing task set. Participants were cued 800 msec in advance of a stimulus word either to semantically classify it or to make a go/no-go response to the symmetry of the distribution of colors over its letters. For the lexical task, a task switch delayed the onset (~300 msec) and peak (~450 msec) of the effects of frequency on the waveform, suggesting that the switch slows lexical access or earlier processes, not just response selection—a finding with implications also for automaticity of lexical access. ERPs for the symmetry task trials also exhibited a frequency-sensitive component, which was larger on switch trials, consistent with task-set competition contributing to the residual switch cost.

#### 10:40–10:55 (327)

**Top-Down Modulation of Attentional Capture: Evidence for a Relational Set.** ROGER W. REMINGTON & STEFANIE I. BECKER, *University of Queensland*, & CHARLES L. FOLK, *Villanova University*—Certain salient events in the world seem to attract our attention involuntarily, consistent with the claim that exogenous orienting is stimulus driven. This claim has been challenged by evidence of top-down modulation: The features that capture attention are contingent upon task demands. Accounts of this contingent capture have thus far assumed that task goals produce a set for a specific feature property (e.g., color) or value (e.g., red). Here, we test a new relational theory of attention control that postulates that attention is not set for a specific feature property, but for the relation between the target and the background stimuli from which it must be distinguished (e.g., larger, redder). The experiments reported here support the relational theory by showing that capture is strongest not for the distractor sharing the target color, but for the distractor with the most extreme value on the dimension separating target and background.

#### 11:00–11:15 (328)

**Electrophysiological Evidence for Impaired or Postponed Semantic Processing During Multitasking and Task-Set Switching.** FRANÇOIS VACHON & PIERRE JOLICÉUR, *University of Montreal* (read by Pierre Joliceur)—The reconfiguration of cognitive set to adapt to a new task is well known to be detrimental to behavioral performance, but there is a dearth of studies concerned with the exact locus of task-set switching on the processing of target stimuli. We measured event-related potentials to explore the neural consequences of task-set switching on semantic processing. Using the attentional blink and the psychological refractory period paradigms, we examined the context-sensitive N400 component evoked by the second of two target words under conditions that involved either a task-set switch or no switching. Whereas the N400 was unaffected by the temporal distance separating the targets in the absence of switching, it was delayed and strongly attenuated, if not completely suppressed, in the switch condition when the targets occurred in rapid succession. These findings suggest that task-set reconfiguration momentarily prevents meaning extraction and provide further evidence for the nonautomaticity of semantic processing of words.

#### 11:20–11:35 (329)

**Age, Expertise, and Speeded Decisions in Multiple-Task Performance.** PAMELA S. TSANG & CALEB S. HILDENBRANDT, *Wright State University*—The study examines the interactive effects of age and time-sharing expertise on multiple-task performance. A group of middle-aged subjects (40–59 years of age) and an older group (60–70 years of age) are compared. To examine naturally developed time-sharing expertise that is inherent in piloting aircraft, half of the subjects were airplane pilots. Subjects simultaneously performed three tasks that posed cognitive demands similar to those of piloting: a continuous flight control task, a task that required remembering two call signs, and a spatial collision decision task. We examined subjects’ control of their

attention management, as well as older subjects' ability to quicken their collision decisions when encouraged to. Preliminary results suggest that both older and middle-aged subjects could respond adaptively and strategically to varying task demands. In addition, older pilots exhibit smaller age effects than do older nonpilots in several aspects of their performance.

**11:40–11:55 (330)**

**Task Switching: Switching Within and Between Response Dimensions.** KAREN MORTIER & GORDON D. LOGAN, *Vanderbilt University* (sponsored by Gordon D. Logan)—In cued task switching, the cue indicates which task to perform. However, this cue indicates at least two processes that need to be executed. On the one hand, it indicates which

dimension of the target needs to be processed (attentional processes), and on the other hand, the dimension in which the response needs to be selected (response selection). Three experiments were conducted to investigate the contribution of response selection in task switching costs. In one condition, participants switched between different target dimensions and different response dimensions. In the other condition, participants had to switch between different target dimensions while keeping the dimension of response selection the same. Switch costs were found to be substantially reduced when the response dimension remained the same. This indicates that switch costs are related to switching between responses from different dimensions. Furthermore, these findings imply that one can prepare for response selection before the actual stimulus display is presented.

## POSTER SESSION I

## Thursday Evening

Hynes Convention Center, Ballrooms A, B, and C  
Viewing 4:00–7:00, Author Present 5:30–7:00

## • REASONING/PROBLEM SOLVING •

## (1001)

**Individual Differences in Fluid Reasoning on a Complex Recent**

**Probes Task.** ERIC G. FREEDMAN, MICHAEL D. McMANAMAN, & NEZAR KHATIB, *University of Michigan, Flint*—In a modified Sternberg task, participants received two memory sets (both ranging from 3 to 6 letters). A visual cue presented either 1 sec before or 1 sec after the sets indicated which set was relevant for a particular trial. Positive, negative (nonrecent), and several types of recent probes were employed. Although individuals with low fluid reasoning (measured with items adapted from the Raven Progressive Matrices) had lower overall accuracy, their accuracy was relatively lower than the other groups for recent negative probes when the current sets were postcued. Also, when cued after the memory sets, low fluid reasoners showed a relatively greater decrease in accuracy as the set size increased. Finally, postcuing the sets resulted in a relatively greater increase in reaction time as the memory set size increased. Thus, low fluid reasoning appears to be linked to greater difficulty reducing the effects of proactive interference of irrelevant information as task demands increase.

## (1002)

**Conditional Probability Computation in Conditional Reasoning.**

JOHN BEST, *Eastern Illinois University*—Several researchers (e.g., Evans & Over, 2004; Oaksford, Chater, & Larkin, 2000) have suggested that conditional, “if P, then Q” reasoning may be accomplished by a system that converts such statements to conditional probabilities,  $P(Q/P)$ , which are then computed. Under that interpretation, people should be differentially sensitive to the variables that actually influence conditional probability, and they should be relatively insensitive to variables that only appear to influence conditional probability. But are they? When college students were given opportunities to solve four “Mastermind problems” (deductive puzzles based on the logical deduction game), in which the conditional probability of particular conclusions was manipulated independently of the results of a much simpler “covariation heuristic,” the inconsequential surface manipulation was much more influential on the likelihood of subjects’ deductions than was the actual conditional probability. The outcomes of the study raise some questions for the operation of dual-process theories of reasoning.

## (1003)

**Chronic Intrinsic Motivation Qualifies the Effect of Situational Extrinsic Incentives on Problem Solving.**

DANIEL A. DECARO & JOSEPH G. JOHNSON, *Miami University* (sponsored by Robin D. Thomas)—Although the impact of intrinsic and extrinsic motivation on a variety of cognitive skills is well-documented, the relationship between these motives remains hotly contested. Some argue that extrinsic incentives, such as the imposition of performance-contingent monetary rewards, and coercion hurt performance by undermining intrinsic motivation (e.g., Deci et al., 1999), whereas others argue that these are innocuous if not optimal motivators (e.g., Hertwig & Ortmann, 2001). We investigated the impact of individuals’ chronic versus situational motivation during problem solving to help qualify and explain the undermining effect. In Study 1, individuals with chronic intrinsic orientation did not lose situational intrinsic motivation in response to peer coercion; only nonchronics suffered. Studies 2 and 3 replicated this effect for monetary rewards, additionally showing that monetary reward is innocuous to situational intrinsic motivation unless explicitly used as a coercive device. Chronic motivational states should be considered when incentives are used to study cognitive performance.

## (1004)

**Multiscale Dynamics of New Cognitive Structure.** REBECCA BONCODDO & JAMES A. DIXON, *University of Connecticut*—Recently, theories of embodied and dynamical cognition have proposed that

cognitive structure is created through actions. Previous work showed that children spontaneously discover new representations while solving a series of gear-system problems (Boncoddo, Dixon, & Kelley, in press). In the present study, we manipulated participants’ understanding of the simple physics of gear systems before having them solve the gear-system problems. Forty-five preschoolers were randomly assigned to an experimental condition in which they listened to stories that described the simple physics of gear systems (i.e., gears have teeth that push on each other) or to a control condition in which they heard analogous stories that contained no information about the relevant physics. Motion-tracking data were obtained as the children solved the problems. Using methods from nonlinear dynamics, we show that the experimental stories affected the long-scale dynamic organization, and that these differences propagate across scales.

## (1005)

**Improving Public Health Messages: Acting on Emotions.**

INES MEIER & JESSE W. WHITLOW, JR., *Rutgers University, Camden* (sponsored by Jesse W. Whitlow, Jr.)—Research has shown that the emotional content of a public service message influences how the message is processed, but little attention has been paid to how the emotion elicited by a message influences what actions are taken by the message recipient. We asked whether the emotional tone of a message enhances actions consistent with the emotion and suppresses actions inconsistent with it. Implications of the findings for crafting health messages are discussed.

## (1006)

**Counterfactual Reasoning in Text and Images.**

ALEXANDRA Y. CHAMBERS & RUSSELL REVLIN, *University of California, Santa Barbara* (sponsored by Russell Revlin)—The present study uses a counterfactual reasoning task to examine how people revise their beliefs. Students read fictional narratives that described groups of individuals. Each narrative was followed by three statements that agreed with the story: a general premise about a group and two particular premises about an individual. The fourth statement was a counterfactual assumption that participants had to accept as true even though it contradicted the given information. To reconcile this novel information, students retained either (1) the group condition specified in the general premise or (2) the individual’s characteristics specified in the particular premises. Overall, participants reliably preferred to retain the general premise and reject the particular ones. However, the format in which these problems were framed influenced the decision strategy. When the statements were illustrated with pictures, they increased the students’ commitment to the general statement, which resulted in a substantial increase in retaining the generalities.

## (1007)

**The Role of Visual Imagery in Deductive Relational Reasoning.**

JOEL CHAN & JOEL A. HAGAMAN, *University of the Ozarks*—One view of deductive relational reasoning holds that individuals reason by constructing and inspecting models of the possibilities consistent with a problem’s premises. Recent work (Knauff & Johnson-Laird, 2002; Knauff et al., 2003) has suggested that these models are distinct from visual images, in that they are abstract and do not necessarily include object visual information (e.g., color, shape), but may be identified with abstract spatial representations (e.g., spatial images). Consistent with these notions, we found that reasoning with linear syllogisms was significantly slowed with problems containing primarily object visual information (i.e., cleaner/dirtier) relative to problems containing primarily spatial (above/below) or no (better/worse) visual information. Analysis of general and spatial working memory measures (O-span and arrow-span, respectively) and reasoning accuracy provided converging evidence for the separability and differential effects of object and spatial processing during relational reasoning.

## (1008)

**A Dual-Process Approach to Age-Associated Changes in Reasoning**

**Performance.** JAMIE PROWSE TURNER & VALERIE A. THOMPSON, *University of Saskatchewan*—Complex reasoning ability declines with age (e.g., Evans, 2003; Gilinsky & Judd, 1994; Salthouse, 2005).

We integrated two common explanations for this decline by examining performance on multiple reasoning tasks in both older and younger adults. A computational limitation view suggests that aging is associated with decreasing working memory capacity (e.g., Salthouse, 2005). Dual-process theories of reasoning (e.g., Evans, 2003) suggest that a decline in capacity should produce a switch from analytic to heuristic processing. As expected, older adults scored lower on working memory and on the reasoning tasks, even when the groups were equated on verbal ability. Consistent with dual-process views, older adults were especially disadvantaged when analytic and heuristic processes produced conflicting answers—for example, when a conclusion was believable but logically invalid; they were also more likely to respond heuristically on reasoning tests designed to measure cognitive impulsivity.

## (1009)

**Fixation, Incubation, and the Perception of Aha! During Problem Solving.** ANDREW F. JAROSZ & JENNIFER WILEY, *University of Illinois, Chicago* (sponsored by Jennifer Wiley)—Insight and Aha! commonly refer to the experience of suddenly understanding something that was previously incomprehensible. Although this feeling is common, it is still unclear what causes it. Theoretically, the insight process can be characterized by an initial phase in which a solver becomes stuck, followed by a phase in which fixation is broken or released; the problem is re-represented, and the answer emerges. Using fixation and incubation manipulations on a set of remote associate problems, we tested which conditions may increase Aha! effects, and whether the perception of Aha! may be seen as a result of overcoming fixation. Surprisingly, although our results showed that the fixation manipulation had the desired effect on solution, it decreased feelings of Aha!. Our results suggest that considering the source of fixation during solution, as well as the attentional states of the solver, may be important for understanding the insight process and the Aha! experience.

## (1010)

**Age-Dependent Interactions Between Cognitive Profiles and Information Search Strategies.** JESSIE CHIN & WAI-TAT FU, *University of Illinois, Urbana-Champaign*—Previous research showed that older adults performed worse in Web search tasks and attributed poorer performance to a decline in their cognitive abilities. We conducted a study involving younger and older adults to compare their Web search behavior and performance in ill-defined and well-defined search tasks using a health information Web site. In ill-defined tasks, only a general description about information needs was given, whereas in well-defined tasks, information needs, as well as the specific target information, were given. We found that older adults performed worse than younger adults in well-defined tasks, but the reverse was true in ill-defined tasks. Older adults compensated for their lower cognitive abilities by adopting a top-down knowledge-driven strategy to achieve the same level of performance in the ill-defined tasks. Indeed, path analysis showed that cognitive abilities, health literacy, and knowledge influenced search strategies adopted by older and younger adults. Extensions of results to decision making will be discussed.

## (1011)

**Causal Inference When Observed and Unobserved Causes Interact.** BENJAMIN M. ROTTMAN & WOO-KYOUNG AHN, *Yale University* (sponsored by Woo-Kyoung Ahn)—When a cause interacts with unobserved factors to produce an effect, the contingency between the observed cause and effect cannot be taken at face value to infer causality. Yet it would be computationally intractable to consider all possible unobserved, interacting factors. Nonetheless, two experiments showed that when an unobserved cause is assumed to be fairly stable over time, people can learn about such interactions and adjust their inferences about the causal efficacy of the observed cause. When they observed a period in which a cause and effect were associated, followed by a period of the opposite association, rather than concluding no causal relationship, subjects inferred an unobserved, interacting cause. The interaction explains the low overall contingency and allows people to still conclude that the cause is efficacious. These results highlight the importance of

temporal order and beliefs about the stability of background causes in causal learning.

## • ACTION AND PERCEPTION •

## (1012)

**About the Internal Anticipation of Sensory Action Effects: When Action Induces FFA and PPA Activity.** FLORIAN WASZAK, *CNRS*, & SIMONE KUEHN, RUTH SEURINCK, & WIM FIAS, *Ghent University*—Voluntary action—in particular, the ability to produce desired effects in the environment—is fundamental to human existence. According to ideomotor theory, we can achieve goals in the environment by means of anticipating their outcomes. We aimed at providing neurophysiological evidence for the assumption that performing actions calls for the activation of brain areas associated with the sensory effects usually evoked by the actions. We conducted an fMRI study in which right and left buttonpresses led to the presentation of face and house pictures. When comparing a baseline phase before participants experienced the coupling with the same phase after having experienced the association, we found an increase in the parahippocampal place area for the response that had been associated with house pictures and in the fusiform face area for the response that had been coupled with face pictures. This observation constitutes support for ideomotor theory.

## (1013)

**Action Prediction and the Premotor Cortex.** WALTRAUD STADLER, *Max Planck Institute for Human Cognitive and Brain Sciences*, RICARDA I. SCHUBOTZ, *Max Planck Institute Cologne*, & ANNE SPRINGER & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences* (sponsored by Wolfgang Prinz)—Premotor cortex (PMC) activation reflects action planning and is recognized as the neural marker of simulating observed actions. How action simulation differs from more general action representation in terms of PMC activation is yet unclear. In three experiments, using functional magnetic resonance imaging and repetitive transcranial magnetic stimulation (rTMS), we demonstrated how PMC contributes to action simulation, as opposed to other action-related cognitive tasks, such as maintaining action representations. In all experiments, two conditions were compared that used similar stimuli, differing only in task instructions. Participants watched movie clips showing everyday actions that were repeatedly occluded. A prediction condition required mental simulation of occluded actions and was compared with a memory condition in which an action stage was “frozen” in memory during occlusion. Action prediction activated the PMC most efficiently, and rTMS interference in this region decreased prediction performance. These results suggest that PMC functions are required to predict occluded actions.

## (1014)

**Perceiving Nested Affordances.** JEFFREY B. WAGMAN, *Illinois State University*—Successfully performing a goal-directed behavior (e.g., retrieving an object from a shelf) requires perceiving whether that behavior is possible, and if so, how to control bodily movements such that the possibility is realized. However, performing a given goal-directed behavior often requires performing nested (sub)behaviors (e.g., stepping over a child's toy or stepping onto a step stool). Thus, performing a given goal-directed behavior requires perceiving whether nested behaviors are possible as well. In two experiments, participants reported whether an object was at their maximum (overhead) reaching height when this behavior also required (1) walking across the room, (2) stepping over an obstacle, (3) stepping over two obstacles, (4) stepping up onto an object, and (5) stepping over an obstacle and then stepping up onto an object. Participants tended to underestimate their ability in all conditions, especially when a nested behavior created a change in action capabilities.

## (1015)

**Neuronal Correlates of Transformation Rules in Tool Use.** MIRIAM BEISERT, CRISTINA MASSEN, JÖRAN LEPSIEN, & VERONIKA KRIEGHOFF, *Max Planck Institute for Human Cognitive and Brain Sciences*, MARCEL BRASS, *Ghent University*, & WOLFGANG PRINZ,



*Max Planck Institute for Human Cognitive and Brain Sciences*—A simple mechanical tool transforms operating movements at the tool's handle into effect movements at the tool's functional tip. The present fMRI study was conducted to elucidate the neuronal correlates of transformation rules in tool use. Participants had to switch between tools for which the transformation rule was compatible (operating movement = effect movement) or incompatible (operating movement  $\neq$  effect movement). The contrast of incompatible versus compatible transformation rule revealed activation in parietal, cerebellar, and extrastriate areas. These can be associated with a process of visuomotor imagery to derive the correct operating movement. The contrast of transformation rule switches versus repetitions yielded activation in the anterior vermis and the dentate nucleus. Both can be associated with a process of integration between the tool and the operating fingers. With reference to research on the application of explicit mapping rules, we conclude that transformation rules in tool use hold a special status.

(1016)

**A Functional Role for Motor Simulation in Identifying Tools.** JESSICA K. WITT & DAVID KEMMERER, *Purdue University*, & JODY CULHAM, *University of Western Ontario* (sponsored by Dennis R. Proffitt)—Embodied cognition promotes the involvement of the motor systems in cognitive processing such as tool identification. However, patient studies suggest that the motor system is not necessary to identify tools (Negri et al., 2007). Nevertheless, the motor system may still have a functional role in tool recognition. To test this possibility, we used a motor interference task: Participants squeezed a rubber ball in one hand while naming pictures of tools or animals. Participants were faster to name the tools that were oriented with the handle facing away from the squeezing hand. Given that participants simulate grasping the tool with the hand closest to the handle (Tucker & Ellis 1998), this result demonstrates that interfering with the ability to simulate grasping impairs tool naming and suggests a functional role for motor simulation in tool identification.

(1017)

**Motor and Semantic Processes Modulate Internal Action Simulation.** ANNE SPRINGER & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Internal simulation models allow one to predict others' actions in real time. We aimed to specify simulation processes by demonstrating that motor activation and semantic processing affect prediction performance. In two series of experiments, participants watched transiently occluded actions and predicted the action course after occlusion. Prediction accuracy was measured when observers executed arm movements (i.e., motor interference effects) and processed words describing dynamic versus static movements (i.e., semantic interference effects) in parallel. Motor and semantic specificity was accessed when movements were only passively executed and words were replaced by dynamic versus static perceptual stimuli, correspondingly. The results support the sensitivity of real-time simulation processes to situational constraints. First, action execution modulated the predicted real-time pattern. Second, results suggest the use of knowledge-based representations in sensory–motor simulations. Our view accords with embodied theories claiming that sensory–motor processes are closely connected to conceptual processes, proposing a link between action simulation and (language-based) action knowledge.

(1018)

**Implicit Sequence Learning Based on Instructed Action Codes.** ROBERT GASCHLER, *Humboldt University Berlin*, DORIT WENKE, *Max Planck Institute for Human Cognitive and Brain Sciences*, ASHER COHEN, *Hebrew University of Jerusalem*, & PETER A. FRENCH, *Humboldt University Berlin* (sponsored by Peter A. French)—Humans seemingly are able to effortlessly and rapidly translate arbitrary task instructions into behavior. Surprisingly, relatively little is known about exactly how task instructions come to control behavior and how they affect automatic skill acquisition processes. We investigated how response labeling in the instructions determines later implicit sequence learning. We instructed participants to use either color or location (e.g., to respond with the green key vs. the outer left key to the gray diamond shape; four

stimuli and responses total). When participants were instructed to respond in terms of color, they learned the color and the location sequence, as indicated by transfer. With spatial response instructions, they learned only the spatial sequence. The results demonstrate that instructions, in addition to other task characteristics, determine how actions are being controlled. Implicit sequence learning operates both on the instructed action codes and on other features relevant for task performance.

(1019)

**The Effect of Object Rotation on the Activation of Hand Action Representations.** ANDREAS T. BREUER, MICHAEL E. J. MASSON, & DANIEL N. BUB, *University of Victoria* (sponsored by Michael E. J. Masson)—We show that hand action representations automatically elicited by passively viewed pictures of manipulable objects (e.g., stapler) are more strongly influenced by an individual's experiential knowledge of an object than by the contours of the object as they appear in the display. A priming paradigm was used in which objects were presented in their typical orientation or under rotation, followed by a cue to make a reach and grasp response. Regardless of orientation, objects facilitated execution of hand actions associated with the canonical orientation of the object. These results suggest a strong interaction between ventral and dorsal visual processing streams.

(1020)

**Correspondence Effects for Objects With Left and Right Protrusions.** DONGBIN (TOBIN) CHO & ROBERT W. PROCTOR, *Purdue University* (sponsored by Thomas Z. Strybel)—Responses are typically faster if the location of the graspable part of an object, even when irrelevant to a task, is compatible with the location of a keypress response than if it is not, a phenomenon called the object-based Simon effect. We examined the Simon effects for graspable objects, using left- or right-facing teapots as stimuli with responses on the same (within hand) or different (between hands) hands. The Simon effect occurred in the direction of the more salient spout location and was larger within hands than between hands, regardless of whether the relevant judgment was orientation (upright vs. inverted) or color. Teapots with either the spout or the handle removed showed separate contributions of each to the Simon effect that were of similar magnitude within hands and between hands. Because a grasping affordance account predicts no influence of the handle for color judgments or within-hand responses, the results are more consistent with a location coding account.

(1021)

**Video Game Playing Modulates Oculomotor Action.** GREG L. WEST, NASEEM AL-AIDROOS, & JAY PRATT, *University of Toronto*—Habitual action video game playing has been shown to affect both perceptual and attentional processes. Here, we show, for the first time, that playing a video game also modulates oculomotor action. Both video game players (VGPs) and nonvideo game players (NVGPs) were tested in a saccade trajectory deviation task that allowed for the degree of capture or inhibition toward a distracting stimulus to be measured through the motor response. VGPs and NVGPs showed comparable amounts of early capture toward a distracting stimulus when saccadic RTs were short. When saccadic RTs were longer, the saccades of VGPs showed much more inhibition away from distracting information than did NVGPs. A training study was subsequently conducted to rule out the possibility of group self-selection. Together, the results indicated that video game playing can modulate not only perceptual and attention processes, but also overt motor actions.

(1022)

**Video Games: Neural Plasticity and Emotion.** KIRA BAILEY, ROBERT WEST, KELLIE OLSEN, BRANDY N. JOHNSON, COURTNEY VARLEY, & CRAIG A. ANDERSON, *Iowa State University*—The present study examined the effects of video game experience on affective processing. In Experiment 1, high and low gamers rated neutral, positive, negative, and violent images on colorfulness, pleasantness, and threat. In low gamers, there was a parietal slow wave that distinguished positive images from the other images; in high gamers, this effect distinguished positive and violent images from the other images. This effect

was limited to the colorfulness and pleasantness rating tasks. In Experiment 2, nongamers, high violent gamers (e.g., first-person shooter), and high nonviolent gamers (e.g., Rock Band) performed the color rating task. The results from Experiment 1 were replicated with the nonviolent gamers being similar to the nongamers. In Experiment 3, nongamers trained for 10 h. Unreal Tournament players were desensitized to violent images and did not exhibit similar processing for violent and positive images. This effect was not observed in Tetris players.

(1023)

**Detecting Changes in a Multi-Element Display.** CHENG-TA YANG, YUNG-FONG HSU, & YEI-YU YEH, *National Taiwan University* (sponsored by Yung-Fong Hsu)—The present study further examined how observers detect changes in a two-element display. A change detection task was performed. Two Gabor stimuli were presented in the pre- and postchange displays. Changes in luminance and orientation were independently manipulated with two levels of ambiguity (ambiguous/unambiguous). Moreover, a critical manipulation was that redundant signals could occur at either the same object location or at two separate object locations. The results showed that observers conducted serial processing with a self-terminating rule whether redundant changes occurred at one object or at two separate objects. Processing change signals presented at one object location was more efficient than that at two separate object locations. This study provides evidence to show how different features are processed to contribute to the decision process in a multi-element display. Theoretical implications for the object-based selection in the context of change detection are discussed.

(1024)

**Repeating Actions With and Without Vision.** PETER DIXON, *University of Alberta*, & SCOTT GLOVER, *Royal Holloway, University of London*—When a goal can be achieved in different ways, people tend to repeat previous actions. This effect may be due to visual priming: You repeat an action because you just saw yourself perform that action. Alternatively, the effect may be due to motor-control priming: You repeat an action because you have just performed that action. Visual priming predicts that repetition should be mediated by visual feedback on the preceding trial; motor-control priming predicts that repetition should be modulated by whether visual feedback on the preceding trial matches that on the current trial. In the present research, subjects grasped an irregular object on each trial, using one of two postures. Contrary to both predictions, the repetition effect did not vary with the visual feedback provided on either the current or the preceding trial. We argue that repetition is due to the use of memory to plan actions.

(1025)

**Involuntary Motor Simulation in Pianists: A Behavioral Study.** ERIC TAYLOR & JESSICA K. WITT, *Purdue University* (sponsored by William A. Roberts)—Pianists and novices made arm movements to the left or right in response to task-relevant visual stimuli (arrows) while listening to task-irrelevant auditory stimuli, which were scales played on a piano. The scales were either ascending (compatible with right movements) or descending (compatible with left movements). Pianists were slower to respond when the scale direction was incompatible with the movement, whereas novices' movements were unaffected by the scale. In addition, the pitch of the scales was high (congruent with right-hand movements), centered, or low (congruent with left-hand movements). Pianists were faster to respond with the compatible hand. These results suggest that pianists automatically simulate playing along with piano music, and that the motor simulation is sensitive to both the direction of movement and the hand that would ordinarily play the specific scales.

#### • JUDGMENT/DECISION MAKING •

(1026)

**Cognitive Processes in Multiple-Cue Judgments from Continuous Cues.** BETTINA VON HELVERSEN & JÖRG RIESKAMP, *University of Basel*—Recent research suggests that multiple-cue judgments rely on a variety of cognitive processes. Which process takes place depends on the characteristics of the judgment situation. For instance, when the

criterion is a linear function of the cues, a linear regression model predicts judgments well. In contrast, when the criterion is a multiplicative function of the cues, a heuristic strategy, the mapping model, describes judgments best. However, most research has focused on tasks with binary cues. In this experimental study, we generalized the tasks to multiple continuous cues and additionally varied the distribution of the cues. Our results suggest that a linear regression model captures participants' judgments well when the cue values are normally distributed. In contrast, the mapping model predicted people's judgments best for a task with uniformly distributed cue values or in a situation where the criterion was a multiplicative function of the cues.

(1027)

**Effects of Confirmatory and Disconfirmatory Evidence on Biases in Favor of Self-Selected Hypotheses.** JENNIFER C. WHITMAN & TODD S. WOODWARD, *University of British Columbia* (sponsored by Todd S. Woodward)—When the probability of a focal hypothesis is rated relative to a set of alternate hypotheses, we have found that reasoners will rate a self-selected focal hypothesis higher than an externally selected one. Here, we investigated whether this bias affects the revision of ratings when new confirmatory or disconfirmatory evidence becomes available. Overall, participants rated self-selected focal hypotheses more highly than externally selected focal hypotheses, as in previous research. In the confirmatory evidence condition, participants increased ratings of self-selected focal hypotheses (relative to alternate hypotheses) more than they increased ratings of externally selected focal hypotheses. In the disconfirmatory evidence condition, the amount that ratings decreased was independent of whether the focal hypothesis was self-selected or externally selected. These results indicate that the tendency to favor self-selected focal hypotheses biases processing in favor of confirmatory evidence but has no effect on processing of disconfirmatory evidence.

(1028)

**Effects of Decision Support on Knowledge Acquired From Simulated Clinical Practice.** JON TALL, ROBERT C. MATHEWS, & SEAN M. LANE, *Louisiana State University*—In prior research, we distinguished between model-based knowledge (i.e., acquired from explicit instruction) and experience-based knowledge (i.e., acquired from practice) and argued that the issue of how these types of knowledge interact has been largely neglected. Two experiments examined how different types of decision support would facilitate/hinder performance in a diagnostic task that involved finding the most effective drug treatments for patients. In Experiment 1, providing an external memory aid led to increased prescription of effective treatments, and providing a supplemental coding procedure improved awareness of the magnitude of drug effects. In Experiment 2, expanded support in the form of a matrix of patients and drugs allowed participants to appropriately prescribe treatments that were effective for some patient groups but not others. Across both experiments, decision support did not affect awareness of negative side effects associated with drug treatments. We discuss how decision support can alter the representation of task knowledge.

(1029)

**A Dynamic and Stochastic Theory of Choice, Decision Time, and Confidence.** TIMOTHY J. PLESKAC, *Michigan State University*, & JEROME R. BUSEMEYER, *Indiana University, Bloomington*—We present a single diffusion process account of choice and confidence judgments. The model uses a standard random-walk/diffusion process to account for choice and decision time; but to make a confidence judgment, we assume that evidence continues to accumulate after a choice is made. Judges then interrupt the process to select a response based on the accumulated evidence. The two-stage diffusion model, when compared with competing models, is shown to give a better account of the interrelationships between choice, decision and confidence time, and confidence. Furthermore, the dynamic nature of the model reveals the empirically supported moderating effects of time pressure on the accuracy of choice and confidence. Finally, the model specifies the optimal solution for giving the fastest choice and confidence rating for a given level of choice and confidence accuracy. Judges are found to act in a manner consistent with the optimal solution when making confidence judgments.

(1030)

**Making Progress On and Deriving Satisfaction From Goals: Does Urgency Eclipse Importance?** LACEY R. DORMAN & KATHLEEN M. GALOTTI, *Carleton College*—Popular author Stephen Covey (1989; Covey, Merrill, & Merrill, 1994) claims that people engage in urgent (having a specific, approaching deadline) activities more frequently than they engage in important (contributing to personal objectives that provide meaning) activities. Moreover, Covey claims that engaging in important activities contributes heavily to life satisfaction. We tested these claims by having 25 college undergraduates list goals in four categories: important and urgent, important but not urgent, not important but urgent, neither important nor urgent. A control group of 22 undergraduates listed goals in the following categories: academic, social, activities/interests, other. Seven days later, participants reported progress and satisfaction on one (experimenter-selected) goal from each category. Participants reported more progress and greater satisfaction with regard to goals rated as urgent than for nonurgent goals. Surprisingly, the rated importance of a goal was unrelated to progress or satisfaction.

(1031)

**Are Pictures the Voice of Numbers in a Medical Decision Making Task?** JOSHUA KE LADES, PETER J. MCLEOD, & RICK MEHTA, *Acadia University*—We assessed whether a pictograph and/or quiz would decrease people's reliance on personal testimonials in a medical decision making task. One hundred thirty-three undergraduates read a scenario describing a patient's angina symptoms, two treatment options (bypass surgery, balloon angioplasty), and their success rates. The scenario was followed by anecdotes describing the outcome of each treatment for hypothetical patients. Participants then stated which treatment option they preferred and rated their confidence in their decision. The independent variables were (1) whether participants viewed a pictograph illustrating success rates or read a reminder about the success rates for each procedure, and (2) whether participants were quizzed specifically on success rates. Participants were 1.57 times more likely to choose bypass surgery if they viewed the pictograph, whereas the quiz did not appear to affect their decision. However, the order in which the two IVs were administered differentially impacted participants' confidence in their decision.

(1032)

**Belief Revision: Effects of Systemic Variability and Quality of Evidence.** JESSE R. SPARKS & DAVID N. RAPP, *Northwestern University* (sponsored by David N. Rapp)—Research suggests that individuals are likely to revise their beliefs about conditional relations (if A then B) when faced with contradictory evidence. However, in everyday situations, individuals' beliefs about the reliability of particular sources may influence their acceptance of such evidence. In the present project, source credibility was manipulated in order to examine its effects on belief revision. Participants were presented with a description of a mechanical system consisted of conditional relations; the system operated either in a uniform fashion or with a randomly alternating element. Next, participants were presented with a contradictory observation from a reliable, unreliable, or neutral source. When evidence came from an unreliable source, participants were less likely to revise the conditional belief, regardless of the design of the system. This finding indicates that existing theories of belief revision should account not only for contextual effects, but also for potential pragmatic influences on any such activity.

(1033)

**Low Memory Span Individuals Benefit More From Multiple Opportunities for Estimation.** KATHLEEN L. HOURIHAN & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—Recently, Vul and Pashler (2008) demonstrated that the average of two responses from a single subject to general knowledge questions was more accurate than either single estimate. Importantly, this reveals that each guess contributes unique evidence relevant to the decision, contrary to views that eschew probabilistic representations of the evidence-gathering and decision-making process. We test an implication of that view by evaluating this

effect separately in high- and low-memory-span individuals. If memory span is the buffer in which retrieved information is assembled into an evaluation, then multiple estimates should exhibit greater independence from one another in individuals with lower memory spans than in individuals with larger spans. Our results supported this theory by showing that averaging two guesses from low-span individuals reduces error more than does averaging two guesses from high-span individuals. These results demonstrate a rare circumstance in which lower memory span confers an advantage on a cognitive task.

(1034)

**Order Effects in Probabilistic Diagnostic Reasoning.** FRANZISKA BOCKLISCH & JOSEF F. KREMS, *Chemnitz University of Technology*—A well-known phenomenon in sequential reasoning processes is that the order of information influences the assignment of probabilities to hypotheses and to final diagnostic decisions. For instance, order effects are known to have severe consequences in medical diagnosis (Chapman et al., 1996). Hogarth and Einhorn's (1992) belief-adjustment model describes cognitive mechanisms underlying order effects. The model allows the derivation of predictions of probabilities for diagnostic hypotheses and decisions. In the present study, the belief-adjustment model was contrasted with a Bayes net (Pearl, 1988) model. In an experiment ( $n = 30$ ), predictions of the two models were evaluated empirically. Participants had to estimate the probabilities of hypotheses during the diagnostic reasoning process, given different sets of evidences. The results show that the predictions of both models are consistent with different subsets of the same data, depending on the process step and the amount of evidences that are congruent with a given hypothesis.

(1035)

**Sensitivity and Bias in Covariation Detection Processes: Modeling Individual Differences and Learning.** TERESA A. TREAT, *Yale University*, & RICHARD J. VIKEN, JOHN K. KRUSCHKE, & RICHARD M. MCFALL, *Indiana University, Bloomington*—The present work evaluates a signal-detection-based approach to conceptualizing, assessing, and analyzing individual differences in the sensitivity and bias processes hypothesized to underlie clinically relevant covariation judgments. Study 1 ( $n = 256$  undergraduate males) demonstrated that men at risk for exhibiting sexual aggression toward female acquaintances displayed decreased sensitivity to the manipulated covariation between women's affect (sexually interested or not) and clothing style (provocative or not). Regardless of risk status, men displayed a substantial illusory correlation, whereby provocative dress signaled sexual interest and conservative dress indicated disinterest. Study 2 ( $n = 425$  undergraduate males) documented that trial-by-trial feedback on the correct covariation rating markedly reduced illusory correlation and substantially improved sensitivity. Sensitivity fully mediated observed training effects on performance in two subsequent affective-processing tasks. At-risk men exhibited both decreased sensitivity and a stronger illusory correlation, but those receiving feedback showed similar improvement in both covariation detection and later affective processing.

(1036)

**The Role of Uncertainty Information in Weather-Related Decision Making.** JARED E. LECLERC & SUSAN L. JOSLYN, *University of Washington* (sponsored by Susan L. Joslyn)—Public weather forecasts rarely include uncertainty estimates because of research demonstrating human reasoning errors, as compared with normative models of rational choice, when uncertainty is involved. However, the research reported here demonstrates improved decision making with uncertainty information in a realistic road maintenance task, as compared with conditions in which participants had only the conventional deterministic forecast and the deterministic forecast augmented by explicit advice indicating the normatively correct choice. The advantage for forecast uncertainty increased with error in the deterministic forecast, suggesting enhancement of trust in the forecast. Surprisingly, those advised of the correct choice abandoned it after a few trials, perhaps because the cost-loss ratio required action at a nonintuitively low probability (17%). Although participants tended to be risk seeking, those with uncertainty information



made better decisions overall. The results suggest that nonexperts can use uncertainty information to improve decision quality, although resulting decisions do not necessarily meet normative standards.

(1037)

**Personality Factors in Risk-Taking Tendencies on a Gambling Task.** IFEOLUWA TOGUN, REBECCA L. ROBINSON, DANIEL S. LEVINE, PATRICK A. RAMIREZ, & CHELSEA A. ROFF, *University of Texas, Arlington*—Selections of riskier versus less risky alternatives on gambling tasks are known to correlate with outcomes of the riskier alternative. To assess roles of personality differences, we ran three different gamble choices using repeated selection between two virtual card decks and uniform outcomes for each deck across participants. We administered two personality questionnaires to participants: one measuring risk taking (with five subscales), the other measuring sensation seeking. The three gamble choices were certain gain versus high-probability larger gain, low-probability gain versus lower probability larger gain, and certain loss versus high-probability larger loss. Scores on sensation-seeking and risk-taking questionnaires strongly negatively correlated with one another. On the gamble choice involving certain gain versus high-probability larger gain, risky deck selections correlated negatively with sensation seeking, positively with total risk taking, and marginally positively with financial risk taking. All these correlations were reversed on the choice between two low-probability gains. Selections in gambles involving losses were not correlated with personality scores.

(1038)

**A Computational Model of Moral Judgment.** ADAM B. MOORE, MICHAEL T. TODD, & ANDREW R. A. CONWAY, *Princeton University*—The dual process model (DPM; Greene et al., 2004), currently the dominant view of moral judgment, proposes that such judgments are the product of either fast, automatic emotional processing or slower, voluntary abstract processing. The DPM is supported by evidence that these two modes of processing are linked to partially separable, although interacting, neural circuits. However, the question of how these two types of processes interact to produce moral judgments without being controlled by an homunculus has yet to be answered. We propose a computational model that formalizes a method for integrating causal knowledge and automatic affective responses when generating a moral judgment. Relying on principles derived from reinforcement learning theory, we show that this model is able to account for a complex set of empirical data, while maintaining contact with a wider literature on the neurobiological substrates of moral judgment.

• CATEGORIES AND CONCEPTS •

(1039)

**Selective Access to Semantic Memory for Objects Based on Stimulus Modality and Task Demands.** EVANGELIA G. CHRYSIKOU & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Object concepts are frequently described as distributed mental representations implemented across interconnected sensory–motor domains. Knowledge of an object's function may be abstracted from its sensory–motor properties. This study examined whether object knowledge is differentially activated for typical and novel functions of objects. Participants viewed either names or grayscale pictures of everyday objects, or a combination of the two, while generating common, secondary, and ad hoc uses for them. Access to semantic memory was assessed quantitatively through voice-onset reaction times and qualitatively through a novel categorization system that classifies object function on a continuum from conceptually driven to perceptually driven responses. The results revealed differences on both measures depending on task demands. Importantly, while generating ad hoc uses, participants exposed to pictorial stimuli generated more conceptually driven responses, closer to an object's typical functional identity. We discuss the implications of these findings for distributed accounts of semantic memory and their applications for real-life tasks.

(1040)

**Measuring Efficiency in Function Estimation.** DANIEL R. LITTLE & RICHARD M. SHIFFRIN, *Indiana University, Bloomington* (sponsored

by Richard M. Shiffrin)—Typically, we design scientific inferences to trade off fit to observed data (models are good that fit well) and complexity (models or explanations that fit or explain everything are bad). In the present research, we were interested in whether people combine information from noisy data with preexisting beliefs in a manner that balances fit and complexity. We asked observers to estimate functions as causal explanations for a set of noisy data points. The data sets were varied in number of data sets, noise, and extrapolation/interpolation regions. We explored the question of how mental causal models would balance fit and complexity by examining how well the generated functions compared with an ideal, rational solution. Here, the rational solution was instantiated as the posterior of a Bayesian hierarchical regression model. Efficiency was computed in several ways using the Bayesian model averaged posterior predictive distribution from the fit to the observed noisy data.

(1041)

**Emotion Recognition in Prosody Is Faster for Pseudosentences Than for Sentences.** SÃO LUIS CASTRO & CÉSAR F. LIMA, *University of Porto*—We compared the recognition of emotions in prosody (anger, disgust, fear, happiness, sadness, surprise, and neutrality) for sentences with neutral semantic content and for pseudosentences composed of pseudowords and a few function words. Eighty listeners identified the emotions in a forced choice paradigm, and they also performed intensity judgments. Sentences and pseudosentences elicited similar high accuracy (75% and 71% correct, respectively) and intensity judgments. However, pseudosentences were responded to faster (3,070 msec) than sentences (3,310 msec). The similarity in accuracy and intensity ratings for sentences and pseudosentences indicates that the processing of emotional speech can be performed independently of lexical and semantic content. The longer latencies observed for sentences may reflect the processing cost due to the integration of semantics with prosody. The stimuli devised here constitute a database of Portuguese sentences and pseudosentences for research in emotional prosody.

(1042)

**The Effects of Regulatory Focus on Perceptual Triad Classification.** JOHN PAUL MINDA & RUBY T. NADLER, *University of Western Ontario* (sponsored by John Paul Minda)—In regulatory focus theory a promotion focus and prevention focus stem, respectively, from the approach and avoidance systems thought to underlie human behavior. Category-learning research suggests that cognitive flexibility is enhanced when regulatory focus matches the reward structure of the task. However, the effect of regulatory focus on classification alone has not been studied. The present study explored regulatory focus effects, using perceptual triad classification. Triads could be classified using a single-dimensional match or overall similarity. Previous research has shown that a promotion focus enhances global processing and a prevention focus enhances local processing. We hypothesized that subjects with a promotion focus would be more likely to classify using overall similarity, which requires global processing, and prevention focus subjects would be more likely to classify using a single-dimensional match, which requires local processing. Our hypotheses were supported, and we suggest that regulatory focus may affect early visual processing.

(1043)

**Category Learning by Classification and Inference With a More Complex Category Structure.** GUY L. LACROIX & GLEN HOWELL, *Carleton University*—Yamauchi and Markman (1998) have shown that classification and inference learners are equally successful in classifying prototypical items after training. Moreover, inference learners are more likely to select a prototypical feature in a transfer inference task than are classification learners. We argue that these results may be category structure specific. Thus, in the present experiment, we used a category structure that included four general categories with exemplars that were made up of three features that could take one of nine values. During training, participants performed an inference or a classification task for 768 or 1,920 trials. At transfer, classification learners were more accurate and faster to classify prototypical items than were inference learners. Furthermore, under certain conditions, they selected



a prototypical feature in an inference transfer task more often than did the inference learners. Thus, the results may be more readily amenable to a transfer-appropriate processing explanation than Yamauchi and Markman originally suspected.

(1044)

**Eye Movements and Knowledge in Category Learning.** SHINWOO KIM & BOB REHDER, *New York University* (sponsored by Bob Rehder)—Research has shown that category learning is affected by (1) attention, which selects which aspects of stimuli are available for further processing, and (2) the existing semantic knowledge that learners bring to the task. However, little is known about how knowledge affects what is attended. Using eyetracking, we found that (1) knowledge indeed changes what features are attended, with knowledge-relevant features being fixated more often than irrelevant ones, (2) this effect was not due to an initial attentional bias toward relevant dimensions but rather emerged as a result of observing category members, and (3) the effect grew even after a learning criterion was reached—that is, despite the absence of error feedback. Models of knowledge-based learning will remain incomplete until they include mechanisms that dynamically select prior knowledge in response to observed category members and which then directs attention to knowledge-relevant dimensions and away from irrelevant ones.

(1045)

**Temporal Construal Moderates the Effects of Category Variability on Belief Revision.** LAUREN A. KEARNEY & BRETT K. HAYES, *University of New South Wales* (sponsored by Brett K. Hayes)—Two experiments examined the effect of category variability on the updating of beliefs about the category central tendency. In Experiment 1, participants learned new categories via exposure to numerical distributions of category attributes. Categories had the same mean value, but either high or low levels of variability. During the test phase, participants were shown disconfirming instances that contradicted the acquired beliefs and were asked to reestimate category central tendency and judge whether it had changed. When task instructions implied that the disconfirming instances were drawn from a new sample (collected 10 years after the original), category variability affected belief revision (Experiment 1). Beliefs about the central tendency of low-variable categories were more influenced by disconfirming information than were beliefs about highly variable categories. However, when task instructions implied that test instances were drawn from the same sample as training instances, there was no effect of variability on belief revision.

(1046)

**Two-Item Versus 16-Item Same–Different Discrimination in Humans.** LEYRE CASTRO, DHAYASHINI RAMASAMY, & EDWARD A. WASERMAN, *University of Iowa*—Prior research suggests that variability discrimination is basic to same–different conceptualization (Young & Wasserman, 2001). There, people were trained with 16-item arrays; this training might have encouraged people to use perceptual variability to solve the task. Here, two groups were trained with either 2- or 16-item same and different arrays. Participants had to learn which of two responses was correct without being told about the sameness or differentness of the stimuli. Surprisingly, approximately half (48%) of the 2-item participants did not learn the discrimination, as compared with only 10% of the 16-item participants. Overall, participants' accuracy and reaction time scores suggest that, regardless of training conditions, same–different learning relies on variability discrimination. Finally, when mixed arrays of same and different items were presented, participants in both groups exhibited two strikingly disparate behavioral patterns. The Raven Progressive Matrices Test, a measure of higher order general cognition, predicted these two patterns of performance.

(1047)

**Testing a Fast, Efficient Method for Multidimensional Scaling.** MICHAEL C. HOUT, RYAN W. FERGUSON, DONALD HOMA, & STEPHEN D. GOLDINGER, *Arizona State University*—The classic methods used in multidimensional scaling, although useful, suffer from several shortcomings. Specifically, as the stimulus set increases,

possible pairwise comparisons grow exponentially. This leads to lengthy experimental protocols for participants, or procedures that involve scaling only subsets of the stimuli. In the present project, we examined a method proposed by Goldstone (1994) in which scaling is accomplished by presenting many stimuli at once. The participant moves the stimuli around the screen, placing them at distances from one another that are proportional to the user's subjective similarity ratings. This method takes advantage of the spatial nature of similarity, and provides a fast, efficient method for obtaining an MDS space. We provide evidence that the Goldstone method works well on controlled 2- and 3-D visual stimuli and on nonvisual stimuli with less well defined dimensions. We also make our software (written in E-Prime) available to the public through the first author's Web site.

(1048)

**Counterexamples in Category-Based Property Induction.** DANIEL HEUSSEN, *Katholieke Universiteit Leuven*, & JAMES A. HAMPTON, *City University London* (sponsored by James A. Hampton)—How do counterexamples affect argument strength? Participants evaluated two-premise blank-property arguments with typical or atypical category members, or with the category as conclusion. The premises consisted of typical or atypical members of six natural categories resulting in four argument types (TT, TA, AT, AA) for three types of conclusion (T, A, C). Arguments consisted of two positive premises (e.g., *Sparrows have a syrinx*; *Crows have a syrinx*) or one positive and one negative premise (e.g., *Sparrows have a syrinx*; *Crows do not have a syrinx*). Positive premises add to argument strength and negative premises detract from argument strength, both in proportion to the similarity between the premise and the conclusion term. Categories as conclusions behaved in the same manner as typical members with a monotonic increase in argument strength in the order of  $A \neg T$ ,  $A \neg A$ ,  $T \neg T$ ,  $T \neg A$ , whereas atypical conclusions showed the exact reversal. There was no evidence for a diversity principle.

(1049)

**Semisupervised Category Learning: The Impact of Feedback in the Perceptual Representation System.** KATLEEN VANDIST, MAARTEN DE SCHRYVER, & YVES ROSSEEL, *Ghent University* (sponsored by André Vandierendonck)—In category learning, evidence for different cognitive processes mediating the learning of different category structures is growing (Ashby & O'Brien, 2005). System-level properties are generally investigated with the supervised classification paradigm, in which feedback is given immediately after the response. Recently, the more ecologically plausible semisupervised category learning paradigm was introduced (Vandist, De Schryver, & Rosseel, 2009). In this type of learning, feedback follows only a (prespecified) percentage of trials, allowing the impact of feedback (or the lack of feedback) to be assessed. The purpose is to examine semisupervised category learning in the perceptual representation system, which is thought to mediate the learning of the A-not-A category structure (Casale & Ashby, 2008). Learning was successful in the supervised, 50%, and 25% conditions. Replacing the no-feedback trials by fillers in the 50% condition had no impact on the learning process, suggesting no effect of the no-feedback trials.

# • DISCOURSE PROCESSING •

(1050)

**Representing the Time Course of Events.** RAY BECKER & TODD R. FERRETTI, *Wilfrid Laurier University*, & CAROL J. MADDEN, *Erasmus University Rotterdam*—The representation of events is influenced by several types of temporal information. First, an event can progress toward an endpoint or continue indefinitely. Second, time shifts can signal the continuation of a described event or its termination. Finally, grammatical aspect can imply that the described event has reached its endpoint or that it remains in progress. This study manipulated all three factors to investigate how they would constrain the availability of event information in a narrative. Our results demonstrated greater availability (smaller N400s) for target events that were initially presented in the imperfective versus perfective aspect. This effect of grammatical aspect was stronger after short than after long intervening events. After long intervening events, the distribution of the effect differed for target events

that had a natural endpoint versus those that continued indefinitely. These findings demonstrate how language cues affect subtle variations in the temporal structure of event representations.

(1051)

**Readers Describe More Situational Dimensions at Event Boundaries.** CHRISTOPHER A. KURBY & JEFFREY M. ZACKS, *Washington University*—Readers of narrative construct models of the situation described by the text, which are segmented into separate events. Previous research has shown that readers index at least six situational dimensions: character, object, space, time, goals, and causation. When a particular dimension changes, readers are more likely to think about it. When situation dimensions change, readers are also more likely to perceive event boundaries. Do readers simply think more about new information, or does event segmentation independently lead readers to index situational dimensions? To answer this question, we asked readers to think aloud while reading a narrative and then to segment the narrative into events. Readers indexed dimensions that were changing, as was expected. But they also indexed more at event boundaries, above and beyond what would be expected on the basis of the changes. Thus, the mechanisms of event segmentation themselves may lead to selective processing of situational information during reading.

(1052)

**Perceptual and Social Information in Reading: Repetition and Meaning Selection Effects.** APRIL M. DRUMM & CELIA M. KLIN, *Binghamton University* (sponsored by Celia M. Klin)—Klin, Drumm, and Ralano (2009) found transfer effects when a repeated phrase was described as a written note in two unrelated passages. In contrast, when the phrase was described as a written note in Story A but a spoken conversation in Story B, transfer effects were eliminated (Klin & Drumm, 2009). Klin and Drumm concluded that perceptual experiences of story characters can affect readers' memory representations. The present studies suggest that a mismatch in social interaction experienced by characters contributed to the lack of effects found by Klin and Drumm; effects were reduced when characters in Story A encountered the repeated phrase during a social interaction (e.g., phone conversation) but characters in Story B did not (e.g., voice mail). These findings suggest that just as perceptual and social information are important in the real world, similar details from the world of story characters are encoded into readers' memory representations.

(1053)

**Beliefs and Comprehension: Importance of the Reason for Holding Beliefs.** MICHAEL B. W. WOLFE, CHRISTOPHER L. BOVEN, SHAWNA M. TANNER, JENNIFER V. LORD, & GABRIELLE J. AUSTIN, *Grand Valley State University*—Processing and memory of evidence related to a scientific topic were examined as a function of belief with regard to the topic and the reason for holding the belief (evidence vs. affect based.) Sentence reading times were recorded while subjects read texts supporting or refuting evolution and the effects of television violence. Processing was assessed by regressing reading times on characteristics of the sentences, including the extent to which each sentence supports or refutes the text position. Reasons for holding beliefs, but not beliefs themselves, predicted reading times. Evidence-based subjects slowed down reading for sentences that refuted the text position (e.g., anti-evolution sentences in a text that argues evolution is real). Affect-based subjects did not show this pattern, however. Better cued recall mirrored slower reading times for the evolution but not the television texts. The results suggest that evidence-based subjects engage in more situation model processing than do affect-based subjects.

(1054)

**Graphic Novels: Effects of Format on Comprehension.** LESLIE A. VALDES, JOHN BUCKNER, KAILASH MALLA, & BRADLEY CHISHOLM, *St. Cloud State University*—Research has shown that comprehension is often enhanced by multimedia presentations or graphics (e.g., Adaval, Isbell, & Wyer, 2007; Huk & Steinke, 2007; Kools, Wiel, Ruiter, & Kok, 2006). In this study 48 participants read stories presented as text only, graphics only, or graphics and text. The stories

were created by Eric DeWald for this study and contained at least three panels in a style similar to graphic novels. The layout was preserved for each format. Participants answered more questions about the stories correctly when they studied the multimedia format than either single media format. Performance for the graphic novels was unrelated to performance on the multimedia comprehension battery (Gernsbacher & Varner, 1988). Informal observations of student comprehension of actual graphic novels suggest that there are individual differences in comprehension. Further research is planned to explore potential sources for these individual differences.

(1055)

**Diagrams: Not for Everyone.** ADAM M. RENNER & DANIELLE S. MCNAMARA, *University of Memphis*—This study investigates whether diagrams influence the interactive effects of text cohesion, domain knowledge, and reading skill on the comprehension of science text. College undergraduates ( $n = 88$ ) read either a low- or a high-cohesion text about cell mitosis that was or was not augmented by diagrams depicting the stages of mitosis. The participants then answered text-based and bridging-inference comprehension questions. The results revealed substantial effects of prior knowledge and reading skill, as well as a marginal effect of cohesion for text-based questions and a marginal three-way interaction between cohesion, diagrams, and prior knowledge. Accordingly, low-knowledge students significantly benefited from cohesion on text-based questions when the text did not contain diagrams. Diagrams did not affect their comprehension. High-knowledge students, regardless of question type, benefited from high-cohesion text accompanied by diagrams. Although there was a combined benefit, neither cohesion nor diagrams alone influenced comprehension of the text for high-knowledge readers.

(1056)

**Using Prosody While Reading Silently.** DANIELLE N. GUNRAJ & CELIA M. KLIN, *Binghamton University* (sponsored by Peter C. Gerhardtstein)—Research suggests that phoneme-like sounds are activated during silent reading. Are these sounds accompanied by the prosody found in speech? Three experiments examined the influence of characters' described speech rate on participants' reading rate. Participants read one of two passages, each containing the same dialogue lines. In the first passage, the main character was described as speaking quickly; in the second, he was described as speaking slowly. In Experiment 1, participants read silently. Reading times on lines "spoken" by the fast speaker did not differ from those of the slow speaker. In Experiment 2, participants read out loud. Lines "spoken" by the fast speaker were read faster than lines "spoken" by the slow speaker. In Experiment 3, participants read silently but were asked to read as the main character. Lines "spoken" by the fast speaker were read faster than lines "spoken" by the slow speaker. The results suggest that the prosodic cues in text can influence reading.

(1057)

**Interactions Between Cue Informativeness and Reliability in the Resolution of Referential Ambiguity.** REBECCA NAPPA, *Harvard University*, & JENNIFER E. ARNOLD, *University of North Carolina, Chapel Hill* (sponsored by Jennifer E. Arnold)—Three experiments disentangled the effects of reliability and informativeness of cues to the speaker's referential intentions on pronoun comprehension. Participants viewed videos of a speaker telling stories about two puppets ("Bunny is playing with Froggy. She wants the toy."). "She" is typically interpreted as referring to the first-mentioned (Bunny). We modulated this first-mention bias by superimposing an attention-capture cue over one puppet at pronoun onset, manipulating whether (1) participants believed it was intentionally created by the speaker (i.e., was informative) and (2) it reliably indicated the referent on unambiguous items. In Experiment 1, the cue was informative and reliable and significantly modulated the first-mention bias. In Experiment 2, it was reliable but not informative and was used only when it agreed with the first-mention bias. In Experiment 3, it was informative but not reliable and had no effect. These results highlight the importance of concurrent reliability and informativeness in ambiguity resolution.

(1058)

**The Effect of Partner-Specific Memory Associations on Reference Resolution.** DANIEL G. SLATEN & WILLIAM S. HORTON, *Northwestern University* (sponsored by William S. Horton)—Using a visual world eyetracking paradigm, we tested the influence of partner-specific memory associations on reference resolution. Prerecorded instructions from each of two partners (one male, one female) told participants which of two pictures to select on each trial. Across trials, the pictures were organized into category pairs. In the between-speaker mapping, each partner was heard repeatedly referring to only one picture from each pair (e.g., “the cat drinking milk” vs. “the cat sitting up”). In the within-speaker mapping, each partner repeatedly referred, across separate trials, to both pictures within each pair, but categories differed across partners. In the final block, we tracked participants’ eye movements on critical displays that included both items from each category pair to examine whether, following the between-speaker mapping, participants would show earlier fixations on pictures described previously by the current speaker. These results demonstrate how partner-specific memory traces can constrain online language comprehension.

## • LETTER/WORD PROCESSING •

(1059)

**Both the Meaning and Visual Appearance of Words Guide Visual Search for a Target Word Within Other Words: Evidence From Eye Movement Recordings.** JULIEN DAMPURÉ, JEAN-FRANÇOIS ROUET, & CHRISTINE ROS, *CeRCA, CNRS, University of Poitiers, UMR 6234*, LAURE LÉGER, *University of Paris 8, EA 4004*, & NICOLAS VIBERT, *CeRCA, CNRS, University of Poitiers, UMR 6234*—An experiment including eye-movement recordings was designed to assess how visual search for a known target word within other words would be guided by the visual similarity and/or semantic relatedness 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. Orthographic distractors looking like the target word were fixated more often and for longer durations than neutral words, which suggests that they drew the attention of participants toward them once detected parafoveally. More surprisingly, a gaze-attracting effect was also obtained with semantic associates of the target word, which suggests that in the context of visual search, parafoveal vision of words was sufficient to access their meaning. However, the semantic associates of the target word were distinguished from the target and rejected as quickly as neutral words, once fixated.

(1060)

**Does Frequent Repetition of a Word Enable Automatic Word Processing?** SCOTT KOUCHI & MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & JOEL LACHTER, *NASA Ames Research Center* (sponsored by Frini Karayanidis)—We examined whether semantic activation of words occurs without spatial attention for highly activated words. We presented a very brief distractor word in lowercase, followed by a target word in uppercase. Participants indicated whether the target word belonged to a prespecified category (e.g., “sport”). If participants can read the distractor word, it should prime the response to the target. We found a priming effect when we used a cue to draw spatial attention to the distractor word, but not when spatial attention was drawn away from the distractor word. This finding held not only when a large sample of words was presented only 8 times, but also when a small sample of four words was presented 160 times each. We conclude that semantic activation of words is difficult to accomplish without attention, even for very highly activated and expected words.

(1061)

**Transposed-Letter Masked Primes Facilitate Lexical Decision Performance When Primes Are Morphologically Related But Not Orthographically Related.** PATRICK A. O’CONNOR, *University at Albany*, & LAURIE BETH FELDMAN, *University at Albany and Haskins Laboratories* (sponsored by Laurie Beth Feldman)—In two experiments, we investigated transposed-letter (TL) priming effects within a morpheme

of a morphologically complex prime in the masked priming paradigm. Nonaffixed target words (*beat*) were primed by either a morphologically related or affixed orthographic neighbor prime (*beating* or *beamed*) in the intact conditions and by a TL version of each prime type in the TL conditions (*betaing* or *bemaed*). Lexical decision performance was better overall for morphologically related trials, as well as intact trials. Importantly, an interaction indicated that the TL decrement was robust for morphologically related primes but not significant with any measure for the orthographic condition across two experiments. Furthermore, performance was consistently better with TL morphological primes than with intact orthographic neighbor primes. We discuss implications of these results for various models of letter position coding.

(1062)

**Written Age-of-Acquisition Effects Reflect Family Resemblance in the Lexical Network.** BRENDAN S. WEEKES, *University of Sussex*—The arbitrary mapping hypothesis assumes that age-of-acquisition (AoA) effects on oral reading depend on whether phonology can be predicted from orthography. One prediction that follows is that AoA effects will be larger for written words with inconsistent rime spellings than for written words with consistent rime spellings. An alternative hypothesis is that AoA effects on oral reading depend on the family resemblance between lexical items that share orthography-to-phonology mappings. The results from a multiple regression study show that the effects of written AoA on oral reading interact with the number of words containing the rime. Specifically, written AoA has a larger effect on the oral reading of consistent words with few family members than on that of inconsistent words with many family members. The conclusion from these results is that a binary distinction between predictable and unpredictable mappings is not sufficient to explain effects of written AoA on oral reading.

(1063)

**Transpositions Within Letter, Number, and Symbol Strings: Behavioral and Electrophysiological Evidence.** MARIA DIMITROPOULOU, *University of La Laguna*, JON ANDONI DUÑABEITIA, *Basque Center on Cognition, Brain, and Language*, ALEJANDRO MARIN, *University of La Laguna*, JONATHAN GRAINGER, *CNRS and University of Provence*, & MANUEL CARREIRAS, *Basque Center on Cognition, Brain, and Language* (sponsored by Manuel Perea)—The present study examined whether strings of letters, numbers, or meaningful symbols are processed and encoded differently. To this end, ERPs were recorded while participants made perceptual matching judgments on two visually presented strings that were either identical or different. Strings were different when two internal characters were transposed or replaced. Behavioral data showed that participants took longer to respond to different strings related by transposition than to different strings including character replacements. Critically, transpositions within letter strings were the costlier ones. ERP data showed an early (200–300 msec) negative-going difference for replacements, as compared with transpositions only for letter strings. Furthermore, character replacements produced a significant positive-going deflection (300–600 msec), as compared with transpositions for all string types. These findings suggest that the segmentation and encoding of different character strings occur in a stimulus-specific manner, and that letter strings are more sensitive to position manipulations than are number and symbol strings.

(1064)

**Dynamic Changes in Semantic Feedback During Visual Word Recognition.** JASON F. REIMER, *California State University, San Bernardino*, THOMAS C. LORSBACH, *University of Nebraska, Omaha*, & SCOTT P. MCKINNEY, DANA M. BLEAKNEY, & ANA L. RAYO, *California State University, San Bernardino*—In models of visual word recognition that incorporate an interactive-activation framework, activation spreads from orthographic and phonological units to semantic units, as well as from semantic units back to phonological and orthographic units. The present research tested whether the nature of semantic feedback varies over time and as a function of stimulus quality. Using a mediated priming paradigm, prime and target words were associatively related (*tulip–flower*), phonologically mediated (*tulip–flour*), or orthographically mediated (*tulip–flowed*). When the prime duration was



150 msec, semantic feedback spread to both orthographic and phonological units. When the prime duration was 250 msec, feedback spread only to phonological units. However, when using degraded targets with a 250-msec prime duration, feedback spread only to orthographic units. These results suggest that the dynamics of semantic feedback change over the time course of lexical processing and in response to the visual quality of targets.

(1065)

**Word Knowledge Influences Character Perception Sensitivity.** XINGSHAN LI, *Vanderbilt University*—Some theories of word recognition assume that word knowledge influences character perception in an interactive manner. However, there is no direct evidence supporting this. In this study, Chinese readers saw two Chinese characters located at two corners of an imaginary equilateral triangle surrounding the fixation cross. The corner that was horizontal to the fixation point was occupied by one of the characters. The other two corners, including the one that was occupied by the second character, were blended with a dynamic noise pattern. The subjects' task was to judge whether the second character was higher or lower relative to the fixation point. The two characters constituted a word in the word condition, and did not constitute a word in the nonword condition. The results showed that reaction time was shorter in the word condition. This suggests that word knowledge could influence character perception sensitivity, supporting the interactive assumption.

(1066)

**Costs and Benefits Associated With Repeated Occurrences of a Homograph.** KIMBERLY K. WEAR, *High Point University*, & DAVID S. GORFEIN, *University of Texas, Dallas*—Deciding that *organ* is related to TRANSPLANT facilitates the decision that *liver* is related to *kidney*, but has no effect on word pairs related to the contrasting meaning (*church*–*CHOIR*). However, when the homograph is also included in a subsequent pair (i.e., when *organ*–TRANSPLANT occurs before *organ*–PIANO), a cost is associated with this change in meaning. The present study examined this in greater detail, varying the presence of the homograph on repeated occurrences, as well as the number of intervening trials in the case of contrasting occurrences. Priming for consistent, inconsistent, and unrelated pairs was evaluated, in addition to pairs varying the presence of the homograph, using relatedness decisions. Several theories propose that processing an ambiguous word to the point of selecting a meaning results in the inhibition of the unselected meaning. Our results suggest that any decrements in performance are clearly tied to the presence of the homograph.

(1067)

**Transposed-Letter Effects Depend on the Lexicality of the Primes: Behavioral and Electrophysiological Evidence.** JON ANDONI DUNABEITIA, *Basque Center on Cognition, Brain, and Language*, NICOLA MOLINARO, *University of La Laguna*, MANUEL PEREA, *University of Valencia*, & MANUEL CARREIRAS, *Basque Center on Cognition, Brain, and Language* (sponsored by Manuel Carreiras)—We examined the electrophysiological correlates of the transposed-letter masked priming effect. Transposed-letter nonword–word pairs were included (*jugde*–*judge*), as well as transposed-letter word–word pairs (*casual*–*causal*), to investigate the influence of primes' lexicality in the transposed-letter effect. The results showed that when compared against a substituted-letter control condition (*jugde*–*judge* vs. *jupte*–*judge*), transposed-letter primes produced a lower negativity in the N250 component. In contrast, no differences were obtained between the two word–word priming conditions (*casual*–*causal* vs. *carnal*–*causal*). In a series of behavioral masked priming lexical decision experiments a similar pattern was also found: transposed-letter nonword primes produced a significant target word recognition benefit, whereas transposed-letter word primes did not. The influence of lexicality in the transposed-letter priming effect is discussed according to models of visual word recognition.

(1068)

**Repetition Effects on Word and Nonword Reading: An fMRI Study.** KAREN A. AICHER & SHIN-YI FANG, *University of Connecticut and Haskins Laboratories*, WILLIAM E. MENCL & STEPHEN J. FROST,

*Haskins Laboratories*, KENNETH R. PUGH, *Haskins Laboratories and Yale University School of Medicine*, & JAY G. RUECKL, *University of Connecticut and Haskins Laboratories* (sponsored by Leonard Katz)—Increased familiarity with words and nonwords has been associated with changes in cortical activation patterns, and whether the activation increases or decreases in response to a learning task has been hypothesized to be related to the extent to which the particular item has been overlearned at the time of measurement. We examined the changes in brain activation resulting from multiple repetitions of words and pseudowords in an overt reading task using fMRI. Repetition-related changes in activation were noted in a number of left-hemisphere areas strongly associated with reading functions, with nonmonotonic changes noted in some areas. Generally, stronger repetition suppression effects were observed for pseudowords than for words. Implications for normal and impaired readers are discussed.

(1069)

**ERP Correlates of Orthographic Similarity Using the Levenshtein Distance Measure.** MARTA VERGARA-MARTÍNEZ & TAMARA Y. SWAAB, *University of California, Davis* (sponsored by Debra L. Long)—Visual word recognition studies using Coltheart's orthographic neighborhood size criteria do not account for recent research investigating other types of neighbors (deletion, addition, or transposition). We used Levenshtein distance and manipulated orthographic similarity over words of different lengths. Experimental words were presented in an ERP semantic categorization task. Our results for short words replicate early (180–500 msec) neighborhood effects: larger negativities for large than for small neighborhoods. However, long words show a later (300–500 msec) reversed neighborhood effect (larger negativity for small neighborhoods than for large ones). The differences between these neighborhood effects (temporal course, scalp distribution, and polarity) reflect the fact that longer words' orthographic neighborhoods also have substantial morphological overlap; this may elicit the facilitative N400 effect. We interpret our results in terms of the opposite effects of orthographic and morphological neighborhoods on the N400 and discuss alternative measures of orthographic similarity for understanding the mechanisms underlying word reading.

(1070)

**The Differential Processing of Orthographic and Phonological Representations of Print in the Cerebral Hemispheres.** CHRISTOPHER DOMEN & LORI BUCHANAN, *University of Windsor*—The differential abilities of the cerebral hemispheres to process orthographic and phonological representations of print was investigated in two forward masked priming experiments in which 50- and 150-msec SOAs were employed and the stimuli were presented using a visual half-field methodology. In Experiment 1, the facilitating effect of unrelated primes (e.g., *halb*) and form primes (e.g., *jork*) on target word (e.g., *JERK*) recognition was compared. Form priming was observed regardless of SOA and visual field of presentation. In Experiment 2, the facilitating effect of form primes and pseudohomophone primes (e.g., *jurk*) on target word recognition was compared. Pseudohomophone priming was observed only at the 150-msec SOA for stimuli presented to the right visual field/left hemisphere. These results are consistent with the framework posited by Chiarello (2003) in which the right hemisphere maintains more shallow, orthographic representations, whereas the left hemisphere rapidly processes print at a deeper, phonological level.

(1071)

**Both-Ends Representation of Letter Position in Reading.** SIMON J. FISCHER-BAUM, JONATHAN CHARNY, & MICHAEL McCLOSKEY, *Johns Hopkins University* (sponsored by Michael McCloskey)—We report results from a letter migration experiment in which subjects viewed pairs of briefly presented nonwords. Letters from context nonwords (e.g., the N in BALENT) migrated into target nonwords (e.g., BORT), leading to errors such as BONT. Migrating letters tend to maintain position, allowing us to ask, According to what definition(s) of position is position preserved in letter migrations? We found that migrating letters maintain both left- and right-aligned position, but not center-aligned position, more often than would be expected by chance. This pattern of results is consistent with



a both-ends theory of letter position encoding and is inconsistent with open bigram (Grainger & Heuven, 2003; Whitney, 2006), spatial (Davis, 1999), and other recent theories. We have reported experimental results that support both-ends representation in spelling and verbal short-term memory. We raise the possibility that both-ends position representation is a general property of sequence processing.

(1072)

**Turning the Negative Into Something Positive: Investigating Emotion Word Processing in the Negative Priming Paradigm.** TINA M. SUTTON & JEANETTE ALTARRIBA, *University at Albany*—Negative priming was examined for three word types: (1) color words (e.g., *red*), (2) color-related, emotionally neutral words (e.g., *frog*), and (3) color-related emotion words (e.g., *sad*). Participants named the ink color of each word aloud. All words appeared in an ink color that was incongruent with the word itself (e.g., *red* in blue ink; *frog* in yellow ink, and *sad* in green ink). In the first experiment, word type was blocked. The results revealed the standard negative priming effect for the color words and color-related, emotionally neutral words; however, the color-related emotion words produced facilitation instead of inhibition on the critical trials. In the second and third experiments, the word types were mixed within block. Once again, the standard negative priming effect was obtained for the color words, and the color-related emotion words produced facilitation. Implications of these results are discussed with reference to automatic vigilance and emotion word representation.

## • ANIMAL COGNITION •

(1073)

**Spontaneous Photo Preference in Orangutans (*Pongo abelii*).** LAURA ADAMS, HEIDI MARSH, & SUZANNE E. MACDONALD, *York University*—Studies of primate cognition often use photographs as stimuli. However, untrained systematic preferences for certain categories of photographs and objects has been observed and needs to be accounted for in experimental designs. Our study examined photo preferences in 8 zoo-housed orangutans. Orangutans were shown photo slide shows simultaneously on two computer screens, using a preferential looking paradigm modeled on the type used with human infants. Stimuli were color photographs of different categories including objects, shapes, food, animals, scenery, unfamiliar orangutans, familiar orangutans, and control slides. Participation was voluntary, and orangutans were not given food rewards. Frequency and duration of visual attention to stimuli were coded from videotapes of the sessions. Preference was operationally defined as a bias in visual attention to certain categories of photographs. Individual and group preferences (age, sex) were examined. These results have important implications for research using photo stimuli with nonhuman primates.

(1074)

**Do Young Chimpanzees Have Extraordinary Working Memory?** PETER COOK & MARGARET WILSON, *University of California, Santa Cruz*—Do chimpanzees have better spatial working memory than humans? In a highly publicized report, a juvenile chimpanzee outperformed 3 university students on memory for briefly displayed digits in a spatial array (Inoue & Matsuzawa, 2007). The authors likened the chimpanzee's performance to eidetic (so-called "photographic") memory. However, the chimpanzee received extensive practice on a non-time-pressured version of the task, whereas the human subjects received none. Here, we report that, after practice at longer exposures, 2 university students performed substantially better than the chimpanzee in the brief-display posttest (95% vs. the chimpanzee's 80%). Inoue and Matsuzawa also report anecdotally that their chimpanzees could pause before responding yet still maintain high performance. Our human subjects showed no decrement in performance when a delay was enforced. In short, there is no evidence for a superior or qualitatively different spatial memory system in chimpanzees.

(1075)

**Encoding of Geometry by the Food-Storing Clark's Nutcracker.** DEBBIE M. KELLY, *University of Saskatchewan*—Previous research

has shown that animals can use an environment's shape to orient. Two geometric properties that may be used for orientation are relative wall length and the angle subtended when two walls join to form a corner. In this study, Clark's nutcrackers were trained to locate a hidden goal in one corner of a parallelogram-shaped enclosure. Once the birds were accurately locating the goal during training, they were presented with three sets of nonreinforced transformation tests. Two were designed to examine whether the birds could use wall length ratios or angular information alone, whereas the third set was designed to examine how nutcrackers would weight the two geometric properties when they provided conflicting information as to the correct search location. The results of this study show that nutcrackers encode both wall length and corner information. However, the nutcrackers' reliance on these cues seems to depend upon initial training experience.

(1076)

**Effects of Transport Response Elicitation and Nest Material on Activity in Rat Pups.** CHRISTOPHER WILSON, KRISTINA NUNGARAY, LOPA PAUL, EMILY KENNEDY, & JEFFREY S. ANASTASI, *Sam Houston State University*—Investigators tested duration of elicitation of the transport response (TR) and home-nest versus clean bedding (placed in the center of an open field) on subsequent open-field behaviors in 14-day-old rats. Pups had higher levels of activity and remained in the center of the open field when exposed to bedding from the home nest. With clean bedding, pups had a higher rate of exploration in the periphery of the open field. Prolonged TR elicitation reduced locomotor activity and, in pups placed in clean bedding, negated peripheral exploration. The results are discussed with respect to adaptive significance of reductions in exploratory activity following TR elicitation and exposure to home- and clean-nest cues.

(1077)

**Stick to the Plan: How Tamarin Monkeys Coordinate Sequential Motor Actions.** KATE M. CHAPMAN & DANIEL J. WEISS, *Pennsylvania State University* (sponsored by Judith F. Kroll)—Recent research has shown that cotton-top tamarins (*Saguinus oedipus*) are capable of sophisticated anticipatory motor planning when grasping an object (Weiss, Wark, & Rosenbaum, 2007). Here, we extend the previous work by exploring whether tamarins plan in the context of a task requiring a coordinated series of motor actions. The tamarins were presented with the end of a rope that contained a food reward located at either a near or far distance. We found that the tamarins scaled their pulls as a function of food location, even when the food was shown only briefly and subsequently occluded. We discuss the implications of these findings in light of cognitive theories of motor planning.

## • SELECTIVE ATTENTION •

(1078)

**Evidence for a Fixed Capacity Limit in Visual Perception.** EDWARD F. ESTER, KEISUKE FUKUDA, & EDWARD AWH, *University of Oregon* (sponsored by Edward Awh)—Research suggests that visual working memory (VWM) is best described by a model that enables the storage of a discrete number of items with limited precision. Motivated by known similarities between VWM and visual attention, we asked whether performance in an attention-demanding perceptual task could be described by a similar model. Observers were required to monitor multiple locations in a masked visual display in order to detect a single oriented target. Task performance was well-described by a model assuming that observers could monitor a fixed number of spatial locations with limited precision, while encoding no information from other locations. Moreover, capacity estimates in this task were predictive of capacity estimates in a VWM task using the same stimuli. These data suggest that both perceptual monitoring and VWM storage depend on a common fixed capacity system that allows the monitoring or storage of a discrete set of positions or items.

(1079)

**The Attentional Blink Is Diminished for Targets That Form Coherent Semantic Categories.** HELEN TIBBOEL, JAN DE HOUWER,

ADRIAAN SPRUYT, & GEERT CROMBEZ, *Ghent University* (sponsored by Jan De Houwer)—Previous research has shown that the attentional blink (AB) is attenuated for emotionally arousing T2 stimuli (e.g., Anderson, 2005). One confounding factor in these previous studies was that arousing stimuli belonged to a more coherent semantic category than did neutral control words. We report results that show that the AB is diminished not only for highly arousing taboo stimuli, but also for neutral words belonging to a coherent category (i.e., music-related words or numbers). This finding suggests that coherence increases salience of the stimuli and gives them priority access to awareness.

(1080)

**Whole-Object Match in Object-Based Attention.** YONGNA LI & W. TRAMMELL NEILL, *University at Albany* (sponsored by W. Trammell Neill)—Davis (2004; Davis & Holmes, 2005) found a between-objects benefit when participants matched notches in objects as “same” or “different” in U-like shapes. This effect was replicated in the same task when rectangular shapes were used. One possible explanation of the between-objects benefit is that participants adopt whole-object match in the same/different judgment task. The present experiment examined the object match account by comparing the between-objects benefit in the two-identical-object condition (both shapes are either rectangles or U-shapes) and in the mixed-object condition (one shape is rectangle and the other is U-shape). The results showed a between-objects benefit in the two-identical-object condition, but not in the mixed-object condition. This suggested that the whole-object match facilitated the responses in the same/different judgment task, resulting in the between-objects benefit.

(1081)

**Influence of Spatial Attention on the Negative Compatibility Effect.** GEOFF G. COLE & GUSTAV KUHN, *University of Durham*—Response time to determine the left–right orientation of an arrow (i.e., the target) is relatively slow if a prime is also an arrow whose direction corresponds with that of the target. When the direction of the arrow is opposite to that of the prime, response times are relatively fast. In four experiments we examined the influence of attention on this negative compatibility effect. Specifically, we assessed whether the prime shifts attention from the location of the target and whether this attention shift affects target processing. The results showed that the prime does indeed move attention. We also found that the consequence of this is that response times to discriminate and detect the central arrow are slowed if it points to the location where attention has just been. We therefore argue that attention influences the negative compatibility effect and that the role of attention in the phenomenon has thus far been largely ignored.

(1082)

**The Effect of Abrupt Onsets in the Stroop Task.** YOUNG EUN PARK & YANG SEOK CHO, *Korea University* (sponsored by Yang Seok Cho)—Visual attention is exogenously oriented to abrupt visual onsets in the display. In this study, we tested the idea that color word recognition in the Stroop task depends on visual attention. Two experiments, in which a color word was presented at one of three placeholders or at nonplaceholder location as a distractor, were conducted to show that the magnitude of the Stroop effect is modulated by whether the color word is presented as an abrupt onset or a nonabrupt onset. The Stroop effect was significantly larger for the abrupt onset color word than for the nonabrupt onset color word in Experiment 1. When a neutral word was presented at the nonabrupt onset location in Experiment 2, a significant Stroop dilution effect was obtained only when the color word was a nonabrupt onset stimulus. These results suggest that the color word in the Stroop task is recognized when it captures attention.

(1083)

**Relative Priming of Temporal Local–Global Levels in Auditory Hierarchical Stimuli.** ALEXANDRA LIST, *Northwestern University*, & TIMOTHY JUSTUS, *VA Northern California Health Care System*—Both absolute and relative temporal information are important in auditory perception. In absolute terms, information presented too quickly or too slowly is uninterpretable to a listener. Within these absolute limits,

however, listeners can recognize auditory patterns, such as melodies or speech, presented at various temporal rates, or tempi. Listeners thereby demonstrate the ability to rely on relative temporal information for perception. Previously, using hierarchical stimuli, we demonstrated that listeners are better at identifying patterns presented over a repeated (vs. changed) temporal range; we demonstrated auditory temporal level priming. Here, we addressed whether level priming relied on absolute or relative temporal information. We first confirmed that temporal level priming generalized over new temporal ranges. Second, in the context of varying tempi, we found that temporal level priming operates on the basis of relative, not absolute, temporal information. These findings are interpreted in the context of temporal expectancies and relational invariance in audition.

(1084)

**The Role of Working Memory Capacity in Attentional Filtering.** IVAN K. ASH & SCOTT A. MILES, *Old Dominion University*—Lachter, Forster, and Ruthruff (2004) found evidence for an early filter model of attention using a repetition-priming task. In the present study, we attempted to replicate these findings and investigate the role of working memory (WM) capacity in attentional filtering. Participants completed WM span tasks and a repetition-priming task. Primes were presented at three durations (55, 110, 165 msec) and at two locations (target, nontarget). Priming task results partially replicated Lachter et al., with larger priming effects in the target locations. However, we did not replicate the finding of priming effects in the nontarget location at the longer prime durations (i.e., no attentional slippage). Furthermore, there was a correlation between WM span and nontarget priming effects in the 55-msec condition. Lachter et al. proposed that priming effects in this condition represent evidence of attentional leakage, suggesting that those with high WM capacity may be using a late filter.

(1085)

**An Eye Movement Analysis of Tracking Multiple Moving Objects.** LAURI O. OKSAMA & JUKKA HYÖNÄ, *University of Turku*—Do observers track multiple moving objects by shifting their eyes between targets? Or can observers track them covertly without any overt eye movements? This fundamental question of dynamic visual attention (parallel vs. serial tracking) was examined in two experiments. In Experiment 1, observers tracked the whereabouts of visually and semantically distinct objects, whereas, in Experiment 2, identical objects were used. When the task required what–where bindings, observers fixated longer on the targets than on the background. However, when identical targets were tracked, observers fixated most of the time on the background and only rarely on targets. The results suggest an “ecumenical” solution to the dispute: When the task includes distinct objects, targets have to be visited serially in order to continuously refresh the identity–location bindings (Oksama & Hyönä, 2008). On the other hand, when the target set is identical, tracking is carried out using peripheral vision (Pylyshyn, 1989).

(1086)

**Temporal Preparation Decreases Perceptual Latency: Evidence From a Clock Paradigm.** TANJA SEIFRIED, ROLF ULRICH, KARIN M. BAUSENHART, BETTINA ROLKE, & ALLEN M. OSMAN, *University of Tübingen* (sponsored by Allen M. Osman)—A clock paradigm was employed to assess whether temporal preparation shortens the time to detect the onset of a stimulus—that is, perceptual latency. In the present experiments, participants watched a revolving clock hand while listening to soft or loud target tones under high or low temporal preparation. At the end of each trial, participants reported the clock hand position at the onset of the target tone. The deviation of the reported clock hand position from the actual position indexed perceptual latency. As was expected, perceptual latency decreased with target tone intensity. Most important, however, greater temporal preparation decreased perceptual latency, which supports rather directly the idea that temporal preparation diminishes the duration of perceptual processing.

(1087)

**Auditory Spatial Negative Priming: A Case of Identity–Location Mismatch.** SUSANNE MAYR & AXEL BUCHNER, *Heinrich Heine*

*University Düsseldorf*—Whereas spatial negative priming has been intensively investigated in the visual modality, studies of auditory spatial negative priming are nonexistent. We investigated spatial negative priming with an auditory four-alternative forced choice localization task. Participants had to localize one of two simultaneously presented sounds while ignoring the location of the second sound. Spatial negative priming—that is, slowed down responses to a location that had to be ignored in the previous trial—was found only when the sound at the repeated location changed between prime and probe. There was also no increase in prime response errors to the probes of ignored repetition trials. These findings suggest that auditory spatial negative priming is caused by sound identity–location mismatches only (analogous to visual symbol identity–location mismatches as proposed by Park & Kanwisher, 1994). Other mechanisms, such as inhibition of ignored locations or episodic retrieval of transfer-inappropriate prime information, do not seem to play a role.

(1088)

**Do You See What I See? Differences in Eye Movements and Gaze Behavior in Conservatives Versus Liberals.** MICHAEL D. DODD, JOHN R. HIBBING, & KEVIN B. SMITH, *University of Nebraska, Lincoln*—Several recent studies have provided evidence that genetic factors may influence political attitudes. For example, Oxley et al. (2008, *Science*) demonstrated that physiological response to threat is highly correlated with political ideology. We extend this research to the cognitive realm, investigating whether political temperament (conservative vs. liberal) is linked to core differences in eye movements and gaze behavior. First, we demonstrate that gaze behavior of conservatives and liberals differs when viewing collages consisting of positive, negative, and disgusting images: Conservatives have a bias toward negative images, whereas liberals focus more on positive images. Second, we show that, when asked to discern the emotion shown by a face, conservatives take much longer than liberals, despite identical accuracy in the two groups. These results have the potential to further our understanding of the biological basis of political temperament, by providing evidence that there may be basic cognitive differences between the two groups.

(1089)

**Object-Based Cuing Effects Depend on Peripheral Cues.** ELISABETH HEIN & CATHLEEN M. MOORE, *University of Iowa*—When attention is oriented to a location within an object, targets are detected faster at other locations within this cued object than at equally distant locations within a different object. This object-based cuing effect is thought to be caused by visual attention's being spread within the boundaries of the object. Some studies suggest that object-based effects are obtained only when attention is oriented exogenously. These studies, however, confounded the information that was provided by the cue (informative vs. noninformative) and the type of cue (central vs. peripheral) by using either informative central cues or noninformative peripheral cues. We fully crossed these variables and found object-based effects with both informative and noninformative peripheral cues, but no object-based effects with either type of central cue. Thus, object-based cuing effects seem to be elicited only by peripheral cues, raising the possibility that they reflect perceptual artifacts.

(1090)

**The Attentional Blink and Illusory Conjunctions.** JUAN BOTELLA, *Universidad Autónoma de Madrid*, JESÚS PRIVADO, *Colegio Cardenal Cisneros*, & BEATRIZ GIL-GÓMEZ DE LIAÑO, *Universidad Autónoma de Madrid*—The attentional blink (AB) is an impairment of performance for the second of two targets when presented within 200–500 msec from the first target. Capacity limitations, bottlenecks, masking, loss of control, gating mechanisms, and so on, are in the basis of the models proposed to account for the U-shaped function usually observed. Illusory conjunctions in RSVP tasks appear when the response feature reported pertains to a different stimulus than that containing the target-defining feature. The temporal distribution of the origin of the features reported can be manipulated as a function of several factors and is deeply influenced along the time course of the AB. Two new experiments, in which the participants have to identify the letters in a specified

color, are reported. The results, together with several other previously published, support models of the AB based on two different mechanisms, as in the boost-and-bounce model. The AB is produced when the continuity of the stream is interrupted (by a distractor, a blank, or any other sudden change), but the depth and length of the blink is a function of the processing of the first target. The different time courses of the T2 hits and the origin of the errors reveal the two mechanisms.

• HUMAN LEARNING AND INSTRUCTION •

(1091)

**The Spacing Effect Revisited.** LARA N. SLOBODA & RICHARD A. CHECHILE, *Tufts University*—The spacing effect has a long history in the literature of learning. This study revisited the spacing effect by using multinomial models to examine the underlying processes that are involved. In the first two experiments, a recognition memory procedure was used that enabled the measurement of the processes of memory storage and guessing. The only consistent difference in the proportion of correctly stored memories was that between an extreme massed condition and any of the other spacing conditions tested. In the third and fourth experiments, recognition as well as recall measures were utilized with a procedure that enabled multinomial modeling in terms of storage and retrieval processes. Strong spacing effects were found for recall measures, and these effects were primarily attributable to underlying changes in retrieval processes.

(1092)

**Repeated Testing Promotes Transfer of Learning.** ANDREW C. BUTLER, *Duke University* (sponsored by David G. Elmes)—Many studies have shown that repeated testing increases long-term retention, relative to repeated study, as measured by a final test on which the same questions are repeated verbatim. The present research investigated whether repeated testing on material can be used to promote transfer to new questions that require the application of information from that material. Subjects read prose passages and then they either repeatedly restudied or took tests on the passages. One week later, they took a final transfer test. Experiments 1 and 2 showed that repeated testing increased transfer to new inferential questions within the same knowledge domain, relative to repeated study. Experiment 3 showed that repeated testing also led to better transfer to different knowledge domains. Overall, the results indicate that retrieval practice produced greater availability and accessibility of knowledge, thereby increasing the potential for successful retrieval and application of that knowledge on the subsequent transfer test.

(1093)

**Retrieval Practice Aids Performance on New Memory Tests, But Not on Inference Tests.** SCOTT R. HINZE, JAMES W. PELLEGRINO, & JENNIFER WILEY, *University of Illinois, Chicago*—Retrieving information from memory often leads to better long-term retention of that information than does reexposure (Roediger & Karpicke, 2006). This “testing effect” suggests that retrieval practice may be a useful mnemonic and pedagogical tool. The question remains whether retrieval practice alone can also facilitate understanding of complex materials. In a within-subjects design, participants read five short science texts, each followed by a different study activity: a no-activity control, rereading, retrieving specific text (i.e., fill-in-the-blank), and paragraph recall, with or without feedback. After a 2-day delay, participants took new multiple-choice tests, testing both memory of the text material and inferences from the material. Memory performance was best after paragraph recall, with or without feedback, but inference performance was unaffected by study activity. Retrieval seems to aid memory of text, even facilitating performance on new, nontrivial questions. However, we have yet to find benefits for conceptual understanding.

(1094)

**Reappearance of the Positive Testing Effect Through the Provision of Feedback on Items Where “None of the Above” Is the Correct Response.** EMILY A. FARRIS, *University of Texas, Arlington*, JOSHUA D. KOEN, *University of California, Davis*, & AIDAN DOUGLAS, MAXI M. WILSON, HEATHER F. WOOD, & TIMOTHY N. ODEGARD,



*University of Texas, Arlington*—No positive and an inflated negative testing effect were observed for cued-recall questions when “none of the above” was the correct response on an initial multiple-choice test. To determine whether this resulted from the absence of the correct answer, participants received no feedback or were provided with the correct factual answer after each multiple-choice question. Participants not receiving feedback did not differ in their ability to correctly recall control items ( $M = .33$ ,  $SE = .03$ ) and items for which “none of the above” was correct ( $M = .31$ ,  $SE = .04$ ), but recalled more items when “none of the above” was incorrect ( $M = .56$ ,  $SE = .04$ ). However, participants who received feedback recalled more items when “none of the above” was incorrect ( $M = .71$ ,  $SE = .04$ ) and correct ( $M = .65$ ,  $SE = .04$ ) in comparison with control questions ( $M = .28$ ,  $SE = .03$ ). Yet, even with feedback, the negative testing effect was greater when “none of the above” was correct.

(1095)

**Enhancing Visuospatial Learning: The Benefit of Retrieval Practice.** SEAN H. KANG, *University of California, San Diego* (sponsored by Doug Rohrer)—Studies examining the beneficial effect of testing on memory have relied mostly on verbal materials. The present study investigated whether testing can improve the learning of novel visuospatial information. Subjects (without prior Chinese language background) studied English words paired with their Chinese equivalents. Subsequently, they either restudied the pairs twice or got tested twice (English word cue, instructed to mentally visualize the Chinese character) with feedback provided. Study and test/feedback trials were equated in duration. Across three experiments, subjects were more accurate at writing/drawing the Chinese characters from memory after testing than after repeated studying, and this result was found on both immediate and delayed (1 day) final tests. Subjects’ predictions of future test performance, however, indicated no awareness of the benefit of initial testing. The implication for learning a foreign language that uses a different writing script from one’s own language is that practicing retrieval from memory trumps repeated studying.

(1096)

**Retrieval Practice With Short-Answer, Multiple-Choice, and Hybrid Tests.** MEGAN A. SMITH & JEFFREY D. KARPICKE, *Purdue University* (sponsored by Jeffrey D. Karpicke)—In three experiments, we had students read educational texts and practice retrieval by taking a short-answer, multiple-choice, or hybrid test. On hybrid tests, the students first attempted to recall answers in short-answer format and then identified answers in multiple-choice format (cf. Park, 2005). We also examined the effects of retrieval practice with two different question types: verbatim questions, where answers could be recalled directly from the texts, and integrative question that required students to relate multiple concepts to answer the questions. Retrieval practice enhanced long-term retention on a week-delayed final test, and positive effects occurred for both verbatim and integrative questions. However, we did not see differences among test formats. We argue that the mnemonic effect of retrieval practice is determined by the difficulty of the initial discrimination problem afforded by the retrieval attempt and that this is not necessarily correlated with the format of the test (short answer vs. multiple choice).

• METAMEMORY/METACOGNITION •

(1097)

**Exploring the Role of Metacognitive Accuracy in Visual Search.** JOSHUA S. REDFORD & MICHAEL HUMPHREY, *Boise State University*, SEAN GREEN & MICAH GEER, *University at Buffalo*, & KEITH W. THIEDE, *Boise State University* (sponsored by Keith W. Thiede)—Although visual search performance has been studied extensively, metacognitive accuracy in visual search has gone unexplored. Data regarding metacognitive accuracy in visual search are important to both applied research (e.g., Do people know when search will be difficult?) and basic research (e.g., What properties affecting performance are people aware of?). Set size and search asymmetry were explored in a metacognition paradigm. Prior to a visual search task, participants rated multiple search scenes in terms of their predicted search speed and

their accuracy in discerning the presence of the target. A second cycle of rating and searching yielded information on the influence of practice on performance and metacognitive accuracy.

(1098)

**Framing Metamemory Judgments: Judgments of Retention Interval.** SARAH K. TAUBER & MATTHEW G. RHODES, *Colorado State University*—Prior research suggests that people are poor at predicting the impact of a long retention interval on subsequent memory performance (e.g., Koriat, Bjork, Sheffer, & Bar, 2004). We explored the possibility that this occurs because traditional metamemory measures do not fully capture sensitivity to a retention interval. Specifically, in several experiments, we examined sensitivity to a retention interval, using a new measure of metamemory, judgments of retention interval (JORIs). Participants studied lists of words and predicted how long they would be able to remember a particular item (e.g., minutes or seconds). Such JORIs resulted in more realistic predictions of the impact of a retention interval on memory performance than has been documented previously. These data thus suggest that the framing of a metamemory measure is critical in examining metacognitive awareness.

(1099)

**Metacognitive Judgments of Improvement Do Not Correlate With Improvement.** CORINNE TOWNSEND & EVAN HEIT, *University of California, Merced*—Can learners accurately judge their own rate of learning? Metamemory theories, such as proximal learning theory (Metcalfe, 2002), suggest that this ability would be valuable for allocating study time optimally. However, in an experiment, students showed poor accuracy when estimating how much they improved (or will improve) between presentations. We investigated judgments of improvement (JOIs) by asking students to make predictions of future learning or postdictive assessments of how much they had improved, on either a percentage or an absolute scale. Participants studied a list of paired associates and made JOIs for six study–test cycles. In each condition, JOIs had approximately zero correlation with actual improvement. This finding was also obtained in two other experiments using different materials and response measures. The results suggest that learners’ ability to judge their rate of learning is poor and pose challenges for theories of metamemory that rely on judgments of improvement.

(1100)

**Factors Affecting Bias in Evaluations of Performance on a Test.** YANA WEINSTEIN & HENRY L. ROEDIGER III, *Washington University*—We examined the effect of three variables (test list structure, report option, and framing) on bias in global evaluations of test performance. Participants answered general knowledge questions and estimated their performance after each block. First, the ordering of the questions within a block affected bias such that participants were overconfident when questions were sorted from the easiest to the hardest and underconfident when questions were sorted from the hardest to the easiest, relative to a condition where the same questions were randomized. This effect was not apparent on item-by-item confidence ratings. Second, forcing participants to produce a response to every question increased performance without affecting evaluations. Finally, framing the evaluation question in terms of the number of questions answered incorrectly did not affect bias but rendered evaluations less accurate, as compared with evaluations made in terms of correctly answered questions.

(1101)

**Are Students Sensitive to Lag and Criterion-Level Effects When Monitoring Learning During Retrieval Practice?** MARY A. PYC & KATHERINE A. RAWSON, *Kent State University*—Research on retrieval practice has shown that longer lags between trials and higher criterion levels (i.e., number of correct recalls) during acquisition generally lead to higher levels of final test performance, as compared with shorter lags and lower criterion levels. However, are students aware of the influence of these variables? Two experiments explored students’ sensitivity to lag and criterion-level effects, using judgments of learning (JOLs) and aggregate judgments. Participants learned items to a predetermined criterion level with long or short lags during practice. JOLs measured



item-specific sensitivity to lag and criterion level, whereas aggregate judgments evaluated global knowledge. The results showed that both JOLs and aggregate judgments were positively related to criterion level. However, aggregate judgments were not related to lag, and JOLs were negatively related to lag, suggesting that students unfortunately do not understand the robust effects of lag on memory.

## (1102)

**Feedback Increases Middle School Students' Resolution and Retention of Correct Responses.** POOJA K. AGARWAL, HENRY L. ROEDIGER III, MARK A. McDANIEL, & KATHLEEN B. McDERMOTT, *Washington University* (sponsored by Henry L. Roediger III)—Prior laboratory research has demonstrated the beneficial effects of feedback on initially incorrect and correct answers (Butler, Karpicke, & Roediger, 2008), yet the potential benefits of feedback have not been examined in a classroom setting. Seventh-grade students received multiple-choice quizzes before a class lesson, at the end of a class lesson, and the day before a unit test. Students also rated their confidence after each response. Immediate feedback was provided for half of the items, and retention was measured on a unit test. Completing three initial quizzes improved criterion test performance, and feedback further improved retention. Feedback improved retention of initially incorrect responses and low-confidence correct responses, replicating the findings of earlier work (Butler et al., 2008). In addition, feedback improved retention for high-confidence correct responses on initial tests and improved students' resolution across the three initial tests, demonstrating the robust benefits of feedback for students' retention and metacognition.

## (1103)

**Training Metacognition in the Classroom: The Effect of Feedback and Incentives.** TYLER M. MILLER & LISA GERACI, *Texas A&M University*, & MARYELLEN HAMILTON, *Saint Peter's College*—In three semester-long studies, we examined whether students in a classroom could improve their ability to accurately predict their own performance across multiple tests. We tested whether providing feedback and incentives (i.e., extra credit) for accuracy would improve predictions by improving students' metacognition, or awareness of their own knowledge. The results from all three studies replicated the robust overconfidence effect. Students' predictions were almost always higher than the grade they earned, and this was particularly true for low-performing students. The results also showed improved metacognitive accuracy for low-performing students, despite stable exam scores across tests, suggesting that feedback and incentives influenced metacognitive monitoring but not control. Finally, we found that, although low-performing students showed the biggest overconfidence effect, they were actually less confident in their ability to predict their exam scores than were high-performing students.

## (1104)

**Does Concept Mapping Improve Metacomprehension Accuracy?** JOSHUA S. REDFORD & KEITH W. THIEDE, *Boise State University*, & JENNIFER WILEY & THOMAS D. GRIFFIN, *University of Illinois, Chicago*—Concept maps can improve metacomprehension accuracy of young adults. We explored whether the same approach also improves metacomprehension accuracy of seventh graders. Without training, concept maps were ineffective. With training, concept maps improved metacomprehension accuracy among seventh graders. The data also suggest that concept maps improve metacomprehension accuracy because mapping encourages the construction of situation models, with the actual concept map quality having little influence on metacomprehension accuracy.

## • WORKING MEMORY •

## (1105)

**Working Memory Strategy Training and Attention.** CINDY J. SCHIERS, KANDI J. TURLEY-AMES, & KELLY L. PEARCE, *Idaho State University*—Previous research suggests that ADHD symptoms may reflect deficits in working memory (WM). Furthermore, it has been

shown that WM performance is enhanced with training (McNamara & Scott, 2001; Turley-Ames & Whitfield, 2003), and training effects generalize to other forms of higher order cognitive functioning (Klingberg et al., 2002). However, it is unknown whether WM training influences attention and whether changes in cognitive performance are maintained over time. In the present research, participants with discrepancies in their attention and intelligence and matched controls completed a pretest, posttest, and follow-up (5–6 weeks after posttest) cognitive battery (WM, attention, general cognitive functioning, and higher order cognitive functioning). Between pre- and posttest, all participants completed five WM measures, with half being instructed to utilize a rehearsal strategy. The results demonstrate how WM training influences WM performance, generalizes to other aspects of cognitive functioning, and impacts those with and without a cognitive discrepancy, immediately and over time.

## (1106)

**Measuring Working Memory With Automated Block Span and Automated Letter–Number Sequencing.** SHARONA M. ATKINS, J. ISIAH HARBISON, MICHAEL F. BUNTING, SUSAN TEUBNER-RHODES, & MICHAEL R. DOUGHERTY, *University of Maryland, College Park*—A series of studies examines the performance of two newly developed working memory tasks: block span (BS) and letter–number sequencing (LNS). BS and LNS are computer-automated assessments and use within-task interference to assess working memory ability. BS assesses spatial working memory, requiring participants to remember the spatial location and serial order of a set of one or more sequences of visually presented blocks appearing in a grid. LNS assesses verbal working memory ability, requiring participants to remember and restructure a series of one or more sequences of characters (visual or auditory), consisting of both letters (A–Z) and numbers (1–9), reporting first the digits in ascending order, then the letters in alphabetic order. Performance on BS and LNS are highly correlated with each other and with other working memory assessments and are specifically so with other measures of spatial/visual and verbal working memory, respectively.

## (1107)

**Differences in Global and Local Updating in Working Memory Are Associated With Arithmetic Calculation Ability.** BENJAMIN J. KAPP & GEETA S. SHIVDE, *West Chester University of Pennsylvania*—Local updating involves modifying a subset of the information in the working memory store, whereas global updating involves the entire contents of the store. We used Kessler and Meiran's (2008) tasks to dissociate global and local updating. Participants monitored sets of one to three items for changes in the identity of some or all of the items over a trial sequence and reported the contents of the set during the trial. In this self-paced procedure, the measure of updating was the RT from the presentation of each set to the participants' keypress that advanced the trial. Participants also completed an arithmetic calculation task with math problems varying in difficulty. RT to complete each problem was recorded. Participants were divided into groups on the basis of RT in this task. Analysis showed interactions between math ability and measures of local updating. In contrast, measures of global updating seemed not to be associated with math ability.

## (1108)

**Remembering and Forgetting Concurrently: New Benefits of High Working Memory Span.** ANGELA M. AU BUCHON & NELSON COWAN, *University of Missouri, Columbia* (sponsored by Nelson Cowan)—Can participants satisfy conflicting demands when a word meaning must be disregarded in one task and, concurrently, kept active in another? We presented word lists to be recalled, with the final word being polysemic (e.g., *fence*). Before recalling the list, participants were to judge this word as being consistent or inconsistent with a picture (e.g., of a swordfight: consistent). For diagnostic purposes, the middle of the list contained another word related to the polysemic word. High- and mid-span individuals kept the tasks separate. For them, the picture task had no effect on recall, although, for high spans, the type of relation between list words did. In contrast, low spans mixed up the tasks; recall was superior when the picture meaning was dominant in the language

(a picket fence but not swordfight). In mid- and high spans, irrelevant meanings may not be lost but, rather, tagged as relevant or irrelevant to each task separately.

(1109)

**Chunk Size or Number of Chunks: What Explains Working Memory Development?** AMANDA L. GILCHRIST, NELSON COWAN, & MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia* (sponsored by Todd Schachtman)—Child development involves substantial growth in immediate memory span. The neo-Piagetian researchers hotly debated whether this growth occurs because older children can remember a larger number of coherent chunks of information (Pascual-Leone, 1970) or because they can more efficiently pack information into each chunk (Case et al., 1982). We reexamined this question in first- and sixth-grade children and adults, using free recall of lists of short, unrelated, one-clause sentences, for which each sentence was expected to be perceived as a coherent chunk. We distinguished between clause access, or recall of at least one substantive word from the clause, and clause completion, or the proportion of words recalled from accessed clauses. The results showed nearly equivalent clause completion across age groups (about 80%) but, nevertheless, greater clause access in older children and adults. These results imply a developmental increase in the number of chunks that can be held in working memory.

(1110)

**Exploring the Role of Working Memory Capacity in Encoding and Retrieving Episodic Memories.** GREGORY J. SPILLERS, GENE A. BREWER, & NASH UNSWORTH, *University of Georgia*—We examined the extent to which differences in encoding processes or contextual retrieval account for the relation between individual differences in working memory capacity (WMC) and variation in episodic recall. Using a continual distractor task, with incidental versus intentional encoding conditions, results indicated that high-WMC individuals outperformed low-WMC individuals across both encoding conditions and, notably, to a greater degree in the intentional encoding condition. These results suggest that WMC differences in episodic recall are likely due to a combination of differences in both contextual retrieval and differential encoding processes. These findings are consistent with prior work showing that high-WMC individuals are better at engaging in strategic encoding processes during the presentation of items than low-WMC individuals and are better at using contextual cues to focus the search on correct items during retrieval.

(1111)

**Backward Serial Recall and Benchmark Effects of Working Memory.** TAMRA J. BIRETA, *The College of New Jersey*, SHEENA E. FRY, ANNIE JALBERT, IAN NEATH, & AIMEE M. SURPRENANT, *Memorial University of Newfoundland*, & GERALD TEHAN, *University of Southern Queensland*—Working memory was designed to explain four benchmark memory effects: the word length effect, the irrelevant speech effect, the acoustic confusion effect, and the concurrent articulation effect. In four experiments, we examined whether each effect would be observable with immediate backward serial recall. Subjects did not know which recall direction (forward or backward) would be required until the time of test, ensuring that processing would be identical for both recall directions until the time of recall. In all four experiments, the benchmark memory effect was observed with forward serial recall but was either absent (no effect of word length, irrelevant speech, or similarity) or greatly attenuated (reduced effect of concurrent articulation) with backward serial recall. Backward serial recall had no effect on the more difficult conditions (e.g., long words, similar-sounding items, items presented with irrelevant speech, and items studied with concurrent articulation). Implications for theories of immediate memory are discussed.

(1112)

**Working Memory and Fluid Intelligence in Children.** PASCALE M. J. ENGEL, *University of Oxford*, & ANDREW R. A. CONWAY, *Princeton University* (sponsored by Gareth Gaskell)—The present study investigates how working memory and fluid intelligence are related in young

children and which aspect of working memory span tasks—short-term storage or controlled attention—might drive the relationship. A sample of 119 children were followed from kindergarten to second grade and completed assessments of working memory, short-term memory, and fluid intelligence. The data showed that working memory, verbal short-term memory, and fluid intelligence were highly related but separate constructs in young children. The results further showed that when the common variance between working memory and short-term memory was controlled, the residual working memory factor manifested significant links with fluid intelligence, whereas the residual short-term memory factor did not. These findings suggest that in young children, the executive demands, rather than the storage component, of working memory span tasks are the source of their link with fluid intelligence.

(1113)

**The Nature of Processing in Working Memory: Temporal-Contextual Cues and Characteristics.** VANESSA LOAIZA & DAVID P. McCABE, *Colorado State University*—Recent theories of working memory suggest that processing involves more temporal-contextual retrieval during complex span tasks than during simple span tasks. In order to assess this prediction, subjects were asked to complete trials of list length four of operation span and word span, followed by completion of either a delayed cued recall test (Experiment 1) or a delayed recognition test that asked for subjects to rate the memorability of characteristics of the represented items (Experiment 2). Temporal-contextual, phonological, and semantic cues/judgments were used to assess the availability of different types of information. In support of cue-based retrieval theories, temporal-contextual cues were more likely to elicit accurate performance, as well as higher ratings of memorability, for operation span, as compared with word span. Hence, both objective and subjective measures suggest that complex span tasks involve more temporal-contextual processing than do simple span tasks.

#### • IMPLICIT MEMORY •

(1114)

**Implicit Learning Produces Two Types of Familiarity.** GREG J. NEIL & PHILIP A. HIGHAM, *University of Southampton* (sponsored by Timothy J. Perfect)—Implicit learning experiments typically involve a study phase where participants are shown stimuli that were produced according to a structural rule set (for instance, all stimuli are common nouns). Participants can usually identify never before seen structurally compliant stimuli at above chance levels while not being able to verbalize the rule set. Such knowledge can operate through feelings of familiarity. Familiarity is also implicated in recognition decisions, where participants only have to distinguish previously seen stimuli from those they have not seen. This set of experiments examined structural and recognition decisions with the same stimuli. The results demonstrated that recognition and structural familiarity are distinct and different. Specifically, familiarity in structural decisions is not sensitive to an increase in the number of times stimuli are displayed at study, whereas familiarity in recognition decisions is sensitive to such manipulations.

(1115)

**Long-Term Semantic Antipriming Is Task Dependent.** KATRINA SCHLEISMAN, *University of Minnesota*, NICOLE LANDI, *Yale University School of Medicine*, MATTHEW OLSON, *Macalester College*, & CHAD J. MARSOLEK, *University of Minnesota*—In addition to the widely studied phenomenon of short-term semantic priming, recent work indicates that long-term semantic priming also occurs. We examined whether long-term inhibition (antipriming) effects necessarily accompany long-term facilitation effects in priming paradigms. In one experiment, we first measured baseline lexical decision performance, unaffected by previous word processing. We found enhanced lexical decision performance—compared against baseline—for cross-modal repetition-primed words (e.g., viewing “intellect” after hearing “intellect”). However, we did not find impaired lexical decision performance—compared against baseline—for potentially cross-modal, semantically related, antiprimed words (e.g., viewing “intellect” after hearing “intuition”). In our second experiment, we used word naming in place of lexical decision,

and we found both cross-modal antipriming and cross-modal repetition priming. These results indicate that the inhibitory effects of long-term semantic antipriming depend on a task in which the target word must be uniquely identified/distinguished from other words.

(1116)

**Is Survival Processing Advantageous for Recognition Memory?** JEREMY K. MILLER, *Willamette University*—Nairne, Thompson, and Pandeyra (2007) have proposed that human memory is particularly adapted to remember survival-relevant information. Further experimentation has demonstrated that participants recall words that have been rated for their relevance to a survival situation significantly better than words that have been studied using a number of effective encoding manipulations (Kang, McDermott, & Cohen, 2008; Weinstein, Bugg, & Roediger, 2008). The present experiments sought to extend these findings to recognition memory. The results replicate the finding that participants recognize words studied under survival-related encoding conditions better than words rated relative to a travel-related scenario. However, contrary to the results of experiments using recall tests, the results do not demonstrate a significant survival processing advantage when compared with more powerful encoding manipulations such as self-referential encoding and pleasantness ratings. The results are discussed in relation to functionalist theories of human memory (Nairne, 2005).

(1117)

**The Role of Awareness in Hebb Digits Learning: An Investigation Using the Process-Dissociation Procedure.** GEOFFREY O'SHEA, *SUNY College at Oneonta*—The Hebb digits (HD) task, which involves the incidental learning of a repeating nine-digit sequence, has been a useful paradigm for investigating the transfer of serially ordered information from short-term to long-term memory. Previous results, using a self-report measure to assess awareness, have indicated that equivalent learning of the repeated digit sequence occurs irrespective of awareness of sequence repetition (McKelvie, 1987). In the present experiment, awareness of sequence repetition was assessed by examining knowledge of item positional information, using Jacoby's (1991) process dissociation procedure. The results showed that learning of the repeated sequence was greater for aware than for unaware participants, suggesting that information learned via implicit mechanisms may not be as strongly represented in memory compared to information learned via explicit mechanisms. These results are discussed in terms of the role of awareness in directing serial learning as well as the importance of using alternative methods for assessing awareness in the HD paradigm.

(1118)

**Recognition Memory in the Absence of Subjective Confidence.** HEATHER SHERIDAN & EYAL M. REINGOLD, *University of Toronto, Mississauga*—In two experiments, a paradigm developed by Merkle and Reingold (1990) to study unconscious perception was applied to the study of recognition memory in the absence of subjective confidence. During encoding, participants either read or generated words. In each trial during test, two words were presented on the screen (50% of trials = two new words, 50% = one new word, one old word) and participants answered two questions: (1) Is either word old? (response options in Experiment 1: strong yes, weak yes, weak no, or strong no; response options in Experiment 2: remember, know, or new), and (2) Which word is old? Participants were above chance for the second question, even in the absence of subjective confidence. Importantly, a generate/read effect was observed in forced choice recognition performance that was accompanied by subjective confidence, but not in recognition performance in the absence of confidence.

(1119)

**Parallel Implicit Learning of Spatial and Phonological Sequences.** ANNETTE BOLTE & THOMAS GOSCHKE, *Dresden University of Technology*—We investigated implicit learning of spatial and phonological sequences. In a sequential search task, four letters were presented visually, followed by an auditory target phoneme. Participants responded manually to the location of the phoneme in the visual array. In Experiment 1, either locations or phonemes followed repeating

patterns, whereas the other sequence was random. In both conditions response times (RTs) reliably increased when sequences switched to random sequences even when participants showed no explicit knowledge. In Experiment 2, both phonemes and target locations followed repeating but uncorrelated sequences. Occasional deviants violating either the phoneme or the location sequence produced reliable RT costs even when participants showed no explicit knowledge. In Experiment 3, concurrent spatial or phonological distractor tasks disrupted selectively either spatial or phonological sequence learning. The results show that location and phoneme sequences are learned in parallel, suggesting that implicit sequence learning may rest on processes in multiple representation systems.

(1120)

**Memory for Pictures Is Influenced by Verbal Labels and Encoding Strategy.** GARY LUPYAN, DAVID J. M. KRAEMER, RANJANI PRABHAKARAN, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Memory for familiar pictures may be influenced by their category labels. Referring to an item by its name may augment the item's memory representation with the broader conceptual category (Lupyan, 2007). We investigated the effect of referring to an item by its name during the test phase of a recognition memory task. After they had studied pictures of familiar items, participants' recognition memory was tested with a two-alternative forced choice task (as in Brady et al., 2008). For half the items, participants viewed a category name (e.g., "toaster") along with the two picture alternatives. Overall, accuracy was lower than predicted by Brady et al. Recognition memory was correlated with the Verbalizer-Visualizer Questionnaire: Participants with high scores on the verbal dimension performed better on the label trials; participants with high scores on the visual dimension performed better on the no-label trials. In addition, people remembered items as being more typical of their category than they actually were.

(1121)

**Coupling Timing to Action: The Proceduralization of Anticipatory Timing.** JACQUELINE C. SHIN, *Indiana State University*—How does the procedural learning system bind different time intervals to appropriate actions, allowing for well-timed sequences? Does a time interval become learned as an outcome of a cued response or in anticipation of subsequent events? In a serial reaction time task, stimulus and timing (response-to-stimulus intervals [RSIs]) sequences were presented together repeatedly and in a consistent phase relationship. Importantly, the stimulus and response (and RSIs) were predictable on every other trial but unpredictable on the intervening trials. In one condition, a predictable RSI was presented immediately after a predictable stimulus and response. In the other, a predictable RSI was presented immediately before them. The main result was that the RSI and stimulus-response sequences were integrated only in the latter case, supporting the conclusion that temporal patterns are learned in anticipation of environmental cues or as part of planned actions, rather than as reactive expectations based on previous events.

(1122)

**Direct Evidence for the Role of Inhibition in Resolving Interference.** M. KARL HEALEY, KAREN CAMPBELL, LYNN HASHER, & LYNN OSSHER, *University of Toronto*—Interference is a powerful determinant of memory retrieval. Yet the mechanisms of interference resolution are not fully understood. Using a three-phase paradigm, we tested the hypothesis that interference is overcome by suppressing interfering traces. In the first phase, participants counted the vowels in a series of words that included pairs of morphologically similar words (e.g., ALLERGY and ANALOGY). In the second phase, participants solved word fragments (e.g., A \_ L \_ \_ GY) that resembled both words in a pair but could be completed only by one. In the final phase, we measured the consequence of resolving interference between the correct solution and the rejected foil by having participants read the foils in a speeded naming task. Participants were slower to name the foils than were control participants who had not experienced interference. These results constitute some of the most direct evidence available for suppression in memory retrieval.



## • EXPLICIT MEMORY •

(1123)

**Measuring True and Phantom Recollection in Younger and Older Adults With Fuzzy Trace Theory's Dual-Retrieval Model.** TAMMY A. MARCHE, *University of Saskatchewan*, CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*, & DAVID G. LANE, *University of Saskatchewan*—A trichotomous theory of recall—a mathematical model that separates and quantifies direct access retrieval and reconstructive retrieval, as well as a metacognitive familiarity judgment process—was used to examine the effects of list repetition and aging on the model's parameters. Younger and older adults listened, either once or thrice, to four DRM lists of words and completed three recall tests. The preliminary findings indicate that (1) with three list presentations, younger adults found it easier to directly access presented and nonpresented (phantom recollection) items than did older adults; (2) reconstructive retrieval varied little with age; and (3) familiarity ratings tended to be higher with younger than with older adults. The age effect in direct access was slightly more marked than it was in reconstruction, both of which were smaller than the age effect in the familiarity judgment process. These findings are consistent with the theoretical conceptions of the two retrieval operations.

(1124)

**Aging and Spacing Effects Across Criteria in Continuous Recognition.** ASLI KILIC, MARC W. HOWARD, & WILLIAM J. HOYER, *Syracuse University* (sponsored by William J. Hoyer)—Extensive research has demonstrated a spacing effect in recall tasks. However, much less work has been done on the spacing effect in recognition tasks, and even less examining the effect of spacing on performance at different criteria. We conducted an experiment in which college students and older adults performed a continuous recognition experiment in which words were presented a total of three times. We refer to the interval between the first and second presentation as the lag and the interval between the second and third presentation as the retention interval. Responses were given on a nine-point scale allowing us to evaluate performance at different criteria. Both older adults and younger adults showed a decrease in performance on the second presentation as a function of lag, but neither group showed a robust effect of lag on performance on the third presentation. Despite nearly equivalent levels of accuracy, older adults showed reliably higher *z*ROC slopes, suggesting a differential sensitivity to criteria in this task for older adults.

(1125)

**Aging and Associative Memory for Objects in Scenes.** ZIHUI LU, EYAL M. REINGOLD, & MEREDYTH DANEMAN, *University of Toronto, Mississauga*—During study, young and older adults' eye movements were monitored while they viewed naturalistic scenes containing focal objects presented on scene backgrounds. To create the study and test images, groups of four exemplars (e.g., four different fish) from a variety of categories were combined with plausible scene backgrounds (e.g., underwater scenes). Recognition memory performance in the intact condition, in which old objects (e.g., an orange fish) were paired with their original old backgrounds (e.g., underwater scene with red coral), was contrasted with that in two additional retrieval conditions in which the same old objects (recombined condition) or new focal objects (control condition) were combined with old backgrounds that had been paired during study with different focal objects from the same category (e.g., different fish). Although we demonstrated the standard age-related item memory deficit (i.e., recombined vs. control), our elderly participants displayed preserved associative memory (i.e., intact vs. recombined). Theoretical implications are discussed.

(1126)

**The Effects of Emotional Valence on the Associative Memory Deficit of Older Adults.** MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia*, GEOFF MADDOX, *Washington University*, & SUSAN OLD, ANGELA KILB, PETER JONES, YOKO HARA, & TINA CHEN, *University of Missouri, Columbia* (sponsored by Moshe Naveh-Benjamin)—This study assessed the potential moderating role of valence in older

adults' associative memory deficit. In two experiments, young and older participants studied lists that included neutral and emotionally valenced word pairs (positive and negative) and completed recognition tests for the words and their associations. In Experiment 1, the majority of word pairs were composed of two nouns, whereas in Experiment 2, they were composed of adjective–noun pairs. The results extend evidence for older adults' associative deficit and suggest that older and younger adults' item memory improves for emotionally valenced words. However, associative memory for the word pairs does not seem to benefit (and even shows a slight decline) from emotionally valenced words, which was the case for both younger and older adults.

(1127)

**Differential Response Biases Between Older and Younger Adults on Recall Tests.** MARK J. HUFF, MICHELLE L. MEADE, & KEITH A. HUTCHISON, *Montana State University*—We examined the role of differential response biases between young and older adults on recall performance and confidence judgments. Subjects studied categorized and unrelated word lists and were asked to recall the items under one of the following test conditions: standard free recall, free recall with a penalty for guessing, free recall with no penalty for guessing, or forced recall. The results showed that younger adults adjusted their responses in accordance with test condition by increasing the proportion of errors produced under no-penalty instructions and decreasing the proportion of errors produced under penalty instructions, relative to the standard free recall instructions. However, although older adults also decreased errors under the penalty conditions, they showed less difference between no-penalty and standard recall conditions, suggesting that older adults may approach standard free recall tests with a more liberal basis for responding than do young adults.

(1128)

**The Role of Cue Familiarity in Prospective Memory Performance: Age and False Fame Effects.** KRISTINA M. RAND & KEITH A. HUTCHISON, *Montana State University* (sponsored by Keith A. Hutchison)—Past prospective memory (PM) research has often shown no age differences when instructed to detect a single focal PM cue. Such null effects may result from an ability to rely on familiarity in detecting a PM cue. In Experiment 1, older and younger adults performed an ongoing gender-judgment task with one PM target name. Replicating past studies, no age differences occurred. In Experiment 2, the gender-judgment task was replaced by a fame-judgment task so that familiarity alone was insufficient to identify the PM cue and could, instead, lead to incorrect "famous" responses. Under these conditions, older adults missed more PM cues than did younger adults by mistakenly responding "famous." In Experiment 3, younger adults were given either a speeded deadline or a filler task between the PM cue and ongoing task. Although both manipulations increased overall errors, the filler task, but not the speeded deadline, increased younger adults' reliance on familiarity.

(1129)

**Individual Differences in Frontal Functioning Modulate Age Effects on the ERP Correlates of Retrieval Success.** LUCIE ANGEL, MICHEL ISINGRINI, BADIÂA BOUZZAOUI, LAURENCE TACONNAT, & SÉVERINE FAY, *University of Tours* (sponsored by Laurence Taconnat)—According to the executive decline hypothesis of cognitive aging, the deficit in executive function may be the main mediator of age differences in cognitive abilities. In the present study, we investigated whether executive functioning level modulated the effects of aging on episodic memory performance and on the electrophysiological correlates of retrieval success (*old/new effect*). To do so, participants were divided into four groups of 14 subjects according to age and to their score on a composite executive index. ERPs were recorded while participants performed a word-stem cued recall task. Behavioral results demonstrated that age-related deficits in memory performance were reduced in individuals with higher executive functioning level. Age differences in ERP old/new effects on frontal and parietal areas were greater for participants with the lowest executive level. These findings suggest that neural correlates of retrieval success in episodic memory are differentially affected by aging according to executive functioning level.



(1130)

**Executive and Cultural Abilities in Old Age As Protective Cognitive Reserve.** BADIÁA BOUZZAOUI, SÉVERINE FAY, LAURENCE TACONNAT, LUCIE ANGEL, & MICHEL ISINGRINI, *University of Tours* (sponsored by Arnaud Rey)—This study aimed at exploring the relationship between cognitive reserve, measured with cultural and executive indexes, age, and episodic memory. Eighty-five participants divided into three age groups (young, old, old-old) were administered a cued-recall task and executive functions and cultural abilities tests. To determine a plausible age-protective effect of executive or cultural abilities, each age group was divided into two subgroups according to their executive and cultural level. Regarding cultural level, the results showed a significant effect on memory performance but no interaction with age group. Regarding executive level, significant effect and interaction with age group appeared, indicating that age-related memory deficits were lesser for the high-executive participants. Moreover, there were no reliable differences between the young group and high-executive old group. This finding supports the view that preserved executive functioning in early and late old age may act as a better cognitive reserve than does cultural level.

(1131)

**Can Selection Bias Explain the Positive Effect in Old Age?** CHRISTIE CHUNG, *Mills College*, MAKOTO ONO, *Atascadero State Hospital*, & EKATERINA MAHINDA & FRISHTA SHARIFI, *Mills College*—Research suggests that older adults remember positive information better than negative information (Charles, Mather, & Carstensen, 2003). In the present study, we examined the effect of participant selection bias on this positivity effect in old age. Older adults who participate in laboratory studies are in general independent healthy individuals, who may hold a more positive attitude toward life than those who are unable or unwilling to participate in laboratory studies. We hypothesized that this possible positive attitude may moderate their emotional memory performance. Our results showed that healthy, nondepressed older adults tested at the laboratory ( $n = 48$ ) remembered more pictures on an incidental memory task than did their counterparts tested at home ( $n = 34$ ), but the emotional enhancement effect was maintained only in the group tested at home when depressive symptoms increased. These findings shed light on the generalizability of results from laboratory-based emotional memory and aging studies.

(1132)

**Reversing Developmental Reversals in False Memory.** ROBYN E. HOLLIDAY, *University of Leicester*, & CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*—The Deese/Roediger-McDermott paradigm was used to investigate the effects of encoding and test repetition on 7- and 11-year-old children's false recognition. All children studied one block of four lists of whole words (read condition) and one block of four lists of word fragments. Some children took one recognition test after each of the two blocks, and some took three identical recognition tests after each of the two blocks. In the single-test condition, the typical age increase in false recognition was found for the read condition. In the word fragment condition, false recognition decreased with age. This effect was not found in the three test condition. These findings suggest that recognition test repetition and the word fragment condition neutralize age increases in false recognition. Fuzzy trace theory proposes that both repetition of recognition probes and word fragment completion strengthen verbatim traces of targets. The superior verbatim memories of the older children facilitated rejection of critical lures.

(1133)

**Are Children's False Memories Automatic?** MARINA C. WIMMER & MARK L. HOWE, *Lancaster University* (sponsored by Mark L. Howe)—Adult research suggests that false memories occur relatively automatically. Little is known about the automaticity of children's false memories. The present study used a levels-of-processing paradigm to investigate 7- and 11-year-old children's ( $N = 40$ ) false recognition. Children encoded information in three different conditions: (1) control, which was a standard Deese/Roediger-McDermott paradigm; (2) deep processing, in which each item was presented in a sentence conveying a

story; and (3) shallow processing, in which each item was presented in a sentence conveying a story and children counted the number of words per sentence. As was expected, true and false recognition increased with age. However, levels of processing had different and age-invariant effects on true and false recognition. Specifically, regardless of age, shallow processing decreased true recognition, relative to deep processing, but had no effect on false recognition. That levels of processing did not alter patterns of false recognition suggests that children's false memories may occur automatically, just as they do in adults.

(1134)

**The Immediate and Aftereffects of Collaborative Recall in Older Adults.** LINDA A. HENKEL, *Fairfield University*, & SUPARNA RAJARAM, *Stony Brook University*—Collaboration can inhibit how much information is recalled by young adults, but the findings on collaborative inhibition in older adults have been mixed. The present study examined older adults' collaborative memory under experimental conditions where collaborative inhibition has been reported for young adults. Following an initial individual recall test (where recall was equivalent between subsequent collaborative and nominal groups), on a second recall test, collaborative triads recalled fewer items than did nominal groups, demonstrating a collaborative inhibition effect in older adults. Interestingly, despite this reduction collaboration produced positive aftereffects; on a subsequent, third recall test where all participants were tested alone, the individuals who had earlier been tested in a group recalled numerically more items than did those tested alone, and this gain was statistically significant in the increase in the number of items recalled from Test 1 to Test 3. Thus, collaboration produced subsequent benefits.

(1135)

**Differential Effects of Delay on Time-Based Prospective Memory in Younger and Older Adults.** DAWN M. MCBRIDE, *Illinois State University*, & JASON DRWAL, *Iowa City Veterans Hospital*—Few studies have measured the effects of delay on prospective memory (PM) tasks, and of the few that have, most have examined event-based, laboratory tasks. In addition, results from these studies have been mixed, with some studies showing a decline in PM performance as delay increases and others showing no effect of delay on task performance. In the present study, college students and older adults were asked to mail a postcard 1, 2, 5, 14, or 30 days after the initial test session. Younger adults' results followed the typical forgetting curve seen in retrospective memory tasks, with an exponential function fitting the data well. Older adults' results indicated very high task performance for delays up to 14 days, with a small decline in performance for the 30-day delay condition. These results indicate that effects of delay may be similar for PM and retrospective memory under some conditions.

(1136)

**The Persistence of Incorrect Inferences in Memory for Younger and Older Adults.** JIMMEKA J. GUILLORY & LISA GERACI, *Texas A&M University*—Research shows that younger adults have difficulty forgetting inferences they make after reading a passage, even if the information that the inferences are based on is later shown to be untrue. The present study examined the effects of these inferences on memory and tested whether older adults, like younger adults, are influenced by the lingering effects of these false inferences. In addition, this study examined the nature of these inferences by examining younger and older adults' subjective experiences and confidence associated with factual recall and incorrect inference recall. The results showed that younger and older adults were equally susceptible to the continued influence of inferences. Both younger and older adults tended to remember facts from the stories but believe their inferences, although confidence did not differ for facts and inferences.

(1137)

**Identification From Lineups Matching Suspect Resemblance, Recall, Recognition, or Composites.** IN-KYEONG KIM, *La Sierra University*—This study investigated the selection of distractors for identification lineups based on suspect-matched, description-matched, and composite-

matched strategies. Seven adults participated in verbally describing the perpetrator or making facial composites (using *Identi-Kit v.6*) with mock police officers immediately after viewing a crime scene video. Lineups were then produced based on the similarity to the suspect picture, the picture of a person who was similar to the suspect, to the verbal description (recognition, cued-recall, and free recall), and to the multiple composites. An additional 72 adults participated in the identification of the perpetrator 2 days after viewing the video. The results showed no significant difference on the accuracy of true identification among different strategies, although higher false identification from the suspect-matched lineups was found when the suspect picture was used. Participants' confidence on their answers was not different among strategies and other conditions. No gender, ethnicity, or age differences were found.

(1138)

**Effects of Age of Acquisition and Presentation Modality on False Recognition of Words.** EMILIANO DÍEZ, *University of Salamanca*, MARÍA A. ALONSO, *University of La Laguna*, & ANGEL FERNANDEZ, *University of Salamanca*—Recent empirical findings relate the age of acquisition (AoA) of words to certain structural properties of lexical associative networks (e.g., connectivity between network nodes). These properties could modulate the direction and extent of automatic spreading activation, eventually determining the degree to which lexical representations in memory become accessible during retrieval operations. In this study, that hypothesis was tested in two Deese/Roediger-McDermott experiments involving the manipulation of AoA (early or late) and modality of presentation (auditory or visual). The results showed that critical words with earlier AoA were more likely to be falsely recognized, but only when the studied associates were presented in the auditory modality. The pattern of results highlights the importance of both activation and monitoring processes in the production of associative illusions of memory.

(1139)

**Causal Connections and the Development of False Memories for Entire Fabricated Events: The Role of Alternative Explanations.** QUIN M. CHROBAK & MARIA S. ZARAGOZA, *Kent State University* (sponsored by Maria S. Zaragoza)—Studies of the forced fabrication effect have found that participant-witnesses are prone to developing false memories for entire events that they have been forced to fabricate previously (Chrobak & Zaragoza, 2008). Subsequent investigations have shown that false memory development is greater when the fabrication provides a causal explanation for a witnessed outcome. The present study investigated one factor known to influence the strength of such causal relations: the availability of alternative explanations. Participants viewed a movie clip and were later forced to fabricate an entire event—one that explained an outcome witnessed in the movie. Afterward, half the participants learned additional information that could also explain that same outcome, and half did not. On a recall test administered 6 weeks later, participants were less likely to develop false memories for their fabricated events when there was a possible alternative explanation for the witnessed outcome than when no alternative had been presented.

(1140)

**Memory-Related Increases in Variance Are Due to Recollection Rather Than Encoding Variability.** JOSHUA D. KOEN & ANDREW P. YONELINAS, *University of California, Davis*—A common finding in the recognition memory literature is that the variability of memory strengths for studied items is greater than that for new items. The present study tested the encoding variability and dual-process accounts of this finding. Encoding variability was manipulated by presenting all study items at the same rate (pure list) or by presenting half the items at a faster rate than the other half (mixed list). At test, participants made both a confidence and remember/know/new judgment. There was no evidence that the old item variance was related to encoding variability (e.g., the slope of the confidence *z*ROC was not smaller in the mixed list than in the pure list). In contrast, the old item variance was directly related to the relative contributions of recollection and familiarity, as indexed by the remember/know reports. Thus, the present findings support a dual-process interpretation of the increased variability for studied items.

(1141)

**Depth of Encoding Affects Schema-Based Guessing in Source Monitoring.** BEATRICE G. KUHLMANN, *University of North Carolina, Greensboro*, BIANCA VATERRODT, UTE J. BAYEN, & ANDRE HAESE, *Heinrich Heine University Düsseldorf*, & EDGAR ERDFELDER, *University of Mannheim*—When participants cannot remember the source in a source-monitoring task, they may guess according to schematic knowledge about sources (Bayen et al., 2000). However, according to probability-matching theory of source guessing (Spaniol & Bayen, 2002), source guessing will be schema-based only if participants do not have a representation of the contingency between sources and item types in the study list. If they do have such a representation, source-guessing probability will reflect this perceived contingency. Two experiments were designed to affect contingency representation. We measured source guessing with a multinomial model of source monitoring (Bayen et al., 1996). In Experiment 1, instructions to pay attention to the source increased contingency representation and affected source guessing accordingly. In Experiment 2, depth of encoding of consistent versus inconsistent item–source pairings also affected source guessing as predicted by probability-matching theory.

(1142)

**Saccade-Induced Retrieval Enhancement: A Fast, Easy, and Free Way to Improve Eyewitness Memory?** KEITH B. LYLE & NOAH E. JACOBS, *University of Louisville*—Recent research has indicated that retrieval of information from memory can be enhanced by making alternating bilateral (i.e., left–right) saccades immediately before the retrieval attempt. Saccade-induced retrieval enhancement (SIRE) occurs for simple laboratory stimuli and recently was found to reduce eyewitness misinformation effects using more realistic stimuli (Parker, Buckley, & Dagnall, 2009). The latter finding suggests that SIRE may be a fast, easy, and free way to improve eyewitness memory, but important questions remain unanswered. We report two eyewitness misinformation experiments that explored (1) the dynamics by which SIRE arises (i.e., increased hits, decreased false alarms, or both?), (2) potential individual differences in SIRE, (3) SIRE effects for additive (vs. contradictory) misinformation, (4) whether SIRE affects confidence in addition to accuracy, and (5) the duration of SIRE. The results advance our understanding of how SIRE might ultimately be used to improve eyewitness memory in real-world settings.

(1143)

**Creating False Memories: Affective Pictures DRM.** LILIAN M. STEIN, LUCIANO H. PINTO, & LUIZA R. FEIJÓ, *Pontifícia Universidade Católica do Rio Grande do Sul*—The hypothesis that valence could have differential effects on true and false memories was tested for emotionally evocative photographs within a paradigm similar to the Deese/Roediger-McDermott paradigm (DRM; Roediger & McDermott, 1995). First, 20 semantic categories of eight photographs from the International Affective Picture System (Lang et al., 1999, 2005) were evaluated for arousal, valence, semantic, and visual association ( $N = 351$ ). Then, 4 positive and 4 negative categories of pictures (semantic and visual relatedness, as well as arousal were equated across valence categories) were presented to 94 college students. Each category was composed of six pictures semantically related to two nonpresented ones. One week later, a recognition test yielded more false responses to negative nonpresented pictures than to positive ones. Turning to veridical memory, there was a much smaller effect of valence on true recognition. The results are discussed in light of current theories of false memory and emotion.

(1144)

**Speeded Retrieval Eliminates the Effect of Theme Identifiability on False Memories.** PAULA CARNEIRO, *University of Lisbon*, & EMILIANO DÍEZ & ANGEL FERNANDEZ, *University of Salamanca*—Previous research has shown that lists with highly identifiable critical words produce fewer false memories in adults (Carneiro, Fernández, & Dias, 2009). One explanation for this effect could be that adults spontaneously use an identify-to-reject strategy to edit out false memories of critical words that are easy to identify. According to this

interpretation, the effect of theme identifiability might be disrupted when retrieval conditions do not facilitate the operation of recollective/monitoring processes. In order to test this explanation, false recognition of easy- and hard-to-identify critical words was analyzed in two test conditions: self-paced and speeded response (with a signal-to-response delay of 250 msec). The results showed the expected interaction between identifiability and test condition, replicating the previous finding in the self-paced condition and eliminating the effect when very fast responses were required.

## (1145)

**The Effects of Social Pressure on False Recognition in the DRM Paradigm.** MASANOBU TAKAHASHI, *University of the Sacred Heart*—We investigated whether a confederate's response would affect participants' false recognition, using the Deese/Roediger-McDermott (DRM) paradigm. After participants listened and studied a long list of 75 words (five 15-word DRM sublists), they received three successive 5-word recognition tests, which consisted of all critical nonpresented words. The initial and final recognitions were individual, and the second was in pairs (with a confederate). The real participants always made a judgment after the confederate's correct response, which was made covertly in the control group or overtly in the social pressure group. We found that the social pressure group produced more correct rejection than did the control group in both second and final recognition tests.

## (1146)

**Congruency and Survival: The Mnemonic Advantage After Priming Survival Processing Depends on What Was Studied.** DEVON E. MCINTYRE, *Colby College*, POLLEE J. HRUBY, *Yale University*, & JENNIFER H. COANE, *Colby College* (sponsored by Martha E. Arterberry)—The survival-processing advantage refers to the enhanced retrieval of words rated for relevance to a survival scenario, relative to other encoding methods. The purpose of this study was to determine the extent to which survival processing occurs implicitly (i.e., without an explicit rating task) and whether survival-related words are remembered better than matched control words. Congruency effects between processing and the thematic coherence of words were also examined. Participants watched a video (survival related or control) to prime a specific processing mode (survival or nonsurvival) and then studied a list of words (survival related or control). A survival-processing advantage in recall emerged only when the survival-related video was followed by survival related words, indicating that implicit survival processing occurs only under congruent conditions. These findings suggest that processing information for survival may not be automatic but requires directed attention, thus raising questions concerning the evolutionary and modular nature of this phenomenon.

## (1147)

**Recollection and the Testing Effect: The Role of Intervening Test Performance and Delay.** DALE L. SMITH, DEANNA BLACKLOCK, & LAUREN EDWARDS, *Olivet Nazarene University*—We first replicated Chan and McDermott's (2007) Experiments 1A and 2, which found a recollection advantage for words in recall intervening test conditions over nontested words, modifying the testing procedure to ensure that the advantage did not result merely from the 90 sec of additional exposure to recalled words. The results supported Chan and McDermott's findings. Previous research (Smith & Barker, 2008) failed to find an advantage for recall, multiple-choice, or yes–no testing conditions over no-test conditions that included a second study presentation. However, because testing effects are often more robust with longer delays between intervening and final test, we attempted to determine whether a 48-h delay would result in a significant recollection advantage for tested items. The results were similar to those in previous research and did not indicate a recollection advantage. The results suggest that performance at intervening test plays an important role in recollection when using recognition final tests.

## (1148)

**Bilateral Shifts of Eye Movements and Attention in Younger and Older Adults.** CAROLYN L. DUFAULT, SANDRA S. HALE, & RICHARD A. ABRAMS, *Washington University* (sponsored by Sandra S.

Hale)—There is evidence that making 30 sec of bilateral eye movements improves memory in strongly right-handed young adults. The proposed mechanism underlying this effect is an increase in interhemispheric communication. Given that attention and eye movements share many overlapping neural mechanisms, it is possible that bilateral shifts of covert visual attention may have similarly beneficial effects on memory. To test this idea, we compared recognition memory performance following either overt shifts of attention (eye movements) or covert shifts of attention in right-handed younger and older adults. Both overt and covert shifts of attention led to a reduction in false memories on a Deese/Roediger-McDermott task for the younger adults. No such reduction was observed for either shift type in the older adults. These findings are consistent with theories that suggest common neural pathways for covert and overt visual attention and with those that posit an age-related breakdown in interhemispheric communication.

## • ASSOCIATIVE LEARNING •

## (1149)

**Trial-by-Trial Trends in Expectancy and Performance: Testing Associative and Nonassociative Explanations of a Dissociation.** EVAN J. LIVESEY & LOUISE C. BARRETT, *University of Sydney* (sponsored by Robert Alan Boakes)—Perruchet, Cleeremans, and Destrebecqz (2006) reported a striking dissociation between trends in the conscious expectancy of an event and the speed of a response that is cued by that event. They argue that this indicates the operation of independent processes in human associative learning. However, there remains a strong possibility that this dissociation is not a consequence of associative learning and is, instead, caused by changes in vigilance or sensitivity based on the recency of events on previous trials. We tested this possibility using a similar task in which trends in performance cannot be explained by these nonassociative factors. In each experiment, similar trends in performance were evident, suggesting a genuine automatic influence of associative learning on the execution of a cognitively controlled response.

## (1150)

**Effects of Fixed and Varied Repetition on Associative Recognition in Amnesia.** DANIEL L. GREENBERG & MIEKE VERFAELLIE, *Boston University and VA Boston Healthcare System*—We previously showed that fixed and varied repetition yield equivalent benefits on overall recognition in amnesic participants and in controls. However, varied repetition was associated with greater recollection in controls, but not in amnesics. The present study examined whether varied repetition would yield better performance than would fixed repetition on an associative recognition task that required recollection. Participants read a series of phrases (KID drops FLAG), each presented thrice. For half of the phrases, the verb varied each time; for the other half, it remained constant. At test, participants read pairs of nouns from the study phase and judged whether they had appeared in the same sentence. Half the pairs had appeared together; the other half had been recombined. Controls performed better in the varied than in the fixed repetition condition. Patients performed worse than controls, and their performance did not differ between conditions. Thus, varied repetition does not enhance recollection in amnesia.

## (1151)

**Similarity- and Rule-Based Generalization in Human Associative Learning: The Role of Working Memory.** ANDY J. WILLS, *University of Exeter* (sponsored by Stephen Monsell)—Shanks and Darby (1998) presented participants with concurrent negative (A+, B+, AB-) and positive (C-, D-, CD+) patterning problems and tested generalization to novel items. Participants who achieved a high level of accuracy in the discrimination showed evidence of rule-based generalization (i.e., consistent with the rule that a compound and its elements signal opposite outcomes). Participants with lower accuracy showed generalization consistent with a feature-based similarity process. These data have recently been cited in support of propositional accounts of human associative learning (Mitchell, De Houwer, & Lovibond, 2009). Across two experiments, we investigated the effect of a concurrent working memory load and the effect of individual differences in OSPAN on generalization in this task. In both experiments, participants achieved a high level of



accuracy in the discrimination. Concurrent load, and low OSPAN, were associated with feature-based generalization. Implications for associative, inferential, and dual-process accounts are discussed.

(1152)

**On the Anticipatory Nature of Memory.** JOHN P. TAYLOR & KAYLA O'CONNELL, *University of Minnesota, Duluth*—The networked nature of memory gives rise to a potential class of errors in which the rememberer may exclude or transpose items in anticipation of future items. We attempted to assess these errors using a “Simon Says” memory game in which the participants reported the sequences of word lists that were presented. Errors of anticipation were found to be quite common (accounting for more than 50% of errors, in some cases) and seem to be curtailed by repetition of the list orders when presented at slower speeds, as compared with novel list orders or presentations of word lists at faster speeds. The results imply that anticipation may be an automatic feature of memory that can be overcome through rehearsal. We will discuss possible variables that may affect anticipation errors and the implications for real-world learning situations.

(1153)

**The Frequency of the Cue Increases the Outcome Density Effect.** FERNANDO BLANCO, *Katholieke Universiteit Leuven*, & HELENA MATUTE & MIGUEL A. VADILLO, *University of Deusto* (sponsored by Helena Matute)—In a noncontingent setting, both a high frequency of the cue,  $P(C)$ , and a high frequency of the outcome,  $P(O)$ , are known to lead to overestimations of contingency in humans. Our experiment was aimed at exploring the way these two covariational manipulations interact. Our results show that the overestimation of null contingency is likely to occur when the outcome is frequent, but this overestimation becomes even stronger if the probability of the cue is also high. This conclusion is of theoretical interest because not all current models of learning can account for this interaction without further assumptions.

(1154)

**A Multivariate Randomization Test of Association Applied to Cognitive Test Results.** AL AHUMADA & BETTINA L. BEARD, *NASA Ames Research Center*—Randomization tests provide a conceptually simple, distribution-free way to implement significance testing. We have applied this method to the problem of evaluating the significance of the association among a number ( $V$ ) of variables. The randomization method was the random reordering of  $V - 1$  of the variables. The criterion variable was the value of the largest eigenvalue of the correlation matrix. The experimental data for which the test was devised involved the assessment of cognitive abilities following a simulated space ascent in a vibration-augmented centrifuge. The study was limited to 11 participants, each of whom was given a five-test battery before and after the “ride” and who also were asked to rate the difficulty of each test on a five-question scale. The randomization test is seen to be more powerful than tests based directly on the correlations corrected for the multiplicity of tests.

(1155)

**Difficult Rule-Based Category Learning Benefits From Massed Practice.** MICHAEL A. GARCIA, *UCLA*, NATE KORNELL, *Williams College*, & ROBERT A. BJORK, *UCLA* (sponsored by Nate Kornell)—Spacing learning events apart has recently been shown not only to enhance recall of repeated material, but also to enhance the induction of categories from their exemplars (Kornell & Bjork, 2008). This result is surprising because learning what defines a category requires retrieving previous instances of the category when new instances are presented, which should be helped by blocking/massing and hindered by interleaving/spacing. We investigated the limits on spacing as a friend of induction by having participants learn difficult categories of cartoon fish, which were defined by rule-based similarities—such as “no ventral fin, dot on face”—we deemed difficult to remember from one exemplar to the next. Participants learned the same number of category-identifying rules in the spaced and massed conditions, but they learned far more correct rules in the massed condition. In the limit, then, at least for such difficulty rule-based categories, massing is the friend of induction.

(1156)

**Evaluating Associative Explanations for the Intermixed–Blocked Effect in Human Perceptual Learning.** YVONNA LAVIS & GEOFFREY HALL, *University of York* (sponsored by Geoffrey Hall)—It has now been shown in animal and human perceptual learning procedures that discrimination between similar stimuli is enhanced to a greater extent by intermixed than by blocked preexposure. An explanation for this intermixed–blocked effect that has arisen from the associative learning literature is that the unique elements are higher in salience following intermixed than following blocked preexposure. There is evidence that such salience differences exist following intermixed and blocked preexposure in rats, but no corresponding evidence from human procedures has been provided. The experiments presented in the present paper aimed to determine whether the unique elements of intermixed stimuli are more salient than their blocked counterparts in a human perceptual learning procedure that has been shown to produce the intermixed–blocked effect. The results support the existence of these salience differences, with some caveats. The results will be discussed in the context of human and rat perceptual learning.

• SPATIAL COGNITION •

(1157)

**Selecting Landmarks in Novel Environments.** JARED E. MILLER & LAURA A. CARLSON, *University of Notre Dame*—People use salient landmarks when learning a route through a novel environment. However, it is not clear what makes a given landmark salient. In two experiments, subjects learned a route through a virtual museum, performed a recognition memory test for objects in the museum, and provided written directions and a map of the learned route. We manipulated whether objects with strong perceptual features (such as color, size, shape) that made them stand out relative to the surrounding objects occurred at decision points or at nondecision points along the route. Objects with both of these features were recognized faster and more accurately, and were included more often in the maps and written directions. When these features were separated, perceptual features maintained a strong influence on all tasks, with spatial features having an influence only on the direction-giving tasks. We explore a model that integrates these dimensions in a task-specific manner.

(1158)

**A Computational Model of Reference Frame Selection in Spatial Term Use.** HOLGER SCHULTHEIS & LAURA A. CARLSON, *University of Notre Dame*—Spatial terms such as *above* and *left* specify the location of a target relative to a reference object. Such terms are defined by a reference frame, a set of coordinate axes that organizes space around the reference object. There are different types of reference frames that can be distinguished by the source of information used to assign direction and orientation to this space. Previous research has shown that when reference frames are in conflict, they compete to assign these values, resulting in the need for selection. In the present work, we formalize and implement the mechanisms that underlie reference frame selection in a localist connectionist model in which shunting models are embedded in a lateral inhibition structure. The model is supported by mathematical analyses, qualitative and quantitative accounts of pertinent empirical effects, and an empirical test of a key prediction of the model.

(1159)

**Facilitation of Learning Spatial Relations Among Locations in the Absence of Coincident Visual Cues.** BRADLEY R. STURZ, *Armstrong Atlantic State University*, DEBBIE M. KELLY, *University of Saskatchewan*, & MICHAEL F. BROWN, *Villanova University*—Participants searched in a real environment or 3-D virtual environment for four hidden goal locations arranged in a diamond configuration within a  $5 \times 5$  matrix. Participants were randomly assigned to one of three groups: pattern only, landmark + pattern, or cues + pattern. Participants experienced a training phase followed by a testing phase. During training, visual cues were coincident with goal locations for the cues + pattern



group, whereas one visual cue at a nongoal location maintained a consistent spatial relationship with goal locations in the landmark + pattern group. Groups were tested in the absence of visual cues. Participants learned the spatial configuration of goal locations. When visual cues were removed during testing, performance of the landmark + pattern and cues + pattern groups did not differ and was superior to that of the pattern-only group. The results suggest that learning based upon spatial relations among locations may not be susceptible to cue-competition effects and that facilitation of learning spatial relations does not require coincident visual cues.

(1160)

**Serial Position and Salience Effects in VR Route Learning.** MARC M. SEBRECHTS & JENNIFER M. MILES, *Catholic University of America*—Thirty-eight subjects learned a complex route through an unfamiliar virtual building, using a virtual environment with either opaque or transparent walls. Sixty-directional decisions were required along the route, which included 23 objects. Navigation accuracy and object recall were measured on each of six sequential trials. Route navigation accuracy showed strong primacy and recency effects, with near-optimal performance (~3%) for the first five and last five locations on the route. In contrast, the regions adjacent to the endpoints had average error rates of roughly 14%. The rear of the virtual building, which had distinctive features, showed low error rates comparable to those at the endpoints of the route. Object recall also demonstrated serial order effects, including primacy and recency, but with substantial variability across individual objects. Order of objects along the route was less consequential for transparent than for opaque subjects, suggesting emergence of a survey representation even during route learning.

(1161)

**Navigation on Parallel and Perpendicular Paths: Affine Structure or Response Error?** ELIZABETH CHRASTIL & WILLIAM H. WARREN, JR., *Brown University*—Previous research (Chrastil & Warren, 2007) suggests that the geometry of spatial knowledge derived from path integration may be affine, because responses for parallel versus perpendicular paths are inconsistent. However, other results (Chrastil & Warren, 2008) suggest that path integration performance contains large execution errors. To determine whether such inconsistencies are due to spatial encoding or execution error, we matched the range of response angles across parallel and perpendicular tasks. Participants walked down a primary path, turned onto a branch path, and made one of four response types: walk parallel to the primary path in the same direction, parallel in the opposite direction, perpendicular toward the primary path, or perpendicular away from the primary path. The results allow us to determine whether there is something special about parallelism in spatial knowledge, or whether the inconsistencies are due to execution error in path integration.

(1162)

**Ordinal Violations in Spatial Knowledge for Navigation.** JONATHAN D. ERICSON & WILLIAM H. WARREN, JR., *Brown University* (sponsored by William H. Warren, Jr.)—At one extreme, human spatial knowledge might preserve Euclidean distance and angle; at the other, it might preserve only topological structure such as the graph of the environment. To investigate this question, we created a non-Euclidean virtual environment containing two “wormholes” that seamlessly transport actively walking participants between locations. On test trials, participants walked from Home to Starting Object A, the walls of the maze disappeared, and they took direct shortcuts to Object B. Because of the wormholes, B has two locations toward which they might walk. From some starting objects, participants walk to the “wormhole” location of B when taking shortcuts, whereas from others, they walk to the “Euclidean” location of B, revealing a reversal of the ordinal relations among objects. The results suggest that human spatial knowledge may preserve some local metric properties but is globally non-Euclidean.

(1163)

**North is Up(hill): Route Planning Asymmetries in Real-World Environments.** TAD T. BRUNYÉ & CAROLINE R. MAHONEY, *Tufts*

*University and U.S. Army NSRDEC*, JASON S. AUGUSTYN, *U.S. Army NSRDEC*, & HOLLY A. TAYLOR, *Tufts University*—In *The Lord of the Rings: The Two Towers*, the bombastic Treebeard states “I always like going south. Somehow it feels like going downhill.” In two experiments, participants used maps to plan routes between landmarks. Participants completed 40 trials: 10 posing north–south dilemmas and 10 posing east–west dilemmas, plus 20 fillers. Dilemma trials presented equal-length routes going either north or south, or east or west. On north–south dilemma trials, Experiment 1 demonstrated a south bias, supporting Treebeard’s assertion: Students chose northern options on 36.7% of trials and southern options on 63.3% of trials. This occurred only when participants described routes using intrinsic reference frames. East–west dilemma trials did not show a bias. Experiment 2 used forced reference frames and replicated this effect with the intrinsic reference frame: northern routes, 34.6%, and southern routes, 65.4%. Extrinsic reference frame showed no bias. The results are discussed with regard to wayfinding heuristics and predicting spatial behavior.

(1164)

**Can Verbal Labels Facilitate the Comprehension of Layout Configuration?** CHRISTOPH HÖLSCHER, *University of Freiburg*, DANIEL R. MONTELLO, *University of California, Santa Barbara*, MAGDA MAVRIDOU, *University College London*, & SIMON J. BÜCHNER, *University of Freiburg*—Building layouts with corridor configurations close to “good form” (Gestalt Prägnanz) can support both efficient navigation and spatial learning. Many building layouts are difficult to grasp from navigation alone (i.e., from a horizontal egocentric perspective), even when they have good form and can be concisely described from a survey perspective. In this study, we investigated how short, simplified verbal descriptions of layout patterns may support spatial learning. Participants traveled through buildings simulated in desktop virtual reality until they could sketch a map of it from memory. One group was given a short verbal label for each layout (e.g., two squares overlapping diagonally). Initial results suggested that the labels can reduce error rates and exploration times. This is moderated by layout complexity and by the nature of the participant’s interpretation of the label. An analysis of errors in the maps replicates the prominent role of layout simplification toward good form.

(1165)

**Dynamic Landmark Placement for Spatial Learning.** SIMON J. BÜCHNER & CHRISTOPH HÖLSCHER, *University of Freiburg* (sponsored by Christoph Hölscher)—Architectural differentiation is a major environmental factor influencing wayfinding performance (Weisman, 1981). Landmarks can help overcome the challenge of differentiating structurally and visually similar places. This study addresses two main questions: (1) Which places should be marked in order to facilitate the comprehension of space? (2) Does it help participants to actively place landmarks? Participants explored four virtual reality simulated mazes and afterward drew sketch maps from a survey perspective. The availability of landmarks was systematically varied: In Condition 1, layouts did not include landmarks; in Condition 2, landmarks were placed at fixed locations; and in Condition 3, the participants were allowed to freely place a limited number of landmarks at any location. The drawing task required participants to transform the egocentrically acquired perceptual information into a coherent allocentric representation. Time and drawing errors were analyzed. The results are discussed with respect to strategic landmark placement and ego- to allocentric transformation ability.

• COGNITIVE CONTROL •

(1166)

**Predictable Task Switching: Switching Costs and Practice Effects, But No Preparation Effects.** REBECCA A. BURSON & TODD C. JONES, *Victoria University of Wellington*—In three experiments on task switching, participants performed two tasks in alternating two-trial runs. The intertrial interval (ITI: short or long) was manipulated between two blocks of trials to examine preparation effects (long ITI switch cost < short ITI switch cost) and practice effects (Block 2 switch

cost < Block 1 switch cost). A pattern consistent with a preparation effect was observed when the long ITI block followed the short ITI block. However, the reverse pattern was observed when the long ITI block preceded the short ITI block. This pattern remained when a small amount of practice for both ITIs was administered prior to each block. These findings highlight the importance of practice effects and show a limitation of preparation effects on task-switching costs (e.g., a preparation effect might emerge only after considerable practice). Finally, the results suggest that task-switching theory could benefit from a skill acquisition approach.

(1167)

**Preparation in Cued Task Switching and Concurrent Timing.** CHARLES VIAU-QUESNEL & CLAUDETTE FORTIN, *University of Laval*—In previous experiments on concurrent time production and task switching, produced intervals were unaffected by switching from one task to another. In the present study, cues were used in a bivalent task-switching paradigm, allowing participants to prepare for a switch. Preparatory processes and timing being strongly related, the objective was to verify whether preparation in task switching would affect concurrent timing. Two tasks, memory search or digit classification (odd/even), were executed successively in switch and no-switch trials. Background color identified which task was to be accomplished, the cue (color) being presented 0, 200, 400, or 600 msec before the target stimulus. Produced intervals were unaffected by varying cue duration, and, as in previous studies, time production did not differ in switch and no-switch trials. These results suggest that resources involved in preparation, as well as in switching itself, are distinct from those involved in timing.

(1168)

**Task-Switching Efficacy Between Different Types of Switch Tasks in the Elderly.** SHULAN HSIEH, *National Cheng Kung University*, & MENG-YAO WU, *National Chung Cheng University*—The aim of the present study was to investigate whether older adults' switching efficacy may be affected. The present experiment classified types of switch tasks into either shifting between stimulus dimensions or shifting between judgment rules. The data showed that mean reaction time was slower in the switch than in the repeat trials. More importantly, the older adults showed much larger switch costs than the younger adults did. Nevertheless, the older adults' switch costs were found to be decreased significantly as the length of cue–target interval was increased, suggesting that the efficacy of task preparation for older adults was maintained at the normal level. The results further showed that the reduction in switch costs for stimulus dimension shift cannot be attributed to general slowing, whereas for judgment rule shift, the reduction may be partly attributed to general slowing. The implication of these results will be discussed.

(1169)

**Modality Overlap and Dual-Task Costs.** TIM WIFALL & ELIOT HAZELTINE, *University of Iowa* (sponsored by Eliot Hazeltine)—In the psychological refractory period (PRP) procedure, stimuli for two tasks are separated by a stimulus onset asynchrony (SOA). Dual-task costs are observed primarily on Task 2, which decrease as the SOA increases—termed the *PRP effect*. The PRP effect is attributed to competition for an amodal response selection process shared by a wide range of tasks. We tested an alternative hypothesis, that the PRP effect results from cross talk between the two tasks, by pairing the same Task 2 with Task 1s that differed in terms of their input and output modalities. The largest PRP effects were observed when either the input or output modality was shared between tasks. When tasks shared both input and output modalities, the smallest PRP effect was observed. Thus, it appears that the PRP effect does not result from competition for an amodal processor but, instead, is sensitive to the shared modalities of the tasks.

(1170)

**The Effect of Stimulus Modality on Thought Suppression.** ERIN J. LIGHTMAN, *Georgia Institute of Technology*, TRAVIS L. SEYMOUR, *University of California, Santa Cruz*, & ERIC H. SCHUMACHER, *Georgia Institute of Technology*—Humans often attempt to suppress or eliminate unwanted thoughts from working memory. Unfortunately,

these thought suppression strategies are not only ineffective but counter-productive. They often lead to stronger and more frequent intrusions of these unwanted thoughts. Increasing cognitive load by adding a working memory or perceptual–motor task can further impair the effectiveness of thought suppression. Previous research has examined how thought suppression is affected by factors such as emotional valence and personal relevance but has ignored the influence of stimulus modality—despite the importance of this factor in models of working memory. This study investigates the effects of modality (viz., visual and auditory) of thought suppression on perceptual–motor task performance. The results suggest that the modality of the suppressed thought interacts with the stimulus modality of a primary perceptual–motor task.

(1171)

**An Exploration of the Temporal Dynamics of Cross Talk Between Simon and Spatial Compatibility Tasks Using Speed–Accuracy Trade-Off Functions.** RYAN BLAGDON, MELANIE MCNEIL, STEFANIE FEENER, & JASON IVANOFF, *Saint Mary's University*—The Simon effect refers to a performance advantage when responding toward the location of a stimulus if location is task irrelevant. Recent evidence has shown that the Simon effect may reverse when alternating a Simon task with an incompatible spatial task in which participants are instructed to respond away from the stimulus. Here, we use speed–accuracy trade-off functions (SATFs) to explore the temporal dynamics of this reverse Simon effect. Although the Simon effect tended to reverse with RT metrics, there was little indication of a complete reversal when the Simon effect was assessed with SATFs. However, there was an overall reduction in the magnitude of the Simon effect assessed with SATFs, especially with increased speed stress. Our findings suggest that the general tendency to respond toward the source of stimulation may be modulated, but does not reverse, with transfer of stimulus–response mappings from a spatially incompatible task.

(1172)

**Anticipating Control Demands: A Simon Task fMRI Study.** GAMZE ALPAY & CHRISTIAN KAUFMANN, *Humboldt University Berlin*, STEFANIE KEHRER & STEPHAN BRANDT, *Charité–Universitätsmedizin Berlin*, & BIRGIT STÜRMER, *Humboldt University Berlin*—In stimulus–response interference tasks, separable processes underlie cue-induced control and sequence-dependent conflict adaptation. To clarifying the neural underpinnings, three cuing conditions were realized in a Simon task fMRI study: (1) A noninformative cue induced alerting, (2) a position cue allowed spatial orientation, and (3) a rule cue informed about the upcoming compatibility condition. Rule cues elicited the largest advantage in behavioral performance and did not affect sequence-dependent conflict adaptation. Our fMRI results showed stronger activation of left prefrontal cortex (PFC) areas for rule cues in the cue–target interval, whereas position cues strongly activated occipital and posterior parietal areas. Moreover, cuing an incompatible trial activated the superior parietal lobe, premotor areas, and the left anterior PFC more than did cuing a compatible trial, whereas the latter cues involved the dorsolateral PFC more strongly. Present findings are discussed in terms of rule recollection and compared with neural networks involved in sequence-dependent adaptation.

(1173)

**Cognitive Styles, Reasoning Abilities, and Cognitive Control.** DAVID J. M. KRAEMER, RANJANI PRABHAKARAN, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Previous research suggests that performance on tasks of verbal processing abilities is not always correlated with performance on visual (nonverbal) tasks. Moreover, individuals have varied preferences for representing information in a verbal or a visual format (mentally generating words or pictures). These “cognitive styles” appear to be correlated with testable visual and verbal reasoning abilities, although some controversy remains. Less is known about the relationship between cognitive styles and cognitive control. Here, we tested the effects of cognitive styles on separate measures of reasoning and cognitive control. We also investigated whether cognitive control is a domain-general ability or, instead, cognitive control abilities are themselves domain specific and, therefore, correlated with

relevant measures of preference and ability. The results show correlations between cognitive style measures and performance on variants of the Stroop task. Additionally, the strength of one's cognitive style preference predicts the difference between scores on visual versus verbal reasoning tests.

(1174)

**Individual Differences in Cognitive Control Unveiled by Components of the ERP.** A. EVE MILLER, JASON M. WATSON, & DAVID L. STRAYER, *University of Utah*—Event-related brain potentials (ERPs) were used to investigate individual differences in cognitive control in a high-congruency variant of the Simon task. Thirty-two participants were sorted on the basis of their scores on the operation span task into “high-span” and “low-span” groups. Lateralized readiness potentials from incongruent trials revealed greater ipsilateral activation for high-spans, followed by a more rapid transition to contralateral activation, providing evidence of greater cognitive control. Response-locked ERPs revealed larger error-related negativity and error-related P300 activity following an error for high-spans. The response-locked ERPs support the view that high-spans have enhanced error monitoring and also reestablish task goals more readily than do low-spans. Together, the data are interpreted within the dual mechanisms of control framework developed by Braver, Gray, and Burgess (2007). We suggest that high-spans can quickly transition from proactive to reactive control as task demands require, whereas low-spans are more rigid in their level of cognitive control.

(1175)

**Differential Modulation of Cognitive Control Through Social Versus Nonsocial Motivation.** ADAM C. SAVINE & TODD S. BRAVER, *Washington University* (sponsored by Todd S. Braver)—Motivational factors can influence cognitive processing but there has been little exploration of whether social incentives (e.g., competition, altruism), have different effects than do nonsocial incentives (e.g., monetary bonuses). The present study used a cued task-switching paradigm to determine whether increasing motivational priority via social or nonsocial incentives facilitated cognitive control in a similar or distinct fashion. Following a baseline, nonincentive block, participant pairs performed in one of three incentive conditions (*monetary*, money for self; *altruism*, money for friend; *competition*, beat friend), in which precued incentive trials randomly alternated with nonincentive trials. In the competition condition, the incentive cue effect (incentive vs. nonincentive trials) was dominant, whereas, in the altruism condition, the primary effect was of incentive context (nonincentive trials vs. baseline block); both effects were present in the monetary condition. These results suggest that different categories of motivational information (particularly competition vs. altruism) differentially impact cognitive control processes.

(1176)

**Is Consciousness Necessary for Cognitive Control?** BERT REYNVOET & EVA VAN DEN BUSSCHE, *Katholieke Universiteit Leuven*, & WIM GEVERS, *Université Libre de Bruxelles* (sponsored by Gert Storms)—The existence of unconscious perception is largely acknowledged. However, the limits and possibilities of unconscious processing remain unclear. Here, we wanted to explore whether unconscious stimuli can induce some form of control by activating metacognitive processes. For example, subjects might consciously notice the consequences of an unconscious manipulation, which will influence their responses. To

examine this, we used the response eligibility effect, showing that, in a Stroop task, RTs were slower when the distractors were response eligible. In the present study, subjects had to discriminate between two numbers (1 and 9) that were preceded by either response eligible (1 and 9) or ineligible (2 and 8) primes. Primes were presented either consciously or unconsciously. The results revealed a response slowing when response eligible primes were shown in both conscious and unconscious conditions, indicating that unconscious stimuli can, just like conscious stimuli, induce metacognitive processes leading to indirect control.

(1177)

**Awareness and Feature Integration in Spatial Localization: A Qualitative Difference Result.** JOAQUÍN M. M. VAQUERO, *University of Granada*, & CHRIS FIACCONI & BRUCE MILLIKEN, *McMaster University*—We report the results of a series of experiments in which participants were surprisingly unaware of strong prime–target spatial contingencies. In Experiment 1, 12 of 14 participants appeared to be unaware, as measured by a postexperiment questionnaire, that a target O appeared in the same location as a preceding prime X on 75% of experimental trials. By contrast, in Experiment 2, 11 of 12 participants were aware that a target letter O appeared in the same location as a preceding prime O on 75% of experimental trials. In Experiments 3 and 4, a similar methodology led aware and unaware participants to produce qualitatively opposite effects of repetition on spatial localization. The results demonstrate a powerful influence of feature integration processes (Hommel, 1998; Kahneman, Treisman, & Gibbs, 1992) on detection of spatial contingencies and constitute a novel application of the qualitative difference method to the study of awareness and cognitive control.

(1178)

**Encoding Variability Revisited in the Spacing and Lag Effects of Free Recall.** LYNN J. LOHNAS, *University of Pennsylvania*, SEAN M. POLYN, *Vanderbilt University*, & MICHAEL J. KAHANA, *University of Pennsylvania* (sponsored by Saul Sternberg)—Encoding variability theory suggests that repeated items spaced apart in a study list will be associated with more unique retrieval cues than will items presented near one another. This has been proposed as the basis of the spacing and lag effects in free recall (e.g., Crowder, 1976). However, Ross and Landauer (1978) noted that by this logic, the probability of recalling at least one item from a pair of once-presented items should increase as the two items are spread apart in a study list. Their failure to observe this result was taken as evidence against encoding variability theory. We replicated their analysis on four free recall studies, revealing a consistent advantage for spaced once-presented items in every experiment. A retrieved-context-based model of episodic memory (Howard & Kahana, 2002; Polyn et al., 2009) can simultaneously account for these data, as well as other classic findings concerning spacing and repetition effects in free recall.

(1179)

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

(1180)

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

## POSTER SESSION II

Friday Noon

Hynes Convention Center, Ballrooms A, B, and C  
Viewing 9:00–1:30, Author Present 12:00–1:30

## • CATEGORIES AND CONCEPTS •

(2001)

**Causal Status and Coherence in Causal-Based Categorization.** BOB REHDER & SHINWOO KIM, *New York University*—Two models of how interfeature causal knowledge affects classification are evaluated. First, a causal status effect was present for probabilistic but not for deterministic causal links (Experiment 1). Second, a causal status effect was stronger when category features had no alternative causes (Experiment 2). Third, a causal status effect was stronger for essentialized categories (Experiment 3) although only for probabilistic causal links (Experiment 4). Fourth, the causal status effect was mediated by features' category validity, the probability with which they occur in category members. Fifth, all experiments exhibited robust coherence effects in which good category members were those that manifested the interfeature correlations one expects to be generated by a category's causal laws. These findings were consistent with a generative model of categorization but inconsistent with an alternative model.

(2002)

**Are Detection and Categorization Tightly Coupled?** MICHAEL L. MACK & THOMAS J. PALMERI, *Vanderbilt University*—What is the relationship between knowing that an object is there (detection) and knowing what it is (categorization)? Grill-Spector and Kanwisher (2005) suggested a tight coupling between detection and categorization in an experiment examining the dependency between detection performance and categorization performance within the same trial. We explored this potential linkage in a series of experiments that systematically compared detection with categorizations defined by living versus nonliving distinctions, and by superordinate- versus basic-level contrasts. We found no dependent link between detection and categorization, except for the specific categorization contrast used by Grill-Spector and Kanwisher: person versus cars. Our results cast doubt on the general claim for an initial stage of visual perceptual processing that both detects and categorizes objects at the basic level; our results do suggest some prioritization of detecting and categorizing people.

(2003)

**The Temporal "Sweet Spot" for Feedback Presentation in Information-Integration Category Learning.** DARRELL A. WORTHY, W. TODD MADDOX, & ARTHUR B. MARKMAN, *University of Texas, Austin* (sponsored by W. Todd Maddox)—Previous research has shown that long delays between a response and presentation of the feedback can lead to worse performance on information-integration category-learning tasks (Maddox & Ing, 2005). In Experiment 1, we compared performance on an information-integration task for participants receiving different delay intervals between response and feedback presentation times. Participants received feedback delays of either 0 msec, 500 msec, or 1,000 msec. Performance was significantly better for participants receiving 500-msec delays in comparison with those receiving delays of either 0 msec or 1,000 msec. In Experiment 2, we varied feedback delay intervals around a mean interval of 500 msec. Participants were placed into either a low-variance ( $SD = 75$  msec) or a high-variance ( $SD = 150$  msec) condition based on the variance of feedback delay intervals around the mean. Participants performed significantly better in the low-variance condition than in the high-variance condition. These results suggest a temporal "sweet spot" for presenting feedback to optimally train the procedural learning system.

(2004)

**The Magical Contagion Effect: Associative and Essence-Transmission Mechanisms.** LAURA R. KIM & NANCY S. KIM, *Northeastern University*—People prefer not to use items touched by an undesirable person, even if the items have been thoroughly cleaned (Rozin et al., 1989). This magical contagion effect has generally been attributed to implicit

beliefs about an invisible, perhaps symbolic essence that is transferred from the source to the recipient. Although associative thinking has been identified as an alternative potential source of the contagion effect (e.g., Walther, 2002), its role has not been examined systematically. The present work aimed to uncover the relative contributions of associative thinking and essence-transmission beliefs underlying the contagion effect. We manipulated the valence connected to a hypothetical individual by dramatically changing his internal state, and examined people's judgments about the contamination of an item belonging to the individual in one state versus the other (vs. control states). The results indicate influences of both associative thinking and essence-transmission beliefs. Implications for contagion theories are discussed.

(2005)

**Facilitating Learning of Probabilistic Relational Categories.** WOOKYOUNG JUNG & JOHN E. HUMMEL, *University of Illinois, Urbana-Champaign* (sponsored by John E. Hummel)—Kittur, Hummel, and Holyoak (2004, 2006) showed that people have great difficulty learning relation-based categories with a probabilistic (i.e., family resemblance) structure. Experiment 1 tested three factors predicted to facilitate learning such categories: naming the relevant relations, informing subjects of the family resemblance structure, and changing the task from category learning to choosing the "winning" part of each stimulus, which was predicted to help subjects learn a higher order relation that remains invariant over category members. Only the third factor facilitated learning. Experiment 2 investigated the reasons for this effect. The results suggest that the "who's winning" task helps both by refocusing subjects' attention on exemplar parts and by invoking schemas for "winning," which help subjects find a higher order relation that remains invariant across all members of a category. Together, the results suggest that learning probabilistic relational categories is facilitated by tasks that encourage the discovery of an abstract invariant.

(2006)

**Modeling the Roles of Category and Feature Information in Inference.** MATTHEW T. ZIVOT & ANDREW L. COHEN, *University of Massachusetts, Amherst* (sponsored by Andrew L. Cohen)—The goal of the present research is to use the experimental methods and mathematical models of the information integration framework to precisely determine how category and feature information are combined when making an inference. In three experiments, participants were trained on a probabilistic relationship between a category label and the presence of a property and, separately, on the relationship between a visual feature and the presence of the property. Participants were then shown the category label alone, the feature alone, or both in combination, and asked to infer the presence or absence of the property. Two information integration models, the FLMP and the LIM, were fit to the data. The modeling results show that participants were suboptimal in their use of the two sources of information, showed diversity in the relative weight placed on category information, and consistently used each source of information to the extent to which it was known.

(2007)

**Common and Distinctive Features of Similarity: Effect of Behavioral Method.** BRUNO L. GIORDANO, CATHERINE GUASTAVINO, EMMA MURPHY, MATTSON OGG, BENNETT SMITH, & STEPHEN MCADAMS, *McGill University*—We measured the dissimilarity of various sets of sound stimuli using dissimilarity ratings (DRs), hierarchical sorting (HS), or free sorting (FS). HS is the behavioral analogue of agglomerative hierarchical clustering: Participants create a set of nested partitions with progressively fewer and larger groups. We modeled data using a common features model, ADCLUS, and two distinctive features models, MDS and DFCLUS. Model fit was virtually the same for DRs, FS, and HS. ADCLUS and DFCLUS had the same fit, which was lower than that of MDS. We then considered each of the nested HS partitions in isolation. Whereas the lower HS partitions were better fit by the common features model, the higher partitions were better fit by distinctive feature models. Interestingly, the HS partitions where common and distinctive features models had the same fit allowed the best recovery of known properties of the sound stimuli.



(2008)

**Using Eye Gaze to Examine Induction When Category Membership Is Uncertain.** OREN GRIFFITHS, BRETT K. HAYES, BEN R. NEWELL, & CHRIS PAPADOPOULOS, *University of New South Wales*—When people are uncertain about the category membership of an item (e.g., “Is it a dog or a dingo?”) research shows that they tend to rely only on the most likely (target) category when making inductions (e.g., “How likely is it to befriend me?”). In contrast, Bayesian accounts predict that information from other possible categories should be used. The present research investigated these contrasting accounts using a procedure in which categorical information was shown on screen during feature induction, and eye gaze to respective categories and exemplars was recorded. It was thus possible to examine which stimuli were attended to during induction. It was found that (1) participants used information from multiple categories in feature induction, (2) there was an attentional bias toward the target category, and (3) this bias depended on the manner of question presentation (whether classification or induction questions were asked first). The implications of these findings for theories of single/multiple category reasoning are discussed.

(2009)

**On the Falsifiability of Prototype and Exemplar Models.** WOLF VANPAEMEL, *Katholieke Universiteit Leuven*—In the Popperian view on model testing, models are only amenable to empirical test if they are falsifiable. Despite the widespread philosophical acceptance of Popperian tests, they are extremely rare in the cognitive sciences. The falsifiability of two prominent models of category learning (the prototype and the exemplar models) are evaluated across a wide array of previously used experimental designs (i.e., category structure and sample size). Apart from these previously used category structures, new category structures are constructed in which both the exemplar and prototype models are falsifiable and hence testable. The results of these analyses are useful for experimenters interested in contrasting prototype and exemplar models, informing them which experimental designs provide meaningful tests of both models, and which don't.

(2010)

**Prototype Formation and Central Tendencies: Questioning the Use of the Mean.** ETIENNE DUMESNIL, DENIS COUSINEAU, & LAURENCE MORISSETTE, *University of Montreal* (sponsored by Denis Cousineau)—People have the ability to form categories. The possibility that these categories might be represented by a prototype has been studied many times. Most of these studies used the mean as the prototypical central tendency measure. This choice has not been challenged up till now because the items of a category were assumed to be distributed normally. This caused all central tendency measures to have the same value. The study presented here used asymmetric distributions to create different categories. These categories were then used in a classification task. This procedure allowed the mean and the mode to have distinct values within a category. The results showed that items closest to the mode were classified faster and with a higher degree of accuracy than were those closest to the mean. Thus, frequency appears to be a better predictor of an item's typicality than its distance to the mean.

(2011)

**Motor Experience Shapes Abstract Concepts.** DANIEL CASA-SANTO, *Max Planck Institute for Psycholinguistics* (sponsored by Herbert H. Clark)—Right- and left-handers form different implicit associations between space and emotional valence: Right-handers associate good with right, but left-handers associate good with left (Casasanto, 2009). The present study investigated how correlations between handedness and valence might arise. Right-handed participants performed a motor training task in which they arranged dominoes on a table symmetrically, moving both hands in synchrony, while wearing a bulky ski glove on either their right or left hand. After training, they gave oral responses to questions probing associations between space and valence. Participants who had worn the glove on their left hand during training showed the good-is-right bias typical of right-handers, but participants who wore the glove on their right hand showed a good-is-left bias, like natural left-handers. Asymmetries in motor fluency caused either an enhancement or

a reversal of right-handers' natural tendencies. Motor experience shapes implicit associations between space and valence.

• BILINGUALISM •

(2012)

**The Generation Effect Applied to Adult Second Language Vocabulary Learning.** NATASHA TOKOWICZ & KEVIN G. JARBO, *University of Pittsburgh*—We examined the generation effect (the improved retention that results from generating material related to a to-be-learned item) applied to adult second language (L2) vocabulary learning. Specifically, we examined whether the longer term retention of L2 vocabulary would be facilitated by generating a first language sentence and inserting the L2 vocabulary word into it (“generate” condition), as compared with simply repeating the translation pair (“repeat” condition). Twenty-four participants learned 48 Dutch words in each condition. Training was completed in three sessions over a 1-week period, and testing was completed over a 3-week period, including follow-up retention tests. Words learned in the generate condition were processed more meaningfully than words learned in the repeat condition, as assessed with a semantic-judgment task. Free-recall test performance demonstrated better retention for words in the generate condition than for words in the repeat condition. We explore aspects of the generated sentences that led to more accurate retention.

(2013)

**Comparing Within-Language and Across-Language Word Ambiguity.** TAMAR DEGANI, CHELSEA M. EDDINGTON, & NATASHA TOKOWICZ, *University of Pittsburgh*, & ANAT PRIOR, *University of Haifa*—Translation ambiguity, or the availability of more than one translation for a given word, is hypothesized to depend in part on semantic ambiguity within the source language. Supporting this notion, we report a significant correlation between the number of different translations provided for English words when translated into Spanish, German, and Dutch. A closer examination of this relationship demonstrated that measures of within-language semantic uncertainty derived from association norms were significantly correlated with measures of translation ambiguity obtained from translation norms. When providing a single translation for an ambiguous word, bilinguals may need to select which meaning to translate. In this task, the relative saliency of a specific meaning of an ambiguous word in within-language association norms correlated with the probability of the corresponding meaning being translated in translation norms. We also consider the contribution of proficiency and form similarity in relation to these issues.

(2014)

**American Sign Language, English, Phonological Awareness, and Word Attack Strategies.** M. DIANE CLARK, SELINA AGYEN, JASON BEGUE, AMANDA KRIEGER, JONATHAN PENNY, & VIVIANNE SCHROEDER, *Gallaudet University*—Deaf readers often lag behind their hearing peers, and this effect is theorized to be a phonological deficit. Others suggest that encoding at the letter and morphological levels are more important for deaf readers. This prior research found relationships with metacognition as well as fingerspelling and reading skills. The present project evaluates ASL skills, English skills, phonological awareness, and word attack strategies. Our findings showed no overall relationship between English and phonological awareness. Interestingly, those who had demonstrated high levels of skill in both ASL and English showed no differences in comparison with those with high ASL skills and low English skills. In contrast, those with high English skills and low ASL skills showed correlations between phonological awareness and word attack skills. These effects showed high levels of variability among the three ASL/English groups but no significant differences. Therefore, strategy use among deaf readers may be related to early language preferences.

(2015)

**Cross-Language Phonological Activation of Meaning in Bilinguals.** DEANNA C. FRIESEN & DEBRA JARED, *University of Western Ontario* (sponsored by Debra Jared)—The present study investigated

cross-language phonological activation of meaning in English–French bilinguals. The critical stimuli were interlingual homophones, which are words that share phonology across languages, but not spelling or meaning (e.g., *shoe* in English and *chou* in French). Of interest was whether the French word *chou* (“cabbage”) activates the meaning of footwear through its shared phonology with the word *shoe*. Bilinguals performed either a category verification task or a self-paced sentence-reading task. In both tasks, performance on interlingual homophones was compared with performance on single language control words (e.g., *cloche*). In the category verification task, a difference between interlingual homophones and controls was observed regardless of the frequency of the words, but such a difference was found only for low-frequency interlingual homophones in the sentence-reading task. These findings provide evidence for cross-language phonological activation of meaning. Implications are discussed with respect to bilingual models of word recognition.

(2016)

**The Processing of Derivational Morphology in Korean–English Bilinguals: A Masked Priming Study.** SAY YOUNG KIM & MIN WANG, *University of Maryland, College Park* (sponsored by Franz Schmalhofer)—An experiment using the masked priming paradigm with two short prime durations (36 msec and 48 msec) was conducted to examine the time course of the processing of derived words in Korean–English bilingual readers via decomposition. At the 48-msec prime duration, when participants were given real derived words and interpretable pseudoderived words (i.e., an illegal combination of a stem and a suffix) in Korean as the primes, response times for the corresponding English translated stems were significantly faster than for the unrelated primes. At the 36-msec prime duration, however, the priming effect of the interpretable pseudoderived words disappeared. These results suggest that there is an early cross-language activation of constituent morphemes in morphologically complex words in bilingual reading. However, the time course of the decompositional process is dependent on the lexicality of the complex words.

(2017)

**The BRAM: Extending the Reordered Access Model to Bilingualism.** YVETTE AGUILAR & ANA I. SCHWARTZ, *University of Texas, El Paso*—We present findings from an eye-movement study in which Spanish–English bilinguals processed semantically ambiguous English words in a sentence context. These ambiguous words were cognates with Spanish that either shared the dominant meaning (e.g., *novel*) or subordinate meaning (e.g., *arm*). Words were placed in either a biasing or a neutral context. Findings support the major assumptions of the reordered access model and extend the model by demonstrating that the time course of meaning activation is influenced by cross-language lexical activation. A proposed extended model (BRAM) is described.

(2018)

**Age-of-Acquisition Effects in Vocabulary Learning.** JELENA HAVELKA, *University of Leeds*, & SHEKEILA PALMER, *University of Kent*—The aim of this experiment was to examine whether the age at which concepts are acquired influences the speed of picture naming by adult speakers using newly acquired vocabulary. In a single training session, native English speakers were taught new names for pictures representing 15 concepts that are early acquired, and 15 concepts that are typically late acquired in English. Following training, participants performed a picture naming task in which they were asked to name the pictures using the newly learned words. A significant main effect of AoA was observed, indicating that participants were faster at naming pictures representing early acquired relative to late acquired concepts, despite the fact that the English words representing those concepts were not implicated in training or at test. The results suggest that the AoA of a concept exerts influence over processing that is independent of the AoA of the word form.

(2019)

**Testing the Revised Hierarchical Model of Bilingual Memory With an Academic-Style Misinformation Paradigm.** RIVKA C. IHEJIRIKA,

*Davidson College and Harvard University*, & KRISTI S. MULTHAUP, *Davidson College*—The present study examines the revised hierarchical model (RHM) of bilingual memory through a new academic-style misinformation paradigm. The theory says that for unbalanced bilinguals, their second language (L2) is highly dependent on their first language (L1). We tested this idea with a completely within-participants design. English speakers taking advanced Spanish courses (unbalanced bilinguals) were presented with a cross-language misinformation paradigm. In each condition, participants listened to an audio lecture in one language, studied handwritten notes containing misinformation in a second language, and completed a forced-choice recognition test in the same language as the lecture (e.g., hearing a Spanish lecture, studying English notes, taking a Spanish test would be L2–L1–L2). The results showed significantly stronger misinformation effects for L2–L1–L2 than for L1–L2–L1 and no difference between the same-language conditions L1–L1–L1 and L2–L2–L2. The data support the RHM theory, which says that for unbalanced bilinguals, L2 is highly dependent on L1.

(2020)

**Idiom (Non)Decomposability and Cerebral Asymmetries: Bilingual Idiom Processing.** ANNA B. CIEŚLICKA, *Adam Mickiewicz University*, & ROBERTO R. HEREDIA, *Texas A&M International University* (sponsored by Roberto R. Heredia)—The idiom decomposition hypothesis (Gibbs et al., 1989) states that depending on the degree of decomposability (i.e., decomposable vs. nondecomposable), idioms will differ with regard to their storage and language processing strategies. Titone (1998) suggests that given hemispheric differences in sensitivity to central and peripheral semantic relationships (e.g., Beeman’s 1998 fine–coarse coding theory), cerebral asymmetries might arise for the processing of both idiom types. The experiments reported here tested both hypotheses and explored whether idiom decomposability varies as a function of L1 versus L2 processing. L1 (Polish) and L2 (English) idioms were embedded in neutral or figurative-biasing context and presented centrally, followed by laterally presented idiomatically and laterally related targets appearing at 0 msec and 300 msec ISI in Experiments 1 and 2, respectively. In general, results are inconsistent with the idiom decomposition hypothesis and partially consistent with the claim of the differential cerebral involvement in processing (non)decomposable idioms.

(2021)

**Relating Literacy Skills and Executive Attention in Chinese–English Bilingual Children.** HWAJIN YANG & CARISSA P. KANG, *Singapore Management University*, & SUJIN YANG, *York University and University of Toronto, Scarborough*—The relationship between literacy skills and executive attention was examined in 5-year-old Chinese–English bilingual children using a child Attention Network Test (ANT). Hierarchical multiple regression was conducted with age, PPVT scores (English, Chinese), and a composite SES score (parents’ education level and monthly income) entered into the first model, and literacy scores (e.g., English sound detection and rapid object naming) entered into the final model. All variables in Model 1 explained only a small portion of the variance (14.4%) in overall accuracy of ANT, whereas literacy skills of Model 2 accounted for an extra 45.3% of the variance ( $p < .001$ ). Literacy level was the only significant predictor of the performance on the ANT and it significantly mediated the relationship between PPVT scores and ANT accuracy. We provided insights into the impacts of literacy skills on bilingual children’s executive attention and linked our findings to the bilingual advantage in executive functions.

(2022)

**Relationship Between Gaze Shifts and Selective Attention in Bilinguals and Monolinguals.** HENRIKE K. BLUMENFELD & SZU-HSIEN KO, *San Diego State University*, & VIORICA MARIAN, *Northwestern University* (sponsored by Viorica Marian)—Eye movements to visual-world referents are closely linked to linguistic performance throughout the life span. It was hypothesized that, since bilinguals frequently consider word candidates from two languages rather than one when they listen to speech, their gaze shifts between picture referents might reflect changes in selective attention mechanisms in anticipation of greater ambiguity in the input. In a visual-world eyetracking paradigm

conducted in the participants' native language, gaze shifts between target (*cat*), competitor (*cab*) and filler (*oar*) pictures were examined in relation to performance on a nonlinguistic Simon task that indexed selective attention. In bilinguals, better Simon-type inhibition resulted in later gaze shifts from task-relevant pictures (i.e., targets, similar-sounding competitors) to task-irrelevant pictures (i.e., fillers,  $p < .05$ ). In monolinguals, no relationship between gaze-shift patterns and nonlinguistic Simon performance was observed ( $p > .1$ ). Findings suggest that bilinguals may recruit additional selective attention mechanisms for language processing to manage ambiguity early in the time course of auditory comprehension.

• DISCOURSE PROCESSING •

(2023)

**Biting Language and Fighting Friends: Sarcasm in Conversation.**

ALBERT N. KATZ & ANDREA BOWES, *University of Western Ontario*—We examine sarcasm in written communication between friends. Previous studies have shown that the use of irony “mutes” a negative message, in comparison with a direct literal counterpart. It is plausible, however, that with blatant aggressive sarcasm, the negative communication would override any possible muting. Using a realistic conversational format, male and female participants read the same transcripts depicted as between male–male or female–female friends. Participants provided ratings of their impressions and were asked to produce continuations of the conversation. We find that muting exists even in this blatantly negative situation. Surprisingly, since Gibbs and others have speculated that sarcasm is more likely to be produced by males, we find no such differences in production, with both males and females continuing to communicate aggressively (whether done sarcastically or not). However, in line with the speculations, males who use sarcasm are not perceived as negatively as are females who do so.

(2024)

**An ERP Examination of a Pragmatic Repeated Name Penalty.** TALI DITMAN, MANTE S. NIEUWLAND, & GINA R. KUPERBERG, *Massachusetts General Hospital and Tufts University*—We used event-related potentials (ERPs) to investigate whether pragmatic cues could modulate the facilitation effects of lexical repetition in discourse. Participants were presented with short discourse scenarios: Sentence 1 introduced two characters; Sentence 2 linked one of these characters to a specific entity (“Chloe bought some hamburgers”); Sentence 3 either referred to this character or to a different character (“She” or “Nick”), followed by the word “also,” and then either the same entity (“purchased hamburgers”) or a new entity (“purchased chicken”). The results demonstrated that readers quickly used both lexical and pragmatic information during comprehension. Specifically, (1) repeated entities (“hamburgers”) evoked smaller N400s than did new entities (“chicken”) and (2) when comparing the repeated entity conditions, infelicitous entities (“hamburgers,” in “She also purchased hamburgers”) evoked a larger N400 than did felicitous entities (“hamburgers,” in “Nick also purchased hamburgers”), providing evidence for a pragmatic repeated name penalty.

(2025)

**Conversational Puppetry: Priming via Pseudo-Confederate.** JENNIFER M. ROCHE, GINA M. CAUCCI, RICK DALE, & ROGER J. KREUZ, *University of Memphis*—Interlocutors often omit important words during conversation, but the omission of some words can lead to impaired comprehension (Rayner, Carlson, & Frasier, 1983). Haywood, Pickering, and Branigan (2004) showed that listeners are highly sensitive to primes (e.g., “that”) from a live confederate, which help them disambiguate future utterances. The present study replicates this finding in that the use of disambiguating primes is highly effective. We used a prerecorded pseudo-confederate that primed participants to say “that” during ambiguous and unambiguous conversation scenarios. Participants were successfully primed to disambiguate their statements during the ambiguous scenarios as opposed to the unambiguous scenarios. Also, for the ambiguous scenarios, participants mimicked the pseudo-confederate more when they were primed than when they were not being primed. This suggests that participants are not merely imitating their

pseudo-conversation partner, but are sensitive to cues that help clarify their own statements.

(2026)

**Go With the Flow: Semantic Interference in Episodic Recognition of Idioms.**

CLAUDIA SANCHEZ-GUTIERREZ, *University of Salamanca*, CHELSEA M. STILLMAN, JENNIFER A. CORRIVEAU, & JENNIFER H. COANE, *Colby College*—Idioms do not fit into typical syntactic and semantic structures because of their rigid structures and unpredictable figurative meanings. Are they short sentences or large words? This study examined whether idioms are processed and stored in memory as lexical units or as individual word strings. Participants studied a list of intact (e.g., “kick the bucket”) and altered (e.g., “kick the pail”) idioms. They then completed an episodic recognition test in which the idioms were either in the same or a different form as at encoding. If idioms are processed and stored as units, the stored figurative meaning of the idiom in semantic memory should interfere with episodic traces from the study phase. When idioms were altered at study and intact at test, participants made more errors than when idioms were intact at study and altered at test, suggesting that idioms might be processed as meaningful units in the mental lexicon.

(2027)

**Knowledge-Based Causal Inferences and Emotional Language.**

CONNIE SHEARS, LISA TWACHTMANN, TIFFANY KEE, DANIELLE COSME, BRANDON BROWN, & RYAN SIGLER, *Chapman University*—Abstract emotions influence every aspect of our lives (Blanchette, 2006). Processing of emotion-related information has been investigated for decades and has motivated several theoretical explanations for brain areas involved in processing emotions, physiological states related to processing emotions, and comprehension processes that support our understanding of others' emotional states (Smith & Bulman-Fleming, 2005). Still, controversy exists as to whether emotional information supports inference processes in language comprehension (Gygax et al., 2007). We examined readers' inference processes across positive, neutral, and negative two-sentence texts that either supported an inference or did not (control). We hypothesized that if valence had an impact on readers' formation of inferences, then we should find differences in accuracy or response times to comprehension questions per valence. We found that readers were faster and more accurate responding to questions following positive texts, meaning that they were less likely to form causal knowledge-based inferences for neutral and negative emotional texts than for positive texts. Thus, when comprehending positive information, readers form causal inferences.

(2028)

**Confirming Spontaneity in Spontaneous Trait Inferences.**

KARLA A. LASSONDE, *Minnesota State University*, DAVID N. RAPP, *Northwestern University*, & EDWARD J. O'BRIEN, *University of New Hampshire*—Researchers have argued that traits are spontaneously inferred as behavioral information is described in text (e.g., Newman & Uleman, 1990; Uleman, Hon, Roman, & Moskowitz, 1996). Evidence for such claims comes from studies in which participants take longer to recognize trait probes following trait-related sentences in comparison with trait-unrelated sentences. However, this method may not measure inferences activated during reading, but rather inferences generated after reading is completed. In the present study, participants read descriptions of a protagonist that either supported a target trait, or were neutral with respect to a target trait. We examined participant naming time for target traits immediately following the descriptions. Target traits were quickly named following consistent contexts in comparison with neutral contexts. These results confirmed that trait inferences are activated during reading.

(2029)

**The Generation of Elaborative Inferences While Reading.**

W. MATTHEW COLLINS, *Nova Southeastern University*, & KEITH RAYNER, *University of California, San Diego*—Although a number of researchers have examined the generation of elaborative inferences, very little is known about the types of elaborative inferences that are generated during online reading. This experiment examined two main questions. First,



do readers generate elaborative inferences during online reading? Second, if elaborative inferences are generated online, are certain types of elaborative inferences more likely to be generated than others? Readers were presented with two sentence passages. The first sentence in the passage afforded the generation of a predictive inference, an instrumental inference, or a semantic inference. In the second sentence, a noun was presented to probe whether an inference had been generated. Readers' eye movements on the probe word were measured to examine the types of elaborative inferences generated during online reading.

(2030)

**Reading Skill and the Maintenance of Global Coherence.** JENNIFER J. STIEGLER & EDWARD J. O'BRIEN, *University of New Hampshire* (sponsored by Edward J. O'Brien)—In two experiments, we explored comprehension differences between skilled and less-skilled readers. Participants read stories in which a character's action was consistent or inconsistent with a character description presented earlier in the text. In Experiment 1, probe response times confirmed that immediately after reading a target sentence that presented the inconsistent character action, the earlier described characteristics were activated. This was true for both skilled and less-skilled readers. In Experiment 2, the distance between the character action and the inconsistent action was varied. When distance was short, reading times for the sentence containing the inconsistent character action disrupted reading for both skilled and less-skilled readers. However, when distance was long, reading times were disrupted for only the skilled readers. The findings are discussed in terms of differences in reading skill and how comprehension difficulties result from processes taking place at integration and not at activation.

## • PSYCHOLINGUISTICS •

(2031)

**An Electrophysiological Index of Learned Anomaly Anticipation in Reading.** JIA LI, SHIN-YI FANG, & JAMES S. MAGNUSON, *University of Connecticut and Haskins Laboratories*—The early left anterior negativity (ELAN) is an ERP component associated with fast detection of form class errors (Neville et al., 1991). Because the ELAN appears to be insensitive to attentional manipulations (Hahne & Friederici, 1999), it is consistent with an initially encapsulated phase of syntactic processing (Friederici, 2002). We manipulated attention by manipulating anomaly proportion in a word-by-word reading paradigm, using sentences analogous to spoken materials from Hahne and Friederici (1999). We did not observe ELANs at the point of syntactic anomaly ("The dish was in the WASHED . . ."). However, as anomaly proportion increased, the probability of anomaly given a preposition increased, and we observed ELANs in response to the preposition that increased with anomaly proportion. This challenges the idea that the ELAN is an index of local grammatical fit, since it also occurs at a nonanomalous word at which anomaly can be anticipated, and increases with learned anomaly probability.

(2032)

**Verb Factivity and Text Indeterminacy.** TODD R. FERRETTI, *Wilfrid Laurier University*, MURRAY SINGER, *University of Manitoba*, & JENNA HARWOOD, *Wilfrid Laurier University*—We used ERP methodology to investigate how readers integrate discourse concepts when they followed factive (e.g., knew) and nonfactive (e.g., guessed) verbs, and they were true, false, or indeterminate with previous discourse. Consistent with previous research (Ferretti, Singer, & Patterson, 2008; *Cognition*), relative to true concepts, false concepts following factive verbs elicited a less positive P2 and a more negative N400 that was extended. Relative to true concepts, indeterminate target words also elicited a less positive P2 and a more negative N400. Indeterminate concepts elicited a late positivity instead of an extended N400. Following nonfactive verbs, no differences were found between the conditions in the P2 region or late component region. However, there was a clear N400 gradient, with false concepts being the most negative, followed by indeterminate concepts and then true concepts. This research demonstrates that indeterminate and false concepts are easier to interpret following nonfactive than factive verbs.

(2033)

**Structural Priming in Aphasic Language Production: Verb Effects.** MALATHI THOTHATHIRI, *Moss Rehabilitation Research Institute & University of Pennsylvania*, & LAUREL BREHM & MYRNA F. SCHWARTZ, *Moss Rehabilitation Research Institute*—Structural priming refers to people's tendency to repeat sentential structures. Recent studies suggest that this priming reflects long-term adaptation of abstract structural representations, independent of experience with individual verbs. Here, we show that the verb matters in a previously uncharacterized way. Five anomic aphasics participated in a dialogue task involving dative sentences. A fluency measure showed a significant priming effect: Pauses after the verb were longer when the target sentence used a different structure from the prime than when the two structures were the same. However, this effect was driven by one group of target verbs (low frequency, semantically heavy) and not the other (high frequency, semantically light). The results have implications for the nature of the interaction between lexical and abstract structural representations during language production. The differential effect for different verbs has implications for characterizing the syntactic deficits of aphasic patients.

(2034)

**Phonetic Convergence in College Roommates.** JENNIFER S. PARDO, *Barnard College, Columbia University*, & RACHEL GIBBONS, ALEXANDRA SUPPES, & ROBERT M. KRAUSS, *Columbia University*—Previous studies have found that interacting talkers converge or diverge in phonetic form during a single conversational session and as a result of long-term exposure to a particular linguistic environment. In the present study, five pairs of previously unacquainted male roommates were recorded at five time intervals throughout the academic year. Phonetic convergence over time was assessed using both perceptual and acoustic measures. Each roommate pair showed a unique pattern of convergence during the academic year, and perceptual detection of convergence varied across different linguistic items. In addition, phonetic convergence correlated moderately with roommates' self-reported closeness. These findings suggest that phonetic convergence in college roommates is variable and moderately related to the strength of a relationship.

(2035)

**Understanding the Link Between Dual-Task Performance and Embodied Cognition.** ANNIE J. OLMSTEAD & CAROL A. FOWLER, *University of Connecticut and Haskins Laboratories* (sponsored by Claire Michaels)—Recently, considerable evidence of motor system involvement in language comprehension has been amassed. A neglected, but potentially important avenue of investigation is the effect of language comprehension on the dynamics of movement. In a series of experiments, the interplay between bimanual rhythmic coordination, a dynamically described motor task, and sentence comprehension was investigated. We used a dual-task paradigm in which participants simultaneously perform a bimanual task and a sentence comprehension task. Characteristics of each task were systematically varied. We found that comprehending sentences led to changes in dynamical and kinematic characteristics of movement. We also found differences in reaction time to sentences that described hand movements and sentences that described nonperformable events when participants were concurrently performing the bimanual task, but no difference in a single-task condition. The implications of these findings for theories of embodied cognition and dual-task performance are discussed.

(2036)

**Production and Processing of Restrictive Relative Clauses in Pragmatically Appropriate Context.** WILLIAM R. BATTINICH & WILLIAM H. LEVINE, *University of Arkansas*—Restrictive relative clauses (RCs) help to identify the referent of the noun phrase they modify, yet in most psychological research on RCs, no referential context is provided to introduce referents to be selected. In our research, participants were provided with short contexts in which two similar entities were introduced (e.g., two children), followed by a prompt (e.g., "The child that . . .") to write an open-ended continuation; the contexts were written such that an RC was needed to disambiguate which entity was referred to, and so that subject and object RCs were (intuitively) equally felicitous. Analysis of



the continuations revealed a strong preference for subject RCs, although a sizable minority of these RCs were passivized and semantically equivalent to object RCs. A reading-time study of subject and object RCs in these pragmatically appropriate contexts was conducted to further examine the role of referential context in processing RCs.

(2037)

**Function Follows Form: Activation of Shape and Function Features During Spoken Word Recognition.** EILING YEE, STACY HUFFSTETLER, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Distributed theories of semantic memory characterize object knowledge as distributed patterns across a set of semantic features, such that objects sharing features have overlapping representations. We used eye movements to explore whether activating one object leads to the activation of other objects that are similar in shape or function. Participants viewed a four-picture display and clicked on the picture that corresponded to a heard word. In critical trials, the conceptual representation of one of the displayed objects was similar in function or shape to the heard word. Importantly, similarity between related objects was not apparent in the visual depictions (e.g., for the target “frisbee,” the shape-related object was a triangular slice of pizza), allowing preferential fixations on the related object to be attributed to overlap of the conceptual representations on the features of interest. We observed relatedness effects for both shape and function, with shape information becoming active before function.

(2038)

**Chimaera Neural Networks for Self-Organizing Grammar Acquisition.** PETER A. JANSEN, SCOTT WATTER, & KARIN R. HUMPHREYS, *McMaster University*—Although many neural network models of word and grammar acquisition have been proposed, these models tend to make use of supervised neural architectures such as the simple recurrent network, and as such, have difficulty modeling developmentally plausible acquisition. This work examines the use of the Chimaera architecture, a novel neural network architecture combining a self-organizing Kohonen map with a Hebbian associative network, in unsupervised grammar acquisition from a corpus of natural language. Similar to recent psycholinguistic models, the Chimaera uses an alternative dual-representational system approach separating conceptual and grammatical content. Here, words are represented explicitly, whereas sequential grammar knowledge is stored implicitly through time-delayed Hebbian association. Although a single-layer Chimaera network can generate predictions for the next part of speech in a sentence for a known grammar, we show how these predictions can be ambiguous, and how multiple layers offer a route for complex ambiguities to be resolved with instance-specific information.

(2039)

**Script Properties Underlie Morphological Priming in Word Naming: Evidence From Urdu and Hindi.** CHAITRA RAO & JYOTSNA VAID, *Texas A&M University*—Is morphology distinctly represented in the lexicon? Findings of greater priming for morphologically related as opposed to form-related words in Hebrew and Arabic argue for the morphological independence position. However, in written Hebrew and Arabic, vowel omission results in morphologically related words also being similar in their surface form. The present research tested skilled readers of Urdu and Hindi, languages that are identical in their morphophonology but differ in writing: Urdu, like Arabic, omits vowels, whereas Hindi does not. If surface similarity arising from vowel omission underlies the greater priming of morphologically related pairs observed in Semitic scripts, then only Urdu should show greater priming of morphologically related words in comparison with form-only-related words. Ninety-six biscriptal readers of Hindi and Urdu named target words (e.g., *bak*) preceded by morphologically related or form-only-related primes (e.g., *bakvaas* vs. *bakri*). A superior priming of morphologically related over form-related pairs was observed only for Urdu, supporting a script-based interpretation of morphological priming effects.

(2040)

**An Online Examination of Syntactic Complexity, Load, and Span Effects.** CHRISTY M. SEIDEL & JANET L. McDONALD, *Louisiana*

*State University*—Using an offline comprehension measure, last year we reported that working memory span interacted with syntactic complexity in clefts + relative structures, and in the hardest sentences, also with external load (visual or auditory in nature). High spans generally outperformed low spans on object cleft structures, but dropped to low working memory span levels on object cleft + subject relatives (e.g., “It is the doctor that the patient visits that contacts the dentist. Who contacts?”) under the auditory load. The present experiment replicates this design using an online listening time measure. The results show that the addition of the listening time methodology may have added to the processing load, because comprehension performance was poor on the most demanding sentences. Listening time data will also be examined for evidence of span and/or load interaction with sentence complexity.

# • LETTER/WORD PROCESSING •

(2041)

**Searching for O: Evidence for Cognitive Control in Eye-Movement Behavior.** POLINA M. VANYUKOV, ERIK D. REICHLER, & TESSA WARREN, *University of Pittsburgh*—Theories of eye-movement control posit that eye movements in reading are driven predominantly by either oculomotor (e.g., fixation location) or cognitive (e.g., word frequency) factors. A visual search experiment employing strings of Landolt Cs examined how string frequency, length, and difficulty of processing (i.e., gap size of Cs within a string) affected eye movements. Participants scanned lines of eight strings from left to right while searching for a string containing an O. Gaze durations and number of fixations on the distractor strings varied inversely with gap size and increased with string length. Frequency also affected eye-movement behavior: Participants learned to look at the more frequent distractors less often and for shorter durations than they did for the less frequent distractors. The latter result provides evidence for the local (immediate) control of eye movements and is consistent with cognitive control theories of eye-movement behavior.

(2042)

**The Development of Morphological, Semantic, and Orthographic Sensitivity in Visual Word Recognition.** IN YEONG KO & MIN WANG, *University of Maryland, College Park*—The present study investigates how children develop their sensitivity to morphological information in relation to semantic and orthographic information. Native Korean-speaking adults and children in grades 4 and 6 make visual lexical decisions on stem targets preceded by four different types of masked primes, with a SOA of 57 msec. The four conditions of prime-target pairs are (1) orthographically related only (–M–S+O: 도시락–도시, *scandal–scan*), (2) orthographically related, morphologically decomposable, but semantically unrelated (+M–S+O: 궁두쇠–궁두, *archer–arch*), (3) morphologically decomposable, orthographically and semantically related (+M+S+O: 음악가–음악, *bravely–brave*), and (4) semantically related only (–M+S–O: 반대–이의, *accuse–blame*). In the preliminary results, adults showed morphological sensitivity regardless of semantic relatedness. However, we predict that children largely rely on orthographic and semantic information. We also predict that the sensitivity to the morphological decomposability develops with grade level. Taken together, these results provide evidence for a developmental shift from early orthographic and semantic to later morphological sensitivity in visual word recognition.

(2043)

**Effects of Lexical Status and Morphological Complexity in Masked Priming.** JOANNA A. MORRIS, *Hampshire College*, JAMES PORTER, *Tufts University*, JONATHAN GRAINGER, *CNRS and University of Provence*, & PHILLIP J. HOLCOMB, *Tufts University*—We examined behavioral and event-related potential responses to monomorphemic words (e.g., *flex*) preceded by briefly presented masked primes in which the target was embedded. Primes were (1) pseudowords made of the grammatical combination of a root and a suffix, such as *flexage*, (2) nonmorphological pseudowords, such as *flexint*, where *-int* does not function as an affix in English, (3) true derived primes, such as *flexible*, and (4) unrelated word primes, such as *musical*. In Experiment 1, the

unrelated primes were all morphologically complex real words, whereas in Experiment 2, the unrelated primes were of the same three types as the related primes. Subjects performed a lexical decision task. The results of both experiments show that all prime types significantly facilitated target recognition. Facilitation was reflected in both the electrophysiological and behavioral data, suggesting that in some instances, masked morphological priming cannot easily be distinguished from orthographic priming.

(2044)

**Context-Dependent Motor Simulation in Language Comprehension.** WESSEL O. VAN DAM, SHIRLEY-ANN RUESCHEMEYER, & HAROLD BEKKERING, *Radboud University Nijmegen* (sponsored by Harold Bekkering)—Support for motor simulation in language processing comes from studies showing that action words modulate the execution of congruent and incongruent motor responses (the ACE effect). Until now, it has been unclear whether motor simulation depends merely on the word meaning or is also affected by the linguistic context. Participants performed a hand movement toward or away from the body in response to words for objects (e.g., *hammer*) that were associated, depending on the preceding context word (e.g., *nail* or *toolbelt*), with either a toward or away action. Interestingly, we observed a modulation of the ACE effect by the linguistic context. Beyond previous research, this finding suggests that motor simulation during language comprehension is context dependent and argues against the notion that a single action word invariably activates a specific motor code.

(2045)

**Word Frequency Effects and Masked Repetition Priming: An ERP Study.** MARIANNA D. EDDY, *MIT*, JONATHAN GRAINGER, *CNRS and University of Provence*, DANIELLE LOPEZ & PHILLIP J. HOLCOMB, *Tufts University*—Previous behavioral studies have demonstrated that word frequency and repetition interact when the prime word is visible; however, under masked priming conditions this interaction is eliminated. These findings are typically used to support an episodic account of the influence of word frequency on repetition effects. This interpretation is incompatible with interactive activation models of word recognition that predict an interaction of frequency and repetition whether or not the prime is masked. Because behavioral measures may be insensitive to subtle effects, we used ERPs to provide precise temporal information about the interactive effects of repetition and frequency in masked priming. We presented masked primes followed by the same or different high- or low-frequency target words. Preliminary results suggest that repetition effects in the N400 time window interact with word frequency, where the repetition effect is larger for low-frequency word pairs than for high-frequency word pairs.

(2046)

**Comparing Incidental and Deliberate Phonological Word-Form Learning.** STEPHANIE PACKARD & PRAHLAD GUPTA, *University of Iowa*—Four experiments examined phonological word-form learning (i.e., the learning of novel, word-like sound patterns) after differing types of training. In each case, learning at the end of training was assessed via stem-completion ability. Experiment 1 presented subjects with 11 blocks of listening and repeating (incidental learning) and found significant stem-completion ability. The results of Experiment 2 showed greater stem-completion ability after 11 blocks of listening, repeating, and stem-completion testing (deliberate learning). Experiment 3 replicated results from Experiments 1 and 2 in a within-subjects design and demonstrated that learning of both types is item specific and not merely the result of generalized task facilitation. Experiment 4 measured stem-completion ability after 100 blocks of incidental learning and found that it remained lower than after only 11 blocks of deliberate learning in Experiments 2 and 3. These results suggest that incidental learning does not yield full mastery of phonological word forms.

(2047)

**A Comparison of Semantic and Repetition Priming Effects Within the EZ Diffusion Model.** CLARK G. OHNESORGE, *St. Olaf College*, & JAKE C. KURCZEK, *University of Iowa*—Priming results when the

processing of an initially presented word (prime) influences the speed of responding to a subsequent (target) word. The most common methods are semantic (e.g., *cat–dog*) and repetition (e.g., *dog–dog*) priming. Both forms reliably yield large reductions in response time. In order to compare these two processes, we conducted two studies that used the same stimulus set to produce both semantic and repetition priming effects. We modeled the resulting data using a three-parameter random walk model developed by Wagenmakers (2007). The parameters of the EZ Diffusion model are drift rate ( $v$ ), boundary separation ( $a$ ), and nondecision time ( $ter$ ). Although both types of priming increased the drift rate ( $v$ ) parameter, semantic and repetition priming produced strikingly different effects for both boundary separation ( $a$ ) and nondecision time ( $ter$ ).

(2048)

**The Time Course of Lexical Ambiguity Resolution in the Cerebral Hemispheres.** HOANG VU, *Saint Mary's College of California*, GEORGE KELLAS, *University of Kansas*, & MICHAEL HAJI, *Saint Mary's College of California*—What is the fate of meaning activation during the time course of lexical ambiguity resolution in the cerebral hemispheres? Coney and Evans (2000) showed that at an SOA of 750 msec, dominant-biased sentences activated only the dominant meaning of an ambiguous word in both the LH and the RH, whereas subordinate-biased sentences activated both meanings in both hemispheres. The present research examined lexical ambiguity resolution in the cerebral hemispheres using strongly biased subordinate contexts with different ISI intervals being manipulated between the sentence-final ambiguous word and the target word. Lexical decision times showed that in the LH, only the contextually appropriate subordinate meaning was activated across all ISI intervals. In contrast, in the RH, multiple meanings were activated at the 0- and 750-msec ISI conditions with only the subordinate meaning being activated by the 1,500- and 2,000-msec ISI conditions.

(2049)

**Processing Stages in Speech Production: A Masked Priming ERP Investigation.** TREVOR J. BLACKFORD & PHILLIP J. HOLCOMB, *Tufts University*, JONATHAN GRAINGER, *CNRS and University of Provence*, & GINA R. KUPERBERG, *Tufts University, Massachusetts General Hospital, and Martinos Center for Biomedical Imaging* (sponsored by Holly A. Taylor)—We examined electrophysiological activity and naming times to pictures (e.g., of a cat) preceded by identity words (*cat*), semantically related words (*dog*) and words that shared the initial phonological segment of the picture name (*canoe*) during masked priming presentation. Modulation of the N400 was taken as an index of lexicosemantic activation. Attenuation of the N400 and shorter naming times were seen to pictures preceded by identity (vs. unrelated) words (electrophysiological and behavioral identity priming). Attenuation of the N400 (electrophysiological lexicosemantic priming) but increased naming times (behavioral semantic interference) were seen to pictures preceded by semantically related (vs. unrelated) words. No ERP modulation but shorter naming times were seen to pictures preceded by phonologically related (vs. unrelated) words (behavioral phonological priming). These findings suggest that semantic interference occurs postlexically, at a distinct stage of processing from lexicosemantic activation, and that phonological priming also occurs postlexically, during phonological encoding of the speech response.

(2050)

**Expertise Effects in Visual Word Recognition: A Scrabble Study.** IAN S. HARGREAVES, PENNY M. PEXMAN, & PETER M. SARGIOUS, *University of Calgary*—Like other cognitive skills, visual word recognition shows individual variability. This variability must be accounted for by models of the word recognition process. In the present research, we tested the effects of one source of individual variability: competitive Scrabble expertise. Competitive Scrabble players engage in deliberate training to expand their word knowledge. We investigated the effects of this type of expertise using two modifications of the lexical decision task (LDT). The first LDT incorporated horizontal and vertical presentation of trials and included a semantic (concreteness) and lexical (frequency) manipulation. The second LDT used transposed letter

nonwords (e.g., DIRVE) as foils to increase LDT difficulty for Scrabble experts who practice anagramming. We quantified Scrabble expertise using publicly available National Scrabble Association ratings and participant-reported survey data. To capture other differences between Scrabble experts and nonexperts we administered tests of perceptual speed, letter fluency, vocabulary, and anagramming skill.

## (2051)

**Deficits of Spatial Attention in Developmental Dyslexia.** MARCO ZORZI & ANDREA FACOETTI, *University of Padua* (sponsored by Roberto Dell'Acqua)—Developmental dyslexics show a variety of low-level deficits in sensory and attentional processing, but their link to the core reading disorder remains contentious. We investigated the link between spatial attention and dyslexia within the framework offered by the CDP+ computational model of reading aloud (Perry, Ziegler, & Zorzi, 2007; *Psych. Rev.*), which assumes that spatial attention is selectively involved in the sublexical spelling-to-sound mapping process. Our studies of children with developmental dyslexia reveal an abnormal time course in the deployment of spatial attention across visual and auditory modalities, in comparison with both chronological age and reading level controls. Importantly, the efficiency of attentional processing is strongly predictive of phonological decoding skills (nonword reading). Spatial attention is also impaired in preschoolers at risk for dyslexia. These results support the assumptions of CDP+ and suggest that sluggish attention is a plausible account of how a low-level, nonlinguistic deficit can adversely affect reading development.

## • MOTOR CONTROL •

## (2052)

**Influences on Transfer of Motor Learning Across Learning-Transfer Effector Combinations.** SIEN HU & CHARLES E. WRIGHT, *University of California, Irvine*—We investigated transfer of motor learning across learning-transfer effector combinations for several tasks and learning mechanisms. Differences in transfer of learning are reflected in how performance depends on body side (left vs. right), body part (hand vs. arm), and their relations, including laterality (ipsilateral vs. contralateral) and homology (homologous vs. heterologous). Four experiments are reported: Experiment 1 studied transfer of explicitly learned, short, spatially defined discrete movement sequences; Experiment 2 differed from Experiment 1 in that the sequences were long; Experiment 3 studied transfer of implicitly learned regularities in spatially defined discrete movement sequences; Experiment 4 studied transfer of explicit learning for a tracking task. The results suggest that transfer of learning is affected by the following: learning-transfer effector combinations, the complexity of the movement learning task, the learning mechanism, and task-imposed movement representation requirements.

## (2053)

**Movement Time When Circumventing Obstacles in a 3-D Workspace.** JONATHAN VAUGHAN, DEBORAH BARANY, & ANTHONY SALLI, *Hamilton College*, STEVEN JAX, *Moss Rehabilitation Research Institute*, & DAVID A. ROSENBAUM, *Pennsylvania State University*—According to Fitts's Law, movement time (MT) varies linearly with the logarithm of the index of difficulty, so that MTs over longer distances, or to smaller targets, are slower. Although Fitts's Law predicts MT for direct movements from one target to another, predicting MT when an obstacle must be circumvented (causing a curvilinear movement) requires taking into account how far the obstacle intrudes into the movement path (Jax, Rosenbaum, & Vaughan, 2007). In the present study, participants moved a handheld pointer between targets in a 3-D workspace, while there was sometimes an obstacle in the direct movement path. MT was significantly longer for movements around obstacles than for direct movements, as Jax predicted. This modification of Fitts's Law accounts for MT when circumventing obstacles, and extends a posture-based model for modeling trajectories in a 3-D movement task.

## (2054)

**Hemispheric Communication in Motor Control.** ROBERT M. KOHL, RAYMOND W. MCCOY, & JACOB K. MUTCH, *College of William*

*& Mary*—Previous experimental paradigms examining the behavioral characteristics of hemispheric communication have compared one stimulus presented to a visual field with two stimuli, where each was presented to a visual field, or compared a one-handed response with a two-handed response. In general, the results from the former paradigms were consistent with interhemispheric facilitation, whereas the results from the latter paradigms were consistent with interhemispheric inhibition. In two experiments, hemispheric communication was investigated while participants were provided with one stimulus to both visual fields and while they performed either dual ipsilateral (emphasizing one hemisphere in response control) or dual contralateral (emphasizing two hemispheres in response control) hand/foot responses. Experiment 1 demonstrated that simple dual ipsilateral hand/foot responses produced faster reaction and movement times in comparison with contralateral hand/foot responses. Experiment 2 replicated this pattern with complex dual responses. The pattern of results from both experiments was consistent with the inhibition hypotheses of interhemispheric communication.

## (2055)

**Hemispheric Asymmetry in Frontal EEG: Non-Right-Handers Are More Right Hemisphere Active.** RUTH E. PROPPER & JENNA PIERCE, *Merrimack College*, STEPHEN D. CHRISTMAN, *University of Toledo*, MARK W. GEISLER, *San Francisco State University*, & NATHAN BELLORADO, *Merrimack College*—Withdrawal- versus approach-based emotions are associated with increased right hemisphere (RH) versus left hemisphere (LH) resting frontal activity. Non-right-handedness is associated with increased anxiety, caution, and introversion, suggesting increased RH activity in this population. We examined resting frontal alpha during 30 sec each of eyes open (EO) and eyes closed (EC) in strong right-handers (SRH) versus non-right-handers (NRH). Handedness was determined via median split on Edinburgh Inventory scores. Mixed ANOVAs examined EO and EC alpha power in Fp1 and Fp2. A significant interaction between handedness and hemisphere during EO revealed decreased RH relative to LH alpha power in NRH, but no hemispheric asymmetries in SRH. Analyses also revealed decreased RH alpha power lateralization in NRH relative to SRH. Alpha power is inversely related to hemispheric activation. Therefore, increased RH versus LH activation in NRH and increased RH activation in NRH versus SRH supports research demonstrating increased negative/withdrawal emotions in NRH in comparison with SRH.

## (2056)

**Motor Planning for What Matters: Pursuing a Quantitative Model of Effort.** CHASE J. COELHO & DAVID A. ROSENBAUM, *Pennsylvania State University* (sponsored by Dorothee J. Chwilla)—How does the motor system generate particular movements when countless alternative movements could complete the task at hand (the problem of motor equivalence)? Performance costs are presumably reduced via movement selection, but a method is needed to identify those costs. We used a recently developed task choice method to address this challenge. We gave participants two possible back-and-forth object-displacement tasks and asked the participants to perform whichever task seemed easier. The choice data over many trials allowed us to identify the costs that were taken into account. This work demonstrates the promise of the task choice method for identifying performance costs and, more generally, for establishing a rigorous approach to the study of effort.

## (2057)

**Compatibility Interference Occurs Regardless of How Action Plans Are Mentally Represented.** LISA R. FOURNIER, JOY KIRKWOOD, PAUL S. MATTSO, & THEIBOT HERZOG, *Washington State University, Pullman*—Withholding actions to one event (A) in working memory can delay responses to a second event (B) if A and B share similar action features (response hands). We examined whether this compatibility interference (CI) is dependent on the type of mental representations (verbal or visual) used to encode the two action events. Two visual events (A and B) occurred sequentially. Event A was either an animation of boxes that visually defined the response (with concurrent articulatory suppression) or an object whose identity verbally defined the response. Event B was an object whose spatial location defined the response or



whose identity verbally defined the response. Participants planned and withheld a left- or right-hand response to A. Then B occurred, which required a rapid right- or left-hand response. Afterward, the response to A was executed. The results showed CI regardless of whether the mental representations of the actions were the same or different.

(2058)

**Task-Level and Effector-Level Representations in Intermanual Transfer of Motor Skills.** KEITH R. LOHSE, ALICE F. HEALY, & DAVID E. SHERWOOD, *University of Colorado, Boulder* (sponsored by Alice F. Healy)—Current experiments on the intermanual transfer of skills show considerable disparity. Some tasks show symmetrical transfer, whereas other tasks transfer only from the dominant to the non-dominant hand or from the nondominant to the dominant hand. Within a task, effects of transfer on performance can change on the basis of what variable is measured (e.g., response time or number of errors made). The present study resolves some of this ambiguity by treating transfer as a function of task-level and effector-level processes. For a handwriting task, there was substantial transfer from practice with the dominant to the nondominant hand, in both time to produce a character and in size of the character, but the reverse was not found. There was also significant transfer as a result of mental practice in production time but not character size. Transfer as a result of mental practice is posited to result from transfer of task-level processes but not effector-level processes.

(2059)

**Social Effort Reduction in Door Opening.** JOSEPH P. SANTAMARIA & DAVID A. ROSENBAUM, *Pennsylvania State University* (sponsored by Jonathan Vaughan)—The study of effort reduction in motor control has focused on the performance of individual actors. Much less attention has been paid to effort reduction among groups of actors. We observed 889 people passing through a doorway at Penn State University and found that the probability of holding the door for the follower fell from above .5 to below .5 at a following distance of about 4 m. A model that accounts for these results says that the first person at the door expends more effort than usual, provided this allows the total effort of the pair of individuals to be less than the sum of the individuals' acting-alone efforts. A prediction of the model is that followers should increase their speed of approach to the door if the door is held open for an abnormally long time.

(2060)

**Transfer to Mirrored Sequences.** ELIAN DE KLEINE, ROB H. J. VAN DER LUBBE, & WILLEM B. VERWEY, *University of Twente* (sponsored by Willem B. Verwey)—If someone is instructed to write down his name on a sheet of paper with either his dominant or nondominant hand, then the shapes produced by both hands are rather similar in several respects. This and other findings have been ascribed to a common representation of the movements required. In the present study, the question was raised whether this idea also applies to a sequence of keypresses, and whether this common representation includes temporal aspects. Fixed series of five keypresses, which could be familiar, unfamiliar, or mirrored, had to be prepared and executed/withheld after a go/no-go signal. The results showed a transfer from familiar to mirrored sequences. Furthermore, results showed that the relapse at Key 3 transferred from the familiar to the mirrored sequence. These results indicate that the representation underlying the execution of mirrored sequences is effector independent (a general motor program) and includes the segmentation pattern of a sequence.

• COGNITIVE CONTROL •

(2061)

**Central Crosstalk in Task Switching (Evidence From Manipulating Input–Output Modality Compatibility).** DENISE N. STEPHAN & IRING KOCH, *RWTH Aachen* (sponsored by Iring Koch)—Two experiments examined the role of compatibility of input and output (I–O) modality mappings in task switching. We define I–O modality compatibility in terms of similarity of stimulus modality and modality of response-related sensory consequences. Experiment 1 included switching between

two compatible tasks (auditory–vocal vs. visual–manual) and between two incompatible tasks (auditory–manual vs. visual–vocal). The resulting switch costs were smaller in compatible tasks than in incompatible tasks. Experiment 2 manipulated the response–stimulus interval (RSI) to examine the time course of the compatibility effect. The effect on switch costs was confirmed with a short RSI, but it was diminished with a long RSI. Together, the data suggest that task sets are modality specific. Reduced switch costs in compatible tasks are due to special linkages between input and output modalities, whereas incompatible tasks increase crosstalk due to dissipating stimulus-based priming of incorrect response modalities.

(2062)

**A Model of Random Task Selection in Voluntary Task Switching.** ANDRÉ VANDIERENDONCK, JELLE DEMANET, BAPTIST LIE-FOOGHE, & FREDERICK VERBRUGGEN, *Ghent University*—Whereas standard randomization behavior typically shows an alternation bias, a repetition bias is characteristic of randomization in voluntary task switching. On the basis of the same principles that have been used to explain behavior in randomization tasks, a model was developed that assumes (1) that short sequences of events are retrieved from long-term memory, (2) that these short events have an alternation bias, and (3) that bottom-up priming is responsible for a shift toward repetitions. Runs of task selections and their transitions were used to estimate the free parameters of this model. The estimations were then used to predict specific features of the generated task sequences. The model's predictions showed an excellent correspondence to the data. The implications for our views on the process of task selection will be discussed.

(2063)

**Effects of Perceptual and Conceptual Cues in a Response Switching Task.** WHITNEY A. HANSEN & STEPHEN D. GOLDINGER, *Arizona State University*—In the directed response switching (DRS) task, participants keep two conflicting responses active, choosing between responses on each trial. The primary response was word naming, whereas the secondary response was a generic verbal response, “bam.” In previous versions of DRS, we used color as the sole cue for the correct response, potentially allowing people to make decisions about correct responses without fully encoding the stimuli. In the present experiment, we varied perceptual (color) and conceptual (group membership) cues to examine the effects of more complex cues on decision making. We also manipulated the ease of discriminating the primary and secondary response cues. Using response times as the dependent measure, we found a three-way interaction: Altering the nature of response cues led to dramatic changes in cognitive control performance. Conceptual input exaggerated both the task and discrimination effects, relative to perceptual input.

(2064)

**Asymmetric Switch Costs As Sequential Difficulty Effects.** DAR-RYL W. SCHNEIDER & JOHN R. ANDERSON, *Carnegie Mellon University*—When switching between tasks of unequal difficulty, there is often a larger switch cost for the easy task than for the difficult task. We propose a new account of these asymmetric switch costs based on sequential difficulty effects. We argue that the asymmetry arises from impaired performance after a difficult trial, regardless of whether the task switches or repeats. Empirical support for this idea is provided in two experiments on arithmetic task switching in which asymmetries are observed for secondary difficulty manipulations, even in the context of task repetitions. A criterion shifting account of sequential difficulty effects is developed and tested in a third experiment involving a speed–accuracy manipulation that yields data inconsistent with criterion shifting and consistent with a general processing impairment.

(2065)

**Trial-to-Trial Modulations of the Simon Effect in Conditions of Attentional Limitations: Evidence From Dual Tasks.** RICO FISCHER & FRANZISKA PLESSOW, *Dresden University of Technology*, WILFRIED KUNDE, *Dortmund University of Technology*, & ANDREA KIESEL, *University of Würzburg*—Interference effects are reduced



after trials including response conflict. This sequential modulation has often been attributed to a top-down mediated adaptive control mechanism and/or to episodic retrieval mechanisms. In the present study, we tested whether mechanisms responsible for such sequential modulations are subject to attentional limitations under dual-task situations. Participants performed a Simon task in mixed single- and dual-task contexts (Experiment 1), in blocked contexts with dual-task load, either in trial  $N$  (Experiment 2A), in trial  $N-1$  (Experiment 2B), or in both trials (Experiment 3). The results showed that the occurrence of a sequential modulation did not depend on dual-task load per se, because it occurred in conditions of lowest and highest task load. Instead, task factors such as the repetition of task episodes and stimulus–response repetitions were of prime importance.

(2066)

**Sequential Modulation of the Orthogonal Simon Effect.** JAEYONG LEE & YANG SEOK CHO, *Korea University* (sponsored by Gregory Francis)—The Simon effect is evident only when the previous trial is congruent, but it tends to be reversed when the previous trial is incongruent. Two experiments were conducted to investigate whether this sequential effect occurs with the vertically arrayed stimulus set and horizontally arrayed response set. In Experiment 1, in which participants responded to the color of the stimulus at the body midline, the orthogonal Simon effect was evident when the previous trial was paired in an up–right/down–left manner, whereas a reversed orthogonal Simon effect was obtained when the previous trial was paired in an up–left/down–right manner. In Experiment 2, in which participants made responses at the left, center, or right position, the orthogonal Simon effect was modulated by response position and congruency of the previous trial, additively. The results indicate that the sequential effect can occur when there is a structural overlap between the stimulus and response dimensions.

(2067)

**Differential Patterns of Dynamic Cognitive Control Revealed by Matching Sequential Stroop and Flanker Tasks.** MARK E. FAUST, *University of North Carolina, Charlotte*, KRISTI S. MUTHAUP & KATHLEEN M. GREENFIELD, *Davidson College*, & FADEL ZEIDAN, *University of North Carolina, Charlotte*—The Stroop and flanker interference tasks both require ignoring task-irrelevant information, but differ in what is filtered. The Stroop task requires filtering an irrelevant stimulus dimension at the target location (word identity during color identification), whereas the flanker task requires filtering a relevant stimulus dimension at nontarget locations (flanker identity). Dynamic changes in cognitive control have been proposed to underlie the reduction in interference effects observed in both tasks following a conflict versus a congruent trial. Do task differences in what must be filtered result in distinct patterns of trial-by-trial cognitive control? We used matched buttonpress versions of Stroop and flanker tasks that used color names (red, blue, green) to assess sequential modulation of interference effects. Our results yielded a different pattern of control for the Stroop and flanker tasks, suggesting different strategies for control over different types of task-irrelevant information.

(2068)

**Sensitivity of Lexical–Semantic Competition to Accumulation of Shared Meaning.** JARED M. NOVICK, ALEXEI SMALIY, TIMOTHY C. CLAUSNER, & HENK J. HAARMANN, *University of Maryland, College Park* (sponsored by Henk J. Haarmann)—Lexical–semantic competition and its generalization to new exemplars have been demonstrated in picture naming (Belke, 2005). The present study aimed to replicate this effect and examine its buildup across successive items. Sixteen participants named pictures of objects across repeated cycles; list items were either all from the same semantic category (homogeneous) or from different categories (heterogeneous). In consistent lists, the same set of items was used across all cycles, whereas in inconsistent lists, new items from the same category were presented during the second half of the cycles. Naming latencies were longer in the homogeneous than in the heterogeneous cycles (semantic-blocking effect), even when new same-category exemplars were presented (semantic-generalization effect). A new analysis testing the effect by item position within a cycle

revealed that the blocking and generalization effects take time to build up across positions. These findings suggest that lexical–semantic competition is sensitive to the accumulation of shared meaning.

(2069)

**Conflict-Control Processes Influence Task Performance but Not Task Choice in Voluntary Task Switching.** CATHERINE M. ARRINGTON & STARLA M. WEAVER, *Lehigh University*—Conflict-control models applied to task switching predict sequential effects resulting from strengthening of task set in the face of response conflict (Brown, Reynolds, & Braver, 2007). The present research tests the proposal that conflict-control processes that strengthen the task set on trial  $n-1$  will result in increased task repetitions on trial  $n$  in a voluntary task-switching (VTS) paradigm. Two experiments using a double registration variant of VTS, allowing for response conflict by using multivalent responses, showed the expected effect of response conflict on sequential task performance in terms of RT (i.e., a conflict adaptation effect when the task repeats). However, task choice measured in terms of switch probability was unaffected by response compatibility on trial  $n-1$ . A third experiment using compatible or incompatible flanker stimuli showed a similar dissociation between RT and choice. These results suggest that conflict-control processes may influence task performance, but not task choice.

(2070)

**Executive Function Abilities in Parkinson's Disease: Problems With Action or Using Feedback (or Both)?** SUSAN M. RAVIZZA & JOHN GOUDREAU, *Michigan State University*, MAURICIO R. DELGADO, *Rutgers University, Newark*, & SANDRA RUIZ, *Michigan State University*—Parkinson's disease (PD) is linked to problems with learning from feedback, and is attributed to impairments in forming response–outcome associations. However, these patients also show difficulty in executive control tasks in which learning is minimal and feedback is absent. It may be that problems with action selection and inhibition have an impact on both executive control and feedback-based learning. PD patients and controls performed a task-switching experiment in which action selection demands and availability of feedback were manipulated. Switch costs were greater for those with PD when action demands were high than in an equally difficult condition in which action demands were low. All of the participants had lower shift costs when feedback was presented. These results suggest that feedback can benefit performance in executive function tasks, but that the executive function deficits in PD are more likely due to problems with action selection rather than an inability to use feedback.

(2071)

**Where Tasks Collide: A Behavioral and fMRI Study of Individual Differences in Multitasking Ability.** WINSTON E. JONES, JARROD MOSS, & STEPHANIE M. DOANE, *Mississippi State University*—Multitasking is a complex cognitive process that facilitates quick and accurate completion of simultaneously presented tasks. In a behavioral study, we used a task that reliably correlates with multitasking ability in real-world situations to sort participants into two groups: low performers and high performers. The behavioral data show that performance metrics such as scoring rate, strategy strength, and ratio of immediate to delayed return to interrupted items each represent important characteristics of multitasking situations. Specifically, results suggest that the maintenance of task strategies after interruptions is vital for increased performance. We asked subsets of each group of participants to perform the same type of task in an fMRI study. The results will be discussed in terms of our hypothesis that activation levels in executive control areas (ACC/pSMA, posterior parietal, bilateral temporoparietal areas, and insula) would differ between low- and high-performance groups, specifically during task interruptions.

• SELECTIVE ATTENTION •

(2072)

**Single-Feature Preview: When It Helps Conjunction Search and When It Hinders.** ELIZABETH S. OLDS, WAFI SAOUD, TIMOTHY J. GRAHAM, & JEFFERY A. JONES, *Wilfrid Laurier University*—Olds,

Graham, and Jones (2009) presented observers with a conjunction search display that was immediately preceded by a “feature-preview” display showing one of the two relevant features of each upcoming search item. Overall, size previews produced the most facilitation (for both color/size and size/orientation conjunctions), followed by color previews (for color/orientation conjunction only); orientation previews never facilitated search, and disrupted search, in some cases. A feature preview helped search if (1) the feature that was displayed in the feature preview was easy to perceptually group and (2) the transition between the feature-preview display and the search display did not create expansion/loom/contraction signals; here, we investigated the role of such visual transients by roughly equating these across conditions (i.e., inserting a blank screen in between the two displays). The overall pattern of results was the same as Olds et al. (2009) found without a blank screen between feature preview and search display.

(2073)

**Target-Colored Distractors Attract Feature Attention.** KATHERINE S. MOORE, MELANIE SOTTILE, ELISE F. DARLING, & DANIEL H. WEISSMAN, *University of Michigan*—Much evidence indicates that a target-colored distractor attracts spatial attention to its location. Here, we investigated whether a target-colored distractor also attracts feature attention toward the target-defining color (e.g., red) that is signaled by the distractor. Study participants identified target letters presented in any of three possible colors (e.g., orange, green, and purple) within a central rapid serial visual presentation (RSVP) stream. Critically, some targets were preceded by two target-colored distractors: one in the central RSVP stream, whose color matched or mismatched the target’s color, followed by a second in either of two peripheral RSVP streams, whose color always differed from that of both the central distractor and the target. As predicted, a target letter was much more likely to be correctly identified when its color matched the central distractor’s color than when it did not. Thus, target-colored distractors appear to attract feature as well as spatial attention.

(2074)

**The Interactive Aftereffects of Spatial Cuing and Attentional Selection.** HSUAN-FU CHAO, *Chung Yuan Christian University*—After a target has been selected, it takes more time to respond to the location of the distractor. This is termed the location negative priming (location NP) effect. Recent studies indicate that a response to the location of the previously selected target is slowed as well. Such a finding is similar to the phenomenon of inhibition of return (IOR). This finding raises the possibility that location NP and IOR can be attributed to the same mechanism. The present study combined a spatial cuing task with a location NP task to investigate whether these two phenomena share a common process. The results showed that IOR interacted with the cost of target-to-target repetition and did not interact with location NP. This finding suggested that the cost of target-to-target repetition and location NP should be attributed to different processes. In addition, it may be premature to conclude that location NP and IOR share a common mechanism.

(2075)

**How Top-Down Is Contingent Capture?** ARTEM V. BELOPOLSKY, DANIEL SCHREIJ, & JAN THEEUWES, *Vrije Universiteit Amsterdam*—The present study tested the boundary conditions of the contingent capture hypothesis of Folk et al. (1992). Rather than keeping the target (onset or color) fixed over a whole block of trials (as is traditionally done with contingent capture experiments), we informed participants on each trial about what the target would be on the upcoming trial. If, as is claimed by the contingent capture hypothesis, top-down attentional set determines which features capture attention, then one would expect that only features that match the top-down set would capture attention. In several experiments, we show that even though participants knew what the target would be on the upcoming trial, often both relevant and irrelevant features captured attention. When participants were forced to adopt the required top-down set, irrelevant cues were suppressed, suggesting that top-down control might operate through disengagement of attention from the location of a feature that does not match top-down goals.

(2076)

**Attentional Uncertainty in the Stroop Priming Task.** BRANDY N. JOHNSON, *Iowa State University*, & SHARON A. MUTTER, *Western Kentucky University* (sponsored by Sharon A. Mutter)—There is extensive evidence that structures in the anterior attentional system (i.e., dorsolateral prefrontal cortex and anterior cingulate) are susceptible to normal aging processes, whereas structural changes in the posterior attentional system are minimal. Using the Stroop priming task, we investigated whether reducing the involvement of the anterior attentional system by precuing the location of the target stimulus would eliminate age differences in interference. Older adults continued to be susceptible to interference when the location cue was ambiguous or invalid, but were less susceptible when the target location of a stimulus was presented with a valid cue.

(2077)

**Distractor Conflict and Intensity Mediate the Negativity Bias in a Face-Word Emotional Stroop Task.** DENISE L. EVERT, MARGARET R. BAUER, & PATRICIA SHEEHAN, *Skidmore College* (sponsored by Mary Ann Foley)—We assessed interference from distracting faces in a word-processing task (report the color ink of a word) and distracting words in a face-processing task (report the frame color) to evaluate the effects of distractor conflict and intensity. Conflict was low (when an emotional distractor was paired with a neutral target) or high (when an emotional distractor was paired with an emotional target of a different valence). Intensity of the nontarget distractor was also either low or high. The results indicated that interference was found only in the word-processing task. Negative faces interfered with reporting word ink color only under conditions of high conflict, and this interference was more pronounced with higher intensity negative facial expressions. Positive faces did not interfere under either conflict or intensity condition. The results suggest that the negativity bias is mediated by conflict and intensity and that there are conditions under which this bias can be inhibited. Implications for coping with interference from intrusive information are discussed.

(2078)

**Object-Based Maintenance of Attentional State in Rapid Serial Visual Presentation.** ATSUNORI ARIGA, *University of Illinois, Urbana-Champaign*, JUN-ICHIRO KAWAHARA, *AIST*, & KATSUMI WATANABE, *University of Tokyo/ERATO, Japan Science and Technology Agency/AIST* (sponsored by Jun-ichiro Kawahara)—The visual system dynamically modulates attention to identify a target embedded in a rapid sequence of nontargets. Typically, target identification accuracy increases as the number of preceding items increases and is kept heightened as the sequence continues. Our previous study showed that inserting a gap of 1,000 msec in the sequence reset the enhanced state of attention. The present study investigated the conditions with which the attentional state would be maintained even with the temporal gap. We found that the attentional state was maintained when the temporally separated sequences were encapsulated by a continuous sequence of random dots. In the following experiments, we systematically manipulated the spatiotemporal configurations of random dots and found that the attentional state could be maintained as far as the object continuity is maintained.

(2079)

**Fixation Patterns Predict Old/New Recognition for Young and Older Faces.** YI HE, NATALIE EBNER, & MARCIA K. JOHNSON, *Yale University* (sponsored by Marcia K. Johnson)—Using eyetracking, young and older participants’ fixation patterns were examined during incidental encoding of neutral young and older faces. Later old/new recognition was better for own-age than for other-age faces in young and older participants. In overall scan patterns, there was an interaction between the age of the faces and the age of the participants, in that both young and older participants spent more time scanning own-age in comparison with other-age faces. Comparing fixation patterns in lower versus upper halves of faces, all of the participants fixated longer on upper halves of young faces in comparison with older faces. In addition, longer scanning time for lower halves of faces predicted successful face recognition later.

The results are discussed in the context of attention and memory biases (e.g., own-age bias) in face processing in adults of different ages.

(2080)

**Perceptual Adaptation in Time–Event Specific Preparation.** RO-LAND THOMASCHKE, ANDREA KIESEL, & JOACHIM HOFFMANN, *University of Würzburg* (sponsored by Marco Steinhauser)—According to a recent study, individuals are able to rapidly adapt their behavior to redundancies in time–stimulus distributions, in the sense of responding faster to frequent foreperiod–stimulus combinations than to less frequent ones. The present study aims at determining which aspects of cognitive processing are responsible for this adaptation phenomenon. In three 2AFC experiments, participants had to respond to either the form of a stimulus, to its orientation, or to a combination of both features. In each experiment, one of the responses was required more frequently after a long foreperiod (1,600 msec), whereas the other one was correlated with a short foreperiod (600 msec). Reaction times and error rates indicate that participants adapted to these time–stimulus redundancies only when form or orientation alone were relevant, but not in the combined condition. The results suggest that time–event specific preparation is due to the adaptation of perceptual and central mechanisms rather than motor ones.

(2081)

**Unique Sudden Onsets Capture Attention Even When Observers Are in Feature-Search Mode.** MATTHEW R. YANKO & THOMAS M. SPALEK, *Simon Fraser University*, PAOLA POIESE, *University of Trento*, & VINCENT DI LOLLO, *Simon Fraser University*—Two sources of attentional capture have been proposed: exogenous (stimulus bound) and endogenous (goal oriented). A resolution between these opposing views has not been straightforward. Even such a clearly exogenous event as the sudden onset of a stimulus can be said to capture attention endogenously if observers operate in singleton-detection mode rather than feature-search mode (Bacon & Egeth, 1994). In three experiments, we show that a unique sudden onset captures attention even when observers are in feature-search mode. The displays were RSVP streams of differently colored letters, with the target letter defined by a specific color. Distractors were four #s, one of the target color, surrounding one of the nontarget letters. Capture was substantially reduced when the onset of the distractor was not unique because it was preceded by other gray distractors in the RSVP stream. This is unambiguous evidence that attention can be captured both exogenously and endogenously within a single task.

(2082)

**Assessing the Boundaries of the Attentional White Bear Phenomenon.** AYA LAHAV & YEHOSHUA TSAL, *Tel Aviv University* (sponsored by Yonatan Goshen-Gottstein)—Failures of selective attention may be explained by the attentional white bear (AWB) hypothesis (Tsal & Makovski, 2006), maintaining that prior knowledge of distractor location causes attention to be allocated to it. The AWB effect is demonstrated in a flanker task that includes infrequent trials comprised of two simultaneous dots embedded among flanker trials. The dot at the expected distractor location is perceived as appearing before the dot at the expected empty location, indicating that attentional resources are allocated to expected distractor locations. We sought to uncover the boundaries of the effect by setting sensory, perceptual, and memory constraints on the flanker task. The AWB effect was not altered when each constraint was added alone, but it disappeared when sensory and memory constraints were combined. We propose that a process-all mechanism guides attention to expected locations of all stimuli and that it is minimally influenced by task demands and available resources.

(2083)

**Subsequent Distractibility Suppressed by Thought Suppression.** DONALD J. TELLINGHUISEN, *Calvin College*—Effects of exercising self-control on the performance of a next task have been studied in various task domains. For example, in Muraven, Tice, and Baumeister (1998), participants instructed to not think about a white bear quit a subsequent, unrelated anagram-solving task sooner than participants

with no thought restrictions. In an initial study to explore how thought suppression influences a basic attention task, we measured effects of auditory distractors while participants performed a visual search task varying perceptual load. Participants first performed a set of the attention task trials and then verbally reported all conscious thoughts for 5 min. Half of the participants were required to not think about white bears (thought suppression condition). Finally, all participants performed the attention task again. Thought suppression condition participants had smaller distractor effects in the high load condition than did participants in the nontought suppression condition on the second performance of the attention task.

(2084)

**Stimulus-Dependent Effects of Involuntary Attention on Perception.** DIRK KERZEL, *University of Geneva*—There is general consensus that task-irrelevant peripheral cues shorten reaction times to subsequent target stimuli. However, it is a matter of debate whether perceptual accuracy is also affected. In a large number of cuing studies, a target grating was presented together with a highly similar distractor grating. It was reported that peripheral flashes enhanced the perceived contrast of the cued grating and improved judgments of grating orientation. Contrary to those reports, we show that effects of involuntary attention on perceptual accuracy depend on the type of stimulus. No effects of involuntary attention occurred when observers judged small differences in the orientation of faintly visible gratings. In contrast, improvements of perceptual accuracy did occur when observers judged highly discriminable forms that were presented for only a very short duration and masked. We conclude that involuntary shifts of attention speed up perception, but do not enhance spatial resolution.

(2085)

**When Categories Collide: Interference Effects in Gist Processing.** KARLA K. EVANS & JEREMY M. WOLFE, *Brigham and Women's Hospital and Harvard Medical School* (sponsored by Helene Intraub)—Observers can report on semantic content of scenes presented for milliseconds amid masks. Under these conditions, few objects can have been selectively attended. How nonselective is this nonselective processing? We cued observers with one of nine target categories (e.g., beach, animal, bridge) before presenting a scene for 20 msec in a stream of masks. Targets were present on 50% of trials. Critically, on half of target-present trials, an uncued target category was also present. That is, “beach” would be cued but the scene might include both beach and animal—a target category on other trials. On trials containing only a cued target, observers were 76% correct. When a trial-irrelevant category was also present, however, performance dropped to 52% correct. Apparently, observers can activate multiple templates at once. Indeed, here, they seem unable to avoid it. When two possible targets are present in these brief presentations, they interfere destructively.

#### • HUMAN LEARNING AND INSTRUCTION •

(2086)

**Training and Transfer of an Artificial Grammar.** MICHAEL D. YOUNG, ALICE F. HEALY, & LYLE E. BOURNE, JR., *University of Colorado, Boulder*—Subjects were trained in one of two finite-state five-consonant artificial grammars. During acquisition, they saw 17 exemplar grammatical strings, each 3–8 letters long. The strings were shown for 200 msec/letter. Subjects typed each string, and presentation and typing continued until the subjects responded correctly. A test, containing 30 new strings (15 grammatical and 15 ungrammatical), followed acquisition, when subjects indicated whether a given string was grammatical and gave a confidence rating. Subjects completed acquisition and testing 1 week later with new consonants and either the same or the alternate grammar. Using the same grammar in the second session reduced the number of typing attempts. However, at test, in the second session there were no improvements from using the same grammar in accuracy, confidence, or correct response time. Thus, artificial grammar learning was evident only when subjects were not explicitly instructed to base their responses on the artificial grammar.



(2087)

**Adaptive Sequencing in Perceptual Learning.** EVERETT W. METTLER & PHILIP J. KELLMAN, *UCLA* (sponsored by Philip J. Kellman)—In perceptual learning (PL), learners come to extract distinguishing features of categories across a series of classification trials, enabling transfer to novel instances. Little is known about practice schedules that optimize this type of PL, nor their relation to laws of learning for factual items. We tested an adaptive algorithm for PL that arranged spacing for categories as a function of the individual learner's trial-by-trial accuracy and reaction time. We taught participants to classify images from 12 butterfly genera. Participants received (1) random presentation, (2) adaptive sequencing, or (3) adaptive sequencing with sets of three sequential category exemplars (miniblocks). Learning efficiency (accuracy per learning trials invested) was reliably greater for adaptive sequencing. Effects persisted over a 1-week delay and were larger for novel items. The results suggest that adaptive sequencing increases the rate of learning and novel transfer—key components of PL and fundamental aspects of learning in many domains.

(2088)

**Keeping an Eye on the Spatial Contiguity Principle.** CHERYL I. JOHNSON & RICHARD E. MAYER, *University of California, Santa Barbara*—Forty-four participants had their eye movements recorded while viewing a short multimedia presentation about how car brakes work. Half of the participants viewed a separated presentation, in which the words and pictures were presented far away from each other on the screen, whereas the other half viewed an integrated presentation, in which words and pictures were presented close to one another. Previous multimedia learning research has shown that performance on retention and transfer tests is higher for those who receive an integrated presentation, a finding researchers call the spatial contiguity effect (Moreno & Mayer, 1999). In the present study, the eyetracking analysis showed that individuals in the integrated condition made significantly more eye movements between the pictures and text in comparison with those in the separated condition ( $d = 1.50$ ). The results are explained by the cognitive theory of multimedia learning (Mayer, 2009).

(2089)

**Causal Reasoning in Pedagogical Settings.** PATRICK SHAFTO, *University of Louisville* (sponsored by John D. Coley)—Much of human learning takes place in pedagogical settings, settings in which there is a person who chooses data for the purpose of teaching someone else a concept, and this has been argued to be an important difference between humans and other animals. I will present a computational model of pedagogical reasoning, which formalizes the problem and explains when and how teaching can facilitate learning. I will present the results of a teaching experiment in which participants chose interventions to teach someone the latent causal structure among sets of three variables. I will also present the results of a learning experiment contrasting data from pedagogically and randomly chosen interventions. The results show that the pedagogical model predicts which interventions people choose, and that in learning situations in which the data are ambiguous or surprising, learners use knowledge about the pedagogical nature of the data to guide inferences.

(2090)

**Virtual, Relatively Unfamiliar Environments and the Method of Loci: Significantly Worse or Equivalent to Traditional Approaches?** ERIC L. LEGGE, ENOCH NG, & JEREMY B. CAPLAN, *University of Alberta* (sponsored by Douglas S. Grant)—The method of loci (MoL) is an ancient mnemonic used to aid memory recall by placing ideas within an imagined environment and imagining navigating the environment to recall the material in order. We investigated the strengths and weaknesses of the MoL in its conventional form as well as asking participants to learn a virtual environment and use it as the basis for their MoL strategy. Our results suggest that the virtual variant of the MoL can function almost as effectively as its traditional counterpart. Thus, a high degree of environmental familiarity was not required to use the MoL efficiently. Also, both MoL variants did not seem particularly specialized for concrete lists or particularly susceptible (or resilient) to proactive interference. Finally,

we assessed participants' compliance in using the MoL as instructed and found that there was a large degree of individual variability in comparison with a different imagery-based mnemonic (the link method).

(2091)

**Effects of Presentation Order During Training to Follow Navigation Instructions.** VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado, Boulder*, IMMANUEL BARSHI, *NASA Ames Research Center*, & BLU MCCORMICK & LYLE E. BOURNE, JR., *University of Colorado, Boulder*—In what order should conditions varying in difficulty be presented during training? Subjects were trained to follow navigation instructions for movement in grids on a computer screen simulating a 3-D space. They repeated and then followed the instructions by mouse-clicking on the grids. They were trained, given a short distractor task, and then tested. Messages varied from one to six commands. Three groups differed in the order of message lengths during training: ascending (short to long), descending (long to short), and mixed (all lengths intermixed pseudorandomly), with all groups tested on all lengths in the mixed format. At test, there were no effects of training condition for short lengths, but performance was best with descending training for long lengths. This result is inconsistent with previous reports concerning the advantages of errorless learning (easy to difficult) but is consistent with previous reports concerning the advantages of initial training with complexity (difficult to easy).

#### • METAMEMORY/METACOGNITION •

(2092)

**Structural Knowledge About Inaccessible Target Words During TOTs.** ALAN S. BROWN & CHRISTOPHER N. BURROWS, *Southern Methodist University*—Prior research indicates that structural aspects of target words (letters, syllables) are available during tip-of-the-tongue (TOT) experiences. Laboratory support is often based on selective reporting, potentially exaggerating the incidence of such availability. To eliminate selectivity, we assessed target word partial knowledge on every trial in which retrieval was unsuccessful. Although it was most accurate during TOTs (35% above chance), first-letter recognition also occurred when the target word was rated as unfamiliar, vaguely familiar, and moderately familiar (10%, 14%, 23% above chance). The utility of alphabet search was supported: Correct letter selection precipitated target word retrieval most often during TOTs (23%), with no difference among lesser confidence levels (4%, 6%, 12%). Syllable number information is weak, and evident only on TOT and moderately familiar trials (5% above chance). Recognition was higher following correct (vs. incorrect) first-letter selection, raising methodological concerns about recognition tests with designs requesting partial TOT target word information.

(2093)

**Error Prevalence Affects Detection in the Moses Illusion Paradigm.** ANDREA N. ESLICK, *Duke University*, HAYDEN C. BOTTOMS, *University of Nebraska*, & ELIZABETH J. MARSH, *Duke University* (sponsored by Ian G. Dobbins)—The Moses illusion occurs when participants fail to detect semantic errors in questions and instead answer them as if they were correct (Erickson & Mattson, 1981). For instance, participants might answer the question "How many animals of each kind did Moses take on the Ark?" with "Two," despite knowing that Noah, not Moses, built the Ark. A correlation among published articles suggests that the frequency of errors affects participants' error detection; that is, if errors are more prevalent, detection ability increases. The present experiment directly manipulated this relationship and further examined whether failure to detect errors affected performance on later general knowledge tests. The results suggest that error prevalence affects participants' error detection: Detection increases when errors are common. Furthermore, failing to detect errors has negative consequences on later general knowledge tests: Participants are more likely to produce the misleading answer (e.g., Moses) if they previously failed to detect the error.

(2094)

**Aging, Abilities, and Effective Monitoring of Part-Set Cueing Interference.** EDWARD T. COKELY, *Max Planck Institute for Human*



*Development*, & AINSLEY L. MITCHUM, *Florida State University*—When a subset of studied items is presented at retrieval, large and “surprising” interference effects can result. Recent research indicates that in certain situations, and with some practice, young adults can effectively monitor interference at retrieval during part-set cuing (Rhodes & Castel, 2008). The present studies investigate the relations between abilities, aging, strategies, and effective monitoring. Despite evidence that normal aging tends to be associated with increased memory interference, research on the relationship between aging and part-set cuing interference is mixed. Experiment 1A demonstrated that when participants were instructed to use associative encoding strategies, older adults tended to produce robust interference effects (Cokely, Kelley, & Gilchrist, 2006). Experiment 1B demonstrated that following practice, older adults accurately judged the impact of retrieval cues. Monitoring and strategy efficacy was independent of basic abilities (speed of processing, working memory). The roles of individual differences and strategies in effective monitoring and interference control will be discussed.

(2095)

**Illusory Memory Expectations Can Reduce False Recognition Errors.** IAN M. McDONOUGH & DAVID A. GALLO, *University of Chicago* (sponsored by David A. Gallo)—People make fewer false recognition errors when searching memory for distinctive as opposed to nondistinctive stimuli. These effects have been attributed to the distinctiveness heuristic—a retrieval monitoring strategy used when people expect distinctive recollections. In the present study, we tested the idea that retrieval expectations are critical for this heuristic, using a font size manipulation that creates an illusion of memorability without a corresponding difference in actual recall (Rhodes & Castel, 2008). Replicating the size illusion, we found that subjects expected to remember large words more than small words (via judgments of learning), with no differences in true recollection on subsequent memory tests. Critically, though, these faulty memorial expectations were sufficient to elicit false recognition suppression: False recognition was reduced when subjects searched memory for large in comparison with small words. These experiments demonstrate the central importance of memorial expectations in retrieval monitoring, decoupling these effects from actual memory differences.

(2096)

**Judgments of Forgetting Show Improved Calibration but Impaired Relative Accuracy on a Second Study–Test Trial.** BENJAMIN D. ENGLAND & MICHAEL J. SERRA, *Texas Tech University*—In a recent study, immediate judgments of learning (JOLs) framed in terms of forgetting demonstrated better calibration on a single study–test trial than did JOLs framed in terms of remembering (Finn, 2008). The present study examined whether a similar improvement would occur on a second study trial, when remember-framed JOLs are typically underconfident (UWP effect). In contrast to earlier results, judgments of forgetting in the present study demonstrated worse calibration on Trial 1 than did judgments of remembering. On Trial 2, however, judgments of forgetting demonstrated better calibration than did judgments of remembering. Inaccurate calibration for both judgment types can be explained by anchoring (Scheck & Nelson, 2005), with the two judgment types utilizing different anchors on the JOL scale. In addition, judgments of forgetting had worse relative accuracy than did judgments of remembering on Trial 2 and relied less on predictive memory cues (i.e., memory for past test).

(2097)

**On the Effectiveness of Self-Paced Learning.** JONATHAN G. TULLIS & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign* (sponsored by Duane Watson)—Metacognitive monitoring and control must be accurate and efficient in order to allow self-guided learners to improve their performance. Yet few examples exist in which allowing learners to control learning leads to higher levels of performance than does restricting learners’ control. Here, we investigate the consequences of allowing learners to self-pace study a list of words for later recognition of those words, and show that learners with control of study-time allocation significantly outperformed subjects with no control, even

when the total study time was equated between groups. The self-pacing group also outperformed a group for which study time was automatically allocated as a function of normative item difficulty. The advantage of self-pacing was apparent only in subjects who utilized a discrepancy reduction strategy—those who allocated more study time to normatively difficult items. Self-pacing of study can improve memory performance, but only when appropriate allocation strategies are used.

(2098)

**Overconfidence Versus Underconfidence in the Classroom: Exploring Differences in Metacognitive Calibration.** ANTHONY J. RYALS, AMANDA E. SENSENIG, KIMBERLY L. HENRY, & MATTHEW G. RHODES, *Colorado State University* (sponsored by Carol Seger)—Students are notoriously poor at predicting their own academic performance. Prior research indicates that higher performing students tend to be better calibrated and underconfident, whereas lower performing students are poorly calibrated and overconfident (Hacker et al., 2000). We replicated and extended these findings in an Introductory Psychology student sample and explored individual differences in high- versus low-performing students in relation to calibration accuracy. Students predicted and postdicted exam performance over one term and completed inventories indexing self-efficacy, attributions, and fluid intelligence. Consistent with the prior literature, high performers were better calibrated than were low performers. Additionally, students anchored present judgments on past judgments rather than on actual performance. The results suggest that students can improve accuracy over time and that calibration error is highly predictive of performance in overconfident but not underconfident students. Finally, we present a novel approach to assessing individual differences in classroom metacognition in relation to knowledge and confidence.

(2099)

**Illustrations Enhance Reading Comprehension—Or Do They?** RAKEFET ACKERMAN & DAVID LEISER, *Ben-Gurion University of the Negev*—Aiming to explore a heuristic basis for the sense of understanding (SOU), this study introduces concreteness-of-learning materials as a cue that might mislead learners. Undergraduate students studied expository texts (300–600 words) and were tested for comprehension. The texts were presented in either a plain version, or in a concreteness-enhanced version containing illustrations intentionally irrelevant to content processing. The participants rated their SOU before being tested. SOU was biased upward by the text’s concreteness, whereas test performance was unaffected. The second study generalized the procedure to understanding of detailed (70–150 words) solutions for difficult logic problems. The participants rated their SOU before facing a transfer problem. Again, illustrated texts did not improve performance. SOU was biased upward by concreteness only when a feeling of complete understanding was absent. These studies can help designers to minimize spurious SOU by careful choice of surface cues in the study material.

#### • WORKING MEMORY •

(2100)

**Investigating the Role of Attention in the Irrelevant Speech Effect.** EMILY M. ELLIOTT & ALICIA M. BRIGANTI, *Louisiana State University*—Sounds that are irrelevant to the current task can nonetheless be disruptive to performance. One variable that affects the magnitude of the disruptive effect of irrelevant sounds is the frequency of usage of the to-be-ignored words. Previous research manipulated the word frequency of distractor words while participants were trying to remember a list of target words (Buchner & Erdfelder, 2005). Low-frequency distractor words more negatively affected the serial recall of visually presented words, relative to high-frequency distractor words, implicating a role for attentional processes in the irrelevant speech effect (ISE). Two theories of the ISE do not explicitly acknowledge a role for attention, and these findings are difficult to reconcile within such frameworks. The present research examined both adult individual differences in working memory capacity as a potential mediator of the size of the ISE, as well as developmental differences, while manipulating word frequency of the distractors.

(2101)

**Modeling Interactions Between Interference and Decay During the Serial Recall of Temporal Sequences.** JARED SYLVESTER, SCOTT WEEMS, JAMES REGGIA, MICHAEL F. BUNTING, & J. ISIAH HARBISON, *University of Maryland, College Park*—We studied a simple computational model of short-term memory for temporal sequences in which both interference and decay limit memory capacity. Our model is a recurrent Hebbian neural architecture that uses oscillatory attractors to represent stored stimuli. Multiple stimuli can be retained using the same neural substrate because the network's state repeatedly switches between them. We collected behavioral data from human subjects performing running memory span tasks and found that the model can match the memory capacity and position-specific recall rates that we observed. Adjusting just one parameter (weight decay rate) produces shifts in the model's recall rates that resemble those seen in our behavioral data. Using temporally asymmetric learning strongly biases stimuli recall to occur in the same order as presented. We conclude that some basic behavioral properties of human short-term memory (limited capacity, recency effect, shifts in position-specific recall) can be captured by a surprisingly simple oscillatory model.

(2102)

**Serial Recall and the Phonological Neighborhood Clustering Coefficient.** KIT YING CHAN & MICHAEL S. VITEVITCH, *University of Kansas*, & STEVEN ROODENRYS, *University of Wollongong*—Clustering coefficient (C) refers to the proportion of phonological neighbors of a target word that are also neighbors of each other. *Bat*, *hat*, and *can* are neighbors of the word *cat*, but the words *bat* and *hat* are also neighbors of each other. In a serial recall task, participants heard a list of six words, and were asked to recall those words in the order they were presented. Half of the trials consisted of high C words. The remaining trials consisted of low C words. Crucially, all the stimuli were comparable with regard to word frequency, neighborhood density, and other relevant variables. Participants correctly recalled more words from the lists containing high C words than from lists containing low C words, suggesting that redintegrative processes are aided by the reservoir of lexical activation found among words with high C.

(2103)

**Semantic and Phonological Effects on Working Memory for Binding Information Between Paired Associates.** MICHAEL D. PATTERSON, *Nanyang Technological University*—Working memory for lists of unrelated items is generally stored in a phonological form. On the contrary, we propose that working memory for binding information relies strongly on semantic knowledge in long-term memory (LTM). We created paired associates that varied in the degree to which they were rated as matching or nonmatching pairs. After viewing 2–4 briefly (1.5 sec/pair) presented paired associates, participants immediately selected the associate that was linked with the probe earlier in the trial. In this task, memory was only required for associations between items and not for the individual items. Participants identified high-match associates significantly more accurately than low-match associates. Phonological similarity had only a small effect on accuracy. Instead, the degree of expected semantic groupings was most predictive of performance. We propose that, when possible, LTM is used to quickly classify and chunk perceived information into groups, occasionally leading to false binding memories.

(2104)

**Phonological Similarity Effects in Simple and Complex Memory Span Tasks.** BROOKE N. MACNAMARA, ADAM B. MOORE, & ANDREW R. A. CONWAY, *Princeton University* (sponsored by Andrew R. A. Conway)—The phonological similarity effect, which refers to better recall of phonologically distinct items relative to phonologically similar items, is a benchmark finding in the study of short-term memory. Literally hundreds of experiments have been conducted on the phonological similarity effect, and several theoretical accounts of the findings have been proposed. However, phonological similarity effects in complex span tasks, such as the reading span task, have received less attention, which is surprising, because some investigators have found that phonologically similar items are actually recalled better than

phonologically distinct items in complex span tasks (e.g., Copeland & Radvansky, 2001). Here, we report a series of new experiments exploring phonological similarity effects in simple and complex span tasks and provide a novel theoretical account of previous and current findings.

(2105)

**Serial and Parallel Memory Retrieval Under a Magnifying Glass of the Systems Factorial Technology.** MARIO FIFIC, *Max Planck Institute for Human Development*, & JAMES T. TOWNSEND, *Indiana University, Bloomington* (sponsored by Jonathan D. Nelson)—A growing methodology, known as the systems factorial technology (SFT), is being developed to diagnose whether processes are organized in serial or parallel mental architectures, and whether a stopping rule is exhaustive or self-terminating. Diagnostic power is achieved by utilization of the survivor interaction contrast function (SIC), which analyzes distributions of choice reaction times in a parameter-free manner. The results from a short-term memory experiment, involving four memorized items, revealed striking individual differences: Some subjects were identified as relying on parallel processing, whereas others primarily relied on serial processing. We also revealed a hybrid form of the serial and parallel processing, contingent on a searched item's position in a memory set. This finding is in contrast to many contemporary theories, which assume purely serial or parallel architectures. The fine-grained assessment of individual differences calls for SFT application in cognitive and clinical psychology and potentially in cognitive neuroscience.

(2106)

**How Low Can You Go? Deeper Processing Protects Against Interruption Effects.** HELEN M. HODGETTS, JOHN E. MARSH, THOMAS S. COWELL, & DYLAN M. JONES, *Cardiff University* (sponsored by Dylan M. Jones)—Interruptions increase errors and omissions in primary task performance, and the present experiment investigates how deeper processing may help protect against interruption effects. Participants counted vowels or rated the pleasantness of words on 32-item lists (each comprising four semantic categories, randomly presented). On some trials, participants were interrupted four times to complete a short number shadowing task. Written free recall after each list showed that more words were recalled following deep than following shallow processing, but also that interruption only impaired performance in the “counting” and not the “pleasantness” conditions. Deeper processing allows access to the semantic features of words, promoting better semantic organization (as shown by higher clustering scores) and thus a more efficient retrieval search. Furthermore, activation of semantic features provides more cues associated with each item, which in turn primes retrieval and helps overcome interruption.

(2107)

**A Close Examination of Distraction in Spatial Memory: Mapping of the Sandwich Effect.** KATHERINE GUÉRARD & SÉBASTIEN TREMBLAY, *University of Laval*, & JEAN SAINT-AUBIN, *University of Moncton*—In serial memory, performance is impaired when distractors are interpolated between to-be-remembered (TBR) stimuli. The so-called sandwich effect was investigated with TBR stimuli distributed in space and time, and eye movement was monitored in order to characterize the processes involved in serial memory for spatial information. Black dots were presented sequentially at different locations on the computer screen. Participants had to recall the sequence in the same order in which it had initially been presented. In some trials, to-be-ignored blue dots were presented after each TBR location. Our results show that memory representations of the TBR locations tend to shift toward the location of the distractors. This deviation is related with the participants' tendency to move their eyes toward the distractor location. This pattern of results suggests that TBR and to-be-ignored locations are encoded onto a common map and that such a map may well lie in the oculomotor system.

(2108)

**Individual Differences in Task Switching During Episodic and Semantic Retrieval.** GUNES AVCI & JESSICA M. LOGAN, *Rice University*—Working memory capacity (WMC) plays a pivotal role in

simple cognitive processes (e.g., attentional control) as well as in complex cognitive processes (e.g., problem solving). In this study, the effect of WMC on task-switching performance in a category-generation task that relied on either episodic or semantic memory was investigated. Participants recalled the categorical words that were presented beforehand (episodic task) or generated categorical words on the basis of their own knowledge (semantic task). Participants worked on either one category (single task) or two categories (double task) at a time, yielding four experimental groups: semantic single task, episodic single task, semantic double task, or episodic double task. The effect of WMC was observed only in the episodic double-task group, such that participants with higher WMC recalled more words in the double-task condition than did those with lower WMC. The results are discussed in terms of how individual differences in WMC might affect retrieval from episodic versus semantic memory systems.

• IMPLICIT MEMORY •

(2109)

**Temporal Dynamics of Reinstatement During Episodic Retrieval: Combining ERPs and Pattern-Classification Analyses.** JEFFREY D. JOHNSON, BRIAN R. MINTON, & MICHAEL D. RUGG, *University of California, Irvine*—Episodic memory retrieval is thought to involve reinstatement of the cognitive and neural processes engaged during encoding. Recent fMRI studies have supported this hypothesis by demonstrating that content-specific encoding effects overlap with analogous retrieval effects. However, the precise temporal resolution of reinstatement remains unclear. The present study addressed this issue by applying pattern-classification methods that have been previously validated with fMRI to ERPs. Subjects studied words in one of two encoding tasks and then completed a recognition memory test. Pattern classifiers were trained to discriminate between the encoding tasks based on study-phase ERPs, and were then validated on test-phase ERPs. The classifications demonstrated that the prior encoding history of test items could be accurately determined, providing evidence that encoding-related patterns were reinstated during retrieval. Crucially, the ERP data provided novel evidence about the within-trial dynamics of reinstatement. We additionally explored methodological issues surrounding the application of pattern-classification analyses to ERPs.

(2110)

**Recognition and Priming Under Midazolam.** LINDSAY W. VICTORIA, LYNNE M. REDER, & JANINE M. DUTCHER, *Carnegie Mellon University*, & HOWARD J. AIZENSTEIN, JOSEPH J. QUINLAN, & FERENC GYULAI, *University of Pittsburgh* (sponsored by Lynne M. Reder)—Midazolam is a benzodiazepine that creates temporary anterograde amnesia. The drug is a useful tool for studying human memory in an impaired state and eliminates the need to use patients with clinical amnesia. Midazolam inhibits the binding of memories to contextual information within an experimental setting. Previous research suggested that priming effects remain intact under the influence of the drug (Hirshman et al., 2001). The present study investigates the relationship between priming effects and subsequent recognition under midazolam in comparison with a saline control. This study tests a theory that familiarity-based recognition judgments and priming depend on the same memory representation. We consider two different types of priming effects: conceptual and perceptual priming. The findings indicate that priming effects differ under midazolam and saline, as well as for these two types of repetition priming. The present study also investigates the relationship of the size of the priming effects to subsequent recognition.

(2111)

**Implicit Sequence Learning Is Represented by Stimulus–Response Rules.** HILLARY SCHWARB & ERIC H. SCHUMACHER, *Georgia Institute of Technology*—For nearly two decades, researchers have investigated spatial sequence learning in an attempt to identify what specifically is learned during sequential tasks (e.g., stimulus order, response order, etc.). Despite extensive research, controversy remains concerning the information processing locus of this learning effect. There are three main theories concerning the nature of spatial sequence

learning, corresponding to either the perceptual aspects, motor aspects, or perceptual–motor associations (stimulus–response, S–R, rules) required for successful task performance. The present data investigate this controversy and support the theory that S–R rules are critical for sequence learning. The results from two experiments demonstrate that sequence learning is disrupted only when the S–R rules for the task are altered during the experiment. When the S–R rules remain constant or only a minor transformation of the S–R rules is required, significant sequence learning emerges. These data implicate spatial response selection as a likely mechanism mediating spatial sequential learning.

(2112)

**Diminutives Are Easier to Remember Than Simplex Nouns.** VERA KEMPE, *University of Abertay, Dundee*, & PATRICIA J. BROOKS & ANNEMARIE DONACHIE, *College of Staten Island, CUNY*—Previous research has demonstrated that diminutives (e.g., Russian: *domik* or *svechka*) can facilitate the learning of complex inflectional systems. An advantage in learning gender agreement for diminutive nouns was shown for Russian in L1 and L2 learners and for Lithuanian in L1 learners. Similarly, a diminutive advantage was found for Serbian, Russian, and Polish in L1 learners inflecting nouns for case marking. We attributed this advantage to the fact that diminutives constitute a homogeneous cluster of words, serving as a low-level schema for the learning of morphological regularities. In the present study, we replicate these findings for the simultaneous learning of Russian gender and case marking in L2 learners. Also, for the first time, we demonstrate an advantage for diminutive nouns in incidental vocabulary retention. We suggest that diminutive derivations benefit word learning because increasing the invariant parts of words reduces the amount of phonological material to be memorized.

(2113)

**The Role of Working Memory in Artificial Grammar Learning.** MICHELLE A. HENDRICKS, CHRISTOPHER M. CONWAY, & RONALD T. KELLOGG, *Saint Louis University*—The extent to which explicit mechanisms, such as working memory, contribute to implicit learning in artificial grammar learning (AGL) tasks is still unclear. Previous studies have demonstrated that individuals use explicit exemplar-specific cues, such as chunking, in addition to implicit rule-based knowledge to make grammaticality judgments in AGL tasks. The present study attempts to determine the impact of explicit mechanisms (e.g., working memory) on implicit learning using a dual-task paradigm in a balanced chunk-strength design. It was hypothesized that a concurrent dual task utilizing working memory resources would not interfere with implicit rule-based learning, but might interfere with the encoding of exemplar-specific cues. However, the results showed that dual-task performance significantly affected neither implicit rule-based learning nor exemplar-specific learning. These results suggest that AGL may only involve implicit learning mechanisms, rather than both implicit and explicit (chunk-based) processes, as has been suggested previously.

(2114)

**Implicit Memory for Novel Associations Between Pictures: Effects of Stimulus Unitization and Aging.** IRENE P. KAN, *Villanova University and VA Boston Healthcare System*, MARGARET M. KEANE, *Wellesley College and VA Boston Healthcare System*, ELIZABETH MARTIN, *VA Boston Healthcare System*, ELIZABETH J. PARKS-STAMM, *VA Boston Healthcare System and Boston University*, LINDSAY LEWIS, *Wellesley College*, & MIEKE VERFAELLIE, *VA Boston Healthcare System and Boston University*—Studies of implicit memory for novel associations have focused primarily on verbal materials. Here, we examined whether novel associative priming extends to the pictorial domain and is modulated by perceptual unitization of stimulus pairs, as defined by physical proximity between objects. We also examined the status of such priming in aging. Using a perceptual identification task, we found that (1) perceptual unitization is not necessary for novel pictorial associative priming to emerge, although it does enhance the magnitude of priming; (2) such priming is age invariant; and (3) novel pictorial associative priming is likely to be mediated by a perceptual representation system.



(2115)

**Implicit Learning in Enumeration With a Process Dissociation Knowledge Test.** HEATHER M. MONG, BENJAMIN A. CLEGG, & CAROL A. SEGER, *Colorado State University*—We investigated the ability to learn repeating spatial information via incidental learning using an enumeration task. One repeating and one new array of each size, with each size featuring 2 to 12 identical objects, were shown per block. After 12 blocks of enumeration trials were completed, a second list was introduced, for a further 12 blocks. Explicit knowledge was assessed using Jacoby's (1991) process dissociation procedure. In the inclusion condition, participants were instructed to call an array "old" if they had seen it during the experiment. In the exclusion condition, an array was to be labeled "old" only if it was seen during List 2. Superior performance on the repeating arrays, indicative of learning, was observed. Furthermore, the results of the process dissociation procedure suggest that participants relied on familiarity processes during the knowledge test.

(2116)

**The Hippocampus and Stimulus Relations: Beyond the Declarative Memory Model.** ANTHONY J. GREENE, *University of Wisconsin, Milwaukee*—The hippocampal system binds complex associations, improving the flexibility of learning. To measure such processes, we have used tasks requiring participants to make inferences, analogies, and associations to context. Our behavioral results indicate that learning can take place without explicit awareness of task contingencies. Furthermore, our fMRI data corroborate literature suggesting that the hippocampal region is active during relational learning. Given the nature of our tasks, this supports the claim that the hippocampus encodes relations among items, but does not necessarily lead to explicit access to the learning.

(2117)

**False Memory Can Be Implicitly Discriminated From True Memory.** JERWEN JOU, *University of Texas, Pan American*—Using the Deese/Roediger–McDermott paradigm, Jou et al. (2004) found that the RT for the false recognition of the nonpresented critical words (NPCW) was significantly longer than that for hits to the studied words. This suggests that subjects might be able to discriminate the two types of memory but simply included the NPCW in the "old" category because they were using a very lenient criterion. If this is true, a much stricter criterion might exclude these nonstudied words from the "old" category. To test this hypothesis, I used a remember/know and a 10-point confidence scale in the recognition judgment in three experiments. The results indicated that the proportion of NPCW classified as "old" decreased as decision criteria became stricter, suggesting that some part of false memory is a function of decision criteria. However, even in the strictest-criterion "old" category, the RT for the NPCW was significantly longer than for the studied words. This suggested that subjects discriminated between these two memories at the implicit level.

(2118)

**Implicit False Memory in Amnesia: Incidental versus Intentional Encoding and the Collection of Verbal Reports.** ILSE VAN DAMME & GÉRY D'YDEWALLE, *Katholieke Universiteit Leuven* (sponsored by Géry d'Ydewalle)—In two studies, we investigated implicit false memory in Korsakoff patients and memory-intact controls following both incidental and intentional encoding in the Deese/Roediger–McDermott paradigm. Encoding type was manipulated within subjects. In addition, participants in Experiment 2 were asked to think aloud, in order to investigate whether conscious activation of the critical lure occurs equally often in both groups under both types of instructions, and whether this affects the likelihood of later false memory. Korsakoff patients showed normal false priming following both types of encoding. They did verbalize fewer critical lures than controls during intentional encoding, and showed impaired recognition performance. Lure verbalization was shown to contribute to explicit false memory, but had no clear effect on false priming. Together, results point to the conclusion that amnesic patients' encoding abilities are sufficiently good to obtain normal implicit false memory, and that conscious lure activation is not required to do so.

• EXPLICIT MEMORY •

(2119)

**Individual Differences in Person Perception: Mixed-Handers Have Better Memory for Counterstereotypical Information.** STEPHEN D. CHRISTMAN & MORGAN STERLING, *University of Toledo*—Mixed-handedness is associated with superior retrieval of episodic memories, arising from greater callosally mediated access to right-hemisphere-based retrieval mechanisms (e.g., Propper, Christman, & Phaneuf, 2005). There is also evidence that the right hemisphere is less prone to stereotyping in person perception (Bourgeois, Christman, & Horowitz, 1998). The present study examined memory for stereotypical versus counterstereotypical trait information. Participants were asked to form impressions of two women by studying 10 traits per woman. Half of the traits were counterstereotypical of older women and half were counterstereotypical of younger women. Moreover, half of the participants were told the women were elderly and half were not told anything (and presumably assumed the women were college aged, like themselves). Participants were then given a surprise memory test for the personality traits. Replicating previous research, mixed-handers remembered more traits overall, and this effect was driven primarily by greater recall of counterstereotypical traits.

(2120)

**Long-Term Retention of Knowledge About Friends, Family, and Unfamiliar Individuals.** 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 in comparison with even the strongest memory-enhancing techniques. This mnemonic advantage may be rooted in cognitive adaptations that improved fitness in ancestral environments. The present experiment tests an extension of these studies by examining whether participants learn and retain facts about kin better than about friends and unfamiliar individuals. Participants learned (fictitious) facts about each of the three types of relations, and were tested both immediately and after a 1-week retention interval. Participants recalled many more facts about familiar than about unfamiliar individuals and more facts about friends than about relatives during both the immediate and delayed test. However, when controlling for familiarity, there was evidence of better retention for knowledge of kin over the 1-week delay. Thus, in addition to phylogeny and fitness-based explanations, current theories must consider ontogeny and the importance of sociocultural factors.

(2121)

**Memory for Movies: Individual Differences in Susceptibility to Misinformation.** JENNIFER L. TOMES & JENA BOWES, *Mount Allison University*—Individual differences in susceptibility to postevent misinformation were examined in the present study. Participants completed a multitrial version of Loftus's misinformation procedure, as well as a series of individual difference measures (social desirability, emotional contagion, and self-esteem). The results revealed that two individual difference measures were significantly related to the amount of false postevent information accepted. Higher levels of social desirability and emotion contagion were predictive of acceptance of more false postevent information. Confidence–accuracy relations were also examined for both true and false memories.

(2122)

**Effects of Education Level and Executive Functioning in Mnemonic Strategies in Aging.** LAURENCE TACONNAT, SANDRINE VAN-NESTE, BADIÁA BOUAZZAOUI, LUCIE ANGEL, SÉVERINE FAY, & MICHEL ISINGRINI, *CNRS and University of Tours*—We explored the effects of education and executive functioning to examine the possible mediators of the effects of aging on two memory tasks and organizational strategies. The difference between these two memory tasks was the level of cognitive support provided by the presentation of the categorized word lists to memorize. The words were either presented organized by categories (high cognitive support condition, HCS<sub>c</sub>), or randomly (low cognitive support condition, LCS<sub>c</sub>). The number of words recalled was taken into



account, and further a clustering index was calculated (strategy). The results revealed (1) aging effects on all measures except on the clustering index in the HCSc and (2) that education level reduced the aging effect in the HCSc, whereas executive function mediated this effect in the LCSc and on clustering strategy in this condition. Thus, education may compensate for the effect of age when the memory task is easy, but the executive functioning is crucial to implement controlled memory tasks.

(2123)

**The Own-Age Bias: Do Teachers Show Less Bias for Child Faces?** BRENT K. JARVIS, GARNER T. PAGEL, & JEFFREY S. ANASTASI, *Sam Houston State University*—Previous studies have demonstrated that individuals recognize own-age faces better than other-age faces. This effect has been demonstrated with children, young adults, and older adults. Additional previous research has shown that this effect can be reduced in individuals who have extensive exposure to individuals of other ages. The present study evaluated the own-age bias of teachers, who have extensive exposure to children, and with undergraduate students, who do not have extensive exposure to children. Participants were required to remember faces of children, young adults, and older adults. Contrary to predictions, results indicated that experienced teachers did not show resistance to an own-age bias with children and performed similarly to undergraduates with no teaching experience or extensive experience with children. Contrary to previous studies, our data suggest that an own-age bias is not affected by contact-based interactions.

(2124)

**Textual Analysis of Written Accounts of Trauma, Identification With Trauma, and PTSD Symptoms.** JOSEPH M. FITZGERALD & CARISSA BROADBRIDGE, *Wayne State University*, DORTHE BERNTSEN, *Aarhus University*, & KENDALL SOUCIE, *Wayne State University*—Recent theory and research have explored the relationship between identification with trauma memories and PTSD symptoms. The available data support the hypothesized central role of memory for trauma in the maintenance of high levels of symptoms. Earlier studies have taken a quantitative approach and relied on participant ratings rather than memory content. Here, we report textual analysis of the responses of 100 participants asked to write detailed accounts of their most traumatic experiences and their life story. Participants also completed evaluations of their memory experiences, identification with the memory, and self-reports of PTSD symptoms. The design was crossed: 2 (levels of identification)  $\times$  2 (levels of symptoms). Analyses included the Pennebaker word count system with a specific focus on self and other reference, emotions, and action terms, as well as global ratings of coherence and other narrative properties.

(2125)

**Is the Emotional Memory Effect Due to Emotion?** STEPHEN R. SCHMIDT, *Middle Tennessee State University*—People often remember emotional words better than matched neutral words. Some have suggested that the emotional memory effect results from the emotional response to the words, whereas others have suggested that organization or distinctiveness explains the effect. To test these hypotheses, participants rated their emotional responses to target words presented in either high (Shane DIED in his car last night) or low (Shane's old car DIED last night) emotional contexts. The rating task was followed by a free recall test for the targets. In mixed lists of neutral and emotional sentences, high emotional contexts led to better memory than did low emotional contexts. However, high and low emotional contexts led to equal memory in homogeneous lists of emotional sentences. These results are more consistent with a distinctiveness interpretation of the emotional memory effect than with either the emotional response or organization interpretations.

(2126)

**What Makes an Emotional Memory Self-Defining?** CEREN C. SÖNMEZ & SAMI GÜLGÖZ, *Koç University* (sponsored by Sami Gülgöz)—Self-defining memories are vivid, affectively intense, repetitively recalled autobiographical memories that are linked to similar memories and to current goals and concerns. To verify the existence of such a distinct group of memories, we requested of 110 participants

examples of four types of memories: self-defining (SDMs), non-self-defining (nSDMs), affective and persistent (APMs), and nonaffective and nonpersistent memories (nAPMs). Analyses on 1,309 memories showed higher affective intensity, recall frequency, and importance scores for SDMs and APMs than for nSDMs and nAPMs. SDMs were considered to be a summary representation of other similar events in memory. Almost all SDMs were highly affective and persistent but most APMs were not self-defining. Further analyses indicated that importance of the event was the primary discriminating factor between APMs that were self-defining and those that were not. The results were supportive of the general framework of the self-memory system (Conway & Pleydell-Pearce, 2000).

(2127)

**Binding and Arousal in Event Memory.** HEATHER M. KLEIDER, SARAH E. CAVRAK, & LESLIE R. KNUYCKY, *Georgia State University*—Accurate event memory requires an eyewitness to bind together event elements (who and what) and maintain these bound representations in memory. Whether event valence (positive or negative) and/or emotional arousal influences memory binding and ultimately recollection remains controversial. Negative stimuli are often better remembered than positive stimuli, suggesting that valence may promote recollection. However, in most studies, the target stimuli are both valenced and arousing (i.e., taboo words), making it difficult to disentangle which factor is most important to recollection accuracy. In this study, arousal type and target event valence were both varied (positive, negative, neutral) in a fully counterbalanced design. The results suggest that memory for event detail improves with emotional arousal, but only for neutral target events. Conversely, in comparison with no arousal, arousal reduces memory for negative event details. Overall results suggest that arousal of any valence may deter binding of negative event details in memory.

(2128)

**Anger's Impact on a Lineup Recognition Task.** MICHAEL GREENSTEIN & NANCY FRANKLIN, *Stony Brook University*—Previous research has shown that anger may simplify many aspects of processing (e.g., those involved in social judgment tasks; Bodenhausen, Sheppard, & Kramer, 1994). Prior work in our lab produced corresponding effects in memory, showing that anger can increase schematic biases in source monitoring. The present work examines whether anger similarly exaggerates the use of simple memory cues when people make recognition judgments. Participants briefly saw the faces of several individuals and read corresponding descriptions. Following a mood induction, they made identifications from target-present and target-absent lineups. As predicted, mood affected some aspects of performance, including higher rates of choosing, particularly in target-absent trials. This suggests that the emotional experience of anger can alter the outcome of a recognition task, including in situations in which a real witness to a crime is attempting to identify a real perpetrator.

(2129)

**Good Quoll, Bad Quoll: Retrieval of Neutral Information Reduces Negative Affect.** GINO CAMP & JORG HUIJDING, *Erasmus University Rotterdam*—Retrieval can improve memory for retrieved information, but may impair memory for related information. This memory impairment of related information is known as the retrieval-induced forgetting effect. In the present study, we investigated whether retrieval practice may have an effect beyond the domain of memory. More specifically, we investigated whether retrieval not only leads to forgetting of related information, but also changes the affective evaluation of the object to which the information pertains. We found that repeated retrieval of neutral characteristics of previously unknown marsupials led to forgetting of emotional characteristics of these marsupials. Crucially, retrieval practice also attenuated the affective evaluations of the practiced marsupials. To our knowledge, this study is the first to demonstrate an effect of retrieval practice on affective evaluations.

(2130)

**Positive Mood and Category Structure in Memory: Separating Encoding and Retrieval.** MICHAEL F. VERDE, SARA M. MURRAY, &

ALISON L. KNIGHT, *University of Plymouth*—Positive mood broadens the scope of thinking, encouraging global processing and the use of heuristics. It has been shown to encourage the use of categories and increase rates of semantic false memories. In order to investigate its differential effects on encoding and retrieval, we manipulated mood (using positive or neutral pictures) either before or after a study list of category exemplars. In the preencoding condition, the positive mood group showed impaired recognition accuracy because of an increase in false alarms. In the postencoding condition, the positive mood group showed improved recognition accuracy because of an increase in hits. We suggest that positive mood emphasizes the encoding of gist information but encourages the use of category structure and cues at retrieval.

(2131)

**Effects of Emotion on Associative Recognition.** BENTON H. PIERCE, *Texas A&M University, Commerce*, & ELIZABETH A. KENSINGER, *Boston College*—Emotional stimuli are often remembered better than neutral stimuli (e.g., Kensinger & Schacter, 2008). We asked whether this emotional enhancement effect extends to pairs of items. Participants studied negatively valenced, positively valenced, and neutral word pairs, followed by an associative recognition test. In Experiment 1, with a short-delayed test, accuracy for intact pairs was equivalent across valences, whereas accuracy for rearranged pairs was lower for negative than for neutral and positive pairs. In Experiment 2, we tested participants after a 1-week delay and found that accuracy was greater for intact negative than for intact neutral pairs, whereas rearranged pair accuracy was equivalent across valences. These results suggest that associative memory for negatively valenced emotional items may improve over time.

(2132)

**The Effects of Emotional Valence on Intentional Forgetting.** CHELSEA K. QUINLAN & TRACY L. TAYLOR, *Dalhousie University* (sponsored by Tracy L. Taylor)—By incorporating an inhibition of return (IOR) task within the study phase of an item–method directed forgetting paradigm, the present study explored the withdrawal of attention following instructed remembering and forgetting of emotionally valenced pictures. We found that when a directed forgetting effect was present (positive and neutral pictures), there was also a significant IOR effect; however, when a directed forgetting effect was absent (negative pictures), there was not a significant IOR effect. In contrast to the within-blocks presentation of emotionally valenced pictures, we found that when only neutral pictures were presented, there was a larger IOR effect following a forget cue than following a remember cue. Therefore, these findings provide evidence of a clear link between attention and intentional forgetting and also demonstrate an effect of emotional valence on the ability to intentionally forget as well as an effect of within-blocks presentation on attention to neutral pictures.

(2133)

**The Role of Pair Familiarity in the Associative Deficit of Older Adults.** ANGELA KILB & MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia*—Although aging seems to cause relatively minor impairment in recognition memory for components, older adults' ability to remember associations between components is typically significantly compromised, relative to that of younger adults (Naveh-Benjamin, 2000). Moreover, researchers have demonstrated that age differences are much larger for measures of recollection than for familiarity. Because older adults seem to have intact use of familiarity, one possibility is that they rely too heavily on their familiarity of the components when making judgments about associations. The purpose of the present studies was to explore possible methods that might allow older adults to capitalize on their intact familiarity in order to accurately remember pairings of information. Two experiments were run in which face–scene pairs were repeated prior to a study list in order to make them more familiar. Remember/know judgments were also collected to determine whether any advantages in associative tests are related to reliance on familiarity.

(2134)

**Retrieval-Induced Forgetting in Young Children: A Deficit in Inhibitory Executive Function.** ALP ASLAN & KARL-HEINZ BÄUML,

*University of Regensburg*—Selective retrieval of previously encoded information can cause forgetting of related, nonretrieved material. Such retrieval-induced forgetting (RIF) is generally attributed to inhibitory executive-control processes, suppressing the nonretrieved items' memory representation. We examined RIF in kindergartners, second graders, and adults, using both recall and recognition testing. Although the three age groups showed significant RIF in recall, only adults and second graders, but not kindergartners, showed RIF in recognition. Because inhibition-based RIF should be present in recall and recognition, these findings indicate that in adults and second graders, but not in kindergartners, RIF is mediated by inhibitory processes. The absence of RIF in kindergartners' recognition supports the proposal that young children show a deficit in inhibitory executive function. The finding of RIF in kindergartners' recall is attributed to (noninhibitory) blocking, reflecting kindergartners' tendency to persevere on strong (retrieval-practiced) items at the expense of weak (unpracticed) items, thus causing RIF without inhibition.

(2135)

**Long-Lasting Collaboration Benefits on Individual Recall in Younger and Older Adults.** HELENA M. BLUMEN & YAAKOV STERN, *Columbia University Medical Center*—A recent study of younger adults suggests that, in comparison with repeated individual recall, repeated group recall results in better individual recall after a short delay (Blumen & Rajaram, 2008). The present study examined (1) whether repeated group recall results in better individual recall in both younger and older adults and (2) the longevity of such collaboration benefits. Younger (18–30 years old) and older (60–75 years old) adults studied a list of words and completed either two collaborative recall trials and two individual recall trials (CCII) or four individual recall trials (IIII). A 5-min delay was inserted between the first three recall trials. The fourth recall trial was administered 1 week later. The results suggest that younger and older adults benefit equally from group collaboration after a 5-min (CC-I-I > II-I-I) and 1-week (CCI-I- > III-I-) delay. This is the first demonstration of collaboration benefits in older adults and at delays as long as 1 week.

(2136)

**The Reminiscence Bump in the Autobiographical Free Recall of Elderly Adults.** KELLI KRILL & PAULA J. WADDILL, *Murray State University*—Previous research on autobiographical memory using cue words to elicit a set of target memories indicates that older adults report an increased frequency of personal memories from adolescence and early adulthood (the “reminiscence bump”). However, little systematic research has used narrative free recall to study this phenomenon of autobiographical memory. To examine the extent to which the reminiscence bump is independent of the method used to elicit the memories, we individually interviewed a set of elderly adults on two separate occasions about their lives. In one interview, they were asked to freely narrate their life story; in the other, they were asked to tell their life story decade by decade. They were also asked to identify the landmark events in their lives. Reminiscence bumps were observed under both free recall methodologies and for landmark events. The implications for theories of autobiographical memory and retrieval are discussed.

(2137)

**Effects of Presentation Mode on Veridical and False Memory.** MICHAEL P. TOGLIA, *University of North Florida*, & MICHAEL T. CARLIN, COLLEEN BELMONTE, & CHIARA DI MEGLIO, *Rider University*—Carlin et al. (2008) examined memory for thematically related pictures, finding lower hits and elevated false alarms for those with intellectual disabilities (IDs) and participants matched for mental age, relative to a chronological age-matched comparison group. This extension compared memory for visual, auditory, and audiovisual presentation modes. Subjects studied two 24-item categorized lists per mode, followed by a yes/no recognition test asking whether object names had been seen/heard previously. Response biases were accounted for. Hits for audiovisual items exceeded visual items, which exceeded auditory items. For critical nonpresented words, false alarms were greater for individuals with IDs than for those without IDs. Related foil endorsements were less for audiovisual than for visual and auditory formats. Novel foils

produced similar results. Although both groups revealed audiovisual superiority, those with IDs had lower sensitivity scores, differentiating the presented items less well in comparison with those likely activated during encoding. Practical and theoretical implications are discussed.

(2138)

**Reduced False Memory After Sleep.** KIMBERLY M. FENN, *Michigan State University*, DAVID A. GALLO & DANIEL MARGOLIASH, *University of Chicago*, HENRY L. ROEDIGER III, *Washington University*, & HOWARD C. NUSBAUM, *University of Chicago*—Several recent studies have shown that sleep contributes to the successful maintenance of previously encoded information, potentially due to an active consolidation process (e.g., Plihal & Born, 1997). However, this research has focused exclusively on the influence of sleep on memory for studied events, as opposed to false memories of events that were never encountered. Here, we report three experiments showing that sleep reduces false memories in the Deese/Roediger–McDermott (Deese, 1959; Roediger & McDermott, 1995) memory illusion. False recognition of nonstudied words was reduced after sleep, relative to an equal retention interval of wakefulness, with no change in correct recognition of studied words. These experiments are the first to show that false memories can be reduced following sleep, potentially owing to an active consolidation process that enhances source monitoring, and they extend the benefits of sleep to increased accuracy of episodic memory.

(2139)

**Dichotic Listening Can Produce False Memories: A Study With the DRM Paradigm.** PEDRO B. ALBUQUERQUE, *University of Minho*, & EDUARDA PIMENTEL, *Portuguese Catholic University*—Many studies with the Deese/Roediger–McDermott paradigm have shown that participants can produce false memories both through free recall and recognition tasks. In our study, we wanted to find out whether this phenomenon is present in a dichotic listening procedure. We decided to present dichotically two lists of words each time, asking the participants to shadow one list (the shadowing condition) or to keep their attention on both lists (the dichotic listening condition). Our results showed that the shadowed lists are better recalled (.40) than the unattended ones (.11), and the same pattern of results is associated with the critical lures (.38 vs. .14). The dichotic listening procedures revealed that the amounts of correct recall and false recall are very similar (.28 vs. .27). Our results seem to show that the production of false memories can occur even when the participants are not focused on processing the lists.

(2140)

**Reconstructive Memory Biases for Object and Scene Views.** TALIA KONKLE & AUDE OLIVA, *MIT* (sponsored by Aude Oliva)—The view of an object or scene depends on where an observer is standing in relation to the object and scene surfaces, as well as the physical size and arrangement of the objects in the space. In a series of experiments, we found that knowledge about the physical size of objects in the world leads to systematic biases in short-term and long-term memory of object visual size. Similar results were found for memory of scenes, in which observers tended to remember their location in a space toward the middle of the scene, showing opposite memory biases for both close-up views and wide-angle views. These biases were amplified in scenes presented on a hemispheric panoramic display. Together, these data broadly support a reconstructive view of visual memory, in which existing knowledge of objects and scenes combines with presented views to be remembered, leading to systematic biases toward a normative or prototypical view.

(2141)

**The Role of Self-Generation and Interviewer Feedback in False Eyewitness Recall.** JENNIFER K. ACKIL, *Gustavus Adolphus College*, & MARIA S. ZARAGOZA, *Kent State University*—Witnesses can develop false memories for misinformation if they were forced to fabricate knowingly (Ackil & Zaragoza, 1998) and confirmatory interviewer feedback can increase this false memory effect (Zaragoza, Payment, Ackil, Drivdahl, & Beck, 2001). The present study assessed whether participants are more susceptible to false memory development if the misinformation is

self-generated than if it is not. To this end, participants viewed a film clip and were later forced to answer questions about plausible false events they did not witness. The primary manipulation was whether participants self-generated the response or chose the response from a two-alternative forced choice. In addition, for both conditions, either neutral or confirmatory feedback was provided after each response. On free recall tests administered 1 week later, false recall of participants' responses to the false-event questions was more prevalent following self-generation, but only in the confirmatory feedback condition.

(2142)

**When Script Activation Reduces Retrieval-Induced Forgetting for Everyday Activities.** ELVIRA GARCÍA-BAJOS & MALEN MIGUELES, *University of the Basque Country*—The act of remembering can prompt forgetting of related contents in memory. This study extends the retrieval-induced forgetting (RIF) paradigm to everyday activities. The participants studied two stories related with script activities that contained high-typicality actions and low-typicality actions. Then, they practiced retrieving half of the high- or low-typicality actions of one activity, serving the other story as a baseline to measure facilitation and RIF effects. This strategy allowed us to study the effects of retrieval practice of high or low typicality on recall (Experiment 1) and recognition (Experiment 2) of the remaining actions of the script story, whether high or low typicality. RIF was found for low-typicality actions exclusively when low-typicality actions were practiced, but a comparable forgetting effect did not emerge in the highly schematic actions. These findings suggest that the activation of scripts may protect typical information from RIF.

(2143)

**Recognition Memory for 3,000 Monosyllabic Words.** MICHAEL J. CORTESE, *University of Nebraska, Omaha*, MAYA M. KHANNA, *Creighton University*, SARAH D. GREGORY, *University of Nebraska, Omaha*, & LUCIE E. SEDLACEK, *Creighton University*—In two studies, participants studied 30 lists of 50 words and were asked to recognize these words on 30 lists of 100 words. Item-level multiple regression analyses were conducted on hits, false alarms, hits minus false alarms,  $d'$ , and C. Predictor variables included objective frequency, subjective frequency, imageability, orthographic  $N$ , phonological-to-orthographic  $N$  (PON), age of acquisition (AoA), and word length. Noteworthy results were that (1) hit rates positively correlated with false alarm rates, (2) frequency negatively correlated with hit and false alarm rates, (3) AoA positively correlated with hit rates and negatively correlated with false alarm rates, (4) length negatively correlated with hit rates and positively correlated with false alarm rates, (5) orthographic neighborhood size negatively correlated with hit rates, (6) PON positively correlated with false alarm rates, and (7) imageability produced the typical mirror pattern. The results will be interpreted in terms of contemporary recognition memory theories.

(2144)

**Untangling the Unique Effect of Intermediate Testing on Recollection in Recognition Memory.** PETER P. VERKOEIJEN, HUIB K. TABBERS, & MARIJE L. VERHAGE, *Erasmus University Rotterdam*—Recently, Chan and McDermott (2007) examined the processes underlying the testing effect in recognition memory. They found that in comparison with studying words once, intermediate testing increased recollection, whereas it did not affect familiarity. However, the increase in recollection may have simply been the result of the re-presentation of words rather than of the testing itself. We conducted three experiments to assess this alternative explanation of Chan and McDermott's findings. In Experiment 1, once-presented words were compared with either restudied words or intermediately tested words. In Experiment 2, we directly pitted restudied words against tested words. Finally, Experiment 3 replicated Experiment 2, with the exception that feedback was provided after each test trial. The results showed a recollection advantage of intermediate testing over restudying, but only when feedback was given during the test. Furthermore, recognition decisions were more familiarity based for restudied words than for tested words.



## • SPATIAL COGNITION •

(2145)

**What Role Does Peripheral Vision Play in Learning Spatial Layouts?**

NAOHIDE YAMAMOTO & JOHN W. PHILBECK, *George Washington University*—Loss of peripheral vision (e.g., caused by ocular diseases such as glaucoma and retinitis pigmentosa) significantly impairs spatial learning and navigation. However, the mechanisms underlying such impairments remain poorly understood. The present study examined two potential benefits that peripheral vision provides for learning a room-sized spatial layout, investigating whether competent performance in spatial learning requires (1) information about environmental surroundings while viewing objects or (2) effective eye movements to objects. The results showed that spatial layouts can be learned well in the absence of visible environmental surroundings, but impeding eye movements during learning makes subsequent retrieval of spatial memory slower and less accurate. These findings highlight the importance of spatial information derived from eye movements for learning environmental layouts. They also provide initial clues for the development of spatial learning and navigation techniques that could be utilized by peripheral field loss patients.

(2146)

**Effects of Spatial and Temporal Proximity on Chunking in Spatial Memory.**

JESSE Q. SARGENT, DANIEL GAJEWSKI, & NAOHIDE YAMAMOTO, *George Washington University*—Research suggests that certain object locations may be grouped together in spatial memory on the basis of a number of factors (e.g., spatial proximity, collinearity, etc.). The present study manipulates spatial and temporal proximity in order to examine the role of these factors independently of one another. Participants learned the location of four objects around them in a dark room, presented one at a time in a specified order. They were then blindfolded and pointed to remembered target locations after no turn, a 70° passive, whole-body rotation around a fixed vertical axis, several back-and-forth turns meant to cause disorientation, and then two more 70° turns. Pointing responses more accurately reflected intertarget relationships for targets that were close spatially. A much weaker effect of temporal proximity was also observed. Theoretical and methodological implications for spatial cognition research are discussed.

(2147)

**Bias in Memory for Object Location in a Cylindrical Environment.**

HYOUN K. PYOUN, STEPHEN C. DOPKINS, & JOHN W. PHILBECK, *George Washington University*—We explored the effects of three sources of bias on memory for the azimuth of a target object in a cylindrical chamber. For one group, we provided two object cues, whose locations were learned before the target object was presented. For a second group, we provided environmental cues (doors). For a third group, we provided neither object nor environmental cues; we assumed that for this group bias would be determined by geometric prototypes, generated by dividing the task room into sectors. Using Fitting et al.'s (2007) cue-based fuzzy boundary model to fit our data, we observed a different pattern of bias than has been seen in prior studies of 2-D domains. Without external cues, the target object was mis-located toward two prototypical locations, given by geometry. With external cues, the target object was mis-located toward six prototypical locations, two given by the cues and four given by geometry.

(2148)

**Category- and Item-Level Contributions to Location Memory: When Categories Don't Weigh In.**

MARCIA L. SPETCH, ALINDA FRIEDMAN, JARED BIALOWAS, & ERIC VERBEEK, *University of Alberta*—Several studies have shown that people's memory for location can be influenced by categorical information. According to a model proposed by Huttenlocher, Hedges, and Duncan (1991), people estimate location by combining fine-grained item-level information in memory with category-level information. When the item-level information is weak, category-level information is given greater weight, which leads to biased responses. We manipulated the distribution of locations presented to alter the usefulness of category information, and we manipulated

background texture to alter accuracy of item-level memory. The distributional information reduced bias without altering overall accuracy of responding, whereas the background texture manipulation affected accuracy without changing bias.

(2149)

**Micro- and Macroreference Frames: Specifying Spatial Relations Coded in Hierarchical Memory Structures.**

NATHAN GREENAUER, DAVID WALLER, CATHERINE MELLO, & TYLER THRASH, *Miami University*—A substantial amount of research has investigated the use of reference frames in memory for locations in both small and large environments. However, little research has examined how locations coded in one reference frame are specified relative to locations coded in another. In Experiment 1, we demonstrate that two distinct microreference frames can be established in memory during a single learning experience if two sets of objects are spatially and semantically distinct, and that a third, macroreference frame is used to specify spatial relations between them. Experiment 2 indicated that the selection of a macroreference frame depends on the superordinate geometry of the two object sets and influences the formation of microreference frames. On the other hand, Experiment 3 indicated that previously coded microreference frames do not influence the formation of a macroreference frame. Collectively, these results indicate hierarchical coding of spatial information, with superordinate reference frames specifying subordinate relations.

(2150)

**Comparing Verbal and Visuospatial Categorical Processing.**

INEKE J. VAN DER HAM & ALBERT POSTMA, *Utrecht University* (sponsored by Albert Postma)—Two types of spatial relations show differences in hemispheric lateralization; coordinate, metric relations concerning distances are processed with a right hemisphere advantage, whereas a left hemisphere advantage is thought to be related to categorical, abstract relations. Kemmerer and Tranel (2003) argue that the left hemisphere advantage for categorical processing might only apply for verbal spatial categories, whereas a right hemisphere advantage is related to visuospatial categories. We conducted two studies to examine the differences in performance and lateralization between verbal and visuospatial category processing. The data indicate that the direction of lateralization is determined by the type of spatial relation (categorical), whereas the strength of lateralization is affected by the nature of the task (verbal/visuospatial). Furthermore, we found that subjects used a fully strategic approach to solve our task; they adapted their strategy fully to the modality of the expected stimulus, whether it was verbal or visuospatial.

(2151)

**Reference Directions During the Development of Spatial Memories.**

JONATHAN W. KELLY, *Iowa State University and Vanderbilt University*, & TIMOTHY P. MCNAMARA, *Vanderbilt University*—Previous research indicates that spatial memories are often organized around reference directions. In those experiments, participants typically studied spatial layouts that were visible in their entirety from each studied view. In contrast, the present experiments explored the role of reference directions during the development of spatial knowledge, when learning occurs incrementally across multiple views. Participants learned two overlapping layouts: Layout 1 was studied first in isolation, and Layout 2 was subsequently studied in the presence of Layout 1. The view from which participants studied Layout 2 was held constant, whereas the view from which participants studied Layout 1 was manipulated between participants. Across a series of experiments, manipulation of the Layout 1 learning view influenced the reference directions used to organize Layout 2. Reference directions established during early exposure to the environment (Layout 1) provided a framework for organizing new spatial information acquired later (Layout 2).

(2152)

**Spatial Reference Directions in Memory of Two Nested Layouts.**

HUI ZHANG, *Chinese Academy of Sciences*, WEIMIN MOU, *University of Alberta*, & TIMOTHY P. MCNAMARA, *Vanderbilt University*—Three experiments investigated the manner in which people select spatial reference directions in two nested layouts. Participants learned the locations



of eight cities around the experiment city, using a map. The map and the environment were aligned, and participants faced north (0°). Participants also learned locations of seven objects on a table while facing north (0°), but were instructed to learn the layout along the northwest–southeast (45°–225°) axis. Judgments of relative direction (imagine you are standing at X, facing Y, point to Z) were used to determine spatial reference directions. Experiment 1 showed that participants used 0° as the reference direction in representing cities' locations but used 45°–225° to represent objects' locations. Experiments 2 and 3 showed that when the objects indicating the imagined heading and the target were from different layouts (e.g., face objects, point to cities), participants used the reference direction of the layout in which the target was located.

(2153)

**Extending the Boundaries of Category Adjustment: Perceptually and Conceptually Defined Categories.** 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 this strategy within simple figures (Huttenlocher, Hedges, & Duncan, 1991) and within natural scenes (Holden, Curby, Newcombe, & Shipley, in preparation). By manipulating the availability of conceptual information within such scenes, Holden et al. found that category identification relies on both perceptual and conceptual information. Here, we use the boundary extension error—that individuals recall having viewed more of a scene than was presented (Intraub & Richardson, 1989)—to examine whether the use of perceptual or conceptual information to identify categories depends on the availability of such information at study or at test. The results suggest that information available at recall is more important to categorization than is information at encoding.

(2154)

**Is the Room Spinning? Mental Rotation in Object Array Memory.** A. REYYAN BILGE & HOLLY A. TAYLOR, *Tufts University*, & GEORGE L. WOLFORD, *Dartmouth College*—Do people engage mental rotation processes when remembering room-sized arrays? The present work investigated effects of cognitive style differences (information preference and representation style) on room-sized array learning based in different geometrical structures (circular, rectangular) and information sources (direct experience, map). Participants learned an object array and then decided whether three-object configurations represented the same, yet rotated, or mirror reflections of the original array. Questionnaire responses provided information on information preference (map, verbal directions) and representation style (survey, landmark). Cognitive style differences reflected mental rotation strategies. Survey-representation and map preference, which were suggested to reflect holistic processing, led to better performance after learning from direct experience. Spatial information preference and mental representation style differentially interacted with room/map geometry and learning source. Fewer differences reflecting strategy were evident with rectangular geometry; such differences appeared magnified with the circular structure, especially with map learning. We discuss the results in the context of cognitive strategies used in mental rotation.

(2155)

**Target Feature and Membership Information Override Strong Default Categorization in Spatial Memory.** CRISTINA SAMPAIO, *Western Washington University*, & RANXIAO FRANCES WANG, *University of Illinois, Urbana-Champaign*—Huttenlocher, Hedges, Corrigan, and Crawford (2004) examined the variation in the distribution of target locations to test its effect on how a space with strong default categories (a circle) was categorized, but found none. We investigated whether strong default categorization can be overcome in spatial memory. In three experiments, we tested memory for locations within a circle while providing participants with an alternative categorization, and we found that explicit report of the alternative category coupled with visual presentation of the boundaries of the alternative categories (Experiment 1) did not affect the use of the default categories in estimation. In contrast, visual

cuing of the alternative category membership of a target (Experiment 2) and unique target feature information associated with each alternative category (Experiment 3) successfully led to the use of the alternative categories in estimation. Taken together, the results indicate that alternative categorization can be induced when appropriate cues are provided.

# • MUSIC PERCEPTION/COGNITION •

(2156)

**Enhancing Temporal Discrimination Performance by Orienting Attention in Time.** STEFAN BLASCHKE, SVEN RITZKOWSKI, & JUTTA STAHL, *University of Göttingen* (sponsored by Gregg C. Oden)—Much work has been done on orienting attention in space, but only a few studies have examined the impact of temporal attention on time perception. Performance to detect a temporally deviating interval within a sequence of sounds can be enhanced by presenting more than one standard (SI) before the comparison interval (CI), leading to Weber fractions of about .06 (Friberg & Sundberg, 1995). Previous studies presented the CI always at the last position within the sequence (e.g., Barnes & Jones, 2000), whereas Blaschke (2009) varied the position of the CI randomly between trials, observing surprisingly low Weber fractions of .17. Giving participants visual information about where the CI would occur improved performance for judging the duration of the CI, with Weber fractions of .06. These results emphasize the importance of orienting attention to a special point of time in order to enhance discrimination performance.

(2157)

**Singing Without Auditory Feedback.** AYSU ERDEMIR, JEANA SIMPSON, GRETCHEN VERHEGGEN, & JOHN RIESER, *Vanderbilt University* (sponsored by John Rieser)—People act on efferent knowledge of how to get a job done, and incorporate afferent feedback to fine-tune their performance. This study is about how well people sing familiar tunes when auditory feedback is masked in different ways. In Experiment 1, the results show that a multibabble mask disrupted performance more reliably than a white noise mask. In Experiments 2 and 3, people were tested repeatedly with and without auditory feedback, while singing from memory and while singing along with a recording. Subjects could hear themselves when singing a cappella and when singing along with the recording at normal volume; subjects could not hear themselves when singing with a multibabble mask and when singing along with the recording at high volume. Performances were scored for pitch, interval, and rhythmic accuracy; subjects were compared according to musical experience and skill. Future studies will compare expert and nonexpert singers.

(2158)

**It Is Not Easy to Ignore an Auditory Rhythm When Making Duration Judgments.** NATHANIEL S. MILLER, *Bowling Green State University*, & J. DEVIN MCAULEY, *Michigan State University* (sponsored by J. Devin McAuley)—Previous studies have shown that judgments about the relative duration of standard-comparison pairs of time intervals marked by tones are distorted by a to-be-ignored preceding rhythmic context sequence. Consistent with entrainment models of timing, duration judgments are more accurate when tones delineating to-be-judged time intervals are on time, relative to the preceding rhythmic context, in comparison with when the tones are early or late. This quadratic pattern of performance has been termed an expectancy profile. The present set of experiments examined the entrainment prediction that expectancy profiles should be eliminated or reduced by repeating the standard interval. Overall, results show that expectancy profiles are surprisingly resilient and that more than four repetitions of the to-be-judged standard interval need to be presented for listeners to be able to ignore a context rhythm. From an entrainment perspective, results suggest that duration judgments involve a relatively sluggish period correction process.

(2159)

**Directing Auditory Attention in Terms of Pitch, Time, and Tonal Scale Membership.** W. JAY DOWLING, *University of Texas, Dallas*—Attending to a familiar melody interleaved with other notes leads listeners to

focus attention on regions of pitch and time where melody notes are expected. Here, listeners detected wrong notes in target melodies. Out-of-key wrong notes are usually easier to detect than in-key wrong notes. However, when the attended melody was interleaved with in-key notes, in-key wrong notes were easier to detect than out-of-key ones. This suggests that the listener can use a sense of key to focus on target notes in the key of the melody. This advantage for in-key wrong notes disappeared when the attended melody was interleaved with out-of-key notes. This suggests that it is difficult to maintain a sense of key when numerous notes in a different key are present (even if unattended), and that makes it difficult to use key as a criterion for selecting target notes.

(2160)

**The Effects of Orienting Task and Familiarity on Remembering and Knowing in Melody Recognition.** ESRA MUNGAN, *Boğaziçi University*, ZEHRA F. PEYNIRCIOĞLU, *American University*, & ANDREA R. HALPERN, *Bucknell University*—We investigated the effects of orienting task (OT) on melody recognition in nonmusicians by varying melody familiarity, eliciting remember (R) and know (K) responses. In Experiment 1, participants either judged the mood (conceptual OT) or counted the number of long notes (perceptual OT) of familiar and unfamiliar tunes. An OT effect emerged for both types of tunes, but only in R responses. In Experiment 2, participants listened to familiar melodies using four different OTs, two of them conceptual and two perceptual. We again found an OT effect in R responses but not in K responses, in that the conceptual OTs led to more correct R responses than did the perceptual OTs. In addition, conceptual OTs led to better overall recognition than did perceptual OTs. The results are discussed within the distinctiveness framework and with respect to the rarity of finding levels-of-processing effects in music.

• MULTISENSORY INTEGRATION •

(2161)

**The Relationship Between Feature Binding and Consciousness: Evidence From Asynchronous Multimodal Stimuli.** SHARON ZMIGROD & BERNHARD HOMMEL, *Leiden University* (sponsored by Gezinus Wolters)—To perceive the various features from different sensory modalities as one coherent event (“the binding problem”) requires a dedicated binding mechanism. But how strongly is this binding mechanism related to conscious perception? We presented subjects with slightly asynchronous audiovisual stimuli and studied whether and when the visual and auditory features were integrated into one binding. Consistent with previous observations, the results show that binding took place up to at least 350-msec feature-onset asynchronies, suggesting that integration is controlled by relatively wide temporal windows. We also asked subjects to explicitly judge whether the two features would belong to the same event and, unsurprisingly, unity of perception decreased with increasing asynchrony. Importantly, however, the conscious perception of unity was entirely unrelated to binding, because binding was much less sensitive to asynchrony than conscious deception was. These findings suggest that a unified conscious experience is not a prerequisite for binding.

(2162)

**Variability in Use of Auditory and Visual Cues for Novel Nonspeech Categories.** JOSEPH D. W. STEPHENS, *North Carolina A&T State University*—The combination of auditory and visual information in speech perception is often assumed to result from learned correspondences between patterns in the two modalities. However, relatively little research has directly investigated the learning of audiovisual categories. The present study used nonspeech auditory and visual stimuli in a brief (200-trial) training task in which participants learned to classify audiovisual combinations into two categories. Participants’ use of auditory and visual cues was then examined in a factorial identification task. Response patterns were examined within the framework of the fuzzy logical model of perception. Across individuals, there was high variability in the degree to which each source of information contributed to identification judgments. Additionally, participants tended to give greater weight to visual information, even when the relative validity of the visual cues was reduced. The results suggest differences between information-

integration processes for newly learned as opposed to highly familiar bimodal categories.

(2163)

**Taste Modifier Influences Synesthetic Perception in a Color–Gustatory Synesthete.** CATHERINE E. LEMLEY & ALEZA FINVER, *Elizabeth-town College*—E.C., a color–gustatory synesthete, experiences distinct taste percepts when viewing specific colors. For example, the color yellow consistently triggers a very sweet taste and the color blue elicits a spicy taste. Richards (2009) provided evidence that E.C.’s synesthesia was not affected by top-down influences. Thus, in the present study, we examined whether or not her synesthetic tastes might be influenced at the receptor level. E.C. rated the intensity of her synesthetic taste percepts under three conditions: with a taste modifier that blocks sweetness, with a placebo, or with no treatment. We found that E.C.’s synesthetic tastes were influenced by the taste modifier, with her sweetness intensity ratings being reduced or even eliminated when she viewed colors that typically elicit sweetness. This finding indicates that E.C.’s synesthetic experience is affected by early perceptual pathways.

(2164)

**Categorical Perception of Syllables and Temporal Intervals.** JAMES F. JUOLA, *Eindhoven University of Technology and University of Kansas*, ROB L. J. VAN EIJK & DIK J. HERMES, *Eindhoven University of Technology*, ARMIN KOHLRAUSCH, *Eindhoven University of Technology and Philips Research Laboratories*, & MICHAEL S. VITEVITCH, *University of Kansas*—We suggest that synchrony is perceived categorically in temporal judgment tasks for simple audiovisual stimulus pairs. That is, pairs within a range of SOAs from about –50 msec, audio leading, to +150 msec, video leading, are more often judged to be synchronous than asynchronous. Furthermore, temporal discrimination thresholds for audiovisual pairs centered within the synchrony range are higher than for those near either extreme. We used similar psychophysical procedures with synthetic speech stimuli (“BA-DA-GA” continuum) and found analogous results for synchrony judgments and speech perception. If we omit the central category from the response set (“synchrony” or “DA,” which corresponds to the temporal order judgment procedure), observers are forced, respectively, to judge which stimulus, audio or video, occurred first, or to categorize the speech continuum into “BA” or “GA” only. Parameter estimates for details of response categories with two or three response alternatives differ from, and are uncorrelated with, each other across observers. The results support a similar categorical nature of speech and temporal interval perception.

• JUDGMENT/DECISION MAKING •

(2165)

**Does Looking Behavior Predict Choice?** ELIZABETH R. SCHOTTER, RAYMOND W. BERRY, CRAIG R. M. MCKENZIE, & KEITH RAYNER, *University of California, San Diego*—We generally spend longer considering options we choose as opposed to those we reject. How does this bias arise? Shimojo, Simion, Shimojo, and Scheier (2003) found that people look longer at an option they ultimately choose in comparison with other options—the gaze bias effect. Glaholt and Reinhold (2008) found that this gaze bias effect was present the first time the stimulus is encountered, suggesting that it arises because people selectively encode information for the task. We tested whether task demands influence the gaze bias effect. Subjects had to choose between one of two pictures, prompted by one of four questions: which one they (1) liked more, (2) liked less, (3) thought was older, or (4) thought was taken more recently. We found a gaze bias effect in all conditions except the “like less” condition, suggesting that a bias to look at liked items competes with the need to encode which item is disliked.

(2166)

**Gaze Control, Theory of Mind, and Self–Other Differentiation in Married Couples’ Shared Memories.** RALUCA PETRICAN & MORRIS MOSCOVITCH, *University of Toronto*—Gaze following may constitute a mirror neuron function (Frischen, Bayliss, & Tipper, 2007). Overactivity of the mirror neuron system and excessive gaze following

underlie clinical social deficits, such as the blurring of the self–other boundaries in schizophrenia (Frischen et al., 2007). To examine the effect of gaze following on self–other differentiation, we had 41 elderly married couples complete autobiographical memory, gaze control, theory of mind, and relationship quality measures. Higher gaze control capacity predicted superior theory-of-mind abilities. Superior theory-of-mind abilities predicted higher accuracy in identifying the spouse's distinct mental states during a past relationship event, which, in turn, predicted higher partner intimacy. Inability to control gaze predicted increased self–other mental state overlap (“we” thoughts/emotions at the expense of the two partners’ distinct mental states) in the autobiographical accounts, which, in turn, predicted lower partner marital satisfaction. We discuss how early perceptual processes may affect or represent a marker of complex social cognitive processes.

(2167)

**The Relationship Between Indecisiveness and Eye Movement Patterns in a Decision-Making Informational Search Task.** ANDREA L. PATALANO, BARBARA J. JUHASZ, & JOANNA DICKE, *Wesleyan University*—Indecisiveness is a tendency to experience difficulty with decision making. It is proposed to be associated with desire for information acquisition and reliance on compensatory strategies—evidenced by alternative-based information search—during decision making. However, existing studies provide conflicting findings. We conducted an information board study, using eyetracking methodology, to test hypotheses that the relationship between indecisiveness and choice strategy depends on being in the early stage of the decision process and in the presence of opportunities to delay choice. We found strong evidence for the first hypothesis, in that indecisive individuals moved from greater to lesser alternative-based search over time, whereas decisive individuals used less alternative-based search across the task. Indecisiveness was also related to time spent both viewing selected-course attributes and looking away from information. Findings resolve past discrepancies, suggest an interesting account of how the decision process unfolds, and contribute to a better understanding of indecisiveness.

(2168)

**Marr, Memory, and Heuristics.** LAEL J. SCHOOLER, *Max Planck Institute for Human Development*—In the context of David Marr's functional approach to understanding cognition, I describe a modeling and empirical effort that bridges two research programs grounded in an appreciation of the adaptive value of human cognition: The program on fast and frugal heuristics explores cognitive processes that use limited information to make effective decisions; and the ACT-R research program strives for a unified theory of cognition. This work illustrates how a memory system that is tuned to automatically retrieve information can be exploited for a different purpose; namely, making inferences about real objects in the world, based on metacognitive judgments about how the memory system responds to stimuli. This work provides a good point of departure to discuss the kinds of cognition that yield to a rational analysis and those that might not.

(2169)

**On the Psychophysics of Matching Fingerprints.** JASON M. TANGEN, *University of Queensland*, & JOHN R. VOKEY, *University of Lethbridge* (sponsored by Jennifer S. Burt)—For over a century, the matching of fingerprints has been used for forensic identification. Despite that history, there have been no published, peer-reviewed studies directly examining the extent to which people can correctly match fingerprints to one another. We report the results of four experiments using naive undergraduates to match a convenience sample of fingerprints as well as real, crime-scene latent prints, and patent prints taken from official, 10-print cards of suspects. Our results demonstrate that people can identify fingerprints quite well, and that matching accuracy can vary as a function of both source finger type and image similarity.

(2170)

**The Effects of Cognitive Load on Online and Memory-Based Decisions.** ANA M. FRANCO-WATKINS, *Auburn University*, HAL

PASHLER & TIMOTHY C. RICKARD, *University of California, San Diego*, & MICHAEL J. MONTANO, *Auburn University*—People are often required to make decisions while being subjected to additional cognitive demands such as competition for attentional resources from nonrelevant tasks (i.e., multitasking). We present several studies that examined decision making in the presence of a demanding cognitive load (a number generation task). When an online decision task (choices between immediate and future rewards) was used, participants became more inconsistent in their decisions under cognitive load. However, online decisions do not necessarily require retrieval of preexisting knowledge or maintenance of information in memory. Two additional experiments examined decisions that relied on utilizing preexisting knowledge about familiar and less familiar U.S. and international cities to infer which city had a larger population. The results indicate that these types of decisions are also prone to the same cognitive load effects as are online decisions. We discuss the implications for making decisions while subjected to the stress of an additional cognitive load.

(2171)

**Preference Reversal: Memory and Contextual Biases With Choice.** PETKO KUSEV, *City University London*, PETER JOHANSSON, *Lund University*, PAUL VAN SCHAİK, *University of Teesside*, PETER AYTON, *City University London*, DANIEL HEUSSEN, *Katholieke Universiteit Leuven*, & SARA AMALIE O'TOOLE THOMMESSEN, *City University London*—A virtue of good theory is that it is general; theories that predict a wide range of events have obvious merit. Several prominent theories of decision making achieve this objective by proposing that all decisions can be modeled with the same generic representation (e.g., Birnbaum, 2008; Tversky & Kahneman, 1992; von Neumann & Morgenstern, 1947). For example, these theories assume that all decisions under risk or uncertainty can be represented as gambles, with monetary amounts representing the outcomes. In five experiments, we pursue an opposing, not previously investigated idea: Risky choices are affected by decision content, even when utilities and probabilities are known. We studied the influences of context (Experiments 1 and 2), memory (Experiments 3 and 4) and computational complexity (Experiment 5). In contrast with traditional theories, we find that people do not have underlying generic preferences; people's experiences “leak” into decisions even when risk information is explicitly provided.

(2172)

**Examining the Influence of Point-of-Purchase Information on Fast-Food Meal Selections.** ERICA L. WOHLDMANN & JILL L. QUILICI, *California State University, Northridge*—Decisions about eating are not made merely on the basis of hunger, but are often, instead, influenced by external factors. This study investigated the impact of point-of-purchase information on the calorie content of a meal selection task by manipulating the presence of calorie information on a menu (Experiment 1), the healthfulness of pictures on a menu (Experiment 2), and the presence of a mirror during meal selection (Experiment 3). Overall, the manipulations did not influence calorie content; however, in all experiments, gender effects were found. Specifically, males responded more to point-of-purchase manipulations than did females, selecting significantly fewer calories when calories, unhealthy pictures, and mirrors were present than when they were absent. Thus, increasing awareness might reduce overconsumption, particularly for males, perhaps because of changes in attitude. The findings will be discussed in the context of the theory of reasoned action, by which attitudes and beliefs alter one's intentions to engage in certain behaviors.

(2173)

**You Don't Want to Know What You're Missing: The Impact of Information About Foregone Payoffs in Dynamic Decision-Making Environments.** A. ROSS OTTO & BRADLEY C. LOVE, *University of Texas, Austin* (sponsored by Bradley C. Love)—In simple delay-of-gratification paradigms, diverting one's attention from immediate rewards is an effective self-control strategy for refraining from short-term gains in order to maximize larger, long-term gains. These findings suggest that knowledge about foregone payoffs (i.e., what could have been

gained at each point by making a different choice) may impede optimal decisions in intertemporal choice. We examined the effect of information about foregone payoffs in a two-choice dynamic decision-making task in which short- and long-term gains were in conflict. We found that providing veridical information about foregone payoffs severely hindered participants' ability to repeatedly make choices that maximize long-term payoffs. In effect, providing more information led to suboptimal decisions across trials. Fits of reinforcement-learning models to participants' choice behavior suggest that information about foregone payoffs accentuated the salience of immediate payoff differences between short- and long-term options, making short-term options more attractive at the expense of larger, long-term gains.

(2174)

**Fast and Frugal Heuristics in High-Stakes Investment Decisions: New Descriptive Models of Bank Customers' Behavior.** MARCO MONTI, *Max Planck Institute for Human Development*, LAURA MARTIGNON, *Ludwigsburg University of Education*, GERD GIGERENZER, *Max Planck Institute for Human Development*, & NATHAN BERG, *University of Texas, Dallas* (sponsored by Konstantinos V. Katsikopoulos)—This paper aims to uncover the decision processes used by average investors, including their investment goals, the information sets they consider, and the number of factors that actually influence high-stakes financial decisions. We present new experimental and survey data collected from bank customers at several Italian banks. Most subjects use a strict subset of the information available to them, ignoring variables that standard economic models typically assume drive investors' behavior. Fast and information-frugal heuristics appear to explain the information search and decision behavior of many subjects observed in this study, reflecting a lexicographic hierarchy of risk, time horizon, and cost, in that order. A simple combination of a fast and frugal tree and a tallying rule predicts more than 80% of investors' decisions.

(2175)

**Playing Roulette With Money and Lives: Gender Differences in Risk Preferences and Response Times.** URSINA TEUSCHER, *University of California, San Diego*, VIRGINIA S. KAY, *University of North Carolina, Chapel Hill*, & BRUCE W. SMITH, *University of New Mexico*—We used context-free computerized roulette wheels to explore how men and women's risk preferences differed when gambling for money as opposed to human lives in both win and loss avoidance tasks ( $n = 248$ ). Overall, participants took greater risks and were less likely to maximize expected value when the goal was to minimize losses. These effects were strongest in the money arena and were more pronounced in men than in women. The tendency to take bigger risks with money gambles led men closer to the optimal strategy in the winning money condition, but served them poorly in the losing money condition. We also found that men took more time to make monetary gambles, whereas women took longer to decide about human lives. Main effects of gender were absent, but because gender interacted with effects of both frame and decision arena, our findings suggest that risk preference studies that collapse results across gender are difficult to interpret.

(2176)

**The Rank Principle in Psychology and Economics.** GORDON D. BROWN, *University of Warwick*—Judgment, decision making, and

choice in many areas of psychology and economics appear to be based on rank-based processes. Why is this? We first review evidence for rank-based judgment and choice in a variety of domains, and show that some alternative accounts can be excluded. Second, we show that rank-based judgment and decision making can be seen as an optimal, or adaptively rational, heuristic in that it maximizes information gain relative to the cognitive cost of processing the information. Third, we show that rank-based social comparison processes can explain a number of imitative "herd behaviors" in consumer purchasing and financial decision making.

(2177)

**Goal-Based Categorization in Budgeting.** YI-CHUN CHEN & JAMES E. CORTER, *Teachers College, Columbia University* (sponsored by James E. Corter)—We studied how participants accomplished the task of making budgets. Budget categories are mental accounts made explicit, and may be considered to be a type of goal-based categories. In a preliminary diary study, participants (college students) kept track of their expenses for 1 week. We compiled a master list of their expenditures (described in their own words). Then, in the main study, two groups of participants categorized these expenditure items by performing a labeled sorting task, one group under instructions to form budget categories and another group under more neutral categorization instructions. Systematic differences in the category structures and category labels were observed in the two conditions, illustrating the effect of the general goal context (budgeting) on categorization processes.

(2178)

**Format Dependencies in Subjective Confidence Reports.** JORDAN R. SCHOENHERR, WILLIAM M. PETRUSIC, & GUY L. LACROIX, *Carleton University* (sponsored by William M. Petrusic)—Studies using confidence reports have found systematic biases related to task difficulty. These biases have been ascribed either to incorrect assessments of accurate stimulus representations or to correct assessments of inaccurate stimulus representations. The present study examines an alternative account: Scale parameters generate the observed bias. Three experiments examine this problem. Experiment 1 required two groups of participants to report confidence using full- (0–100) and half-range (50–100) scales, respectively. On one block of trials, participants reported confidence with only the endpoints of these scales. Experiment 2 replicated Experiment 1, but equated the number of categories (6 and 11) for both half- and full-range scales. Experiment 3 used a mixed-block design, requiring participants to use 2, 6, or 11 confidence categories. These experiments yielded format-dependent effects of scale on confidence reports, confidence response time, and primary decision response time.

(2179)

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

(2180)

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



## POSTER SESSION III

## Friday Evening

Hynes Convention Center, Ballrooms A, B, and C  
Viewing 4:00–8:00, Author Present 6:30–8:00

## • JUDGMENT/DECISION MAKING •

## (3001)

**Why Is Prospect Theory's Evaluation Function S-Shaped?** JESICA M. CHOPLIN & AMBER N. BLOOMFIELD, *DePaul University*—We present the comparison-induced distortion (CID) theory account of prospect theory's S-shaped evaluation function and pit this account against the psychophysical Stevens' law account and frequency accounts like decision-by-sampling. We present several experiments wherein CID theory mathematically fits the data better than Stevens' law does. In addition, comparison wording affected the shape of the evaluation function—a finding that cannot be accounted for by Stevens' law or the frequency accounts. Contrary to decision-by-sample, we present evidence that frequency cannot account for loss aversion. Finally, we demonstrate comparison-induced S-shaped functions in other domains, including S-shaped anchoring effects and S-shaped social comparison effects.

## (3002)

**Effects of Valence and Constraints on Action in Causal Judgments.** DIEYNABA NDIAYE & BARBARA A. SPELLMAN, *University of Virginia*—Previous studies suggest that when judging an actor's causality, people are overly influenced by the valence of the actions and fail to account for factors that might have constrained the actor (Alicke, 1992). For example, a son who stops to sell drugs, thereby missing the last moments of his mother's life, is more causal than a son who stops to help an injured motorist. We independently manipulated valence (positive vs. negative) and level of constraint (urgent vs. nonurgent) of an actor's actions and measured the actor's causality. There were significant main effects of both valence and constraint: The actor was more causal in the negative and nonurgent versions. The interaction was also significant: The positive nonurgent version was not different from the negative versions. The effect of urgency (and other constraints on action) can be explained by the crediting causality model (Spellman, 1997); the lingering effects of valence cannot.

## (3003)

**The Somatic Marker Hypothesis and a Mine Hunter Task.** PATRICK C. LINGENFELTER, ROBERT C. MATHEWS, & MIKE F. HAWKINS, *Louisiana State University* (sponsored by Robert C. Mathews)—Damasio hypothesized that implicitly acquired knowledge might consist of emotional reactions associated with potential negative consequences of risky decisions. He obtained support for this somatic marker hypothesis using the Iowa Gambling Task. This study reports an experiment in which a simulated mine hunting task was used. Participants chose one of two areas to seek valuable minerals. The more advantageous choice (lower payoff but lower losses) contained mountains in the landscape. Participants bet on each trial by sending 1–5 probes to their choice and reported what features influenced their decision. Galvanic skin responses (GSRs) were recorded. The somatic marker hypothesis predicts an increased GSR prior to making a riskier choice. Evidence for this hypothesis was not obtained until participants were fully aware that mountains were the cue to a riskier decision, although performance was above chance long before awareness. Thus, the somatic marker hypothesis was not supported for implicit knowledge of the task.

## (3004)

**The Hot Hand Phenomenon As a Cognitive Adaptation to Clumped Resources.** ANDREAS WILKE, *Clarkson University*, CLARK BARRETT, *UCLA*, & PETER M. TODD, *Indiana University, Bloomington*—The hot hand phenomenon refers to subjects' expectation of streaks in sequences of events whose probabilities are, in fact, independent. We conjectured that the hot hand reflects an evolved adaptation to resources that are clumped and used an experimental computer task to explore when American undergraduates and Shuar hunter-horticulturalists expected clumps in sequences of foraged fruits, coin tosses, and other

resources. Overall, subjects tended to expect clumps in sequences that were, in fact, random, with interesting population differences. Shuar have substantial foraging experience but little experience with coin tosses, whereas the opposite is true of Americans. Americans showed a clumped expectation for fruits but less for coins, whereas Shuar showed a clumped expectation for both. We suggest that this reflects a default expectation of clumps that is still present for Americans in a foraging context, but is reduced (though not eliminated) by experience with genuinely independent random phenomena like coin tosses.

## (3005)

**The Influence of Scientific Literacy on Epistemological Orientations in Undergraduates.** DEBRA MCGINNIS, *Oakland University*—*Epistemological understanding* refers to the cognitive processes individuals apply to issues with ill-defined conclusions and to each individual's ideas about the nature and acquisition of knowledge. Thus far, the primary contribution of this research pertains to characterizing a number of epistemological orientations (EOs; e.g., absolutism, relativism). The present study examined whether completing a research methodology course influenced EOs and evidence evaluation processes. In addition, this study was designed to explore the relationships among variables related to EO (e.g., age, preexisting beliefs, paranormal attitudes.). Statistical analyses of questionnaire data from 503 undergraduates suggest that EOs reflect transitional states (e.g., absolutist to relativist; relativist to evaluator) and that completing a methodology course affects individual EO development. Taken together, these results suggest that EO development in undergraduates may be due to education, as well as to maturational processes related to cognitive development.

## • CATEGORIES AND CONCEPTS •

## (3006)

**Semantically Instantiated Conceptual Metaphors Shape Representations of the Intrinsic Self-Concept.** MARK J. LANDAU & RUTH ANN ATCHLEY, *University of Kansas*, MATTHEW VESS & JAMIE ARNDT, *University of Missouri, Columbia*, & ZACHARY K. ROTHCHILD & DANIEL SULLIVAN, *University of Kansas*—We propose that the intrinsic self-concept—one's perceived "true" self—is represented metaphorically in terms of concrete physical properties. Two studies test whether manipulating perceptions of physical properties has metaphor-consistent effects on self-perceptions and whether these effects are mediated by the online semantic activation of relevant metaphors. In Study 1, exposure to pictorial primes depicting object expansion uniquely facilitated lexical decisions for semantically remote words that metaphorically relate expansion to personal development, and this metaphor activation mediated increased perceived self-actualization. In Study 2, priming pictorial depictions of object fragmentation facilitated relatedness judgments for words reflecting the metaphoric relation between fragmentation and the impaired expression of "core" self, and this metaphor activation mediated increased self-perceived concern with satisfying extrinsic contingencies of self-worth. This research weaves social psychology research on the self-perceptual consequences of an active intrinsic self-concept with cognitive research examining cognitive mechanisms that support metaphor comprehension.

## (3007)

**Mechanisms Underlying Age-Related Differences in Facial-Expression Recognition.** ATSUNOBU SUZUKI, *Nagoya University*, & HIROKO AKIYAMA, *University of Tokyo* (sponsored by Denise C. Park)—Previous studies have shown that aging interferes with the recognition of most of the basic emotions (i.e., happiness, surprise, fear, anger, sadness) from facial expressions but improves the recognition of disgust (Suzuki et al., 2007). In this study, we examined whether cognitive aging (Park et al., 2002) and affective aging (positivity effect; Mather & Carstensen, 2005) underlie age-related differences in facial-expression recognition. By testing 36 older and 36 younger adults, we found that cognitive aging accounted for age-related decline in the recognition of happiness, surprise, fear, and sadness. In contrast, neither cognitive nor affective aging accounted for age-related decline in anger recognition or age-related improvement in disgust recognition. We also found that age-related decline

in anger recognition was correlated with age-related improvement in disgust recognition. The results suggest special and common mechanisms underlying age-related differences in anger and disgust recognition from facial expressions.

(3008)

**Concrete-to-Abstract Representations When Learning a Hierarchy of Categories.** JADE GIRARD & SERGE LAROCHELLE, *University of Montreal* (sponsored by Serge Larochelle)—An experiment was run with the goal of determining which level of a category hierarchy is learned first. A feature overlap factor favored either high-level categories in the high-first condition or low-level categories in the low-first condition. A standard category verification task was administered six times during the learning process. Then, an explicit knowledge test was administered in order to take a closer look at the category representations of participants. Performance was better for low-level categories in both conditions, suggesting that the overlap factor did not determine the first level of abstraction. A closer look at the length and composition of the representations revealed that participants form high-level representations with attributes and values defining low-level categories. These results suggest a concrete-to-abstract process in learning hierarchically structured categories.

(3009)

**Conceptualization of Perceptual Cues Guided by Metaphor, Depth, and Imagined Perspective.** TIMOTHY C. CLAUSNER, *University of Maryland, College Park*, EVAN M. PALMER, CHRISTOPHER M. BROWN, & CAROLINA F. BATES, *Wichita State University*, & PHILIP J. KELLMAN, *UCLA*—We studied the role of magnitude metaphors (e.g., *larger is higher*) and depth cues (e.g., *larger is closer*) in an air traffic control visual search task. The effectiveness of size, contrast, color, and shape cues for encoding aircraft altitude (*z* dimension) in 2-D (*x,y*) displays were measured. Imagined viewing perspectives determined consistency between metaphors and depth cues. Participants looked from above or from below at a physical 3-D model, then imagined that perspective while viewing fronto-parallel displays. Displays imagined from above with depth-consistent cues yielded better performance than did those in the from-below, depth-inconsistent condition, even though the displays were identical and matched the *more is up* metaphor. Performance did not vary with imagined perspective for *more is down* metaphor displays. Both depth consistency and the *more is up* metaphor are required to explain these results. Performance varied with imagined perspective for grayscale—but not color or shape—encodings, possibly due to discrete versus continuous magnitude encoding.

(3010)

**Strategy-Specific Differences in Working Memory Utilization in Category Learning: Evidence for Multiple Systems of Category Learning.** MICHAEL A. ERICKSON & JUSTIN C. ESTEP, *University of California, Riverside*—One use of working memory in category learning is to manage different task representations (Erickson, 2008). We report the results of two studies that examined the relationship between working memory capacity (WMC) and category learning accuracy in Shepard, Hovland, and Jenkins's (1961) task. Although at most three dimensions were relevant for this task, we varied the number of dimensions that were presented and that changed between trials. When only three dimensions were present, WMC was only related to accuracy for problem types II, III, V, and VI. As a fourth dimension was added, this pattern changed. For example, the correlation between WMC and accuracy increased for problem type I (rule structure), whereas it remained at the same low level for type IV (prototype structure). This finding provides evidence that difficulty alone does not account for increased working memory utilization, but that it interacts with the underlying classification strategy.

(3011)

**Applying Principles of Attention Learning From Categorization to Reinforcement Learning.** FABIAN CANAS & MATT JONES, *University of Colorado, Boulder* (sponsored by Matt Jones)—Reinforcement learning (RL) has shown great promise as a framework for learning dynamic tasks. Although RL has performed well on complex tasks, the

models have been dependent on carefully crafted stimulus representations that capture the information relevant to the task. Without such a representation, RL methods are hopelessly lost in realistic, high-dimensional tasks. Here, we apply principles of representational learning established in category learning—specifically selective attention—to develop models that learn their own representations, allowing RL algorithms to learn complex tasks for which they were not specifically tailored. RL and category learning are remarkably complementary: RL's focus is on updating representations by computing sophisticated feedback signals from temporal patterns of reward, whereas category learning focuses on creating powerful representations but uses relatively simple rules to update them. I will present simulation results showing how attention learning speeds RL in high-dimensional tasks, as well as behavioral data testing these models.

(3012)

**Incidental Learning of Rule-Based and Information-Integration Categories.** DENNIS RÜNGER & F. GREGORY ASHBY, *University of California, Santa Barbara* (sponsored by F. Gregory Ashby)—A central tenet in the implicit learning literature is that individuals can learn about environmental regularities unintentionally. We therefore asked whether category learning can occur for irrelevant features. Participants made a two-choice discriminative judgment on the color of a Gabor patch whose orientation and spatial frequency could be ignored. Unbeknownst to participants, two categories were defined on the basis of the irrelevant features and mapped consistently on the two color alternatives. Learning of the categories was tested either directly or indirectly. For the indirect test, we were able to show that responses on ambiguous color trials were influenced by the category information contained in the irrelevant dimensions. For the direct test, the categories were learned intentionally after the color information had been removed. We obtained a learning advantage for participants who had received the same category structure in the incidental learning phase. Learning was the same for rule-based and information-integration categories.

(3013)

**Violations of Screening Off: A Bayesian Error Attribution Model of Causal Reasoning.** RALF MAYRHOFER, YORK HAGMAYER, & MICHAEL R. WALDMANN, *University of Göttingen*—One of the most fundamental assumptions underlying causal Bayes nets is the Markov constraint. According to this constraint, an inference between a cause and an effect should be invariant across conditions in which other effects of this cause are present or absent (i.e., screening off). Previous work in different laboratories has demonstrated that reasoners tend to violate this assumption systematically over a wide range of domains. Moreover, we have shown that the degree of violations of screening off is moderated by assumptions about the mechanisms underlying otherwise identical causal relations. We have developed a causal Bayes net model that includes a hidden common preventive noise source that provides a rational explanation of these apparent violations. We will present two new experiments that confirm predictions derived from the model.

(3014)

**Laypeople's Essentialist Beliefs Based on Experience With a Disorder Category.** DIANA H. HOOTEN & JESSECAE K. MARSH, *Texas Tech University*—Mental health clinicians are less likely than laypeople to believe mental health categories are real categories with essences (Ahn, Flanagan, Marsh, & Sanislow, 2006). This divide could be problematic, given that laypeople make up a clinician's client base. Is this difference due to clinicians' formal training or because they have more experience with mental disorder categories than laypeople do? To examine the impact of experience on essentialist beliefs, we asked undergraduate participants who did or did not identify as members of mental disorder categories to rate whether mental disorders have shared qualities, causal symptoms, and, ultimately, whether they believe the categories have an essence. Participants also rated their level of interaction with the disorder categories. More interaction with mental health categories resulted in lower essentialist beliefs, regardless of whether participants identified themselves as members of the categories. These findings have implications for theories of how beliefs about categories change through experience.

(3015)

**Category Membership Affects Conformity to Examples in a Creative Generation Task.** CYNTHIA SIFONIS, *Oakland University*—Previous studies have demonstrated the existence of a conformity effect in creative generation tasks. Participants viewing a set of category exemplars prior to engaging in creative generation tasks tend to include shared elements of those exemplars in their novel products. This is true whether those shared elements are features or are the relationships between features. The present research demonstrates that participants' tendency to incorporate shared elements of examples into their novel products depends upon the domain in which category generation occurs. Participants viewing examples sharing common elements were more likely to incorporate the higher order relationships shared by the examples into their novel products when the category domain was one in which higher order relationships were important. However, when the category domain was one in which the features of category members were important, the participants were more likely to incorporate the shared features of the examples into their novel products.

(3016)

**Statistical Learning of Compositional Concepts.** NOAH D. GOODMAN, FRANK JÄKEL, ANDREAS STUHLMÜLLER, VIRGINIA SAVOVA, & JOSHUA B. TENENBAUM, *MIT* (sponsored by Joshua B. Tenenbaum)—Classic laboratory experiments on concept learning used simple stimuli varying on a small number of obvious dimensions, such as shapes varying in size, color, and form. Also, the category structures that participants learned were defined in isolation from other concepts. Here, we explore learning of compositional concepts, defined in terms of generative rules and subpart concepts rather than in terms of fixed perceptual features. We study how compositional concepts can be learned from a small number of examples. Since related concepts can reuse the same subpart concepts, learning one new concept may help in learning another. We model learning in a Bayesian framework, making some assumptions about how concepts can be composed. Learning then amounts to inferring from examples the generative processes and parts underlying a set of novel concepts.

• BILINGUALISM •

(3017)

**Masked Translation Priming With Japanese–English Bilinguals: Effects of Cognate Status, Target Frequency, and L2 Proficiency.** MARIKO NAKAYAMA & YASUSHI HINO, *Waseda University*, & CHRISTOPHER R. SEARS, *University of Calgary*—For bilinguals of different scripts (e.g., Hebrew–English, Korean–English, Greek–French), robust masked translation priming has been observed for cognates and noncognates (Gollan et al., 1997; Kim & Davis, 2003; Voga & Grainger, 2007). Cognates produced larger priming effects than noncognates did in two of these studies, whereas no such advantage was observed in the other (Kim & Davis, 2003). The present study examined masked translation priming for cognates and noncognates with Japanese–English bilinguals. Proficient ( $n = 30$ ) and less proficient ( $n = 36$ ) bilinguals made lexical decisions to high-frequency and low-frequency English targets primed by Japanese cognates and noncognates. For proficient bilinguals, a cognate advantage was found for low-frequency targets only. For less proficient bilinguals, a cognate advantage was found for low- and high-frequency targets. Across cognate status, priming effects were larger for less proficient bilinguals. Implications for models of bilingual lexical representation are discussed.

(3018)

**Kitchen Russian: First-Language Object Naming by Russian–English Bilinguals.** BARBARA C. MALT, *Lehigh University*, & ANETA PAVLENKO, *Temple University*—A bilingual's two lexicons are linked rather than isolated from each other. An implication of this linkage is that the contents of one might influence the contents of the other. We examined naming of common household objects by early, childhood, and late Russian–English bilinguals to assess a possible second-language (L2) English influence on first-language (L1) Russian naming patterns and typicality ratings. L2 influence was evident in the data, even for late bilinguals. It was most pronounced with earliest arrival and entailed both narrowing and broadening of linguistic categories.

(3019)

**An Electrophysiological Investigation of Language and Lexical Selection in Bilingual Word Production.** NORIKO HOSHINO & GUILLAUME THIERRY, *Bangor University*—Previous research has demonstrated that cross-language activation is present even when proficient bilinguals perform a task only in one language (e.g., Colomé, 2001). In the present study, we investigated the time course of cross-language activation during word production in a second language (L2) by using a picture–word interference paradigm with event-related potentials. Spanish–English bilinguals named pictures in their L2 (English) while ignoring L2 distractor words that were visually presented with the pictures. Spanish–English bilinguals named pictures more slowly when distractors were semantically related or phonologically related to the English name of the picture or to the Spanish name of the picture than when they were unrelated. Interference was also detectable in the amplitude of the N2 peak. However, only semantic and phonological interference were found in the P3 range. Implications for models of bilingual word production—particularly for the locus of language and lexical selection—will be discussed.

(3020)

**Using Event-Related Potentials to Explore Sentential Code Switching in English–French Bilinguals.** KATHERINE J. MIDGLEY, *Tufts University*, KAITLYN A. LITCOFSKY, *Georgetown University*, TALIT DITMAN-BRUNYÉ, *Massachusetts General Hospital and Tufts University*, & PHILLIP J. HOLCOMB, *Tufts University*—Bilingual individuals have the unique ability to produce and perceive switches between their two languages in conversation. These code switches appear to be effortless, but differences in processing have been demonstrated between code-switched words and nonswitched words. However, it is still unclear what occurs after the code-switched word. English (L1)–French (L2) unbalanced bilinguals participated in an event-related potential study where they read and made plausibility judgments about sentences that began either in English or in French. Sentences contained either no code switches, one code switch (i.e., switching into the second language), or two code switches (i.e., switching into the second language and then returning to the original language). A late positive component was evoked to the first code-switched word. Different patterns of effects were found to the words following the code-switched word in L1 and L2. The results will be discussed within the framework of current models of bilingual language comprehension.

(3021)

**Phonological Processing in Successful Versus Unsuccessful Foreign Language Learners: Electrophysiological Correlates of Vowel Contrast Discrimination.** HILLA JAKOBY, ABRAHAM GOLDSTEIN, & MIRIAM FAUST, *Bar Ilan University*—Aptitude for foreign language learning varies greatly between individuals, and some people exhibit severe difficulties in learning a foreign language without suffering from dyslexia or lower IQ. This difficulty may partly emanate from poor speech discrimination abilities. The present research examined brain responses to novel vowel contrasts in an unfamiliar language during passive listening by successful and unsuccessful second-language learners. Analysis of the mismatch negativity (MMN)–P3–late discriminative negativity (LDN) complex revealed significant differences between the groups in the MMN and P3 component latencies, showing longer latencies for both components in the unsuccessful group. The LDN component was significantly lower in amplitude in the unsuccessful group both in anterior and posterior sites. These results suggest that unsuccessful learners may rely on less efficient neural mechanisms for speech perception at three different stages of pre-attentional phonological contrast processing in an unfamiliar language.

(3022)

**Semantic and Translation Priming From a First Language to a Second and Back.** SOFIE SCHOONBAERT, WOUTER DUYCK, MARC BRYSBART, & ROBERT HARTSUIKER, *Ghent University*—The present study investigates cross-language priming with unique noncognate translation pairs. Unbalanced Dutch (L1)–English (L2) bilinguals performed a lexical decision task in a masked priming paradigm. Two experiments showed significant translation priming from L1 to L2 (e.g., meisje—GIRL) and vice versa (e.g., girl—MEISJE), using two different SOAs (250 and 100 msec). Although translation priming from L1 to L2 was significantly



stronger than priming from L2 to L1, the latter was significant as well. Two further experiments with the same word targets showed significant cross-language semantic priming in both directions (e.g., jongen [boy]–GIRL; boy–MEISJE [GIRL]) for both SOAs. These data suggest that L1 and L2 are represented by means of a similar lexico-semantic architecture, in which L2 words are able to rapidly activate semantics, albeit to a lesser extent than L1 words. This is consistent with models assuming quantitative rather than qualitative differences between L1 and L2 representations.

(3023)

**Cognitive and Noncognitive Predictors of Spanish Foreign Language Proficiency.** ANITA R. BOWLES, JOEL T. KOETH, JARED A. LINCK, & MICHAEL F. BUNTING, *University of Maryland, College Park*—Adults studying foreign language (FL) in a classroom setting vary widely in their attained levels of proficiency. FL aptitude tests aim to predict these differences in outcome primarily through measures of cognitive ability (e.g., fluid intelligence, rote memory, and auditory processing). However, considerable variance in readiness for FL learning remains to be explained, perhaps by noncognitive measures of individual differences. In a single-semester longitudinal study of low and intermediate college-level Spanish students ( $N = 102$ ), we measured general fluid intelligence, FL classroom exposure, a set of noncognitive measures, FL reading and listening proficiency, and end-of-semester grades. The results suggest that measures of motivation, self-efficacy, personality, and attitudes toward learning predict attained Spanish proficiency over and above general fluid intelligence and classroom exposure to the language. Furthermore, certain noncognitive factors were differentially related to FL reading and listening proficiencies. These results implicate both cognitive and noncognitive components to FL aptitude.

(3024)

**Object Categorization in Bilingual Children.** EEF AMEEL, *Katholieke Universiteit Leuven*, BARBARA C. MALT, *Lehigh University*, & GERT STORMS, *Katholieke Universiteit Leuven*—Speakers of different languages map words onto referents in different ways, resulting in idiosyncratic naming patterns for different languages. To use names as a native speaker would, bilinguals must learn separate mappings for their two languages. Recent research, however, shows that bilinguals are not fully native-like in either language. Instead, their naming patterns converge on a common naming pattern. The present study investigates whether this convergence develops from the onset of language acquisition or at a later age, depending on whether language specificities determine naming from the very beginning or only later on. French–Dutch bilingual children (5–14 years of age) named household objects in Dutch and French. Their naming patterns were compared with naming by French and Dutch monolingual children of the same age. The results show, that at each age, bilingual children agree better upon naming than do monolingual children, suggesting that convergence is present from the start of language acquisition.

(3025)

**The Representation of Newly Learned Words in the Mental Lexicon.** XIAOMEI QIAO & KENNETH I. FORSTER, *University of Arizona* (sponsored by Kenneth I. Forster)—Are newly learned words immediately represented in a special form of lexical memory, or is there a gradual process of assimilation? To answer this question, we need a test of lexicalization. Showing masked repetition priming is not diagnostic, because episodic records can be primed. Elgort (2008) proposed using the prime lexicality effect (Forster & Veres, 1998) as a test of lexicalization. Masked form priming experiments show that words do not prime their neighbors (e.g., contrast-CONTRACT), so learning a novel word, such as “abstair,” should reduce the capacity of “abstair” to prime its real word neighbor, ABSTAIN. Elgort demonstrated such an effect with visible primes, and the present report demonstrates such an effect with masked primes. However, it appears that mere familiarization at the level of form is not enough; a meaning needs to be attached as well.

(3026)

**Coactivation of Phonology in Bimodal and Unimodal Bilinguals.** JANET G. VAN HELL, *Radboud University Nijmegen and Pennsylvania State University*, ELLEN ORMEL & JOYCE VAN DER LOOP, *Radboud*

*University Nijmegen*, & DAAN HERMANS, *Radboud University Nijmegen and PonTeM*—Research on lexical activation in bilinguals shows that both languages are active and influence lexical processing, even when bilinguals intend to use only one language. The vast majority of these studies involve two spoken languages, using unimodal bilinguals who perceive their two languages by the same sensory system. Bimodal (speech–sign) bilinguals, however, perceive one language visually and one language auditorily. Do patterns of coactivation of languages found in unimodal bilinguals extend to bilinguals who juggle two languages from different modalities: speech and sign? We report two experiments in which we examined the coactivation of phonology in Dutch–sign language bimodal bilinguals and Dutch–English unimodal bilinguals, using sign–picture and word–picture verification tasks. The results show phonological coactivation within L2 sign language and L2 English and cross-language activation of oral language–sign language and two oral languages. The implications of bimodal bilingualism for models of bilingual language processing will be discussed.

(3027)

**Corn on the Mind When Listening to Mice: An Eyetracking Study in Bilinguals.** LISA VANDEBERG, SAMANTHA BOUWMEESTER, & ROLF A. ZWAAN, *Erasmus University Rotterdam* (sponsored by Rolf A. Zwaan)—Does parallel processing of languages occur during spoken language comprehension? In two experiments using the visual world paradigm, we tracked the eye movements of Dutch–English bilinguals who listened to English (L2) sentences that included interlingual homophones. For example, the English word *mice* is phonologically equivalent to the Dutch *mais*, which means *corn*. The results show that, while listening to L2 sentences in the homophone condition (e.g., with an English target picture of mice), bilinguals were distracted by Dutch nontarget pictures (e.g., of corn) more often than by unrelated filler pictures. Experiment 2 showed that this occurred even when the sentence was contextually biased toward the English target picture. The findings support the language-independent view of lexical access. Multilevel analyses were performed to examine individual differences in susceptibility to L2 activation.

#### • PSYCHOLINGUISTICS •

(3028)

**The Effect of Affect on Cognitive Control and Sentence Processing.** ERIKA K. HUSSEY, SUSAN TEUBNER-RHODES, MICHAEL R. DOUGHERTY, & JARED M. NOVICK, *University of Maryland, College Park*—Recent research demonstrates the influence of emotional/affective states on higher-level cognition: Negative states like anxiety impair participants’ verbal cognitive control performance (e.g., on Stroop). Separately, psycholinguistic studies emphasize the importance of cognitive control during sentence processing, especially when readers/listeners must override early, incorrect interpretations when faced with temporary ambiguity. We explore whether modulating cognitive control via anxiety induction has discriminative effects on ambiguity resolution, versus unambiguous forms not requiring revision/control (*While Anna dressed the baby cried next door; The baby cried next door while Anna dressed*). Eye movements were recorded during reading. Overall, anxious participants read ambiguous sentences slower than did nonanxious participants; crucially, across several dependent measures, reading-time differences were exaggerated in critical regions where revision was necessary. Notably, no group differences emerged for unambiguous sentences. These findings extend research integrating emotion and cognitive control: Real-time sentence processing is influenced by affect under selective conditions—namely, when control must be initiated to recover from misinterpretation.

(3029)

**Ambiguous Adjectives in Noun Phrases: Shared Core Meaning With Sense Specialization.** ALLISON C. MULLALY, CHRISTINA L. GAGNÉ, & THOMAS L. SPALDING, *University of Alberta*—An adjective can have different senses, depending on the noun it modifies (Murphy, 1988). To determine how alternative senses of ambiguous adjectives are represented and accessed during the interpretation of noun phrases, we examined whether ease of processing is influenced by prior activation of a particular sense. Adjectives were paired with a noun that biased



target phrases toward the dominant or subdominant sense (e.g., “green toxin” uses the color sense of “green,” whereas “green conference” uses the eco-friendly sense). The target phrase was preceded by a prime word that was consistent, inconsistent, or unrelated to the sense used in the target. The time to verify the definition of the target phrase was facilitated in the consistent condition but was not affected in the inconsistent condition. In addition, the strength of both senses influenced verification time. These results indicate that alternative senses share a core meaning.

(3030)

**Implicit Prosody in Ambiguity Resolution.** MARA E. BREEN & CHARLES CLIFTON, JR., *University of Massachusetts, Amherst*—We conducted two experiments (self-paced reading and eyetracking) to look for evidence of simultaneous syntactic and metrical reanalysis by embedding noun–verb homographs in sentences like (1), which disambiguated the homograph as a noun (1a) or a verb (1b). These homographs had different stress patterns as a noun/verb (convict) or the same stress pattern (sentence). The two types of homographs were matched on length and overall syntactic category frequency. We also included baseline conditions with unambiguous nouns and verbs (statement, condemn). As expected, reading times were significantly longer when the homograph was disambiguated as a verb rather than as a noun. More important, the stress-alternating words (convict) incurred longer reading times in the disambiguating region than did the non-stress-alternating words, indicating the involvement of implicit prosody (metrical structure) in reading. 1a. Noun: stress-alternating/non-stress-alternating/unambiguous: *The intelligent convict/sentence/statement exhibited surprising coherence.* 1b. Verb: stress-alternating/non-stress-alternating/unambiguous: *The intelligent convict/sentence/condemn criminals after a fair trial.*

(3031)

**Individual Differences in Relational Aggression Influences ERPs to Sarcastic Prosody.** DAWN G. BLASKO & VICTORIA A. KAZMERSKI, *Pennsylvania State University, Erie*—In previous work, those high in relational aggression (RA) showed different patterns of ERPs when reading scenarios in which close friends used sarcasm. In the present study, ERPs were recorded while high- and low-RA participants listened to words spoken in either a sarcastic or a sincere prosody. The sarcastic prosody took longer to judge than did the sincere. Prosody interacted with RA group, so that the high-RA group showed greater differences between words with sarcastic and normal prosody. Similar to the work with written language, a large late positivity was seen to words with sarcastic prosody. A four-way interaction in the early region of the waveform (200–300 msec post stimulus onset) suggested different patterns of processing for low- and high-RA individuals. Those with high and low relational aggression may be differentially sensitive to the acoustic cues of sarcastic intonation.

(3032)

**Metaphors Need No Explanations.** CARLOS RONCERO, *Concordia University, Montreal*, JANE ASHBY, *University of Massachusetts, Amherst*, & ROBERTO G. DE ALMEIDA, *Concordia University, Montreal* (sponsored by John M. Kennedy)—Roncero, Kennedy, and Smyth (2006) found that similes (e.g., “time is like money”) were more often followed by explanations (e.g., “because you never seem to have enough”) than their equivalent metaphor form (e.g., “time is money”). The present experiment measured eye movements as participants read explanations following either a metaphor or an equivalent simile form. Reading times in the explanation region were significantly longer in the simile condition (1,133 msec vs. 1,092 msec for metaphors), but readers were also more likely to regress from the explanation back to the vehicle in the metaphor condition (9% vs. 4% for similes), suggesting that explanations following metaphors caused more disruption in eye movements. Therefore, metaphor explanations may be either redundant (resulting in faster first-pass reading times) or conflicting (as indicated by more regressions to earlier text). Consistent with Roncero et al.’s (2006) findings, our results suggest that metaphors need no explanations.

(3033)

**Breaking the Language Barrier: Social Interactivity Improves Adult Language Learning.** JIMMY TONG, KIMBERLY STONE, KRISTINA

DAHLEN, EMMA CHU, & CATHERINE L. CALDWELL-HARRIS, *Boston University* (sponsored by Catherine L. Caldwell-Harris)—A growing body of work suggests a role for socioemotional interaction in language acquisition, a factor that has been incorrectly overlooked in traditional classroom exercises and videotaped lessons. English monolinguals were taught Samoan phrases in four learning conditions: passive videotape, active videotape, passive live instruction, and active live instruction. Increased social interactivity (active learning and live instruction) yielded the highest scores on a subsequent picture-naming task. We discuss the role of interactive learning for adult language learners and suggest a new approach for increasing learner interest and mitigating anxiety: video game interaction.

(3034)

**People’s Sensitivity to Phonological Universals: Evidence From Fricatives and Stops.** TRACY LENNERTZ & IRIS BERENT, *Northeastern University* (sponsored by Iris Berent)—Are people sensitive to universal restrictions concerning the sound structure of language? To address this question, we examine the sonority levels of fricatives and stops. Sonority is a phonological property correlated with intensity. Across languages, fricatives are more sonorous than stops, but this distinction is absent in English and is not learnable from the statistical properties of its lexicon. We examine whether English speakers nonetheless differentiate between the sonority levels of stops and those of fricatives. Previous research has demonstrated that people are sensitive to sonority distance: Onsets with small sonority distances (e.g., lba) are ill formed; hence, they are more likely to undergo perceptual repair relative to larger distances (e.g., bna). If fricatives are more sonorous than stops, then the sonority distance between fricatives and sonorants should be attenuated (e.g., fna), thereby increasing the vulnerability of fricative–sonorant onsets to perceptual repair relative to stop–sonorant combinations (e.g., pna). Preliminary results support this prediction.

(3035)

**Implicit Learning in Foreign Language Acquisition.** LIDIA SUÁREZ & WINSTON D. GOH, *National University of Singapore* (sponsored by Winston D. Goh)—Lexical stress is critical in word recognition and speech segmentation. Implicit learning of lexical stress during the first stages of foreign language acquisition (FLA) was examined using a lexical decision task. Spanish words that followed a lexical stress rule—trochaic stress for words ending with vowels and iambic stress for words ending with consonants—were presented aurally to English-speaking participants, who subsequently had to discriminate between new Spanish words and nonwords. Although participants were not able to explicitly explain the lexical rule and attributed more of their responses to intuition judgments than to guessing, results showed that Spanish lexical stress was implicitly learned and used in lexical decision, despite word meaning being unavailable. Lexical stress cues seem to be acquired automatically by exposure to a foreign language, highlighting the importance of listening tasks for FLA. Such learning might be further exploited during foreign word recognition and speech segmentation.

(3036)

**Liaison Consonant in French and Exemplar-Based Lexicon: A Priming Experiment in Children Five to Six Years of Age.** JEAN-PIERRE CHEVROT, *University of Grenoble and LIDILEM/LPNC*, & SOPHIE GALLOT, *University of Grenoble and LPNC* (sponsored by Elsa Spinelli)—Liaison in French is one type of the between-word phonological alternations present in many languages. The study of its acquisition allows a better understanding of the mechanisms involved in child segmentation of words, since liaison errors act as an indicator of attempts to segment chunks of speech. In a priming experiment in 62 children 5–6 years of age, we examined the nature of the child lexical representation of nouns that are vowel-initial in adults. The produced targets (determiner–liaison–noun sequences) were preceded by lexically linked or unlinked heard primes that either share the same liaison consonant or do not. The analysis of correctly produced liaisons confirms that the liaison consonant is lexically encoded at the initial of exemplars of the noun (e.g., /nurs/, /zurs/ for *ours* “bear”) and supports the usage-based model of liaison acquisition (Chevrot, Dugua, & Fayol, in press). Moreover, error analysis improves our understanding of the competition between the exemplars of the same noun.

(3037)

**A Test of the Utility of the Associative Judgment Task During Language Processing.** KRISTIN M. WEINGARTNER, *Hofstra University*, KIMBERLY K. WEAR, *High Point University*, DAVID S. GORFEIN, *University of Texas, Dallas*, & HARRIETT AMSTER, *University of Texas, Arlington*—In the associative judgment (AJ) task, participants make judgments on a 7-point scale of the degree of association between members of word pairs at their own pace. It has been demonstrated by regression analysis that this measure contributes a large portion of the variance in a speeded relatedness-decision task where each of the critical test pairs include a balanced homograph. To further examine the validity of the AJ task, we measured the variance it accounted for in a primed lexical decision task where the target items were balanced homographs. Furthermore, our sample included participants from three different universities that varied in location from the southwest to the northeast. Regression analyses indicated that, whereas word frequency accounts for the largest portion of variance in the observed lexical decision performance, AJ accounts for an additional component of the variance. Differences across the three samples are also discussed.

## • LETTER/WORD PROCESSING •

(3038)

**Sentence Context Representation Activated by Transposed Phrases.** MICHIKO ASANO & KAZUHIKO YOKOSAWA, *University of Tokyo*—We examined the influence of sentence context on the perception of contextually anomalous words in a Japanese text. A target word (contextually anomalous two-kanji compound word or its contextually consistent counterpart) in a short text was briefly presented, followed by a four-alternative forced-choice recognition task. The results showed that participants recognized anomalous words less frequently than they did their correct counterparts. This context effect was obtained even when the participants processed sentences that were formed by transposing the phrases in legitimate sentences, so that the sentences contained the same semantic information even though the syntactic structure was disrupted. These results demonstrate that the preliminary representation of sentence context (we call this *proto-context*) is semantically activated by a group of constituent words before it is syntactically processed. This proto-context might be the essence of the sentence context that influences word recognition.

(3039)

**Access Into Memory: Does Associative Memory Come First?** ERIN M. BUCHANAN, *University of Mississippi*—Two experiments measuring the reaction time of semantic and associative judgments will be presented. Both experiments tested how quickly participants could judge relationships between word pairs. Experiment 1 showed a preference for associative information: Participants were able to judge associative relationships faster than they could semantic relationships. Experiment 2, however, showed no preference for relationship type. Interestingly, both experiments showed that judgment reaction time was predicted by associative and semantic relatedness (as measured with word norms). Reaction times were still predicted by semantic and associative relationships, even after accounting for simple lexical decision time (Balota et al., 2007). These findings are discussed in an interactive activation framework modified to include an associative store (McClelland & Rumelhart, 1981; Stolz & Besner, 1999; Williams, 1996).

(3040)

**Fast Phonology and the Bimodal Interactive Activation Model.** KEVIN DIEPENDAELE, *Ghent University*, JOHANNES C. ZIEGLER & JONATHAN GRAINGER, *CNRS and University of Provence* (sponsored by Johannes C. Ziegler)—We describe a new benchmark phenomenon for computational models of visual word recognition called the *fast phonology test*. In order to pass this test, a model must be able to simulate fast-acting phonological influences on visual word recognition, as revealed through masked phonological priming effects (e.g., *blou* primes *BLUE* better than *blai* primes *BLUE*), while maintaining an acceptable level of accuracy in irregular word reading. We show that the bimodal interactive activation model passes the fast phonology test. It does so by virtue of a fast parallel mapping of letters onto input phonemes that provide an additional constraint

on lexical identity. It remains to be seen whether any other computational model of visual word recognition can pass the fast phonology test.

(3042)

**Translation Invariance in Masked Repetition Priming.** YOUSRI MARZOUKI, *Tufts University and University of Provence*, MARTIJN MEETER, *Vrije Universiteit Amsterdam*, & JONATHAN GRAINGER, *CNRS and University of Provence*—An experiment examined the spatial extent of integration of information across prime and target stimuli in a masked repetition priming paradigm with single-letter stimuli. In order to neutralize effects of acuity and spatial attention on prime processing, subliminal prime stimuli always appeared on fixation. Target location varied randomly from trial to trial along the horizontal meridian at one of seven possible locations ( $-7^\circ$ ,  $-4.7^\circ$ ,  $-2.3^\circ$ ,  $0^\circ$ ,  $+2.3^\circ$ ,  $+4.7^\circ$ ,  $+7^\circ$ ). Speed of responding to target letters in an alphabetic decision task (letter/pseudoletter discrimination) was affected by target location and priming, but the size of the repetition priming effects did not significantly vary as a function of target location. These results suggest that masked repetition priming obtained with single-letter stimuli is subtended by representations that integrate information about letter identity independently of letter position.

(3043)

**The Roles of Pronounceability and Bigram Frequency in Letter Transposition Effects.** JINGJING ZHAO & JAY G. RUECKL, *University of Connecticut and Haskins Laboratories* (sponsored by Jay G. Rueckl)—The effects of letter transpositions are often studied using the lexical decision task. Unfortunately, the stimulus-selection constraints associated with this task make it difficult to disentangle the effects of various potentially relevant lexical and sublexical properties. Thus, we turned to the two-alternative forced choice task (Gomez, Ratcliff, & Perea, 2008, *Psychological Review*), in which participants see a briefly presented letter string and report whether they saw the target string (e.g., *AKBO*) or a response alternative formed by transposing (e.g., *ABKO*) or replacing (e.g., *ATNO*) two of the letters in the target. Using this task, we found larger transposed-letter effects with pronounceable pseudowords (e.g., *AKBO*) than with nonpronounceable nonwords (e.g., *QKBJ*). In addition, the frequency of the transposed bigram influenced error rates for pronounceable nonwords, but not for nonpronounceable nonwords. The implications of these findings for various models of the “front end” of reading will be discussed.

(3044)

**Testing the Least Supported Phoneme Account of Phonological Neighborhood Effects on Visual Word Naming.** MARK YATES, *University of South Alabama*—Past research has shown that phonological neighbors facilitate visual word naming. It has been argued that this effect can be explained in terms of the number of neighbors overlapping with the least supported phoneme (LSP). The LSP is defined as the phoneme within a word with which the fewest neighbors overlap. For example, consider the word *geese*, which has the following neighbors: *cease*, *lease*, *niece*, *peace*, *gas*, *goose*, and *guess*. For the word *geese*, the first phoneme, /g/, is the LSP as it overlaps with the fewest neighbors (i.e., the three words *gas*, *goose*, and *guess*). The present research compared naming latencies to words that had either many or few phonological neighbors overlapping with their LSP. As predicted, words with many neighbors overlapping with their LSP were named more rapidly. These results will be discussed in terms of current models of visual word recognition.

(3045)

**Age-of-Acquisition Effects in Pure Alexia.** REBECCA L. JOHNSON, *Skidmore College*, & CHELSIE L. CUSHMAN, *Emory University*—Pure alexia is an acquired reading disorder in which previously literate adults adopt a letter-by-letter processing strategy. Although these individuals display impaired reading, research shows that they are still able to use certain lexical information in order to facilitate visual word processing. The present experiments investigated the role that a word's age of acquisition (AoA) has on the reading processes in an individual with pure alexia (GJ). In Experiment 1, response times from a naming task indicated that GJ shows a strong effect of AoA where late-acquired words are more difficult to process than early-acquired words are. In Experiment 2, results from a sentence reading task in which eye-movement patterns

were recorded confirmed these findings and further showed that the AoA effect is much greater for GJ than for age-matched control participants. This indicates that patients with pure alexia rely heavily on intact top-down information, supporting the interactive activation model.

(3046)

**Emotion Moderates Translation Production in Proficient Bilingual Speakers.** DANA M. BASNIGHT-BROWN & JEANETTE ALTARRIBA, *University at Albany* (sponsored by Jeanette Altarriba)—To date, much of the cognitive research on bilingualism has examined word processing in bilinguals using words that were thought to have only one meaning across languages. Tokowicz and colleagues (2002, 2007) have revealed that as many as 25% of items used in previous experiments have multiple translations across languages. The present series of experiments examined the role of multiple translations in Spanish–English bilingual word production. The influence of multiple translations was examined as a function of word type (concrete, abstract, and emotion words) and word frequency. Two important conclusions emerged: Emotion words elicited the highest number of translations across languages, and the number of translations characterizing emotion words influenced processing differently, depending on translation direction. The implications of these studies have direct bearing on models of bilingual language processing, language acquisition, and emotion word processing.

(3047)

**Development of Orthographic Representation in Reading Chinese.** LING-PO SHIU, *Chinese University of Hong Kong*—A distinctive feature of the Chinese writing system is that most words are made up of two characters. The character is a more clearly defined perceptual and linguistic unit than the word, whereas the word is a more clearly defined phonological and semantic unit. It is often assumed that Chinese children learn to read by recognizing characters one by one. However, results from our recent studies of Chinese third-grade children suggest that these children can recognize Chinese words before they can recognize the characters that make up the words. First, when asked to read a character aloud, they might respond with the name of a character that combines with the target character in a familiar word. Second, when asked to read a word aloud with its two characters in reverse order, they could still read the word but could not detect that the characters were reversed.

(3048)

**Reading Disappearing Text: Why Do Children Refixate Words?** HAZEL I. BLYTHE, *University of Southampton*, TUOMO HÄIKIÖ & RAYMOND BERTRAM, *University of Turku*, SIMON P. LIVERSIDGE, *University of Southampton*, & JUKKA HYÖNÄ, *University of Turku*—We monitored eye movements as participants read sentences that literally disappeared during reading. Children of ages 8–9, 10–11, and adults read two sets of sentences: one that was normally presented and one in which each word disappeared 60 msec after fixation onset. Each sentence contained a target word that was manipulated for length. Children normally make a high proportion of fixations during reading, compared with adults; this strategy becomes redundant with disappearing text. We found no evidence that children require a second visual sample of long (8-letter) words. They frequently refixated these words in the normal condition, but they did not with disappearing text. Despite this, regressions back to the long words were no more likely to occur in the disappearing text condition than in the normal condition. Thus, children's high proportions of refixations during normal reading must largely be driven by factors other than visual sampling.

(3049)

**Nature of Orthographic–Phonological and Orthographic–Semantic Relationships for Japanese Kana and Kanji Words.** YASUSHI HINO, SHINOBU MIYAMURA, YUU KUSUNOSE, & YURI KAWARADA, *Waseda University*—It is generally assumed that orthographic–phonological consistencies are higher for Japanese Kana words than for Kanji words, whereas orthographic–semantic consistencies are higher for Kanji words than for Kana words. In order to examine the validity of these assumptions, we attempted to measure the orthographic–phonological and orthographic–semantic consistencies for 339 Kana words and 775 Kanji

words. The results indicated that both the orthographic–phonological and orthographic–semantic consistencies were more similar between Kana and Kanji words than previously assumed. The nature of reading processes for Kana and Kanji words is discussed.

(3050)

**Do English Readers Use Orthographic Cues to Recover Phonological Syllables' Evidence From ERP.** DANIEL TRINH & DEBRA JARED, *University of Western Ontario*—We investigated whether readers use orthographic cues to activate phonological syllables when reading multisyllabic words. For some English words, the orthography provides a clear indication of the phonological syllable boundary (e.g., com-rade cannot be co-mrade or comr-ade), but the syllable boundary is not clearly marked in the orthography of other words (e.g., plas-tic could be pla-stic or plast-ic). A syllable congruency paradigm was used, in which disyllabic words were presented in two colors, and the color change either did or did not coincide with the syllable boundary. Reaction times and event-related potentials (ERPs) were recorded while participants completed a lexical decision task. A syllable congruency effect was found in the ERP data at the N200 only for words with clear syllable boundaries. We suggest that skilled readers use knowledge of orthographic cues to syllable structure when reading to enhance the quality of the phonological representations of multisyllabic words.

(3051)

**The Influence of Picture Priming on Ambiguity Resolution During Reading.** BRIANNA M. EITER & KRISTIN M. WEINGARTNER, *Hofstra University*, DAVID S. GORFEIN, *University of Texas, Dallas*, & VINCENT R. BROWN, *Hofstra University*—In studies investigating the subordinate-bias effect, typical results show that when the preceding context supports the less dominant meaning of an unbalanced homograph, fixation times on the homograph are longer than when the preceding context is neutral. In previous reading studies, context was provided visually through a sentence or paragraph. In the present study, context is provided aurally through a picture priming task (Gorfein, Brown, & DiBiasi, 2007). In Phase 1, participants were presented with pictures of the nondominant meaning of ambiguous words and their associated spoken labels. In a second phase, eye movements were monitored while participants read sentences that contained homographs, half of which had appeared during Phase 1. The results from eye-movement measures show that priming does occur across contexts, but its effects are delayed. The results are discussed in the context of current theories of ambiguity resolution.

(3052)

**Modulation of Automatic Semantic Priming by Feature-Specific Attention Allocation.** ADRIAAN SPRUYT & JAN DE HOUWER, *Ghent University*, & DIRK HERMANS, *Katholieke Universiteit Leuven*—We argue that the semantic analysis of task-irrelevant stimuli is modulated by feature-specific attention allocation. In line with this hypothesis, we found semantic priming of pronunciation responses to depend upon the extent to which participants focused their attention on specific semantic stimulus dimensions. In Experiment 1, we examined the impact of feature-specific attention allocation upon affective priming. In Experiment 2, we examined the impact of feature-specific attention allocation on nonaffective semantic priming. In Experiment 3, affective relatedness and nonaffective semantic relatedness were manipulated orthogonally under conditions that promoted either selective attention for affective stimulus information or selective attention for nonaffective semantic stimulus information. In each of these experiments, significant semantic priming emerged only for stimulus information that was selectively attended to. Implications for the hypothesis that the extraction of word meaning proceeds in an automatic, unconditional fashion are discussed.

(3053)

**An Eyetracking Study of Proofreading.** JOHANNA K. KAAKINEN & JUKKA HYÖNÄ, *University of Turku*—We examined how proofreading influences readers' eye movement patterns, particularly on short and long compound words embedded in sentences. Thirty-seven participants read sentences for comprehension or looked for spelling errors (transposed or replaced letters). Proofreading increased first fixation duration, gaze duration, and the number of fixations on words during first-pass



reading. The results replicated earlier findings (Bertram & Hyönä, 2003) in demonstrating an early effect of word frequency (indexed by first fixation duration) for long but not for short compounds. In later measures (gaze duration and number of fixations) frequency effects were obtained for both short and long compounds. Surprisingly, even though proofreading encouraged letter-level processing, word frequency effects were stronger in proofreading than in reading for comprehension. Less surprisingly, the effect of word length was greater in proofreading than in reading for comprehension. The results indicate that task demands exert an early effect on eye movements during reading.

(3054)

**Detecting a Letter You Have Not Seen: The Missing-Letter Effect With an Eye-Contingent Display Procedure.** ANNIE ROY-CHARLAND, *Laurentian University*, JEAN SAINT-AUBIN, *University of Moncton*, & ASHLEY BELANGER, *Laurentian University*—While reading, participants miss more target letters in frequent function words than in less frequent content words. The present study tested the influence of predictability on this missing-letter effect using an eye-contingent display preventing parafoveal preview by replacing words to the right of fixation by Xs. Participants produced the basic missing-letter effect with more omissions for frequent function words than for control content words. Most importantly, even when Xs were skipped (thus preventing foveal and parafoveal view of the word), the same detection pattern was observed. Finally, if participants expected a function word—whether it was accurate or not—the Xs were more often skipped, and more omissions were observed. The results suggest that predictability of a word would have a stronger influence on the missing-letter effect than information acquired from both parafoveal and foveal view. Implications of these results will be discussed in light of the attentional disengagement model.

(3055)

**The Distractor Frequency Effect in Picture Naming: Evidence From the Psychological Refractory Period Paradigm.** CLAUDIO MULATTI & FRANCESCA PERESSOTTI, *University of Padua*, & REMO JOB, *University of Trento* (sponsored by Remo Job)—In two experiments, we made use of the psychological refractory period paradigm to locate the source of the distractor frequency effect (Miozzo & Caramazza, 2003) with respect to the locus of the semantic interference effect (Dell'Acqua, Job, Peressotti, & Pascali, 2007) and of the phonological facilitation effect (Ferreira & Pashler, 2002). In Experiment 1, Task 1 is tone discrimination and Task 2 is picture–word interference. In Experiment 2, Task 1 is picture–word interference and Task 2 is tone discrimination. The results suggest a central locus for the frequency of the distractor effect that, in accordance with Dent, Johnston, and Humphreys (2008), we ascribe to the word form retrieval stage.

(3056)

**Language-Specific Processes in Word Recognition: Shallow Versus Deep Alphabetic Orthographies.** SITI SYUHADA FAIZAL, MELVIN J. YAP, & SUSAN J. RICKARD LIOW, *National University of Singapore*—Malay has a very shallow alphabetic orthography, simple syllable structures, and transparent affixation. To investigate which word recognition processes might be language specific, we developed a database of lexical variables for 9,594 Malay words (printed corpus of >1 m) and collected behavioral data on skilled readers' ( $N = 44$ ) lexical decision and speeded pronunciation performance for 1,511 words. After we controlled for onsets, regression analyses on the behavioral data revealed that number of letters is a stronger predictor of latency than are word frequency for lexical decision and speeded pronunciation, consistent with reliance on nonlexical processing. Syllable effects were confined to speeded pronunciation, but number of morphemes reliably predicted latencies for both tasks, indicating routine affix stripping; orthographic and phonological neighborhood size predicted pronunciation accuracy only. These results for Malay are discussed with reference to conventional findings for skilled readers of English, which has a very deep alphabetic orthography.

(3057)

**Word Naming at the Individual Level.** JAMES S. ADELMAN & SUZANNE J. MARQUIS, *University of Warwick*, & MAURA G.

SABATOS-DEVITO, *University of North Carolina, Chapel Hill*—Mega-studies of visual word recognition—assessing large numbers of items averaged over individuals—are increasingly being used to test hypotheses and models. They are useful because they offer a more precise and powerful window onto the relevant cognitive processes than do item-selection designs. However, they are not without limitations, of which some relate to individual differences: Models are not asked to produce the full range of effect sizes produced by participants, and averaged curves do not always reproduce the curves in individual participant data. Models may therefore be asked to produce an (artifactual) functional form that is exhibited by no participant. Here, we present sufficient word naming data on 4 participants who may each be treated as a separate experiment. These data provide (1) evidence for individual differences, which suggests that some effects are not universal, and (2) more stringent  $R^2$  targets for models to meet.

(3058)

**The Role of Syllables in Lexical Access During Elementary School Years.** RAYMOND BERTRAM, TUOMO HÄIKIÖ, & JUKKA HYÖNÄ, *University of Turku*—In Finnish, hyphenation at the syllable level (e.g., KAH-VI, “cof-fee”) is used in early reading instruction in order to facilitate lexical access. In this study, it was examined whether hyphenation at the syllable level is indeed beneficial to Finnish second grade readers. The results showed that second graders processed concatenated (e.g., KAHVI) words faster than they did hyphenated words (e.g., KAH-VI). However, words with a bigram trough at the syllable boundary (i.e., words where the bigram at the syllable boundary is of lower frequency than the preceding and following bigrams are; e.g., KAHVI) were read faster than words without a trough (SIENI, “mushroom”). Taken together, this suggests that syllables are used in lexical access by second graders, but that hyphenation disrupts oculomotor processes or syllable integration. Given the shallow orthography of Finnish, the findings are in line with developmental theories of reading that propose the emergence of access codes beyond the letter level, regardless of the shallowness of orthography.

(3059)

**Binocular Coordination in Adults and in Children With and Without Dyslexia.** JULIE A. KIRKBY & HAZEL I. BLYTHE, *University of Southampton*, DENIS DRIEGHE, *Ghent University*, & SIMON P. LIVERSEDGE, *University of Southampton* (sponsored by Denis Drieghe)—The role of visual deficits in dyslexia remains controversial. We carried out two experiments to examine binocular coordination in three participant groups: adults and dyslexic and age matched control children. In the first experiment, participants were required to scan from left to right along horizontal lines of wordlike dot strings. In the second experiment, they were required to read simple sentences containing a target word that was high or low frequency. Binocular disparity was prevalent in all participant groups in the dot string experiments (cf. Blythe et al., 2006). Unsurprisingly, in the reading experiment, times were longer for dyslexic children than for control children and adults, and reliable frequency effects occurred for both groups of children on the target word. Preliminary analyses of the binocular data show differential disparity effects in dyslexic children relative to adults and control children.

(3060)

**Masked Priming of Pronounceable and Unpronounceable Nonwords: An ERP Investigation.** STÉPHANIE MASSOL & JONATHAN GRAINGER, *CNRS and University of Provence*, & KATHERINE J. MIDGLEY & PHILLIP J. HOLCOMB, *Tufts University* (sponsored by Jonathan Grainger)—The structure of nonword targets (e.g., DCMFPLR; DAMOPUR) was manipulated in an experiment combining masked priming with ERP recordings. Targets were preceded by primes that could be the same as the target or sharing either the first or last five letters of the target. The ERPs revealed a main effect of target type, with differences arising around 180 msec post target onset. Pronounceable nonwords produced larger negativities than unpronounceable nonwords did. Repetition priming affected ERPs starting at the same time, with less negative-going waveforms to targets following related primes. The differences in priming effects as a function of target type were mostly evident in a widely distributed negative-going component starting around 180 msec, peaking around 300 msec, and continuing through to 480 msec post target onset. The results



are in line with the proposal that orthographic structure starts to influence letter string processing immediately following the mapping of visual features onto letter identities at around 180 msec post stimulus onset.

(3061)

**A Neural Network Model of Backward Priming.** JEFFREY FRANSON & HARVEY H. MARMUREK, *University of Guelph* (sponsored by Harvey H. Marmurek)—*Semantic priming* refers to facilitation in the recognition or naming of a target word (e.g., king) that follows an associatively related prime word (e.g., crown). *Backward priming* refers to similar facilitation for related words presented in the reverse order, where the association is weak (i.e., the prime king precedes the target crown). The present research tested a recurrent neural network model that simulates both forward and backward priming. Backward priming effects arise from an interaction between a word pair's semantic relatedness and association strength. Both lexical frequency and stimulus onset asynchrony also contribute to priming effects in the model. Finally, the model was evaluated by comparing its performance with results from previous human studies of backward priming.

• MOTOR CONTROL •

(3062)

**When Reacting Is Faster Than Acting.** YAÏR PINTO, *Harvard Medical School*, MARTE OTTEN & MICHAEL A. COHEN, *Harvard University*, & TODD S. HOROWITZ & JEREMY M. WOLFE, *Harvard Medical School* (sponsored by Jeremy M. Wolfe)—Neuropsychological and neuroimaging studies have demonstrated that self-initiated (SI) and externally triggered (ET) behaviors are preceded by very different patterns of brain activity. However, it is not known whether these patterns have any observable consequences for behavior. In four experiments, participants performed a simple action (releasing the “5” button then pressing the “4” button). They either initiated this action when they chose or responded to an external (visual) trigger. Interbutton time was reliably faster when the action was externally triggered, whether the trigger was a simple flash of light or a picture of a gunslinger. However, this effect tended to diminish across repeated trials, perhaps reflecting either practice or vigilance effects. If reaction (ET) is generally faster than action (SI), this could be relevant to the interpretation of cognitive psychology experiments, since we typically study ET behaviors and attempt to generalize to everyday behavior, which is often SI.

(3063)

**Visual Context Differentially Mediates Left- and Right-Hand Reaching Movements.** JOS J. ADAM, SUSAN HOONHORST, & RICK MUSKENS, *Maastricht University*, JAY PRATT, *University of Toronto*, & MARTIN H. FISCHER, *University of Dundee*—Recently, Gonzalez, Ganel, and Goodale (2006) reported that grasping movements with the left hand are more vulnerable to visual size illusions than are grasping movements with the right hand. They interpreted this finding in terms of a left-hemisphere/right-hand specialization for the visual control of action. The present study investigated whether this advantage extends to another type of visually guided action—namely, reaching. Right- and left-handed participants reached for targets embedded in two different visual contexts with either their dominant or their nondominant hand. Visual context was manipulated by presenting targets either in isolation or within an array of placeholders denoting possible target locations. The results showed that, for both right- and left-handed participants, reaching with the left hand (but not with the right) was substantially slowed down by the presence of placeholders. This finding suggests that, regardless of handedness, the left hemisphere plays a special role in the visual control of reaching movements.

(3064)

**Magnitude Interference Between Number Processing and Response Force Planning.** OLIVER LINDEMANN, ROEL BOUSARDT, & HAROLD BEKKERING, *Radboud University Nijmegen*—The present study investigates the functional connection between number processing and the control of motor actions. Participants were required to judge the magnitude or parity status of Arabic digits and indicate their decisions by pressing a button with either a weak (<100 cN) or a strong force

(>600 cN). The RT analysis revealed that responses with a high force level were initiated faster when the numbers were relatively large, whereas responses with a low force level were initiated faster toward small numbers. The finding of a nonspatial number–response compatibility effect was also mirrored by the error rates and the applied peak motor forces. The observed linear interference between symbolic magnitude information and response force planning will be discussed in the context of an action-based embodied approach to mathematical cognition, which suggests that number processing and motor control are two processes that are linked by a common metric for magnitude information.

(3065)

**Trial-and-Error Learning Eliminates the Simple Interval-Ratio Advantage for Unimanual Tapping.** JEFFREY R. EDER & DAVID A. ROSENBAUM, *Pennsylvania State University*—Evidence from bimanual and unimanual finger-tapping experiments indicates that participants are more accurate at producing sequences of taps that require simple intertap interval ratios (e.g., 1:1 or 2:1) than of those that require more complex intertap interval ratios (e.g., 3:2). Such results have provided the basis for many models of timing. In the present experiment, participants learned to produce a sequence of two time intervals, so that Interval 2 was a certain percentage of Interval 1 (no absolute timing requirements). This was accomplished through a process of trial-and-error, during which participants were provided with performance feedback. The results did not indicate a simple interval-ratio advantage for 1:1 or 2:1. This outcome challenges the generality of the simple interval-ratio advantage that has been observed in other studies, where the series to be generated were imitated rather than discovered. The implications of the results will be discussed.

(3066)

**The Trajectory of Adaptation to the Complex Visuomotor Transformation of a Sliding Lever.** SANDRA SÜLZENBRÜCK & HERBERT HEUER, *Leibniz Research Center for Working Environment and Human Factors*—In a previous experiment, we have shown that a simplified approximation of the transformation of a sliding lever (rather than a correct internal model) is acquired during practice with visual closed-loop control. With this symmetry approximation, the target for the hand movement is derived from the visual target for the tip of the lever as the position which is symmetric around a sagittal axis. In the present experiment, we investigated adaptation to the transformation of a real and of a virtual lever during practice with terminal visual feedback. The results revealed that, in early practice trials, the symmetry approximation was employed. However, in later practice trials, there was a gradual shift toward the correct kinematic transformation of the lever. Thus, the trajectory of adaptation to the complex transformation is composed of a rapid, steplike switch to the symmetry approximation followed by a slow, graded approach to a correct internal model.

(3067)

**Presentation Frequency of a Stimulus Event Can Influence Compatibility Interference.** PAUL S. MATTSON & LISA R. FOURNIER, *Washington State University, Pullman* (sponsored by Lisa R. Fournier)—Withholding actions to one stimulus (A) in working memory can delay responses to a second stimulus (B) if A and B share similar action features (response hands). The code occupation hypothesis assumes that this compatibility interference (CI) results from feature integration's rendering these features temporarily unavailable for other actions. We examined whether integration strength increases for stimuli presented more versus less frequently. Two stimuli (A and B) occurred sequentially. Stimulus A was a high- or a low-frequency stimulus. Participants planned and withheld a response to Stimulus A. Then Stimulus B occurred and required an immediate speeded response. Afterward, the response to Stimulus A was executed. The results showed larger CI effects for high- versus low-frequency stimuli in early blocks of trials and a reverse frequency pattern in later blocks. Thus, frequent event repetition enhances feature integration, and, eventually, the integrated representation moves from working to long-term memory, eliminating CI.

(3068)

**Parallel Processing of Cross-Modal Action: Evidence From Saccades and Manual Responses.** LYNN HUESTEGGE & IRING KOCH, *RWTH*

**Aachen**—Response-related mechanisms of multitasking were studied by analyzing simultaneous processing of responses in different modalities (i.e., cross-modal action). Subjects responded to single auditory stimuli either with a saccade, a manual response (single-task conditions), or both (dual-task condition). We used a spatially incompatible stimulus–response mapping for one task but not for the other. Critically, inverting these mappings systematically varied the asymmetry in single-task processing speed between both tasks while keeping the overall conflict across responses at a constant level. The results revealed mutual interference, but greater dual-task costs for manual responses. Notably, a substantial increase of temporal task overlap (i.e., similar single-task processing speed) did not affect dual-task costs, challenging the notion of serial processing due to a central response-selection bottleneck. Instead, the results suggest that cross-modal action is processed in parallel by a central mapping-selection mechanism in working memory, eventually causing response-related crosstalk.

(3069)

**Simultaneous Event and Emergent Timing.** BRUNO H. REPP, *Haskins Laboratories*, & SUSAN STEINMAN, *Yale University*—It has been claimed that rhythmic tapping and circle drawing represent different timing processes, and also that circle drawing is difficult to synchronize with a metronome and exhibits little phase correction. In this study, musically trained participants tapped with their left hand, drew circles with their right (dominant) hand, and also performed both tasks simultaneously. In Experiment 1, they synchronized with a metronome and then continued on their own, whereas in Experiment 2, they synchronized with a metronome containing phase perturbations. Circle drawing generally exhibited reliable synchronization, though it was more variable than tapping, and also showed systematic phase correction that evolved gradually during the tapping cycle. When carried out in synchrony with or without a metronome, the two tasks affected each other in some ways but retained their distinctive characteristics. This suggests that they were paced by the same cognitive timer and that event and emergent timing can coexist.

# • COGNITIVE CONTROL •

(3070)

**A Dynamic Neural Field Model of Response Selection Using a Dual-Task Paradigm.** AARON T. BUSS, TIM WIFALL, ELIOT HAZELTINE, & JOHN P. SPENCER, *University of Iowa* (sponsored by John P. Spencer)—Dual-task costs are observed as an increase in response time when two tasks are performed simultaneously, as compared with when they are performed alone. Traditional theories attribute these costs to competition for an amodal processor that selects responses. Here, we ground dual-task costs in a real-time dynamic neural field model. This framework assumes that response selection reflects the formation of an activation peak within working memory (WM) fields that encode specific stimulus–response mappings. Decisions are formed on the basis of stimulus inputs and neural dynamics within the WM fields. Control neurons modulate the resting level of activation within these fields, globally boosting the resting level when a stimulus is presented. Dual-task costs emerge from competition through shared inhibitory coupling when each control network is active. This architecture captures differences in dual-task costs with different modality pairings, as well as the reduction in costs with practice.

(3071)

**Voluntary Task Switching Under Working-Memory Load: Investigating the Contribution of Top-Down Control in Intentional Goal-Directed Behavior.** JELLE DEMANET, FREDERICK VERBRUGGEN, BAPTIST LIEFOOGHE, & ANDRÉ VANDIERENDONCK, *Ghent University* (sponsored by Frederick Verbruggen)—We examined the involvement of top-down control and bottom-up influences in goal-directed behavior in the voluntary task-switching procedure. The strength of the stimulus-repetition effect, which refers to the tendency to repeat a task more when a target stimulus repeats than when the stimulus alternates, was used as an estimate of the impact of bottom-up factors. In a single experiment, a concurrent working memory (WM) load was imposed during voluntary task switching. The results showed that the tasks are repeated more often and that the stimulus-repetition effect becomes stronger with a

concurrent WM load. This finding demonstrates that when the efficiency of top-down control is reduced by a concurrent WM load, the impact of bottom-up factors is increased. In general, our findings suggest that top-down control in voluntary task switching—and goal-directed behavior in general—is needed to overrule unintentional activation of task goals in order to optimize intentional activation of task goals.

(3072)

**Individual Differences in Task Switching.** CHRISTINA V. WASYLYSHYN, *Naval Research Laboratory*—Individual differences in three task-switching paradigms (externally cued, alternating-runs, and voluntary) were examined to determine whether the manner by which one is informed to switch between tasks affects switch costs. Several cognitive processes have been proposed to explain switch costs, but because different types of paradigms are used, it is not certain whether the ability to switch between tasks is due to a common process or whether switch costs are paradigm specific. Two hundred fifty young adults completed measures of task switching, processing speed, working memory, and long-term memory. The results indicated that the magnitude of switch costs varied on a per-paradigm basis but shared a subset of the total variance. After accounting for individual differences in processing speed, switch costs were differentially related to other measures of cognition. Individual differences in alternating-runs and voluntary costs were predicted by working memory scores; individual differences in externally cued costs were predicted by long-term memory scores.

(3073)

**Executive Control of Intertemporal Choice: Effects of Cognitive Load on Impulsive Decision Making.** SARAH J. GETZ, DAMON TOMLIN, LEIGH E. NYSTROM, JONATHAN D. COHEN, & ANDREW R. A. CONWAY, *Princeton University* (sponsored by Jonathan D. Cohen)—Intertemporal choice involves trade-offs between costs and benefits over time. If executive control processes are necessary for evaluating delayed rewards, then engaging participants in a task that competes for the executive functions of working memory (WM) should result in increased impulsive decision making during an intertemporal choice task. Previous research on the effects of WM load on impulsive decision making has been inconclusive because of concerns about erratic responding while under load. Participants in the present research performed intertemporal choices while simultaneously performing an *n*-back task under high load (3-back) or low load (0-back). A staircasing algorithm allowed scrutiny of choices relative to participants' point of indifference. Decision making changes as a function of load, so that participants in the high-load condition chose the immediate reward more often than those in the low-load condition did. Thus, imposing a WM load limits evaluation of delayed reward, resulting in more impulsive decision making.

(3074)

**Effects of RTMS Over Right Parietal and Frontal Cortex in the Flanker Paradigm.** BETTINA OLK, *Jacobs University Bremen*, YU JIN, *Pompeu Fabra University*, & CLAUS C. HILGETAG, *Jacobs University Bremen*—In the flanker paradigm, participants respond to centrally presented targets while ignoring peripheral flankers. Responses are slower when flankers and targets are incongruent, indicating that the flankers are not completely unattended and response conflicts occur. We investigated the role of the right posterior parietal cortex (PPC), which is involved in the allocation of attention, and of the right dorsal medial frontal cortex (dmFC), which is involved in the resolution of response conflicts, by applying repetitive TMS (rTMS) offline. Participants completed a flanker task in a baseline condition, in a sham condition, and after 1-Hz rTMS was applied. Critically, rTMS over right PPC abolished flanker effects in a spatially selective manner (i.e., when flankers appeared in left space), indicating that rTMS disrupted attention to the flanker and thereby reduced the response conflict. After rTMS over dmFC, flanker effects persisted and were slightly amplified bilaterally, suggesting that rTMS may have hampered the resolution of the response conflict.

(3075)

**Action and Puzzle Video Games Prime Different Speed–Accuracy Trade-Offs.** ROLF A. NELSON, IAN STRACHAN, SHERRI CONKLIN,

& JARED FLOCH, *Wheaton College, Massachusetts* (sponsored by William Prinzmetal)—To understand the way in which video game play affects subsequent perception and cognitive strategy, two experiments were performed, in which participants played either a fast action game or a puzzle solving game. Before and after video game play, participants performed a task in which both speed and accuracy were emphasized. In Experiment 1, participants engaged in a location task, in which they clicked a mouse on the spot where a target had appeared, and in Experiment 2, they were asked to judge which of four shapes was most similar to a target shape. In both experiments, participants were much faster but less accurate after playing the action game; they were slower but more accurate after playing the puzzle game. The results are discussed in terms of a taxonomy of video games by their cognitive and perceptual demands.

(3076)

**Fractal Dynamics of Perception–Action in the Dimensional Card Sort.** JASON ANASTAS, DAMIAN G. STEPHEN, & JAMES A. DIXON, *University of Connecticut* (sponsored by James A. Dixon)—Recent research suggests that dynamics of perception–action contribute to rule induction. The nested, interactive structure of perception–action entails that those dynamics are fractal (Van Orden, Holden, & Turvey, 2003). A gradual rising and falling of fractality in hand gestures during a visuo-spatial reasoning task predicts rule discovery (Stephen & Dixon, 2009). We sought to extend this finding to the dimensional card-sort paradigm. Twenty-six adult participants completed five sorts with cards varying on three dimensions and received feedback for each card. Experimenters either gave participants explicit description of the rule or left participants to infer the rule strictly from the feedback. A motion-capture device tracked the sorting-hand movements. The fractality of sorting movements exhibits a parabolic rise and fall over the course of each session. This parabolic trajectory was significantly stronger for induction participants. These results provide new evidence that dynamics of perception–action predict changes in higher-order cognition.

(3077)

**Emotional Faces as Remote Distractors in the RDE Paradigm.** VALERIE BENSON, *University of Southampton*—In three experiments, I examined the influence of emotional faces as distractors on the remote distractor effect (RDE), a robust finding of an increase in saccade latencies (SOLs) when two (rather than one) possible targets are presented simultaneously (Walker, Deubel, Schneider, & Findlay, 1997). In Experiment 1, I examined whether facial expression systematically modulated the RDE. In a mixed design with a prespecified unilateral target and distractor presentation, SOLs were greater for central versus parafoveal and peripheral presentation, and this was not modulated by facial expression. In Experiment 2, I used a bilateral target and distractor presentation. The unpredictability of the target location disrupted the eccentricity effects from the previous experiment (replicating Benson, 2008), but again, no effect of expression was found. In Experiment 3, a blocked design resulted in longer saccade latencies for angry faces at all eccentricities. Detailed analysis revealed that, although SOLs are modulated by facial expression, RDE magnitudes are not (replicating Benson, 2009).

(3078)

**The Effect of Object-Based Attention on Cognitive Tasks.** REIKO YAKUSHIJIN & AYAKO OKAMOTO, *Aoyama Gakuin University*—We investigated the effect of object-based attention on cognitive tasks that require different levels of cognitive control. Six white circles (containers) were presented in a circular configuration, and a small colored circle or square (target) was presented inside one of these containers. Participants were asked to discriminate the shape or color of the target as fast as possible. We set two conditions on movement of containers. In one condition, containers were moved clockwise by 60° of arc within the intertrial interval. In the other condition, they were not. In both conditions, we examined whether the reaction time would be affected by the target's being presented inside the same container as the former trial. Results showed that participants discriminated target shape significantly faster when the target was presented inside a different container in each trial, irrespective of the movement of containers. However, this effect disappeared in task-switching situations.

(3079)

**Forced Choice Error Correction With Ambiguous Error Feedback.** ELENA G. PATSENKO & ERIK M. ALTMANN, *Michigan State University*—Most of our knowledge of the mechanisms of error detection and correction comes from simple behavioral scenarios in which errors are caused by impulsive behavior (e.g., the Stroop or Eriksen flanker tasks) and in which feedback is given immediately in response to an erroneous response. Here, we present a paradigm in which a working memory task and a multiple object tracking task are combined to create a complex situation in which multiple things can go wrong (working memory or tracking failures). This paradigm allowed us to ask whether people are able to make informed decisions about what kind of error they make. Given delayed error feedback indicating only generically that something went wrong, participants most often correctly identified the type of error they made, suggesting that the system does detect and represent information about processing errors that occur in the course of performing a complex task.

(3080)

**The Aging of the Wandering Mind: Task-Unrelated Versus Performance-Related Thought.** JENNIFER C. MCVAY, MATTHEW E. MEIER, DAYNA R. TOURON, & MICHAEL J. KANE, *University of North Carolina, Greensboro*—Mind wandering typically impairs task performance, and older adults often show worse performance on cognitively demanding tasks than do younger adults. However, limited research suggests that adult aging reduces self-reported mind wandering. In this study, we administered either a go/no-go or vigilance version of the sustained attention to response task to older and younger adults and probed their thought content immediately following rare target stimuli. Subjects reported frequent task-unrelated thoughts (TUTs), and they committed more errors preceding TUTs than preceding on-task thought reports. Although older adults reported fewer TUTs than did younger adults, they also more frequently reported task-related interference (TRI), or evaluative thoughts about their own performance, than did younger adults. Furthermore, TRI was just as detrimental to performance as were TUTs. We suggest that TRI, which has not been evaluated in previous aging studies, may be frequently labeled by subjects as task-related thought, thereby exaggerating age-related differences in off-task thinking.

#### • SELECTIVE ATTENTION •

(3081)

**Attentional Blink for Detecting Emotions.** MICHAEL VOGEL & CHRISTOPHER J. KOCH, *George Fox University* (sponsored by Christopher J. Koch)—Two experiments were conducted to examine the attentional blink for facial emotions. In the first experiment, happy faces were used as the first target. Fear faces were used as the first target in the second experiment. Distractors were either consistent with the facial emotion (e.g., puppies for happy), inconsistent with the facial emotion (e.g., snakes for happy), or neutral. The second target was presented between one (70 msec) and six (420 msec) items after the first target. Subjects were able to accurately detect the second target at all delays, regardless of the emotional content of the distractors. The results suggest that emotional facial expressions might not exhibit an attentional blink. Instead, this information may be processed either preattentively or outside of typical attentional processing.

(3082)

**Why Don't Color Singletons Capture Attention? The Role of Perceptual Load.** NICHOLAS W. GASPELIN & ERIC RUTHRUFF, *University of New Mexico*, & SHAUN P. VECERA & JOSHUA D. COSMAN, *University of Iowa* (sponsored by Eric Ruthruff)—Recent research has cast considerable doubt on the ability of color singletons to capture spatial attention in a purely stimulus-driven manner. Despite the lack of evidence for it in the laboratory, there are many anecdotal reports of stimulus-driven capture in real-world settings. Perhaps a critical difference between laboratory and real-world visual scenes is the amount of relevant information, or *perceptual load*. Scenes with low perceptual load (as when one is focused on a single visual object) might free attentional resources, allowing them to be more easily captured by salient color singletons. In the present study, we manipulated perceptual load in a visual search task with flanking letters



that were sometimes color singletons. If reduced load increases susceptibility to capture, color singletons should capture attention, prolonging RT and increasing flanker compatibility effects. We discuss our results in terms of singleton capture outside the scope of attention.

(3083)

**Suppression Rather Than Capture of Attention by Salient Singletons: Electrophysiological Evidence.** RISA SAWAKI & STEVEN J. LUCK, *University of California, Davis* (sponsored by Steven J. Luck)—Some investigators argue that salient singletons capture attention because of bottom-up salience, whereas others propose that capture is contingent on top-down control settings. This debate has reached an impasse, and new approaches are needed. The present study therefore used ERP recordings, focusing on N2pc (a measure of focused attention) and the distractor positivity (Pd, a measure of suppression). Subjects searched for letter targets within an attended region of space, with occasional color singleton distractors within either the attended region or an unattended region. We found that the irrelevant color singletons did not capture attention (as indexed by N2pc), whether they were inside or outside the attended region; instead, they were subjected to active suppression (as indexed by Pd). These findings demonstrate that stimulus-driven capture can be eliminated by top-down mechanisms, but they also suggest that this requires an active suppression process to overcome the bottom-up salience of the singleton.

(3084)

**Moderate Working Memory Load Has Minimal Influence on Semantic or Spatial Selection.** CHRISTOPHER M. MASCIOCCHI & VERONICA J. DARK, *Iowa State University*—We have previously shown that report of semantically cued or spatially cued target words is reduced when nontarget words are cued by the opposite cue type. Because Lavie (2005) demonstrated that loading working memory increases attention capture by salient nontarget items, we examined whether nontarget cues would cause a larger decrement when participants were under working memory load. During some blocks of trials, participants remembered either four digits or four spatial locations for a posttrial recognition task while attempting to report a spatially cued or semantically cued target word. Performing the memory task concurrently had minimal effect on word report, regardless of the type of target or memory task, suggesting either that the memory and selection tasks engaged different processes or that the memory task was too easy. We are currently exploring whether a more demanding memory task will produce similar results.

(3085)

**Charting the Attentional Blink in a Moving RSVP Stream.** BRAD WYBLE, *Syracuse University*, & MARCELO MATTAR & MARY C. POTTER, *MIT*—The attentional blink (AB) is an impairment in reporting a second target (T2), whether the two targets are at the same or different spatial locations. Lag 1 sparing from the AB, however, occurs only when the two targets are in the same location. The present experiments asked what happens when the RSVP stream moves smoothly in either spatiotopic or retinotopic coordinates. Subjects searched for letters among digit distractors in an RSVP stream that circled around a fixation point at about 4°, changing identity every 93 msec. Subjects either fixated centrally or tracked the stream with their eyes. In either case, a normal attentional blink pattern was observed, showing lag 1 sparing despite the shift in spatial location, as well as competition with T1 at lag 1. Further experiments examined in more detail the correspondence between object file continuity and the ability to identify rapidly presented targets.

(3086)

**A Distractor's Influence on Saccade Trajectory Depends on Its Location in Visual Space.** KAITLIN LAIDLAW & ALAN KINGSTONE, *University of British Columbia* (sponsored by Alan Kingstone)—When a short-latency saccade is made to a target, saccade trajectories will curve toward a simultaneously presented distractor. If reaction times are slower, the distractor location will be inhibited, and trajectories will curve away from the distractor. Our study reveals that the inhibition of a distractor is dependent on its location in visual space. Distractors presented on the vertical meridian were inhibited much faster than were distractors presented on the horizontal meridian, though trajectories to all locations showed

evidence of increasing distractor inhibition as saccadic reaction times increased. Furthermore, inhibition was stronger for distractors presented in the lower visual field than for those presented in the upper visual field. We suggest that these results are a consequence of how visual space is represented within the oculomotor maps of the superior colliculi.

(3087)

**A Visuospatial Working Memory Load Affects Location-Based Negative Priming Differently Than Does Inhibition of Return.** TODD A. KAHAN, VICTORIA A. OLDAK, & ANDREA S. LICHTMAN, *Bates College*—There is a growing body of experimental research that suggests that location-based negative priming (L-NP; slowed responding to stimuli presented at previously ignored locations) and inhibition of return (IOR; slowed responding to stimuli presented at previously attended locations) are caused by a common underlying mechanism. Evidence for this is briefly reviewed, and an experiment ( $N = 60$ ) is reported where L-NP and IOR are examined under different memory load conditions. We found that L-NP increased under a visuospatial memory load relative to a verbal memory load, but memory load had the opposite effect on IOR. IOR was eliminated under conditions of visuospatial memory load but not under conditions of verbal memory load. These data are among the first to suggest that L-NP and IOR are caused by different underlying mechanisms.

(3088)

**Attentional Bias to Emotional and Smoking Stimuli: Evidence From Eye Movements.** JAMES E. CANE & DINKAR SHARMA, *University of Kent*—Smoking is often accompanied with selective attentional bias for smoking-related stimuli, which is thought to promote smoking behavior. Furthermore, negative affective states are often reported during abstinence, which may increase the chances of selective attentional bias to negative stimuli. The present experiment examined eye movements to smoking, negative, and neutral images across groups of different smoking status while controlling low-level features of images (luminance, contrast, complexity). Sixteen smokers, 14 smokers attempting to quit, and 16 never-smokers completed an image comparison task with pairs of images (negative–neutral, smoking–neutral, control–neutral) while having eye-movement measures recorded. Findings indicated that all participants were quicker to fixate on, made more fixations to, and maintained their gaze longer on negative images, as compared with smoking and neutral images. Thus, the results indicate the presence of selective attentional bias for negative stimuli—but not smoking stimuli—once low-level features of images have been controlled for.

(3089)

**Sexual Words May Inhibit Young Canadians, but They Energize the French (Especially Older Ones).** ANDRÉ DIDIERJEAN, *University of Franche-Comté*, FRANÇOIS MAQUESTIAUX, *Université Paris-Sud 11*, SANDRINE VIEILLARD, *University of Franche-Comté*, ALAN A. HARTLEY, *Scripps College*, & ERIC RUTHRUFF, *University of New Mexico* (sponsored by Alan A. Hartley)—Arnell, Killman, and Fijavz (2007, Experiment 3) showed that sexual distractor words captured the attention of young Canadian adults, decreasing the accuracy of a target occurring 220 msec later in an RSVP stream. They attributed this involuntary attentional blink to the high relevance of sexual material for young adults. The present study tested this hypothesis by comparing the performance of young and elderly French adults, using Arnell et al.'s procedure. Our results were at odds with those of Arnell et al., in that no attentional blink was observed. In fact, target accuracy was higher when the to-be-ignored distractor was a sexual word than when it was a neutral word. Furthermore, the increased accuracy with sexual distractors was more pronounced with advancing age. Sexual words hamper target search for young Canadians, but serve as useful warning signals to upcoming targets for French participants, and even more so when those participants are elderly.

(3090)

**Mood's Influence on Inattentional Blindness for Emotional Stimuli.** MARK W. BECKER, *Michigan State University*—We investigated whether one's mood influences the types of emotional stimuli that one notices during an inattentional blindness task. Participants received either a positive (happy) or negative (sad) mood induction and then tracked three of six



moving balls, counting how often the tracked balls bounced off the side of the screen. The tracked balls were blank; the ignored balls contained the features of a schematic face that were scrambled. In the critical trial, a seventh ball drifted through the screen. The features in this ball were unscrambled to make a smiling or frowning face. Participants were more likely to notice this unexpected face when it expressed an emotion that was inconsistent with their mood. These results suggest that one's mood can influence the objects that one notices in the world: Emotional stimuli that are inconsistent with one's mood are relatively immune from inattention blindness.

(3091)

**Effects of Perceptual and Sensory Load Are Simply Effects of Dilution.** HANNA BENONI & YEHOSHUA TSAL, *Tel Aviv University* (sponsored by Yehoshua Tsal)—Lavie and de Fockert (2003) propose that perceptual load and sensory load reflect two different mechanisms producing opposite effects. Tsal and Benoni (2008), on the other hand, propose that the different results obtained for the two are due to the presence (perceptual load) or absence (sensory load) of neutral distractors capable of diluting distractor interference. Here, we manipulated sensory and perceptual load, as well as the presence of neutral letters. We show that when dilution is controlled, the two load types produce the same rather than opposite effects. Thus, increases in perceptual and in sensory load reflect a general increase in task difficulty, and the effects on distractor interference are produced by dilution, not by load.

(3092)

**The Influence of Scene Viewing Tasks on Sequential Dependencies in Eye Movements: Inhibition of Return, Facilitation of Return, and Saccadic Momentum.** TIM J. SMITH & JOHN M. HENDERSON, *University of Edinburgh* (sponsored by John M. Henderson)—We have previously shown that saccades returning to the last fixation location (1-back) during scene viewing are very common (facilitation of return; FOR) but experience delay due to direction reversal of the eyes (saccadic momentum) and localized inhibition around the 1-back location (inhibition of return; IOR). In this study, we investigated the modulation of these sequential dependencies by task: scene memorization, preference judgment, and object search. Analysis of fixation durations indicated that IOR is present across all tasks but only affects saccades to the 1-back location. Any delay in reorienting to older locations is due to saccadic momentum. IOR did not affect the likelihood of return saccades (FOR), which occur as often as forward saccades in memorization and preference and more often during search. Task influences the degree to which IOR, saccadic momentum and FOR are expressed during scene viewing, but does not completely override these sequential dependencies.

• HUMAN LEARNING AND INSTRUCTION •

(3093)

**On the Transfer of Prior Tests or Study Events to Subsequent Study.** BENJAMIN C. STORM, *University of Illinois, Chicago*, & MICHAEL C. FRIEDMAN & ROBERT A. BJORK, *UCLA*—Tests, as learning events, are often more effective than are additional study opportunities. To what degree, though, do prior tests or study events support subsequent study activities? Participants in the present study learned English–Swahili translations and then underwent a practice phase, during which half of the items were practiced via repeated study and half of the items were practiced via repeated testing. Although tested items were better recalled after a 1-week delay than were studied items, this benefit did not persist after relearning. In fact, once participants had the opportunity to relearn all of the initially learned items, studied items were better recalled than were tested items. These results suggest that measuring the memorial consequences of testing requires more than a single test of retention and, theoretically, a consideration of the differing statuses of initially recallable and nonrecallable items.

(3094)

**Persistence of the Hypercorrection Effect.** LISA K. FAZIO & ELIZABETH J. MARSH, *Duke University* (sponsored by Elizabeth J. Marsh)—The hypercorrection effect is the finding that, after feedback, high-confidence errors are more likely to be corrected than are low-

confidence errors (Butterfield & Metcalfe, 2001). Our question is whether these corrections are long-lasting or subjects revert back to their original high-confidence errors after a delay. In the first session, subjects answered general knowledge questions (e.g., *What is the capital of Australia?*), received answer feedback (e.g., *Canberra*), and retook the general knowledge test (Test 2). Subjects returned 1 week later to take the general knowledge test for a third time. On Test 2, correction rates were highest for errors initially made with high confidence (the basic hypercorrection effect). Critically, these corrections persisted to the third and final test. Hypercorrection appears to be a long-lasting effect and persists over at least 1 week.

(3095)

**Collaboration Impairs Recall of Unshared Study Information.** SARAH J. BARBER & SUPARNA RAJARAM, *Stony Brook University*, & CELIA HARRIS, *Macquarie University* (sponsored by Suparna Rajaram)—Considerable evidence supports retrieval disruption as the mechanism underlying both part-set cuing inhibition in individual recall and collaborative inhibition in group recall. Thus, factors affecting one should also affect the other. Previous findings show that part-set cuing inhibition is eliminated when extra-list cues are interspersed throughout the recall period rather than clustered at the beginning of the recall. This arrangement is especially relevant for examining collaborative recall because people often recall different sets of information together. To this end, triads collaboratively recalled three unshared study lists unique to each member. However, collaborative inhibition still occurred. Thus, any form of interruption, including extra-list information, can disrupt retrieval organization during collaborative recall. But contrary to predictions based on retrieval disruption, collaborative group members continued to recall marginally less on later individual recall than did nominal group members. Alternate explanations for this finding and the operations of multiple mechanisms during collaboration will be discussed.

(3096)

**Exploring the Delay-of-Feedback Benefit: Timing Versus Duration.** SHANA K. CARPENTER, *Iowa State University*, & EDWARD VUL, *MIT*—Some research has shown that, when students must recall information on a test, it is better to delay corrective feedback than to provide it immediately (e.g., Bangert-Drowns et al., 1991). The present study explored the theoretical underpinnings of this interesting and rather counterintuitive finding. In two experiments, participants learned face–name pairings and recalled individuals' names under conditions where feedback was provided immediately or after a 3-sec delay. Retention of these names on a 5-min-delayed test was best for items that received delayed feedback (Experiment 1), and this result replicated even when immediate feedback was presented twice as long as was the delayed feedback (Experiment 2). These results suggest that the delay-of-feedback benefit is driven not by the amount of time spent reviewing the correct answer but by the processing that occurs prior to receiving the correct answer.

(3097)

**Self-Generated Questions and the Testing Effect.** AIMEE A. CALLENDER, *Auburn University*, & MARK A. MCDANIEL, *Washington University*—The testing effect is a robust memory effect in the laboratory. To determine whether the effect can be extended to independent study situations, low- and high-ability readers highlighted or wrote study questions on important information in a text. One week later, participants returned and either reviewed the highlighting or answered the self-generated study questions and took a final test (short answer/multiple choice). High-ability readers performed better than did low-ability readers on all of the criterial tasks. Differences between low- and high-ability readers were also observed for the number of items chosen for study (highlight/questions), the importance of that information, and the likelihood of answering a criterial question correctly after selecting that information to study. Initial analyses indicate that low-ability readers may improve on multiple-choice tests after generating/answering questions, but only when the generated questions overlap with the final test.

(3098)

**Using Multiple-Choice Tests As Learning Events.** JERI L. LITTLE, ELIZABETH LIGON BJORK, & ASHLEY KEES, *UCLA*—Taking an

initial multiple-choice test improves one's ability to answer those questions on a later cued-recall test. Less is known, however, about the effect of testing on answering new but related questions and how any such benefit might be affected by the competitiveness of the lures. To address these issues, participants read two passages: one followed by an immediate multiple-choice test and the other not (control passage). The multiple-choice questions either had noncompetitive or competitive lures. After a delay, cued-recall tests for both passages were administered. For the tested passage, both previously tested and new related questions were asked. Participants answered previously tested questions more often than controls whether the lures had been competitive or noncompetitive, whereas they only answered related questions (for which the answer was a previous lure) more often when the lures had been competitive. These results indicate ways to optimize multiple-choice questions as learning events.

(3099)

**Understanding the Advantage of Retrieval for Long-Term Retention Using Modeling.** PHILIP I. PAVLIK, JR. & KENNETH R. KOEDINGER, *Carnegie Mellon University*—Research has consistently shown advantages for retrieval practice of memory items relative to more passive study practice. Recent work by Roediger and colleagues has made it clear that this effect may be even more pronounced for long-term retention than for immediate learning. Despite this, other researchers (e.g., Pavlik, 2007) have shown that study can sometimes be followed by the same rate of forgetting as is observed after retrieval. To understand this discrepancy in more clarity, we used versions of a computational model to fit data produced by Thompson, Wenger, and Bartling (1978). The detailed models we produced crossed assumptions about the encoding strength and long-term stability of each practice type. These models suggest that passive study has similar long-term benefits early in learning, but that with continued study, there is increasingly little long-term memory benefit for study. In contrast, continued retrieval practice has a consistent benefit to long-term memory.

• METAMEMORY/METACOGNITION •

(3100)

**The Benefits of Testing on Memory, Monitoring, and Control Processes.** MEGAN K. LITTELL, MATTHEW G. RHODES, & EDWARD L. DELOSH, *Colorado State University* (sponsored by Shana K. Carpenter)—In the present study, we examined the effect of taking an initial test versus studying information on later recall, as well as monitoring and control processes. In Experiments 1 and 2, we compared item-by-item judgments of learning (JOLs) to actual recall of studied and tested items. The results revealed that participants showed greater resolution for recall and predictions of recall when items were previously tested. Additionally, resolution was greater for tested items when JOLs were correlated with decisions to study an item again. In Experiment 3, we examined a potential explanation of these findings, suggesting that processing fluency affects participants' predictions. Overall, these findings suggest that testing not only enhances recall but also confers benefits to monitoring and control processes, as compared with simply studying.

(3101)

**On a Brighter Note: Adding a Better End to Difficult Study.** BRIDGID FINN, *Washington University* (sponsored by Lisa K. Son)—Remembered utility is the retrospective evaluation of the pleasure and pain associated with a past experience. It has been shown to influence prospective choices about whether to repeat or to avoid similar situations in the future (Kahneman, 2000; Kahneman, Fredrickson, Schreiber, & Redelmeier, 1993). Evaluations of our hedonic past often disregard the duration of the experience and are influenced more by the peak and final levels of discomfort (Fredrickson & Kahneman, 1993). In the present study, we explored the remembered discomfort of a difficult—even painful—study experience and the influence of this evaluation on prospective study choices. The study resembled Kahneman et al.'s (1993) cold-pressor study but used an exceptionally difficult study experience in place of the painful experience of submerging one's hand in ice water. Extending an unpleasant study experience with a somewhat less difficult interval was preferred to a shorter, unextended interval. Future study choices reflected this preference.

(3102)

**Context Effects on Subjective Beauty Ratings.** CODY TOUSIGNANT & GLEN E. BODNER, *University of Calgary*—Context can influence judgments about the subjective states that accompany recognition experiences (e.g., Bodner & Lindsay, 2003, *Journal of Memory & Language*). We examined whether context can also influence the subjective experience of beauty when one evaluates photographic images. We found that a critical set of medium-beauty images was rated as less beautiful after participants had viewed a high-beauty context set than after having viewed a low-beauty context set. This contrast effect occurred only when the two sets of images shared a general theme (e.g., buildings). Thus, the relative beauty of the context set affected subjective beauty ratings, but only when the context and critical sets were treated as part of the same set. The context set influenced participants' definitions of beauty, but the participants applied these definitions to the critical set only when those definitions were deemed relevant for rating the critical set. Our results suggest that the subjective experience of beauty is functionally defined and contextually bound.

(3103)

**Regulation of Grain Size With Qualitative Questions.** KARLOS LUNA, *University of Minho*, & PHILIP A. HIGHAM, *University of Southampton* (sponsored by Michael F. Verde)—Previous studies have shown that participants can effectively regulate accuracy by reporting either fine-grained or coarse-grained answers, thus maximizing both the accuracy and the informativeness of their report. However, these studies only used questions about numbers and colors. We developed a new procedure that allows the study of the grain size with all kind of questions. After watching a slideshow, participants answered 30 questions with five alternatives. They were asked to provide two answers to each question by selecting (A) one alternative (fine answer) and (B) three alternatives (coarse answer). They then chose which answer (A or B) to report and rated their confidence. The results showed that, as expected, accuracy was higher for coarse-grained than for fine-grained answers, but, surprisingly, confidence was lower. This procedure constitutes a new methodology that can be used in a wide range of circumstances for studying the regulation of accuracy with grain size.

(3104)

**Neuroimaging Metacognition: Could Judgments of Distinctiveness Provide the Basis for Judgments of Learning?** MICHELLE E. AMES, IDA-MARIA SKAVHAUG, LIAM ELLIS, & DAVID I. DONALDSON, *University of Stirling*—Previous investigations indicate that judgments of learning (JOLs) give rise to neural activity that partly overlaps but is partly distinct from that supporting successful memory encoding (Skavhaug et al., 2008). These observations suggest that JOLs are based on more than just encoding. Here, we investigate the possible role of stimulus distinctiveness. Event-related potentials (ERPs) were acquired while participants made judgments of distinctiveness (JODs). The stimuli (word pairs) and memory task (old/new recognition) were maintained from the earlier JOL experiment; only the study task differed. We found that encoding produced the same positive-going posterior maximal ERP effect we observed in our previous study. However, JODs elicited a long-lasting and widespread positivity that differed from previous JOL effects. Our results suggest that the neural correlates of JODs are distinct from those of JOLs and that JOLs do not reflect either generic rating processes or assessments of distinctiveness.

(3105)

**Reducing Conjunction Errors With Pictures: Metacognitive Influences Versus Impoverished Familiarity.** MARIANNE E. LLOYD, *Seton Hall University*—Conjunction errors to compound words are reduced when participants study single pictures instead of words or picture pairs (Lloyd, 2007). The present study was conducted to determine whether error reduction was due to a metacognitive strategy of diagnostic monitoring (e.g., Gallo, 2004) or to a reduced familiarity of conjunction items after single-picture encoding. Participants who studied single pictures (e.g., a picture of a jailbird) instead of two pictures (e.g., pictures of a jail and of a bird) had a reduced conjunction error rate only when responses were not speeded, consistent with diagnostic monitoring but not with impoverished familiarity. However, participants who studied single pictures were also less adept

at recognizing conjunction and feature lures as overlapping with the study phase than were participants who studied words or picture pairs. Overall, the results suggest that pictorial encoding reduces conjunction errors through a combination of decreased familiarity and enhanced recollection.

(3106)

**The Role of Working Memory in Metacognition.** MARIANA V. C. COUTINHO, JOSHUA S. REDFORD, JUSTIN J. COUCHMAN, & J. DAVID SMITH, *University at Buffalo* (sponsored by J. David Smith)—Metacognition is the ability to monitor first-order cognitive processes. Humans engage in metacognition when they are aware they lack knowledge about a task or domain and consequently avoid difficult questions. Researchers have linked metacognition to executive functioning and have proposed that these two capacities may be mediated by similar brain structures. The purpose of the present study is to strengthen this link by examining the working memory requirements of metacognition. To do so, we used a perceptual categorization task with an uncertainty-monitoring component. Participants made perceptual judgments of pixel density or used the uncertainty response to decline a trial when they did not know the answer. They performed this task with or without a concurrent load on working memory. The working memory load significantly disrupted the adaptive use of the uncertainty response, but not the appropriate use of the primary categorization responses.

(3107)

**Grading Determines Students' Monitoring and Self-Regulation When Learning From Text.** ANIQUE B. H. DE BRUIN & GINO CAMP, *Erasmus University Rotterdam*—Students are usually poor at judging how they will do on an upcoming test of text material. Typically, they overestimate performance on errors of commission (i.e., completely incorrect responses). In two experiments, we tested the hypothesis that students believe that partial responses should be awarded at least some credit (Rawson & Dunlosky, 2007). When the partial credit option was absent (i.e., they could only award themselves full or zero credit), students more often chose full credit and, less often, selected texts for re-study (Experiment 1). These data support the “a partial response should receive credit” hypothesis. Experiment 2 showed the opposite: When students were forced to judge whether their responses were indeed completely correct, they more often awarded themselves zero credit and studied the texts longer. The data reveal that students' expectations of grading determine metacognitive monitoring and regulation. The partial credit option leads to poorer monitoring and insufficient restudy.

• PERCEPTION •

(3108)

**Reaction Times in Schematic Faces: More Angles and Curves Than Phylogenetic Response.** KENNETH L. CARTER, JENI J. WELSH, & JESS D. FEAR, *University of Central Missouri*—One challenge facing researchers using schematic faces to explore the face-in-the-crowd effect (Hansen & Hansen, 1988) is the general relationship between the overall curvature of the schematic outline and internal features in happy faces versus the angle and curvature disjunction present in angry faces (Horstmann, Scharlau, & Ansorge, 2006). Presented research demonstrates that reaction times to schematic stimuli that are not faces but maintain characteristics of schematic faces generally replicate existing literature on schematic faces. Furthermore, reaction times are directly related to the relationship of the internal features to the external curvature even when the schematic stimuli fail to maintain features that would activate phylogenetic pathways. The results suggest that processing of schematic faces may be driven more by preattentive feature processing than by social or phylogenetic processes.

(3109)

**Line Bisection and “Where” Perceptual-Attentional Spatial Bias: Aged Men Go Right.** PEII CHEN, *Kessler Foundation and UMDNJ*, ELIZABETH MURRAY, *Queens College, CUNY*, KAREN KELLY, *Columbia University*, SHPRESA AHMETI, *William Paterson University*, & ANNA M. BARRETT, *Kessler Foundation and UMDNJ*—Typically, young adults err leftward when bisecting horizontal lines, but aged individuals may make smaller or rightward errors. Lateralized bias on this task may reflect

asymmetric hemispheric activation of “where” perceptual/representational spatial systems, asymmetric activation of motor-intentional “aiming” spatial systems, or the influence of both spatial systems. To evaluate whether “where” versus “aiming” bias changes with aging, we tested 22 younger (age =  $46.1 \pm 9.8$  years) and 22 aged (age =  $71.5 \pm 10.6$  years) participants in near and far space. We observed a three-way (sex  $\times$  age  $\times$  bias type) interaction [ $F(1,40) = 7.22, p = .010$ ]. Women showed primarily leftward “where” errors without age or distance effects. Aged men, however, performed differently than aged women and younger men, who performed accurately; aged men made rightward “where” errors. Our results suggest that reduced right dorsal spatial activity in aging may reflect male, but not female, adult spatial system development.

(3110)

**The Mirror in One's Mind: Processing Changes in Perspectives.** CHRISTINE SUTTER, JOCHEN MÜSSELER, BEHRAD MOGHADDAM, & LINA A. WIRTH, *RWTH Aachen* (sponsored by Jochen Müsseler)—In the present experiments, participants responded to a visual stimulus with the index finger of one hand while the (irrelevant) index finger of the other hand was visible or not. Stimuli and hand responses were presented from different perspectives. The perspective was either top view (i.e., consistent with looking at one's own hands in a mirror) or left–right inverted (consistent with seeing one's own hand from another person's point of view). The results showed that a mirrored perspective did not impede responses, but that left–right relation and ideomotor similarity between visual and proprioceptive information played an important role in response execution. Performance was decreased when the irrelevant finger was visible, but only when the ideomotor similarity between vision and action was high. With a low similarity or even contradictory information between vision and action, the visibility of the irrelevant finger did not affect performance.

(3111)

**Categorization of Temporal Intervals: No Method Effect but Unequal Weber Fractions.** SIMON GRONDIN, *University of Laval*—Two experiments on temporal categorization addressed a methodological problem: How does the selection of intervals, with the constant method, change threshold estimates? In both experiments, there were two base durations (BDs): 0.2 and 1 sec (the comparison intervals were multiplied by 5). In Experiment 1, the psychometric functions were drawn on the basis of 4, 8, or 12 comparison intervals with the shortest to longest duration ranges being kept constant. The results revealed no effect of the number of intervals, but the Weber fraction (WF) (threshold/BD) was significantly lower at 0.2 sec. In Experiment 2, there were 8 comparison intervals distributed over three duration ranges. There was no range effect, and the WF was once again lower at 0.2 than at 1 sec, although the latter finding was not statistically significant. The results reveal that (1) increasing the number of comparison intervals or the duration range does not seem to overload memory and (2) the WF is not constant.

(3112)

**Influence of Attention and Action on Affective Evaluation of Novel Stimuli.** DANIEL R. BUTTACCIO & SOWON HAHN, *University of Oklahoma* (sponsored by Sowon Hahn)—In recent years, there has been increasing interest among researchers in the relationship between evaluative processes and behavior. In the present study, we investigated how attentional orientation and behavioral inhibition modify affective evaluation of the novel stimuli. In two experiments, participants evaluated pleasantness of the novel geometric shapes in which a target or nontarget digit appeared. In Experiment 1, it was shown that attended stimuli led to a higher affective evaluation than did ignored new stimuli. In Experiment 2, it was shown that refraining from responding to the stimulus resulted in lower evaluation of the stimulus. These two experiments showed that attentional orientation and behavioral inhibition contribute to positive or negative affective evaluation of the novel stimuli. The present results suggest that basic cognitive processes can account for how we form emotional attachments to stimuli.

(3113)

**The Effect of Mood on Pattern Perception: A Signal Detection Analysis.** ANDREA M. CATALDO, ANDREW L. COHEN, & NILANJANA



**DASGUPTA, University of Massachusetts, Amherst**—This research explores the effect of mood on pattern perception. Previous research has shown that people have a tendency to impose patterns on random information and that the perception of such illusory patterns can be altered by factors such as a feeling of lack of control. Mood was used as the modulating factor in the present experiment. An angry, anxious, or calm mood was induced, and participants were asked to identify which of a series of noisy images had an embedded face. A signal detection analysis suggests that, whereas mood has little or no effect on a person's willingness to claim that a face is present (i.e., no significant difference of criterion), an anxious mood can increase the ability to detect an embedded face (i.e., a significant increase of discriminability).

(3114)

**Processing Duration of Figures and Grounds.** LAUREN N. HECHT & SHAUN P. VECERA, *University of Iowa* (sponsored by Shaun P. Vecera)—Recent research suggests that perceptual processing begins earlier for foreground figures than for background regions (Lester et al., 2009, *PB&R*), a “prior entry” effect that accounts for phenomenological reports of foreground figures’ increased salience relative to backgrounds. In addition to a prior entry effect, figures may receive extended processing, as compared with grounds, thereby increasing perceived figural salience. We provide evidence that targets presented on figures are perceived as offsetting later than targets appearing on grounds, suggesting that figures indeed receive extended perceptual-level processing, relative to grounds. These results were not due to a response bias. Moreover, spatially separating the figure–ground regions removes the temporal benefit for ground regions, suggesting that figure–ground processes account for the effect. Consequently, extended processing of figures degrades temporal resolution, as compared with ground regions, as evidenced by increased sensitivity for ground targets in a flicker-fusion task.

#### • EXPLICIT MEMORY •

(3115)

**Stopping Rules in Memory Foraging.** HANSJÖRG NETH, LAEL J. SCHOOLER, & JÖRG RIESKAMP, *Max Planck Institute for Human Development* (sponsored by Lael J. Schooler)—Is search in memory governed by the same principles that make us rummage from room to room in search of our keys? When do we stop searching our memory? To address these questions, we conducted an experiment regarding human free recall in analogy to animal foraging theory (Pirolli & Card, 1999; Stephens & Krebs, 1986). Throughout a 45-min session, participants retrieved exemplars in response to category labels. Participants received instant feedback and accumulated a monetary reward for each correctly entered exemplar. Participants could switch to a new category at any time but incurred a switch cost of either 2 or 12 sec. This self-paced procedure ensured that time-on-task and giving-up times were at the participants’ discretion (Payne, Duggan, & Neth, 2007). We compared how well several simple stopping rules account for participants’ behavior. A metacognitive model that incorporates knowledge about set size and retrieval estimates appears promising.

(3116)

**On the Role of Imagery in Event-Based Prospective Memory.** JOSEPH T. MEEKS, *Southern Illinois University, Edwardsville*, GENE A. BREWER, JUSTIN B. KNIGHT, & RICHARD L. MARSH, *University of Georgia*, & ARLO G. CLARK-FOOS, *University of Michigan, Dearborn*—Event-based prospective memory involves recognizing an environmental cue that subserves fulfilling an intention. The processes that occur when the cue is recognized and the intention is retrieved have acquired much attention. There has been more interest recently concerning the planning/encoding of the intention. Meeks and Marsh (in press) recently showed that imaginal processes at encoding improved prospective memory performance. However, imagery instructions at encoding may simply act to increase the relative importance of the intention. In the present study, we examined how imagery produces differential effects from importance. We found that contextually linked imagery at encoding reduced the slowing to event-based lures out of a planned context, as compared with importance instructions. This differentiation between imagery and importance was not found, however, when the lures were located

in the appropriate responding context. These results support the notion that imagery, unlike importance, strengthens the contextual association between the intention and the responding context.

(3117)

**Planning and Complex Prospective Memory in Virtual Reality.** DEBORAH M. CLAWSON, KAREN E. SCHUBERG, & MARC M. SEBRECHTS, *Catholic University of America*—Assessments of planning and prospective memory are often conducted using artificial tasks. We examined how a virtual environment might provide a means for examining complex prospective memory using real-world tasks. Subjects were given a specified set of errands to run in a virtual town, as well as rules to abide by. Most errands had order constraints (e.g., using the ATM depended on first getting the ATM card from a friend), so completing the errands required planning. Subjects differed in their planning strategies, some developing clear plans before any actions and others constructing plans while executing actions in the virtual environment. They executed tasks in ways that mimicked real-world actions, including demonstrating a wide range of errors: omissions, repetitions, tardiness, order errors, and rule violations. Virtual reality has potential as a tool for studying planning and complex prospective memory in the laboratory in ways that model affordances and constraints of everyday tasks.

(3118)

**Synchrony Effects in Event-Based Prospective Memory.** ANDREW J. KELLY & ANDERSON D. SMITH, *Georgia Institute of Technology* (sponsored by Anderson D. Smith)—The predictions of the multiprocess and PAM models of event-based prospective memory were examined by varying the time of day that testing occurred. This manipulation also allowed for an investigation of whether people have a tendency to rely on spontaneous retrieval. Evening- and intermediate-type young adults were tested on a typical event-based prospective memory task with either focal or nonfocal targets. There was evidence of a synchrony effect, such that evening-type participants tested in the evening outperformed evening-type participants tested in the morning. However, this effect occurred with nonfocal targets only. Reaction times were also analyzed to supplement these findings. The results will be discussed in terms of their implications for the multiprocess and PAM views of prospective memory.

(3119)

**Individual Differences in Event-Based Prospective Memory.** GENE A. BREWER, JUSTIN B. KNIGHT, GREGORY J. SPILLERS, NASH UNSWORTH, & RICHARD L. MARSH, *University of Georgia*—The relation between working memory capacity and event-based prospective memory was examined using an extreme-groups design. High- and low-working memory capacity participants’ performance on focal and nonfocal event-based prospective memory tasks was compared. An interaction was found where high- and low-working memory capacity participants performed equally well on the focal task, whereas the high-working memory capacity participants performed significantly better than the low-working memory capacity participants on the nonfocal task. The present study demonstrates a critical role for attention control in event-based prospective memory. Theoretical implications of the results will be discussed, and future directions will be suggested.

(3120)

**Remembering the Past in the Present.** LILLIAN PARK, *College at Old Westbury, SUNY*, MARIE ST-LAURENT, *University of Toronto*, MARY PAT McANDREWS, *Krembil Neuroscience Center, University Health Network*, & MORRIS MOSCOVITCH, *University of Toronto and Rotman Research Institute* (sponsored by John F. Kihlstrom)—Patients with medial temporal lobe (MTL) lesions have impoverished recollection of past events, as measured by the number of details they can recall. Would this deficit also be reflected in their language? Historical present (the use of present tense verbs for past events) is thought to index a narrator’s reliving of the moment while he or she is describing the event. We hypothesized that MTL patients would be less likely to utilize historical presents in their autobiographical narratives. We administered the Autobiographical Interview to 21 healthy participants and 26 patients with unilateral MTL lesions. We found that healthy participants were twice

as likely to use historical presents, as compared with patients; the use of present tense verbs for semantic details was equivalent for both groups. The use of historical presents may be a useful behavioral measure of recollective experience.

(3121)

**Revisiting the Novelty Effect: When Familiarity, Not Novelty, Enhances Memory.** JORDAN POPPENK, *University of Toronto and Rotman Research Institute*, STEFAN KÖHLER, *University of Western Ontario and Rotman Research Institute*, & MORRIS MOSCOVITCH, *University of Toronto and Rotman Research Institute* (sponsored by F. I. M. Craik)—Reports of superior memory for novel, relative to familiar, material have figured prominently in recent theories of memory. However, such novelty effects are incongruous with classical observations of experience-enhancing memory. In three experiments, we explored whether this discrepancy was explained by differences in the semantic versus episodic basis of prior experience or by a source confusion confound in novelty studies. In Experiment 1, we employed episodically familiar, semantically familiar, and novel proverbs in a typical novelty paradigm. In Experiments 2 and 3, we used these materials in a new paradigm to better examine how novelty influences episodic memory. When we controlled for source confusion, memory was consistently better for familiar proverbs than for novel ones, regardless of the episodic versus semantic basis of prior experience. In keeping with earlier notions that past experiences support new memories, these results indicate that familiarity, not novelty, improves memory for studied items.

(3122)

**Processes Involved in Source Memory of Correctly and Falsely Recognized Words.** ELIZABETH S. BROWNING & KARIN M. BUTLER, *University of New Mexico* (sponsored by Rose Zacks)—Using the Deese-Roediger-McDermott paradigm, memory for the location of words correctly or falsely recognized was compared when source was manipulated according to the backward associative strength (BAS) of studied items to theme words. In Experiment 1, when given a forced choice between two locations, participants attributed falsely remembered theme words more often to the high- than to the low-BAS study location, extending the source-strength effect (Hicks & Hancock, 2002) to word-location source information. A similar effect was observed for studied items: Source memory was better for high- than for low-BAS items. In Experiment 2, the role of retrieval processes in these effects was examined by allowing a “do not remember” source memory response. The source-strength effect persisted for theme words, but the association-based bias for studied words was not observed. The implications of these findings for our understanding of the encoding and retrieval processes involved in false memory are discussed.

(3123)

**Cue Overload in Context-Dependent Recall.** ISABEL MANZANO & STEVEN M. SMITH, *Texas A&M University* (sponsored by Steven M. Smith)—We used videotaped scenes as contexts for examining the effects of cue overload—the number of targets per context—on context reinstatement effects. Target words were overlaid on video scenes and studied with 1 word, 3 words, or 10 words per context. Although strong context reinstatement effects were found, the effects were smaller in the more overloaded conditions (15 words per context). This cue-overload effect, however, could have been caused, in part, by participants’ having tried to mentally reinstate the contexts that were absent at test; fewer contexts would need to be mentally reinstated in the most overloaded condition, making mental reinstatement more effective, thereby weakening the effect of providing video cues at test. Therefore, in Experiment 2, additional video contexts without words were shown following the word list in order to equalize the total number of contexts seen in all treatment conditions. These experiments show the usefulness of video contexts in laboratory investigations.

(3124)

**Recollection: More Than an Epiphenomenon but Less Than the Defining Aspect of Episodic Memory.** KRISTA L. MURRAY & MICHAEL S. HUMPHREYS, *University of Queensland* (sponsored by Michael S. Humphreys)—List-specific memory was explored with an aim to reconcile preexisting theories on how items are identified as belonging

to a specific list with standard thinking on recollection and familiarity. The usefulness of using familiarity to make a recognition judgment was disrupted by repeatedly reassigning words from a small pool to be targets and distractors. The subsequent effects on accuracy and remember-know (RK) decisions showed that participants could adequately discriminate on the recognition task, however the inclusion of RK decisions reduced accuracy, especially when they were first introduced on the final test. At a minimum, the results indicate that there are boundary conditions on the use of the RK paradigm. More important, they may indicate that recollection is not a fundamental episodic memory process.

(3125)

**Recognition Memory for Emotional Stimuli: Response Bias or Distribution Shift?** DAVIDE BRUNO, AYCAN KAPUCU, & CAREN M. ROTELLO, *University of Massachusetts, Amherst* (sponsored by Caren M. Rotello)—Emotional events are often thought to be more memorable than neutral events, in part because subjects have a higher probability of recognizing negative than neutral stimuli as “studied” items. When emotional and neutral stimuli are matched on semantic interrelatedness, no memory enhancement is found for emotional items, but response bias differences remain (Dougal & Rotello, 2007; Kapucu, Rotello, Ready, & Seidl, 2008). Subjects’ increased tendency to say “old” to both negative targets and negative lures can be accounted for by a liberal shift in their decision criterion, an increase in the mean value of the underlying evidence distributions, or a combination of the two. We evaluated these alternatives using Type 2 ROC analyses, diffusion modeling, and Thurstonian scaling. All methods supported the distribution-shift account: Negative stimulus distributions have higher mean values on the evidence dimension than do the corresponding distributions for neutral stimuli.

(3126)

**Why Do Implementation Intentions Enhance Retrieval Cue Accessibility?** JUDITHA. ELLIS & LAURIE T. BUTLER, *University of Reading* (sponsored by Richard L. Marsh)—Researchers in prospective memory have increasingly employed implementation intentions to enhance the realization of delayed intentions (e.g., Chasteen et al., 2001; McDaniel et al., 2008). Implementation intentions, described as “if-then” plans (Gollwitzer, 1993, 1999), are designed to link an intended action with a specific situation in which it can be realized. An impressively large body of research in social and health psychology has revealed that they generally enhance goal attainment for both experimental and naturally occurring intentions (Gollwitzer & Sheeran, 2008). However, prospective memory tasks have been similarly described as if-then plans, raising the question of which additional aspects of instructions to form an implementation intention might underlie their effectiveness and potentially enhance prospective remembering. The findings from two experiments identify two such manipulations—imagery perspective and commitment—that increase the accessibility of the if-then component of an implementation intention and could be expected to improve prospective remembering.

(3127)

**Visual Imagery Processes in Retrieval of Vocabulary Pairs Learned Using Keyword Mediators.** ROBERT J. CRUTCHER, COURTNEY CASTLE, ALLISON WALDEN, & MAUREEN O’MARRO, *University of Dayton*—When foreign-English vocabulary pairs are learned using keyword mediators, retrieving the pairs involves first accessing the mediator from the foreign word and then using it to access the English translation from the visual image relating mediator and translation (Crutcher & Ericsson, 2000). Manipulating phonological or imagery properties of keyword mediators can affect vocabulary recall by influencing one or both of these retrieval steps (Crutcher & Shea, 2007). In the present study, we manipulated the imaging process itself by instructing learners to generate interactive or separate visual images involving keyword and English translation. Interactive imagery produced higher overall vocabulary recall ( $M = .41$ ) than did separate imagery ( $M = .25$ ). A component retrieval analysis showed that this advantage was due to the imagery retrieval step. Accuracy on the keyword-English retrieval subtask was higher for the interactive imagery group ( $M = .67$ ) than for the separate imagery group ( $M = .35$ ), whereas performance on the Indonesian-keyword retrieval subtask did not differ for the two groups.

(3128)

**The Effects of Context at Encoding for Recognition Memory of Repeated Items.** TYLER BANCROFT & WILLIAM E. HOCKLEY, *Wilfrid Laurier University*—It has long been held that the environmental context in which learning occurs plays an important role in memory performance (see, e.g., Dulsky, 1935). Recent studies have investigated the relation between environmental context and recollection by manipulating the context both at study and at test (Gruppuso, Lindsay, & Masson, 2007; Hockley, 2008; Macken, 2002). We examined the role of context at encoding on recognition memory by presenting items in a visual context at study but not at test. Study items were presented twice in either a massed or a spaced format. The picture context was either unique for each item or shared between items, and the context was either the same or different for each presentation of an item. Accuracy was greater for items shown in unique contexts than for those shown in shared contexts and was greater when the two presentations of an item were shown in different contexts rather than in the same context.

(3129)

**The Use of Recollection in Associative Recognition Memory.** HELEN L. WILLIAMS, CHRISTOPHER J. A. MOULIN, & MARTIN A. CONWAY, *University of Leeds* (sponsored by Martin A. Conway)—In two experiments, subjective experiences were measured at test for items that had either been preexposed prior to study or not. Participants studied 40 forename–surname pairs and, at test, chose which of two forenames had been previously paired with each surname. Prior to study, participants were preexposed to items through a vowel-counting task. Experiment 1 used a between-subjects design ( $n = 67$ ) with half of the participants being preexposed. Experiment 2 used a within-subjects design ( $n = 44$ ), and all of the participants were preexposed to half of the names. In Experiment 1, memory performance was positively related to use of recollection and negatively related to use of familiarity, but only for preexposed items. However, in Experiment 2, this was true for both not preexposed and preexposed items. When any preexposure occurred, it was necessary to use recollection to resolve the familiarity induced by preexposure. Critically, prior exposure reduced memory performance but increased use of recollection.

(3130)

**Inhibition in Item-Method-Directed Forgetting: A Modification of the Independent Probe Technique.** KATE THOMPSON & TRACY L. TAYLOR, *Dalhousie University* (sponsored by Kimron L. Shapiro)—This study explores the potential involvement of inhibition after the presentation of a forget (F) memory cue in item-method-directed forgetting. An adaptation of Anderson's independent probe technique (Anderson & Spellman, 1995) was used. In three experiments, the effects of inhibition were assessed by comparing subsequent memory for remember (R) items that were semantically related to F items with those that were not. We predicted that there would be decreased memory for related R items, as compared with that for unrelated R items. The results partially supported this prediction. In Experiment 1, related R items were less well recalled than unrelated R items. In addition, Experiment 2 showed increased response time in speeded recognition for related versus unrelated R items. Finally, Experiment 3 showed that a decrease in memory for related R items only holds for directly related items. The plausibility of inhibition in this paradigm is discussed, along with other possible interpretations.

(3131)

**An Exemplar-Based Account of Performance in the Artificial Grammar Task.** RANDALL K. JAMIESON, *University of Manitoba*, & DOUGLAS J. K. MEWHORT, *Queen's University*—We apply a multitrace model of memory—Hintzman's (1986, 1988) *Minerva 2*—to explain performance in artificial grammar experiments. The model predicts performance in the judgment-of-grammaticality and string completion tasks. The model also predicts the dissociation between performance in recognition and that in classification following amnesia. We extend the model to predict response time; the extended model captures learning in serial reaction-time tasks. Contrary to the view that performance in the artificial grammar task reflects implicit learning of a grammar, we argue that performance in the artificial grammar task reflects retrieval of studied

exemplars. The account ties performance in the artificial grammar task to principles used to understand performance in explicit memory tasks.

(3132)

**Counter to Our Theories, Involuntary Memories for an Event Are As Frequent As Voluntary Memories.** DAVID C. RUBIN, *Duke University*, & DORTHE BERNTSEN, *Aarhus University*—Ratings of the memory of an important event from the previous week on the frequency of voluntary and involuntary retrieval, belief in its accuracy, visual imagery, auditory imagery, setting, emotional intensity, valence, narrative coherence, and centrality to the life story were obtained from a representative sample of 988 Danish adults. Another 992 adults provided the same ratings for a memory from their confirmation day (when they were about age 14). The frequencies of involuntary and voluntary retrieval were similar. Both frequencies were predicted by emotional intensity and centrality to the life story. The results from this study, which is the first to measure the frequency of voluntary and involuntary retrieval for the same events, are counter to both cognitive and clinical theories, which consistently claim that involuntary memories are infrequent, relative to voluntary memories. Age and gender differences are noted.

(3133)

**Vividness of Episodic Future Thought and Episodic Memory Are Differentially Affected by Temporal Distance.** KATHLEEN M. ARNOLD, KARL K. SZPUNAR, & KATHLEEN B. McDERMOTT, *Washington University* (sponsored by Kathleen B. McDermott)—Vividness of episodic memories and episodic future thoughts decreases with increasing temporal distance from the present. Does one mechanism account for these parallel findings? Older episodic memories are less vivid because of forgetting, but future events have not yet occurred. We hypothesized that more distant future events are less vivid because they are placed in unfamiliar locations. In three experiments, we found that (1) the vividness of the representation of location decreased with increasing temporal distance in future events, but not in past events; (2) far future events were more often placed in unfamiliar locations than were near future events; and (3) events in unfamiliar locations were associated with decreased vividness. These results suggest that, for episodic future thought, a decreased location familiarity drives the decrease in vividness associated with increased temporal distance.

(3134)

**Retrieval-Induced Forgetting for Abstract Nouns.** DAVID P. YELLS, *Utah Valley University*, & KENNETH A. DEFFENBACHER, *University of Nebraska, Omaha* (sponsored by Kenneth A. Deffenbacher)—Practicing some items from a study set can interfere with subsequent memory for nonpracticed items (retrieval-induced forgetting; RIF). We investigated the effect of retrieval practice of a subset of study items (abstract nouns) on subsequent memory for the nonpracticed items using various retrieval practice cues and a final recall test. In Experiment 1, the retrieval practice cue was item color. In Experiment 2, the retrieval practice cue was initial letter of the item. In Experiment 3, the retrieval practice cue was background color. Our results are consistent with our view that, in an explicit memory paradigm, the occurrence of RIF involves a complex interaction among item type, practice cue, and final memory task. In general, items that may be encoded weakly (i.e., abstract nouns) are more vulnerable to RIF than are items that may be encoded strongly (i.e., concrete nouns).

(3135)

**Overcoming the Effects of Intentional Forgetting: No Persistent Effects of Compartmentalization.** MELISSA LEHMAN & KENNETH J. MALMBERG, *University of South Florida* (sponsored by Douglas L. Nelson)—To perform complex cognitive tasks, task-irrelevant memories are blocked from consciousness so attention can be focused on the current task. The present experiment investigates the long-term effects of compartmentalization on the task-irrelevant memories and task-relevant memories using a directed forgetting procedure. In contrast to the costs and benefits found when subjects are required to generate their own retrieval cues, performance was selectively enhanced in order to independently eliminate those costs and benefits when adequate cues were provided. The results indicate that compartmentalization enhances the performance of current tasks, but it does not necessarily have long-term costs or benefits for memory of recent events.



(3136)

**Comparing Item-Method-Directed Forgetting to the Active Suppression of Rehearsal: Further Evidence From Reaction-Time Probes.** JONATHAN M. FAWCETT & TRACY L. TAYLOR, *Dalhousie University* (sponsored by Vincent M. LoLordo)—In an item-method-directed forgetting task, study words were presented one at a time, each followed by an instruction to rehearse (R+), not rehearse (R−), or forget (F). Reaction time (RT) was measured in response to visual (E1) or auditory (E2) detection probes presented 1,400, 1,800, or 2,600 msec following each instruction. RTs were longer following R− and F instructions than following R+ instructions; furthermore, participants subsequently exhibited greater yes–no recognition of R+ words than of R− or F words. These results support the notion that item-method-directed forgetting is achieved by the active suppression of rehearsal.

(3137)

**Why Distinctive Processing Reduces Retrieval-Induced Forgetting.** MALEN MIGUELES & ELVIRA GARCÍA-BAJOS, *University of the Basque Country*—In this study, the effects of typicality and distinctive encoding in retrieval-induced forgetting for semantic categories were analyzed. On the basis of a previous normative study, 6 high- and 6 low-frequency exemplars of six semantic categories were selected. In the first experiment, the participants studied 36 high- or 36 low-frequency elements distributed in six blocks of 6 elements. Each block included random presentations of 6 elements of the six categories, or of the 6 elements of each category together. Although organized presentation improved recall performance, selective retrieval practice produced retrieval-induced forgetting only for high-typicality elements. In the second experiment, participants followed intercategories or intracategories encoding strategies to study high-typicality elements. In both cases, the distinctive encoding of the high-typicality elements modulated retrieval-induced forgetting. The distinctive processing broke the associative strength between the exemplar and, as a result, removed the effects of retrieval-induced forgetting for semantic categories.

(3138)

**Differences Between the Processing of FACES 4.0 and That of Real Faces.** CURT A. CARLSON, *Texas A&M University, Commerce*, & SCOTT D. GRONLUND, *University of Oklahoma*—In five experiments, we examined whether computer-generated faces (FACES 4.0) are processed like real faces. There was no effect of inversion on accuracy for FACES generated randomly, but there was an inversion effect for FACES created systematically. Increased encoding time had no effect on recognition memory or RT for real faces; but for the random FACES, both accuracy and RT increased as study increased. FACES created systematically were not processed very differently from real faces, but there were still important differences. Conclusions regarding RT were bolstered by an examination of RT distributions and latent variables derived from the EZ Diffusion model (Wagenmakers et al., 2007). Our findings indicate that FACES may be processed less configurally than are real faces, which has implications for their use as stimuli in research that examines the cognitive processes underlying various applied memory phenomena, as well as for their use by police departments to create composites.

(3139)

**Automatic and Controlled Processes in Prospective Memory Development.** MATTHIAS KLIEGEL, *Dresden University of Technology* (sponsored by Mark A. McDaniel)—Past research on prospective memory has failed to identify a mechanism that underlies early age differences in event-based prospective memory. This study systematically tests predictions derived from the multiprocess theory of prospective memory (McDaniel & Einstein, 2000). Three experiments with 222 children from 6 to 10 years of age are presented, providing novel evidence that 9- to 10-year-old children consistently outperform 6- to 7-year-old children on a measure of prospective memory and that retrieval-based factors influence performance. Specifically, provisions of a less complex ongoing task (Experiment 1), of a higher cue salience (Experiment 2), and of a lower cue focality (Experiment 3) were each associated with better performance. However, of particular importance was the finding of an age  $\times$  cue focality interaction. Thus, age effects were restricted to

the nonfocal (but not the focal) cue condition. The results are discussed in the context of automatic versus controlled processes being involved in prospective memory and cognitive development.

(3140)

**Revisiting the Similarity Paradox in Retroactive Interference.** NATHANIEL L. FOSTER, LILI SAHAKYAN, & PETER F. DELANEY, *University of North Carolina, Greensboro*—Similarity plays a crucial role in retroactive interference (RI). A classic paper on this topic by McGeoch and McDonald (1939) showed that RI increases with the similarity between the interpolated learning and the original learning. However, we found that this is not always the case. We used related items to vary the similarity of materials across two lists. We kept the target list constant and manipulated whether the second list contained items that were unrelated to the target list or bidirectionally associated to the target list (e.g., *salt–pepper*). Memory was tested either with serial recall (to approximate the anticipation method used by McGeoch and McDonald) or with free recall. In serial recall, the results confirmed the earlier findings that similarity increased RI. In contrast, similarity decreased RI when free recall was used. Thus, similarity can either increase or decrease RI, depending on how memory is tested.

# • ASSOCIATIVE LEARNING •

(3141)

**Embodied Statistics.** ELIZABETH R. MARSH, ARTHUR M. GLENBERG, & ANDRÉ VALDEZ, *Arizona State University* (sponsored by Arthur M. Glenberg)—Incidental learning of artificial grammars demonstrates statistical learning. We propose that stimuli are automatically imitated. In grammatical sequences, when stimuli follow each other with a high transition probability, the neuromuscular system learns to fluently produce the transitions between the imitations. Thus, fluency of transitions discriminates between grammatical and ungrammatical sequences. In our experiments, sequences consisted of perfectly correlated pairs of tones and squares. During acquisition, participants judged whether two successive sequences were the same. By imitating the tones, the neuromuscular tone production system should learn transitions between tones. By tracking the squares, the eye movement system should learn transitions between saccades. There is, however, no automatic learning of transitions between squares and tones. At test, participants successfully judged grammaticality of tone sequences and square sequences. However, they judged grammaticality of alternating tones and squares at chance, even though those sequences followed the same grammar as the original sequences.

(3142)

**Knowledge Acquired During Encoding Improves Source Memory in Younger and Older Adults.** CRYSTAL M. COOPER, CHARISE J. JOHNSON, LAURA A. GRESSENS, & TIMOTHY N. ODEGARD, *University of Texas, Arlington* (sponsored by Timothy N. Odegard)—The present experiments were intended to investigate the tendency of younger and older adults to use knowledge acquired during encoding to guide source memory judgments. Participants studied a list of words, with each word belonging to one of four categories. Each category and their exemplars were assigned to a corner of the computer screen, which contained one of four mathematical probability structures—100%, 75%, 50%, and 25%—reflecting how many exemplars from a given category were to be presented in it. Both younger and older adults learned and later used the probability structure to guide source memory judgments. Additionally, Experiment 1 observed that dividing the attention of younger adults hindered their ability to do this. Experiment 2 found that the implementation of this new knowledge appears to be automatic, considering that requiring younger adults to respond quickly did not hinder their ability to infer a word's source on the basis of the probability structure.

(3143)

**Exploring Asymmetry in the Access of Causal Relations in Semantic Memory.** NATHANIEL R. BARR, JONATHAN A. FUGELSANG, & JENNIFER A. STOLZ, *University of Waterloo* (sponsored by Jennifer A. Stolz)—Causal relations are unique from other types of semantic relations, in that they are asymmetrical. Previous research (Fenker,

Waldmann, & Holyoak, 2005) has demonstrated that, when asked whether a causal relation could exist between two words, participants respond faster when the order of presentation follows the predictive cause–effect order than when it follows the diagnostic effect–cause order. The present work focuses on determining the mechanism underlying these reaction time differences by exploring the degree to which the priming asymmetry varies as a function of SOA. Our results demonstrate that the observed differences are persistent even at short SOAs and are thus not easily accounted for by an expectancy-based account. Implications for causal-model and associative theories of causal knowledge are discussed.

(3144)

**On the Fate of an Ignored Stimulus: Method of Target Selection Affects Implicit Learning About a Distractor.** JUSTIN A. HARRIS, HANNAH L. PINCHAM, & EVAN J. LIVESEY, *University of Sydney* (sponsored by Sally Andrews)—We investigated whether associative learning in humans can proceed in the absence of selective processing of the stimuli. Participants performed two concurrent tasks: They detected alphanumeric targets among distractors presented in a rapid sequence and then made a speeded left-versus-right response to a visual cue. On some trials, the position of the visual cue was predicted by a particular distractor. Reaction times to the response cue on these trials indicated that participants learned about the predictive distractors even though only the target stimuli were selected for further processing in memory. Critically, this learning was implicit and was only present when the targets were defined by their categorical (rather than featural) properties. The results indicate that learning occurring outside of conscious cognitive control is still sensitive to attentional selection mechanisms, but that both contingency awareness and retention of the stimulus in short-term memory are unnecessary for learning to occur.

(3145)

**Predictive Primes Provide Greater Recognition Facilitation Than Retrodictive Primes.** JASON J. JONES & HAL PASHLER, *University of California, San Diego* (sponsored by Hal Pashler)—Paired associate learning studies offer a wealth of evidence for the principle of *associative symmetry* (i.e., when two stimuli become associated, the association is formed equally in both directions). An A–B memory can be reversed to B–A with no cost, and performance on A–? cued tests is equal to that on ?–B tests. List-learning studies support a contradicting view. Subjects tend to preserve the original temporal order of experience in free recall and perform better in forward-cued than in reverse-cued recall. In this study, subjects studied lists and were then given a recognition test that included a prime that was either the immediately prior (predictive) training item or the immediately following (retrodictive) training item. Predictive primes provided more facilitation than retrodictive primes.

(3146)

**Distinguishing True From False Memories in Forensic Contexts: Can Phenomenology Tell Us What's Real?** TAMMY A. MARCHE, *University of Saskatchewan*, & CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University* (sponsored by Charles J. Brainerd)—In a classic forensic task, the Gudjonsson suggestibility scale (GSS), we studied the extent to which subjective ratings of memory phenomenology discriminate true- and false-memory responses and whether degree of gist-based processing influences false memory and phenomenology. Participants heard a narrative of a robbery, followed by suggestive questions about the content of the narrative. They were asked to rate the items they recognized as having been studied, using the Memory Characteristics Questionnaire. Consistent with studies of word lists, the results revealed subtle differences between true- and false-memory responses. Memory was richer for items that were more consistent with narrative gist, which supports opponent-process accounts of false memory, such as fuzzy-trace theory. Memory phenomenology appears to be a useful means for differentiating experienced from nonexperienced events.

(3147)

**The Influence of Emotion and Encoding Strategy on Associative Memory.** BRENDAN D. MURRAY & ELIZABETH A. KENSINGER,

*Boston College* (sponsored by Elizabeth A. Kensinger)—Episodic memory requires the remembrance of discrete pieces of information, as well as of their associations. The present study examined how memory for items and associations are affected by emotion and encoding task. Participants studied neutral words paired with either another neutral word or an emotional (positive or negative) word. Participants visualized the referents either separately or together as an integrated image. After a delay, participants performed an item recognition test followed by an associative test. Memory for associated pairs was best when items were encoded as an integrated unit, and this integrative benefit was not influenced by emotion. Item recognition was best when items were visualized separately, and this benefit was not influenced by emotion. However, neutral items that were integrated with negative items showed higher recognition than did negative items themselves. These results suggest that emotion and encoding instruction interact to affect item and pair recognition memory differently.

(3148)

**The Effects of Emotional Transfer on the Misattribution of Product Information.** KEN MATSUDA, *Yamaguchi University*, & TAKASHI KUSUMI, *Kyoto University*—In this study, we examined the effects of emotional transfer on product choice and misattribution of product attributes, and we examined the level of product involvement in the use of product attributes in judgments about such products as well. Ninety-four university students viewed advertisements with pictures that varied in emotional valence (negative or positive). Five minutes later, the participants rated old and new products in terms of purchasing intention and then evaluated product names and attributes in terms of negative or positive associations. Three conclusions emerged from the results. First, emotional transfer from pictures to products occurred, influencing the choice of products. Second, the evaluations of products generated by emotion-laden pictures included misattributed product attributes (central information) and product names (peripheral information). Third, central information facilitated evaluations of products held in high regard, and peripheral information facilitated purchasing intentions with regard to products held in low regard.

(3149)

**The Impact of Emotion on Item and Associative Recognition.** JASON ARNDT, REBECCA GUILLET, KELLY BENNION, ADAM DEDE, SOPHIE DOROT, & CLOE SHASHA, *Middlebury College*—In two experiments, we examined the influence of emotion-inducing words on memory for neutral words. Paired associates composed of an emotion-inducing (taboo, negative valence, or neutral) word and a neutral word were presented during study. Two different types of recognition tasks were used to assess item memory and associative memory. Item memory for emotion-inducing items and their neutral paired associates was tested with old–new recognition. Associative memory was tested with an associative recognition task, in which participants were asked to discriminate between intact and rearranged word pairs. The results indicated that studying word pairs that included a taboo word improved both item and associative memory, whereas studying word pairs containing negative valence words did not improve either item or associative memory above levels found when paired associates were composed only of neutral words. These results suggest that emotional arousal enhances the binding of both emotional and nonemotional objects to their context.

• EVENT COGNITION •

(3150)

**An Implicit Memory Meter for Event Structure.** LLEWYN E. PAINE & DAVID L. GILDEN, *University of Texas, Austin* (sponsored by David L. Gilden)—Under normal circumstances, the perceptual system is heavily invested in the integration of temporally spaced information. This is evident in priming, where faster responses to related stimuli reveal the implicit associations people have formed. However, event segmentation is necessary to provide structure to the ongoing perceptual flow. Examining the strength of these implicit associations at various points within events should yield insight into how people perceive the events themselves. Although many forms of priming are not noticeably affected by event

structure, irrelevant feature priming (a type of priming that rewards change consistency) proves to be robust, yet sensitive to event-based perturbations. Priming is reduced or destroyed for stimuli that occur across certain types of event boundaries. This task appears to be an effective meter for objectively determining when event boundaries are perceived to occur, which has traditionally been difficult in event perception research.

(3151)

**Using Event Knowledge to Generate Predictions.** SUSANNE RAISIG, HERBERT HAGENDORF, & ELKE E. VAN DER MEER, *Humboldt University Berlin* (sponsored by Elke E. van der Meer)—When people generate predictions about forthcoming events, they access event representations (scripts) in long-term memory that store the temporal order of an event sequence. Predictions are then compared with the sensory input when events actually unfold, in order to detect prediction errors. We investigated whether knowledge about the temporal position of events within the representation (beginning-event vs. end-event) influences predictions and the detection of errors. Three script events (triplets) were presented sequentially. Participants had to detect predictions errors that arose due to an incorrect temporal order of events. Prediction errors were detected faster when the triplet focused on the beginning of the event representation. Unfolding events from the end of the event representation demanded more cognitive resources (as indicated by the pupillary response). This is interpreted as difficulty in accessing the representation at the end making the forming of predictions and the detection of prediction more difficult.

(3152)

**Flexibility of Event Boundaries in Autobiographical Memory.** TIMOTHY J. HOHMAN & ZEHRRA F. PEYNIRCIOĞLU, *American University*—One interesting topic in autobiographical memory is the interplay between the details of an event and the event's relationship to one's personal timeline. Just what an event constitutes is a murky concept, however. Although an event is assumed to have set beginning and end points, there is flexibility in whether it can be considered as part of a larger event or, alternatively, whether its details can be considered as separate mini-events. We examined how participants define individual autobiographical events and how they do so as a function of the age of the event. The results showed that the malleability of event boundaries waned with time, as did the amount of neighboring details when boundaries could be expanded. Finally, the size of events showed a quadratic relationship, with the smallest ones found in early childhood and within hours of recall. These findings are discussed within the context of reconstructive memory processes.

(3153)

**Life Scripts Across the Life Span.** ALİ İ. TEKCAN, HANDAN ODA-MAN, & BURCU KAYA, *Boğaziçi University*—The life-script account (Berntsen & Rubin, 2004) argues that people's expectations about a typical life in a given culture provides a framework for autobiographical memory retrieval. Although several studies have supported the idea of life script and its potential role in retrieval of autobiographical memories, almost all relevant data have been obtained from young adults. The first aim of the present study was to investigate the life scripts of elderly participants to properly test the role of life scripts in recall of memories across the life span. A second aim was to provide data regarding the development of life scripts by comparing four groups of participants (adolescents, young adults, middle-aged adults, and elderly adults) in order to provide data regarding the emergence of life scripts. The results indicate that data from elderly adults support earlier conclusions from younger participants and that clear life scripts do not emerge until young adulthood.

(3154)

**Accurate Long-Term Memory for Spatial Location.** JENNIFER M. TALARICO & KIRA M. MOORE, *Lafayette College*—In an effort to enhance the study of “where” (in addition to “what” and “when”) in autobiographical memory, Lafayette College students (18–22 years of age), 30 from each class year, located themselves in an all-black version (with each individual figure outlined in white) of their incoming class photograph and then, subsequently, in the original version of the photograph. The time (in msec) to identify oneself in the obscured version and the

distance (in mm) between the initial choice and the individual's correct location were recorded. The faster a participant selected their location in the obscured version, the more accurate they were. Students from all 4 class years were equally accurate in identifying their location, demonstrating no effect of how long ago the photograph was taken. Moreover, the lack of a forgetting function was not because all participants were unreliable but rather that they were remarkably accurate over the 4-year delay.

(3155)

**Mood Congruence and Incongruence in Autobiographical Memory Tasks.** KATINKA DIJKSTRA & EDMEE TAN, *Erasmus University Rotterdam*—According to the associative network theory (Bower, 1981), mood congruence occurs as a result of the activation of mood-congruent information or events with an emotional state in a semantic network. However, mood incongruence also has been demonstrated when participants were instructed to reappraise negative events in a negative mood-induction condition to more positive outcomes (Rusting & DeHart, 2000). Three experiments were conducted to assess under which conditions mood (in)congruence would occur. Participants submitted entries to an online diary for several months and then performed a free recall test after a mood-induction or reappraisal procedure. The results indicated mood-congruent recall after positive and negative mood-induction procedures and mood-incongruent recall after a reappraisal induction. The duration of the induction (but not the intensity) of the memories contributed to congruence effects. Associative and regulatory processes can help explain effects of mood congruence and mood incongruence.

(3156)

**Event Boundaries and Everyday Clairvoyance.** CHRISTOPHER A. KURBY, JEFFREY M. ZACKS, & NAYIRI HAROUTUNIAN, *Washington University*—Predicting what will happen in the near future is highly adaptive; it allows one to anticipate rather than merely react. Prediction is prominent in current theories of perception, language understanding, and discourse comprehension. A recent theory of event perception (Zacks et al., 2007, *Psychological Bulletin*) proposes that prediction underlies the ubiquitous perception that activity consists of discrete events. According to this theory, perceivers constantly make predictions about what will happen shortly, and when these fail, perceivers update their representations of the current event, leading to the perception that a new event has begun. Here, we present behavioral evidence that predictions of the near future are made with lower confidence and accuracy when they cross event boundaries; we also present functional MRI evidence that predictions across event boundaries selectively activate brain regions associated with error monitoring and cognitive updating, including the midbrain dopaminergic system and the anterior cingulate cortex.

(3157)

**Beyond Prediction: Timing Emerges From Multifractality of Perception–Action.** DAMIAN G. STEPHEN & JAMES A. DIXON, *University of Connecticut* (sponsored by Daniel Mirman)—Timing is often interpreted as prediction from representations of previous events (e.g., Repp, 2005). We investigated timing under circumstances where prediction is impossible. In one experiment, participants attempted synchronization with varied settings of a chaotic oscillator derived from the Ikeda map. Both metronome onsets and participants' responses fluctuated according to a power law (i.e., fractal scaling; see, e.g., Van Orden, Holden, & Turvey, 2003). Power-law exponents of onsets and their corresponding responses correlated at  $r = .96$ , indicating that participants attuned to temporal structure at all available timescales despite local unpredictability. We predicted the emergence of this multiscale attunement from the multifractal structure of perception–action. The fractality of participants' responses varies with the size of fluctuations (i.e., the local variability in interresponse intervals). Timing emerges from a broad spectrum of multiple size-dependent fractal fluctuations. As compared with prediction from representation, multifractality provides a more general foundation for anticipatory behavior.

(3158)

**Findings Support That Schizophrenic Hallucinators Exhibit a Signal Detection Theory Criterion Shift in Perceptual Tasks.** MICHAEL K.



McBEATH, *Arizona State University*, & IGOR DOLGOV, *New Mexico State University*—Most recent research on complex perceptual hallucinations frames them as largely the result of maladaptive, deficient sensory and attentional processing. We propose consideration of a construction-based representation of perception that utilizes signal detection theory. Hallucinations can then be modeled as false alarms when confirmational perceptual information is lacking. This representation allows for occurrence of complex perceptual hallucinations due in part to a criterion shift associated with attentional proficiency. Such a criterion shift would also reduce misses, in effect producing an enhanced perception of some aspects of the environment. Several studies examining auditory and visual schizophrenic hallucinations confirm that such shifts in judgment criterion do occur in the recognition of masked spoken words and visual objects. The findings support the occurrence of a criterion shift that can be associated with hallucinations; they also clarify an aspect of potential utility in the form of reduction in misses of subtle or noisy perceptual phenomena.

(3159)

**Binding Errors in Memory for Criminal Actions and Their Perpetrators.** JULIE L. EARLES, ALAN W. KERSTEN, LESLIE A. BUTLER, & SHAINA F. ROWELL, *Florida Atlantic University*—Kersten et al. (2008) demonstrated that eyewitnesses often falsely remember having seen an ordinary action performed by an actor who had in fact done something else. The present research tested whether eyewitnesses similarly make errors in binding actors with criminal actions. Participants viewed 18 short movies, each involving four actors performing four different actions within the same setting (e.g., the beach). In two movies, an actor performed a criminal action (e.g., stealing from a wallet). Participants were tested 1 week later on their recognition memory for the movies. The critical recognition lures involved an action from one of the movies, performed by an actor who had performed a different action at encoding. Participants were more likely to falsely recognize these conjunction items when they involved a criminal rather than an ordinary action, apparently because participants remembered criminal actions especially well, but still had difficulty remembering who had performed those actions.

## • AUDITION •

(3160)

**Auditory Peak Shift: The Impact of Experience.** MATTHEW G. WISNIEWSKI, BARBARA A. CHURCH, & EDUARDO MERCADO III, *University at Buffalo*—Learning to differentiate stimuli along a dimension can alter the generalization of responses associated with those stimuli. For instance, responses may be made more often to untrained stimuli than to the actual trained one. This phenomenon is known as *peak shift*, and it typically occurs in the direction away from stimuli that are trained to another response (Hanson, 1959). We examined how the amount of experience discriminating complex auditory stimuli along a temporal dimension (FM sweep rate) affected this shift. We found that, initially, as learning progressed, so did shift. As learning further developed, shift disappeared again. The results suggest that the susceptibility to shift is dependent upon the amount of experience one has discriminating stimuli on the dimension. The results further suggest that peak shift may be a result of the auditory perceptual learning processes associated with the differentiation of stimuli and that it may reflect a middle stage in learning.

(3161)

**Generalization of Auditory Discrimination Following Limited Training: Is Progressivity Important?** ESTELLA H. LIU, BARBARA A. CHURCH, ITZEL ORDUÑA, & EDUARDO MERCADO III, *University at Buffalo*—Individuals trained progressively on a difficult discrimination task learn faster and reach better performance levels than do those trained on the difficult discrimination alone (i.e., the *easy-to-hard* effect). In previous work (Liu et al., 2008), we found that 8 days of training significantly improved discrimination of highly similar frequency-modulated sounds in a generalization task. With the same amount of training, greater improvement was observed in progressively trained participants than in those trained only with a constant difficult discrimination. Even after only one training session, progressively trained listeners demonstrated better performance when tested with the training task. To extend previous

findings, we compared listeners' discrimination performance in a generalization task before and after different training conditions (progressive, constant, control). We found that progressive training was the only condition that produced improvement in the generalization task after a single training session, indicating that progressive training is critical for promoting auditory perceptual learning when training is limited.

(3162)

**Laterality Effects in a Novel Nonfused Dichotic Task: Reliability and Validity.** CHERYL TECHENTIN, *Mount Royal College*, & DANIEL VOYER, *University of New Brunswick* (sponsored by Daniel Voyer)—In the present experiment, we examined the psychometric qualities of laterality effects in a novel dichotic listening task under two separate response conditions. In both conditions, right-handers completed a dichotic listening task utilizing words beginning with the same consonant but with different endings in two testing sessions. Under free recall, 41 participants selected the word they heard most clearly among four alternatives, whereas in target detection, 47 participants indicated whether or not a target word was present. A right ear advantage (REA) was found in both conditions, but the REA was larger in target detection than in free recall. Test-retest correlations indicated that free recall ( $r = .79$ ) and target detection ( $r = .72$ ) were both relatively reliable. Additionally, an REA was found in 76% of the participants in the free recall task and in 77% of the participants in the target detection task. The discussion emphasizes the role of attention in the free recall condition.

(3163)

**A Frontal Channel in Human Spatial Hearing?** RACHEL N. DINGLE, SUSAN E. HALL, & DENNIS P. PHILLIPS, *Dalhousie University* (sponsored by Peter J. Urciuoli)—The discovery of an organized topographical map of auditory space in the barn owl popularized a "multi-channel" model of sound localization, in which narrowly tuned neural units are independently responsible for indicating the presence of a stimulus in their preferred azimuthal range. The barn owl model, however, fails to generalize to other animals. Rather, there is compelling neurophysiological and psychophysical evidence that mammalian sound localization, at least in the horizontal plane, is based on the relative activity of two hemifield-tuned channels that are broadly responsive to contralateral auditory space and have overlapping medial borders. There is also some neurophysiological evidence that a third, "frontal" channel may exist in mammals and is made up of neurons that respond to sounds situated at the auditory midline. We have probed the existence of a frontal channel in humans, using an auditory selective adaptation paradigm, and here present our evidence on this issue.

(3164)

**The Temporal Dynamics of Auditory Memory for Static and Dynamic Sounds.** BRANDON ABBS, *Brigham and Women's Hospital and Harvard Medical School*, & PRAHLAD GUPTA, *University of Iowa*—Speech signals contain acoustic information that is static (e.g., vowels) and dynamic (e.g., consonants), occurring over short and long intervals. It is unknown whether or how these dimensions affect auditory perception and short-term memory (ASTM). To fill this gap in knowledge, three experiments investigated the temporal dynamics of auditory memory in 146 adults performing auditory change detection. Static tones maintained their frequency over their presentation, and dynamic tones rose in frequency. By manipulating the time between, duration of, and differences between these tones, we show how the performance of ASTM varied as a function of the information in the trial. The results demonstrate that listeners are consistently better at detecting changes made to static tones than they are to dynamic tones, even for listeners with high ASTM performance. Furthermore, variables that reduce ASTM function (such as dynamic tones, long intervals between tones, and short tone durations) differentially affected listeners with lower ASTM performance.

(3165)

**The Irrelevant Speech Effect and Children: Methodological Considerations.** AMANDA F. O'BRYAN, DORIS J. KISTLER, & FREDERIC L. WIGHTMAN, *University of Louisville* (sponsored by John R. Pani)—The irrelevant speech effect (ISE) is a phenomenon in which

auditory distraction impairs the ability to complete a serial working memory task. The purpose of the study reported here was to examine age differences in the effect of distraction and the interaction of age and working memory capacity on the level of distraction. Child and adult participants were tested using individually determined digit sequence lengths ranging from 2 to 10 digits in three auditory distractor conditions: quiet, tones, speech (letters). For each participant and condition, psychometric functions were fit relating percent correct to digit sequence length in order to estimate the sequence length corresponding to 50% correct performance level, slope, and asymptotic performance. In contrast with previous results, the speech distractor did not impair performance for adults or for children. The results suggest that previous estimates of the ISE may have been inflated as a consequence of certain features of the experimental procedures.

## (3166)

**Impaired Extraction of Meaning From Loudness Change in Paranoid Schizophrenia.** DOMINIK R. BACH, *University College London*, KARIN BUXTORF & WERNER K. STRIK, *University Hospital of Psychiatry, University of Bern*, JOHN G. NEUHOFF, *College of Wooster*, & ERICH SEIFRITZ, *University Hospital of Psychiatry, University of Bern*—Patients with schizophrenia are impaired at pitch perception but are reportedly unimpaired at loudness perception, which they supposedly overutilize in order to extract meaning from emotional speech prosody. Since the extraction of meaning from intensity perception relies on structures that have been shown to be altered in schizophrenia, we hypothesized that the extraction of meaning from the changing intensity in looming sound sources would be impaired in schizophrenia as well. Twenty inpatients with schizophrenia and 20 control participants, matched for age, gender, and education, gave intensity change ratings of looming and receding sounds with different overall loudness. Loudness change was overestimated in looming, as compared with receding, sounds in both groups. However, healthy individuals showed a stronger effect at higher overall loudness, in keeping with previous findings, whereas patients with schizophrenia lacked this modulation. This supports the notion of a more general auditory deficit in schizophrenia, including both pitch and loudness perception.

## • VISION •

## (3167)

**Object Orientation in Canonical and Accidental Views: An fMRI Study.** AYAKO SANEYOSHI, *Teikyo University*, RYOSUKE NIIMI & REIKO ABE, *University of Tokyo*, TATSURO KAMINAGA, *Teikyo University*, & KAZUHIKO YOKOSAWA, *University of Tokyo*—Object orientation information is necessary for identifying objects from accidental views. Furthermore, recent research has suggested that posterior parietal cortex is involved in object orientation perception. We investigated whether the posterior parietal cortex would be more highly activated for orientation perception than for object recognition in a canonical-view condition and whether the activation would be equivalent in an accidental-view condition. In the object recognition task, participants judged whether the two objects were from the same category. In the orientation perception task, they judged whether the two objects were in the same orientation. The objects were presented from a canonical or an accidental view. The posterior parietal cortex was more highly activated for the orientation task than for the recognition task in the canonical-view condition, but there was no difference in activation in the accidental-view condition. This result supports the idea that object orientation information is needed for object recognition from an accidental view.

## (3168)

**Visual Recognition: Perceiving the “Gist” or the Details in Multiple Object Displays?** NURIT GRONAU, *Open University of Israel*—Objects that appear simultaneously typically compete for processing resources. Can functional relations between stimuli reduce competition and enhance object perception and consequent memory? Participants judged whether briefly presented (50-msec) object pairs contained a nonobject. Among real-object pairs, stimuli were either semantically associated (e.g., desk and lamp) or not (e.g., desk and blender) and were

positioned either in plausible or in implausible relative locations (e.g., the lamp/blender appearing above or below the desk, respectively). Each object pair appeared twice during the study. RTs to stimuli pairs during objects’ first appearance were affected by the plausibility of objects’ positions, but not by their semantic relations. Upon second stimulus appearance, semantic associations affected RTs, but only for the correctly positioned objects. These findings suggest that, whereas the “gist” (the spatial layout) of a scene is perceived at first glance, a more refined memory representation is subsequently formed, containing information about the precise functional relations between objects.

## (3169)

**High Spatial Frequency Information Contributes to Hallmarks of Face-Specific Processes.** KIM M. CURBY, *Temple University*, & ROBERT T. SCHULTZ, *Children’s Hospital of Philadelphia, University of Pennsylvania*—Evidence suggests that specialized holistic mechanisms supporting face processing are driven by low spatial frequency (LSF) information: Classic holistic processing effects are attenuated for faces containing only high spatial frequency (HSF) information. However, both HSF and LSF face information recruit face-selective cortex (i.e., the FFA), and evidence suggests that this brain region lies at the junction of channels processing different spatial frequency information. Here, we test whether the FFA response to HSF face information reflects holistic processing mechanisms. Given that inversion disrupts holistic processing, if holistic processing reflects use of only LSF scales, inversion costs should be attenuated for HSF faces. However, we found that behavioral performance and FFA activation demonstrated similar inversion costs for HSF and LSF faces. These results, in combination with previous evidence suggesting independent processing of spatial frequency scales in the FFA, suggest a role for high spatial frequency information in specialized face processing mechanisms.

## (3170)

**Improved Localization by Attention.** DIANA BOCIANSKI & JOCHEN MÜSELER, *RWTH Aachen*—When observers are asked to localize the peripheral position of a flashed probe with respect to a previously presented comparison stimulus, they tend to judge it as being more toward the fovea than the comparison stimulus is (Bocianski et al., 2008). This mislocalization was observed in experiments with undirected attention. As attention is known to improve localization performance, we hypothesized in the present study that directing attention beforehand to the position where target and comparison stimulus appear could reduce or even eliminate the mislocalization. Three experiments revealed evidence in favor of this assumption. The findings are discussed within a framework of locally working priming mechanisms.

## (3171)

**Eye See You: Can Eyetracking Change Looking Behavior?** EVAN F. RISKÓ & ALAN KINGSTONE, *University of British Columbia*—Eye tracking has become a major tool in almost all areas of psychology. This research relies on the assumption that the act of wearing an eyetracker does not in and of itself change one’s looking behavior. In the present investigation, we tested this critical assumption. We used a “free-looking task,” in which participants’ looking behavior was covertly recorded as they sat alone in a room (waiting for the experimenter). Critically, there was a visually provocative stimulus (i.e., a swimsuit calendar) placed in the room. Participants either wore an eyetracker or not. The results revealed rather dramatic differences in the looking behavior of individuals wearing an eyetracker and individuals not wearing an eyetracker. These results question the assumption that the act of wearing an eyetracker does not change one’s looking behavior.

## (3172)

**Toward Online Measurement of Decision State.** JOEL LACHTER & JAMES C. JOHNSTON, *NASA Ames Research Center*, & GREG S. CORRADO & JAMES L. MCCLELLAND, *Stanford University*—In traditional perceptual decision-making experiments, two pieces of data are collected on each trial: response time and accuracy. But how confident are participants and how do their decision states evolve over time? We asked participants to provide a continuous readout of their decision state by moving a cursor along a sliding scale between a 100% certain left response and

a 100% certain right response. Subjects did not terminate the trials; rather, the trials were timed out at random, and subjects were scored on the basis of the cursor position at that time. Higher rewards for correct responses and higher penalties for errors were associated with extreme responses, so that the response with the highest expected value was that which accurately reflected the participant's odds of being correct. This procedure encourages participants to expose the time course of their evolving decision state. Evidence on how well they can do this will be presented.

• DIVIDED ATTENTION •

(3173)

**Individual Differences in Executive Function, Eye Movements, and Dual Task Performance.** RUSSELL S. PIERCE, ZHENG BIAN, & GEORGE J. ANDERSEN, *University of California, Riverside*—Dual task performance in a driving simulator was examined to determine the relationship between specific driving performance and individual differences in a measure of executive functioning. Twenty-five participants performed a car-following task (maintaining a following distance by varying speed to match the speed of a lead vehicle) and were required to detect a light change in an array located above the roadway. In addition, eye movements were recorded using a head-mounted eyetracker. Multiple regression analyses indicated that 53% of the individual subject variability in RT data was based on RMS error in car-following, the standard deviation of eye fixations, and the matrix reasoning subtest of the Wechsler Adult Intelligence Scale. These results suggest that a small number of factors account for a considerable amount of individual subject performance under complex dual task conditions.

(3174)

**Humans Can Simultaneously Attend to Eight Moving Objects.** PIERS D. HOWE, *Harvard Medical School*, MICHAEL A. COHEN, *Harvard University*, & YAÏR PINTO & TODD S. HOROWITZ, *Harvard Medical School* (sponsored by Todd S. Horowitz)—How many objects can be attended simultaneously? Alvarez and Franconeri (2007) showed that observers can attentionally track up to eight moving objects. However, the objects moved so slowly that observers may have been switching attention between them. To distinguish between simultaneous and sequential tracking, we had observers track a range of 2 to 8 of 16 identical, independently moving disks. Each disk cycled between moving and stationary phases, with a 50% duty cycle. Critically, the disks cycled either in phase (synchronous) or out of phase (asynchronous) with each other. If observers shift attention between the tracking targets, then tracking performance should be greater in the asynchronous condition, because fewer targets are moving at any given time. We found that observers performed equally well in both the synchronous and asynchronous conditions, regardless of the number of tracked targets. This suggests that observers can attentionally track up to eight objects simultaneously.

(3175)

**Maintenance of Temporal Order Is Impaired During the AB.** HAYLEY E. LAGROIX, MATTHEW R. YANKO, VINCENT DI LOLLO, & THOMAS M. SPALEK, *Simon Fraser University*—Identification accuracy for the second of two targets (T2) is impaired when presented shortly after the first target (T1). Does this AB deficit also impair the perception of temporal order? In four experiments, three letter targets (T1, T2, T3) were inserted in a stream of digit distractors, with T3 always presented directly after T2. The T1–T2 lag was varied to assess the maintenance of T2–T3 temporal order throughout the period of the AB. Factorial manipulation of the presence or absence of distractors before T1 and between T1 and T2 revealed similar temporal courses for accuracy and temporal order. Critically, temporal order was lost even when accuracy was unimpaired. A model is proposed, whereby identification and temporal order are processed in distinct cortical regions under the control of a central processor. Extant theories of the AB need to be revised to encompass the AB impairment in maintenance of temporal order.

(3176)

**Separating Visual Features From Tracked Objects in Combined VSTM and MOT Tasks.** JUSTIN M. ERICSON & SUSAN T. DAVIS,

*University of Dayton*—Visual short-term memory (VSTM) and attentional tracking are the essential processes involved in tracking multiple objects amidst distractors (MOT) and recalling object features. Previous research has found a deficit in performance accuracy thought to be due to interference between the VSTM and MOT tasks. In order to determine how process resource sharing could be the basis for the interference, the present research attempted to dissociate the VSTM stimulus from objects during tracking. Thus, in a separating-features condition, participants tracked objects that replicated themselves midway through a motion sequence while concurrently remembering the color of the original objects. Performance on the MOT task suffered more than on the VSTM task in the dual-task, separating-features condition, as compared with trials where only MOT or VSTM was tested. Comparisons with performance in single-task conditions indicate that the appearance of additional distractors in the separating-objects condition produces shared-resource deficits that primarily affect attentional tracking.

(3177)

**Attentional-Allocation Policies Affect Cue Detection and Interference on Both Related and Unrelated Tasks.** JOSEPH T. MEEKS, *Southern Illinois University, Edwardsville*, GABRIEL I. COOK, *Claremont McKenna College*, RICHARD L. MARSH, *University of Georgia*, GILLES O. EINSTEIN, *Furman University*, & JASON L. HICKS, *Louisiana State University*—Event-based prospective memory (EBPM) concerns the ability to fulfill a future intention based on the recognition of an event in one's environment. Real-world opportunities to fulfill everyday intentions usually occur while one is concurrently performing unrelated tasks (e.g., delivering a message to a friend upon encountering her while shopping for groceries). Laboratory studies of EBPM often require participants to formulate an intention to respond to event cues encountered while concurrently performing an unrelated ongoing cognitive task. We used this paradigm to examine the functional relationship between three dependent variables associated with EBPM: (1) cue detection, (2) interference associated with successful cue detection, and (3) interference on an ongoing task caused by holding an intention. Our empirical results demonstrate that functional relationships exist between these three variables. We also discuss boundary conditions that represent exceptions to these relationships.

(3178)

**Controlling Spatial Attention Without Central Attentional Resources: Evidence From Electrophysiology.** KHARA CROSWAITE & MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & MIN-JU LIAO, *National Chiao-Tung University, Taiwan*—In the present study, we examined whether the control of spatial attention requires central attentional resources. We addressed this issue using a modified psychological refractory period paradigm. In different experiments, Task 1 was a two-choice or four-choice speeded task on a visual or auditory stimulus. Task 2 required unspeeded identification of a letter in a specific target color (while one ignored other colors). The critical manipulation was the stimulus onset asynchrony (SOA) between Task 1 and Task 2. The question was whether the Task 2 stimulus would capture spatial attention at short SOAs, while central attention was still allocated to Task 1. We measured the N2pc effect, a component of the event-related brain potential thought to reflect lateralized attentional allocation. For the easier two-choice tasks, attention was strongly captured, even at short SOAs, both for auditory and visual stimuli. But for the difficult four-choice tasks, the N2pc effect was attenuated at short SOAs.

(3179)

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

(3180)

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



## POSTER SESSION IV

Saturday Noon

Hynes Convention Center, Ballrooms A, B, and C  
Viewing 9:00–1:30, Author Present 12:00–1:30

## • ACTION •

(4001)

**Object and Goal Locations Contribute Additively to the Simon Effect.** JAMES D. MILES, JESSICA K. WITT, & ROBERT W. PROCTOR, *Purdue University* (sponsored by E. J. Capaldi)—Responses are faster and more accurate when they are congruent to (match) the location of a target stimulus, even when stimulus location is task irrelevant (i.e., the Simon effect). When one plans to move an object to a goal location, it is unclear whether stimulus location influences the movement to the object, the movement to the goal, or both. In four experiments, participants picked up beans that matched the color of a circle on a computer screen and placed them in a bucket of the same color. We varied whether the location of the bean (object) and bucket (goal) were congruent, incongruent, or neutral in relation to the color circle. The results showed that there were Simon effects for both the object and goal locations, and their contributions to reaction time were additive. We discuss the role that task-irrelevant spatial information plays throughout the planning of a complex action.

(4002)

**Effects of Practice With Noncorresponding Location Words on the Simon Task.** ANDREA ROTTERMANN & KIM-PHUONG L. VU, *California State University, Long Beach*, & ROBERT W. PROCTOR, *Purdue University*—A benefit for spatial correspondence, called the Simon effect, is obtained in choice-reaction tasks when the stimulus location is irrelevant. Reversal of the Simon effect to favor noncorresponding stimulus–response locations occurs after subjects perform 84 practice trials with an incompatible mapping of stimulus locations to responses. A similar amount of practice with location words mapped incompatibly to responses has little influence subsequently on the Simon effect for stimulus locations. In the present study, location words were incompatibly mapped to responses in the practice session, but the task was to respond to stimulus color. In this case, the Simon effect was reversed, but only for participants who demonstrated awareness of the noncorresponding stimulus–response relation in the practice session. Thus, although an explicit intention to respond to the location words yields little transfer, awareness of the noncorresponding relation seems to promote transfer when the explicit intention is to respond to stimulus color.

(4003)

**Comparison of Affective and Spatial Simon Effects for Word Stimuli.** YANMIN ZHANG & ROBERT W. PROCTOR, *Purdue University* (sponsored by Kim-Phuong L. Vu)—Do the mechanisms underlying processing of spatial and affective information differ? The present study investigates this issue using a mixing procedure in which the information is relevant on some trials and irrelevant on others, with stimulus color being relevant. Of most concern are correspondence effects (Simon effects) obtained for those trials on which the spatial or affective information is irrelevant. A direct comparison of spatial and affective task versions was performed, using the words *left–right* to convey spatial information and *good–bad* to convey affective information. Spatial and affective Simon effects of similar magnitude were obtained. Furthermore, the two task versions showed comparable patterns of sequential effects: The Simon effects were large when the task, response, or both switched and negligible when both repeated. The results suggest that the spatial and affective Simon effects for words arise from similar mechanisms and are not solely a consequence of task-set switching.

(4004)

**The GROOP Effect: Groups Respond Faster to Group Actions Than to Individual Actions.** JESSICA CHIA-CHIN TSAI, GÜNTHER KNOBLICH, & NATALIE SEBANZ, *Radboud University Nijmegen* (sponsored by Natalie Sebanz)—Humans excel at performing actions together. Do groups perceive the action capabilities of other groups just like individuals perceive individual action capabilities? In order to test this hypothesis, a stimulus–response compatibility task was distributed

between two people. Participants observed either two right hands (individual model) or a left hand and a right hand (group model). They responded to ipsilateral hand movements that occurred either alone or together with a movement of the second hand. When participants performed the task together with a confederate, they responded faster when they perceived the group model. In contrast, in an individual condition, participants responded faster when they perceived the individual model. Thus, the results showed that individuals who perform actions together map observed group actions to their joint action capabilities, rather than to their individual action capabilities. This GROOP effect cannot be explained by anatomical matching or numerical compatibility.

(4005)

**Shared Intentions in Joint Music Performance.** JANEEN D. LOEHR, ROWENA PILLAY, & CAROLINE PALMER, *McGill University* (sponsored by Caroline Palmer)—Research has suggested that shared representational structures are activated by people taking turns; the current research examined whether a performer's task intentions incorporate those of co-performers who produce independent but simultaneous actions. Pianists performed a right-hand melody, with a left-hand part produced by themselves or by another pianist. The left-hand part consisted of a single finger producing a percussion timbre (percussion condition), sequential finger movements producing a simple motor sequence (easy melody), or sequential finger movements producing a complex motor sequence (hard melody). Although temporal asynchronies between parts and interonset interval variance within parts were both larger in the two-performer condition, both measures favored the easy melody over the hard melody: The same pattern of coordination occurred regardless of whether the left-hand part was produced by the self or by another performer. These findings suggest that performers represent the melodic sequences produced by their co-performers in temporally coordinated music performance.

(4006)

**To Sync or Not to Sync: Timing and Symmetry of Movements in Real-Time Interaction.** CHRISTINA JÄGER, ANTJE HOLLÄNDER, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—It has recently been shown that when people are engaged in real-time interaction, they represent, to some extent, the task of a co-acting partner and that this co-representation leads to impairment of their own action performance. We divided a bimanual task between 2 participants in such a way that they jointly performed the task using one hand each. The relation of concurrently executed reaching movements could be either symmetric or asymmetric. The results show a strong coherence between the trial-by-trial correlations (TbT corr) for each dyad and the direction of the symmetry effect. The so-called “synchronizers” (significant TbT corr) are faster in performing same actions with their partner, whereas “nonsynchronizers” (nonsignificant TbT corr) show facilitation when performing complementary movements. The causal relationship of influencing factors such as synchronization, symmetry-effects, and other possible ones will be discussed. Our results show clearly that information acquired by task sharing is used in a flexible manner.

(4007)

**Congruency Effects Between Number Magnitude and Response Force.** ESTHER VIERCK, *Mount Sinai School of Medicine*, & ANDREA KIESEL, *University of Würzburg* (sponsored by Andrea Kiesel)—Numbers are thought to be represented in space along a mental left–right oriented number line. Number magnitude has also been associated with the size of grip aperture, which might suggest a connection between number magnitude and intensity. The present experiment aimed to confirm this possibility more directly by using force as a response parameter. Participants judged parity of a single digit by executing a weak or a forceful keypress. Response selection was faster when small digits required a weak response and large digits required a forceful response than when this mapping was reversed. These findings indicate an effect of number magnitude on the initiation of response intensity. There was no evidence for such an effect on response execution, because the actually applied response force was not associated with number magnitude. These findings confirm a previously postulated link between different magnitude domains such as number magnitude and intensity as a basis for action.

(4008)

**Corepresentation of Others' Action Alternatives: Does the Hick-Hyman Law Hold for Self and Other?** ROBRECHT P. R. D. VAN DER WEL, GÜNTHER KNOBLICH, & NATALIE SEBANZ, *Radboud University Nijmegen* (sponsored by Günther Knoblich)—It has been proposed that people corepresent each other's tasks when they act together (e.g., Sebanz, Knoblich, & Prinz, 2005). In a series of experiments, we tested this claim by manipulating the number of action alternatives for two actors. According to the Hick-Hyman law, reaction time increases with the number of response alternatives for an individual. If people corepresent others' tasks, performance should depend not only on the number of personally relevant action alternatives, but also on the number of action alternatives a coactor has. Analyses of reaction times and errors provide first evidence that performance is indeed modulated by the number of action alternatives available to one's co-actor. The results indicate that taking into account social factors can shed new light on cognitive models of human performance.

## • ANIMAL COGNITION •

(4009)

**Risky Choice and the Sequential Choice Model.** JUSTINE AW, MARCO VASCONCELOS, TIAGO MONTEIRO, & ALEX KACELNIK, *University of Oxford* (sponsored by Roger L. Mellgren)—According to the sequential choice model, latencies during single-option trials capture the relative attractiveness of options, with simultaneous choices resulting from a race between independent processes triggering responses to each alternative. We tested these predictions in a risky choice task, offering European starlings (*Sturnus vulgaris*) choices between a fixed (F) and variable (R) option. R offers a mixture of two equiprobable outcomes (D1 and D2 in Experiment 1 and A1 and A2 in Experiment 2, where D and A denote delays to and amounts of reward). F offers a fixed outcome that varies across treatments. Starlings were indifferent when the fixed delay fell between the harmonic and geometric means of the risky outcomes and at the arithmetic mean when reward amount varied. Consistent with the model, latencies to accept options presented alone reliably predicted preference in subsequent choice trials.

(4010)

**Cooperation, Competition, and Altruism in Tamarins.** JULIE J. NEI-WORTH, *Carleton College*, JULIE GREENBERG, *Max Planck Institute for Evolutionary Anthropology*, & MAI KAO YANG & AMY OLIVARES, *Carleton College*—Cotton top tamarins ( $N = 8$ ) had to work together to pull a container toward themselves to get a treat. A variety of conditions were used to test their willingness to cooperate or act altruistically. Moreover, competition was added, either by exposing other subjects to the cooperative act and thus adding a local threat to the problem, or by literally allowing subjects across cages to cooperate in a tug-of-war condition. Finally, reward distribution was also altered in some conditions to match availability of reward with some of the social conditions (i.e., in altruism, whereby the helper does not get rewarded). The results show an interesting pattern that suggests cooperation emerged prosocially in this species. Competition does not enhance cooperation.

(4011)

**How Schedules of Reinforcement Affect Behavior Depends on Organismic Differences in Stage of Development.** LUCAS COMMONS-MILLER, *Dare Institute*, & JONAS GENSAKU MILLER, *University of California, Davis* (sponsored by Leonard Green)—How reinforcement schedules contact behavior depends on their discriminability by a particular species or organism. Discriminability is partially determined by the order of the hierarchical complexity of the schedule demands. The model of hierarchical complexity is used to classify the discriminability of schedules into three groups of orders of complexity. The majority of schedules, such as those seen in simple discriminations or in concurrent schedules, are classified as being at Circular Sensory-Motor Order 2. This is because the schedules' Order 1 reinforcers are coordinated with Order 1 responses. Schedules requiring concepts are Sensory-Motor Order 3. The second type of schedules are conjoint, which is where most of human performances occur. The orders range from Primary 7 to Metasystematic 11. The third includes hyperrational choice at the

Metasystematic Order 12. This is the first order at which people can reflect on the nature of systems of contingencies.

(4012)

**Hierarchical Complexity of Experimental Paradigms Studied in Quantitative Analyses of Behavior: Part I. From Isolated Sensations and Actions to Simple Discriminations.** MICHAEL LAMPORT COMMONS, *Harvard Medical School* (sponsored by Peter J. Urcioli)—The first two orders of the hierarchical complexity of experimental paradigms used in the quantitative analyses of behavior are described. This analysis makes clear what makes a paradigm simpler and what makes it more difficult. This should become a major variable in comparative psychology. Difficulty is defined in the model of hierarchical complexity. Three axioms define how more difficult or complex tasks are derived from simpler tasks: Axiom 1, a more difficult task action is defined in terms of two or more simpler task actions; Axiom 2, the higher order task action organizes the simpler task actions; and Axiom 3, this organization is nonarbitrary. Thus, 15 orders of hierarchical complexity are defined. This presentation will illustrate this model, using the two lowest orders. In Order 1, organisms either act or sense but do not coordinate the two, except reflexively. In Order 2, sensory input, such as stimuli, and actions or responses are coordinated.

(4013)

**Classifying Experimental Paradigms Studied in Quantitative Analyses of Behavior: Part II. Matching-to-Sample With Stimuli of Different Hierarchical Complexities.** PATRICE MARIE MILLER, *Harvard Medical School* (sponsored by Seth Roberts)—The model of hierarchical complexity shows how more hierarchically complex tasks are constructed from the next lower order task actions. This model explains difficulty of tasks—therefore, evolutionary sequence. A task analysis of matching-to-sample illustrates how the order of complexity and, therefore, the difficulty of the task depends upon the stimuli used. At Circular Sensory-Motor Order 2, the simplest matching-to-sample situation, the stimulus that identically matches a previously presented stimulus is chosen from two stimuli. At Sensory-Motor Order 3, the matching-to-sample task requires a correct response to a stimulus dimension such as "same color" or "same shape." Such Sensory-Motor Order 3 actions are those in which the organism coordinates two or more particular stimulus-response relationships to form a concept. At Nominal Order 4, the sample stimuli were different exemplars of a natural concept class. The exemplar and the correct stimulus in the match differed but represented the same concept.

(4014)

**Effects of Emotional Valence on Temporal Information Processing.** HEATHER VAN VOLKINBURG, *Columbia University*, & PETER D. BALSAM, *Barnard College, Columbia University*—We examined one effect of emotion on short-term memory for time intervals, using a reproduction procedure. In the learning phase, subjects were presented with an image from IAPS for target durations of either 0.8 or 3.5 sec. For the reproduction phase, subjects were then presented with another image and had to mark the end of the interval by pressing a key. Images were divided into three categories: positive valence, negative valence, and neutral valence. Categories of valence were intermixed across learning and reproduction phases, allowing us to dissociate the impact of valence on learning and reproduction. Positive and negative images in both the learning and reproduction phases caused lengthened estimates, as compared with neutral images. This pattern of results is not easily explained by clock or attentional mechanisms. Another proposal is that emotional valence affects the threshold for terminating an interval.

## • REASONING/PROBLEM SOLVING •

(4015)

**Concurrent Verbalization and Reactivity: The Impact of Instructions Examined Through Meta-Analysis.** MARK C. FOX & K. ANDERS ERICSSON, *Florida State University* (sponsored by K. Anders Ericsson)—Concurrent verbalization has long been used to study cognitive processes but remains controversial because of inconsistency in the literature regarding its effects on performance. Ericsson and Simon (1980, 1993) proposed that instructions moderate reactivity, whereby noninvasive think-

aloud (TA) instructions minimally change processes and, consequently, do not alter performance outcomes. In contrast, explanatory instructions, and other invasive methods, qualitatively change the way tasks are accomplished and should impact performance. Meta-analysis of 84 studies with verbalization and silent conditions found that TA is largely nonreactive, yielding a mean effect size indistinguishable from zero ( $r = -.03$ ). In contrast, explanatory instructions that engage task-irrelevant processes are reactive and tend to improve performance. Meta-analytic regression suggests that explanatory instructions enhance performance most on visual tasks, whereas TA does not impact performance on either visual or nonvisual tasks. Verbalizing significantly prolongs solution times.

(4016)

**Learning the Form of Discrete and Continuous Causal Relationships.** CHRISTOPHER G. LUCAS & THOMAS L. GRIFFITHS, *University of California, Berkeley*—Causal relationships can take a wide range of forms involving both discrete and continuous variables, but most psychological models of causal learning restrict their attention to a narrow range of causal relationships, assuming that all relationships of interest involve binary variables and that a small set of parametric classes describes all relevant relationships between those variables. We present a hierarchical Bayesian framework addressing the question of how people can reason efficiently about both the structure and form of causal relationships and can apply knowledge of functional form to learn more efficiently in the future. We consider several forms of causal relationships involving binary, ordinal, and continuous variables and present experimental data supporting our framework.

(4017)

**Confounded: Causal Reasoners Fail to Appreciate the Requirement of Independence.** CHRISTIAN C. LUHMANN, *Stony Brook University*—Correlation does not imply causation. One of the most critical requirements for valid causal inference is that the ostensible cause must occur independently of all other potential causes. Otherwise, the situation is said to be confounded, and inferences are likely to be incorrect. Previous work has shown that reasoners take steps to control for alternative causes when independence is violated. However, this work has always provided reasoners with a rich set of covariation information favorable for such control. Here, we report three experiments that investigated whether reasoners recognize and react to violations of independence when provided with more naturalistic covariation information. Our results suggest that reasoners do not seek out information about whether causes are independent before making causal inferences and judge many confounded situations to be just as informative as unconfounded situations. These results pose difficulties for reasoners who attempt to make valid inferences in an uncertain world.

(4018)

**Updating Beliefs About Garden Path Arguments: A Test of the Relevance Account of Category-Based Induction.** AIDAN FEENEY, *Queen's University Belfast*, JOHN D. COLEY, *Northeastern University*, & AIMEE K. CRISP, *Durham University*—When people evaluate a category-based inductive argument, they consider whether a property possessed by members of one or more categories is also possessed by members of another category. To test the relevance account of category-based inductive reasoning, we used three-premise garden path arguments whose final premise disconfirmed hypotheses about the nature of the property that were made likely by the first two premises. The relevance account predicts that disconfirming final premises will be examined for longer and lead to greater belief change than will confirming premises. The results supported both predictions, and furthermore, we observed that longer inspection times were associated with greater belief change. This last finding confirms a prediction made by relevance theory (Sperber & Wilson, 1995) about the relationship between the cognitive effort expended in processing information and the cognitive effects derived from doing so. Similarity-based and Bayesian models of inductive reasoning have difficulties in explaining these results.

(4019)

**An Item Response Theory Analysis of the Four-Card Selection Task.** KUNINORI NAKAMURA & KIMHIKO YAMAGISHI, *Tokyo*

*Institute of Technology* (sponsored by Kimihiko Yamagishi)—The four-card selection task (Wason, 1966) has been one of the most well-known tasks used in the literature on human reasoning. The aim of this study was to analyze this selection task in terms of item response theory (Lord & Novick, 1968). Japanese undergraduates responded to up to 10 types of representative Wason selection tasks, including the indicative task (Wason, 1966), beer task (Griggs & Cox, 1982), and cassava task (Cosmides & Tooby, 1989). The results of the analysis by the two-parameter logistic model indicated the following: The indicative task was similar to the beer and cassava tasks in terms of the discrimination parameter, and the relative difficulty of the tasks would vary according to the value of theta, estimated by the two-parameter logistic model.

(4020)

**Group and Collaborative Influences on Unconscious Plagiarism.** BRANDY N. JOHNSON, *Iowa State University*, & MARTIN L. BINK, *U.S. Army Research Institute*—Unconscious plagiarism, or cryptomnesia, occurs when an original idea is produced by someone who is unaware that the idea was previously generated by someone else at an earlier time. Most accounts suggest that unconscious plagiarism results from inadequately applying source-monitoring processes during idea generation. In one experiment, both group composition and idea production modality were manipulated in a group brainstorming paradigm in order to change individuals' source-monitoring decision criteria. In a second experiment, a collaboration requirement was used during brainstorming to manipulate the source-monitoring criteria. Across both experiments, the results indicated that manipulations that relaxed source-monitoring criteria (i.e., written responses in group production and collaboration) increased rates of unconscious plagiarism. Importantly, explicit source-monitoring rates did not differ across manipulations. Thus, the results provided additional evidence for a source-monitoring explanation of unconscious plagiarism and demonstrated additional group influences on individual cognition.

(4021)

**Insight Problem Solving: Alleviating Constraints to Promote Transfer.** LEAMARIE T. GORDON & TRINA C. KERSHAW, *University of Massachusetts, Dartmouth*—The four-tree problem is a complex and difficult insight problem that places several constraints on individuals during problem solving. The present study redesigns the constraint of relaxation training developed by Flynn (2008) in order to facilitate transfer of a solution to the problem. Geometry training and analogue comparison, followed by a practice problem with feedback, were presented in the present training, and picture clues were given during target problem solving. Direct comparisons with Flynn's data showed that the new training was significantly more effective. The results support research showing that attending to the structural similarities of analogues promotes transfer. Picture clues increased the likelihood of solution, and incorrect attempts at solving the target problem decreased the likelihood. Unexpectedly, participants who solved an isomorphic practice problem were not significantly more likely to solve the four-tree problem. Implications for theories of constraint alleviation and transfer in problem solving are discussed.

(4022)

**Nominalization As a Problem-Solving Strategy.** MATTHEW E. JACOVINA & MATTHEW A. BEZDEK, *Stony Brook University*, MONICA C. BABES, *Rutgers University, Piscataway*, & RICHARD J. GERRIG, *Stony Brook University*—In everyday conversation, people often spontaneously invent new terms to label novel concepts. We suggest that people can harness that impulse toward nominalization to improve their problem solving. To test the efficacy of nominalization as a strategy, we asked participants to play two computer-based puzzle games that required solvers to make conceptual leaps. One game, called *Sokoban*, served as a training environment. After they had a brief *Sokoban* experience, we provided explicit nominalization training to half the participants. Participants in the control group did not receive the training. We used a second game, called *TipOver*, to assess participants' ability to apply the nominalization strategy. Comparisons between the two groups' performance supported the efficacy of nominalization as a problem-solving strategy.



(4023)

**Mechanism Information Influences the Cell-Weight Inequality in Causal Judgment From Contingencies.** KELLY M. GOEDERT, *Seton Hall University*, & MICHELLE R. ELLEFSON, *Virginia Commonwealth University*—Participants' causal judgments reflect an interaction between mechanism information and contingency information (Fugelsang & Thompson, 2003). Mechanism information may influence the use of contingencies by changing how participants weight events. Typically, the frequency with which a cause and outcome co-occur exerts the most influence on causal judgment (Cell A), followed by the cause alone (Cell B), the outcome alone (Cell C), and the frequency with which neither occurs (Cell D). We predicted that when faced with an implausible causal mechanism, participants would place more weight on Cells C and D. Here, we manipulated both cell frequency and the plausibility of the causal relations. Consistent with previous results, for plausible causal mechanisms, we observed the typical cell-weight inequality: The correlation between participants' judgments and the cell frequencies decreased across Cells A through D. Following our hypothesis here, judgments for implausible mechanisms reflected a greater reliance on Cells C and D.

(4024)

**Reduced Comprehension of Explanatory Texts, Due to Emotional Prior Beliefs and Their Incoherent Conceptual Frameworks.** THOMAS D. GRIFFIN & CARLOS SALAS, *University of Illinois, Chicago*—Much of what has been labeled as conceptual change and knowledge acquisition actually entails forming beliefs about the veracity of propositions. Griffin (2008) claimed that emotional preferences can displace and undermine, rather than merely supplement, the normative evidence and coherence evaluation processes. An implication is that emotional beliefs should be associated with conceptual knowledge frameworks that lack integration and internal coherence, thus impeding the ability to accurately represent new relevant information. The present study assessed whether prior beliefs were the result of normative evidence evaluation processes versus deference to emotionally preferred conclusions. Believers read texts that were either consistent or inconsistent with prior beliefs, and both prior topic knowledge and text comprehension in a similar domain were controlled for. In addition, eyetracking data were employed to test an alternative effort/motivation explanation.

(4025)

**Predicting Fluid Intelligence Across the Adult Life Span: The Roles of Speed, Working Memory, and Learning.** ELAINE TAMEZ, JOEL MYERSON, & SANDRA S. HALE, *Washington University*—Complex associative learning has recently been found to be highly correlated with fluid intelligence (Tamez et al., 2008; Williams & Pearlberg, 2006). Furthermore, learning uniquely predicts fluid intelligence in young adults even after controlling for working memory. The present study extended these findings to adults 30–80 years of age. A regression model with speed, working memory, and learning as predictors accounted for 59% of the variance in fluid intelligence, although only learning and speed accounted for unique variance. Importantly, with learning and speed in the model, age was not a significant predictor of fluid intelligence. These findings highlight the utility of complex associative learning in predicting fluid intelligence across the adult portion of the life span.

#### • DISCOURSE PROCESSING •

(4026)

**Effects of Age on Updating Causal Inferences in Narrative Text.** SHARON A. MUTTER, KRISTI SIMMONS, MELANIE ASRIEL, & JARED HOLDER, *Western Kentucky University*—In a study comparing young and older adults' ability to correct causal misinformation in narrative text, participants read a series of messages about the investigation of a warehouse fire (e.g., Wilkes & Leatherbarrow, 1988) and were subsequently tested for their memory of the messages. An early message in the series suggested that negligent storage of flammable materials might have caused the fire. This causal inference was left uncorrected or was corrected in a later message either by repeating the earlier message and stating that it was incorrect (direct correction) or by stating only that the earlier message was incorrect (indirect correction). Older adults recalled

fewer facts from the messages than did young adults, but there was no age difference in memory for the causal information. Moreover, the discredited causal inference continued to have an influence on both groups' memory whether it was corrected directly or indirectly.

(4027)

**The Effect of Small Mysteries on Narrative Processes and Memory.** JESSICA LOVE & GAIL MCKOON, *Ohio State University*, & RICHARD J. GERRIG, *Stony Brook University* (sponsored by Gail McKoon)—In previous work, we found that when participants read stories that introduced characters by proper name alone (e.g., "Judy"), the characters remained more accessible three lines later than when the characters were introduced with information relating them to other characters in the story (e.g., "our principal Judy"). We suggested that the character remained accessible awaiting resolution. In this poster, we extend our theoretical analysis of small mysteries. We provide evidence that trait information (e.g., "daredevil Judy") is not sufficient to provide resolution, as well as evidence that moment-by-moment processing effects of such small mysteries also affect readers' memory for the stories.

(4028)

**Explicit Versus Implicit Refutation of Misconceptions: Evidence From Eyetracking.** PANAYIOTA KENDEOU, *McGill University*—The purpose of the present study was to examine the effects of refuting readers' misconceptions on the cognitive processes during reading comprehension, using eyetracking. Forty-eight college students with identified misconceptions in the area of Newtonian mechanics were asked to read texts discussing Newton's first and third laws that either explicitly or implicitly refuted their misconceptions. The results showed that readers made more and longer forward fixations when reading sentences that explicitly refuted their misconceptions (as opposed to sentences that implicitly refuted misconceptions). Importantly, subsequent explanation sentences received fewer and faster look-back fixations when following an explicit rather than an implicit refutation. These findings suggest that the explicit (as opposed to implicit) refutation of misconceptions assists readers' processing by increasing the likelihood that subsequent explanations are integrated into readers' mental representation of the text.

(4029)

**Exploring Motor Resonance Effects on Language Comprehension.** MARK A. CASTEEL, *Pennsylvania State University, York*—Researchers studying embodied cognition have shown that reading comprehension often produces a mental simulation of the described actions. Much less is known, however, about whether motor activation influences reading comprehension. Data that I presented at last year's Psychonomic meeting suggested that participants who planned to perform an action slowed on their reading of a story sentence that mentioned an action requiring similar motor behaviors. The present study attempted to replicate and expand this finding. Participants first acted out a behavior involving a common object (swing a bat). Participants then read a passage about another object that required either similar (bang a gong) or different motor behaviors. Finally, participants again acted out the original behavior. Reading times to the passages (particularly the verbs) was measured to see whether motor resonance inhibited reading about a complementary action. The results help to delineate the influence of motor resonance on language comprehension.

(4030)

**Partner Specificity of Lexical Entrainment and Differentiation in Reference Phrase Production.** MIJA M. VAN DER WEGE, *Carleton College*—Lexical entrainment and lexical differentiation (Brennan & Clark, 1996; Garrod & Anderson, 1989; Van Der Wege, 2009) describe some of the choices that speakers make in reference phrase formulation. Lexical entrainment is partner specific, at least in some circumstances, but no such investigation has been done on lexical differentiation. This study uses a referential matching task to investigate the extent to which lexical entrainment and lexical differentiation are partner-specific processes, by comparing references made with the same and a different partner. The memory processes behind partner specificity could involve encoding specificity—specifically, an implicit association between the context of the conversational partner and an association between the reference

phrase and the referent (Horton, 2007). This study also looks at the role of partner salience in the use of partner-specific information by manipulating the amount and type of interaction between the two partners.

(4031)

**Anticipating Upcoming Discourse Relations: Using Eye Movements To Measure Verb-Driven Pragmatic Expectations.** HANNAH ROHDE & WILLIAM S. HORTON, *Northwestern University*—We investigated comprehenders' expectations regarding the pragmatic relationships that are inferred to hold between sentences. First, in an implicit-learning paradigm, comprehenders learned to associate one region of the visual field with explanation relations (e.g., "Leo takes the bus to work. He doesn't have a car") and another region with occasion relations (e.g., "Melissa ran toward Trevor. They embraced"). Then, during a subsequent speeded-response task, we recorded comprehenders' eye movements to examine whether verb-driven contextual cues would bias expectations regarding upcoming discourse relations. We found more anticipatory looks to the explanation region following implicit causality verbs ("Theo congratulated Miriam") and more looks to the occasion region following transfer-of-possession verbs ("Heather bounced a basketball to Josh"). This is consistent with evidence for expectation-driven processing within the sentence (at the level of sounds, words, and syntactic structures) and extends that work to show that comprehenders also anticipate pragmatic relationships between sentences during processing.

(4032)

**The Cost of Interruptions During Reading: An Examination of Eye Movements, Comprehension, and Subjective Difficulty.** JAMES E. CANE & ULRICH WEGER, *University of Kent*—People are frequently interrupted during reading tasks. Such reading-related interruptions are particularly costly because of the long warm-up time needed when returning to text. The present experiment evaluated the consequences of interruptions on normal reading. Thirty-three participants read paragraphs of text while their eye movements were recorded. Unpredictably, an interruption occurred, and participants responded either immediately or after a delay, allowing time for consolidation. In a control condition, no interruption occurred. Participants then finished reading the text and, subsequently, rated paragraph difficulty and responded to comprehension questions. Eye movement parameters indicated that participants took longer to read text, skipped more words, made more comprehension errors, and rated paragraphs as more difficult following an interruption. Furthermore, immediate interruptions led to a significantly larger and greater number of regressions. The results thus indicate that reading is compromised by interruptions, particularly when no time is given to consolidate previously read text.

(4033)

**The Influence of Story Consistency on the Construction of Documents Models.** M. ANNE BRITT, *Northern Illinois University*, JEAN-FRANÇOIS ROUET, CHRISTINE ROS, LOÏC CARROUX, CLEMENT NIVET, & LUDOVIC LE BIGOT, *University of Poitiers and CNRS* (sponsored by Nicolas Vibert)—Two experiments investigated the role of source information in readers' comprehension of short news reports. We hypothesized that readers would be more likely to encode source information when the reports conveyed discrepant viewpoints. In Experiments 1A and 1B, French and U.S. undergraduates summarized a series of short news stories. The participants were more likely to report source information in their summaries when the story was discrepant. In Experiment 2, 24 French undergraduates summarized a series of consistent or discrepant news stories. Then they had to recognize the source of story statements. Again, the participants included more sources in discrepant story summaries. Furthermore, there were almost twice as many source recognition errors for consistent stories. Consistent with the predictions of the documents model framework (Britt et al., 1999), the data suggest that source information participates in readers' representation of stories that involve multiple, conflicting viewpoints.

(4034)

**The Cognitive Components-Resource Model of Reading Comprehension.** BRENDA HANNON, *University of Texas, San Antonio*—Previous

research suggests that lower level word processes, higher level processes, and working memory each contribute to individual differences in reading comprehension. However, because many of these sources were examined in isolation, we know little about their relative contributions to reading performance. The present study begins to address this shortcoming by developing and testing a reading comprehension model—called the cognitive components-resource model—that proposes a set of relationships among lower level word processing, higher level processes, and working memory. With regards to relations among the three sources, the present study showed that (1) lower level word processing has little to no influence on higher level processes and working memory, whereas (2) working memory influenced higher level processes. The results also showed that although both lower level word processes and higher level processes strongly influenced reading performance, working memory exerted very little influence. Rather, working memory's influence on reading performance was mediated by knowledge integration.

#### • LANGUAGE PRODUCTION/Writing •

(4035)

**Priming Metaphor Online.** KAREN A. HUSSEY, *Mount Allison University*, & ALBERT N. KATZ, *University of Western Ontario* (sponsored by Albert N. Katz)—We investigated the interactive effects of interlocutor gender and metaphor production in conversation. A male and a female confederate, trained to employ only literal or metaphoric language, conversed online with male and female participants. That is, conversation dyads were same gender or opposite gender and always with a confederate who either used metaphorical utterances or only used literal language. In an e-mail experiment, males produced more metaphors, particularly in conversation with other males they did not know. Using online chat methodology in a second experiment, metaphor use by confederates primed both females and males to respond with their own metaphor, but priming was greatest for males. Moreover, the male confederate was judged more negatively when he used literal language only. Gendered interlocutor identity is invoked in conversation, is partly dependent on use of metaphor, and is stronger the more synchronous the communicative exchange.

(4036)

**Impact of a Minimal Feedback in Written Picture Naming.** PATRICK BONIN & ARMELLE NUGIER, *LAPSCO/CNRS and Blaise Pascal University* (sponsored by Patrick Bonin)—The impact of a minimal feedback in writing was investigated in two experiments. During the first part, participants wrote down the names of pictures as quickly as possible. Before the second part, half of them were given either positive (Experiment 1) or negative (Experiment 2) feedback on their naming speed. The feedback was a virtual score indicating to the participants that they were among the fastest or the slowest writers. In both experiments, the control condition was an instruction indicating that the continuation of the experiment was being loaded. All the participants then wrote down the names of different pictures. The frequency of the picture names was manipulated. Both types of feedback increased naming speed, as compared with the control condition, but did not alter the frequency effects. We suggest that lexical access in written production is not altered by feedback, whereas the criterion that initializes writing is.

(4037)

**Silent Articulation Affects Error Patterns in Inner Speech.** GARY M. OPPENHEIM & GARY S. DELL, *University of Illinois, Urbana-Champaign*—The production of inner or mental speech results in "slips" that can be "heard" by the producer. These reported inner slips tend to produce words (lexical bias) but, unlike overt speech errors, show no tendency to involve similarly articulated phonemes (phonemic similarity effect), suggesting that inner speech involves intact lexical and phonemic representations but is not fully specified in terms of subphonemic articulatory and/or perceptual features. In a new study, we replicate the finding that inner speech errors show lexical bias but not the phonemic similarity effect. We also demonstrate that silent articulation (mouthing) during internal production restores the phonemic similarity effect to inner speech errors. These results support a distinction between an abstract sublexical level and a phonetic-articulatory level. And they are consistent with action-based

(embodied) accounts of cognition/imagery, provided that it is recognized that people can flexibly vary the abstractness of their verbal imagery.

(4038)

**Vowel Variability Within and Between Days.** SHANNON M. HEALD & HOWARD C. NUSBAUM, *University of Chicago* (sponsored by Howard C. Nusbaum)—Theories of speech production and speech perception assume that phonetic categories can be characterized by stable properties. For example, the notion of stable vowel targets is used to organize articulation, and such targets could serve as the acoustic basis for recognizing vowel categories. However, there is substantial variation in the acoustic patterns of phonetic categories. The lack of invariance between acoustic properties and the phonetic categories of speech has posed a theoretical problem for understanding human speech perception. Although most theories vary in how acoustic-phonetic variability is approached, theories treat such variability as inherent in speech production or statistically regular or noise. In order to begin to understand acoustic-phonetic variability, we examined the naturally occurring variability in speech production over time. Participants' productions of seven different vowels ([IH], [EE], [EH], [AW], [AH], [AE], [UH]) were recorded in nine sessions: at three specific times in the course of each testing day (9 a.m., 3 p.m., 9 p.m.), every other day, over the course of 5 days. Formant frequencies and variability of formant frequencies were analyzed to assess how vowel categories change over time. We discuss the results showing separate effects of time of day and differences between days on the acoustics of vowel production and consider the theoretical implications of these results.

(4039)

**Short-Term Memory and Syntactic Agreement.** L. ROBERT SLEVC & RANDI C. MARTIN, *Rice University*—Some argue that short-term memory (STM) is involved in only syntactic aspects of agreement (e.g., Hartsuiker & Barkhuysen, 2006), whereas others argue that it is involved in agreement effects for all types of information (e.g., Badecker & Kumiak, 2007). We elicited agreement errors in patients with semantic STM deficits by manipulating syntactic attraction (mismatching syntactic number of subject and intervening nouns) and semantic attraction (plausibility of intervening nouns as subject). Although these patients accurately detect agreement errors in grammaticality judgments even across intervening material (Martin & He, 2004), they showed much larger syntactic attraction effects than did age-matched controls, and the size of these effects was not correlated with degree of agrammatism. Some patients also showed abnormally large semantic attraction effects. These data suggest that producing an agreeing verb requires searching STM for an appropriate controlling noun, which may be confused with other elements in STM that have similar syntactic and semantic properties.

(4040)

**Phonological Advance Planning During Sentence Production.** JÖRG D. JESCHENIAK & FRANK OPPERMAN, *University of Leipzig*, & HERBERT SCHRIEFERS, *Radboud University Nijmegen*—Our study addressed the scope of phonological advance planning during sentence production. Participants first viewed drawings of action scenes (e.g., a mouse eating some cheese) along with descriptive sentences ("The mouse eats the cheese"). During the main experiments, the production of the sentences was cued by presenting the agent (e.g., mouse). To tap the phonological activation of the agent and patient nouns, auditory distractor words were presented that were phonologically related to the agent or to the patient or were unrelated to both. As compared with the control condition, distractors that were related to agent nouns in the utterance-initial phrase facilitated the response, whereas distractors that were related to nouns in a noninitial phrase interfered with the response. Because some automatic phonological activation of visually presented objects cannot be responsible for the patient-noun-related interference effect, our results suggest that phonological advance planning exceeds a single syntactic phrase.

(4041)

**Sequential Retrieval of Lexical Items During Noun Phrase Production.** PAULINE AYORA & FRANÇOIS-XAVIER ALARIO, *University of Provence and CNRS* (sponsored by Patrick Lemaire)—The dynamic processes of multiple lexical retrievals were investigated in a series of

noun phrase production experiments. We tested whether speakers who produce several lexical items retrieve them sequentially or in parallel. Participants named pictures of high- and low-frequency names in a color and/or numerosity context. The color and/or number associated with each picture was predictable or unpredictable. Across experiments, naming latencies reflected the difficulty of retrieving each of the words. They were slower for low- than for high-frequency names and were delayed when the color or number attribute could not be known in advance. Importantly, these effects were additive. This pattern suggests that the different lexical items that constitute a noun phrase are not retrieved in parallel. Rather, they appear to be retrieved sequentially, or by simultaneous processes that depend on shared capacity. This conclusion is consistent with those reached in dual-task studies investigating resource limitations in language production.

(4042)

**Evidence for Postselection Inhibition From the Semantic Blocked Cyclic Naming Task.** JASON E. CROWTHER & RANDI C. MARTIN, *Rice University*, & TAO WEI, *Beijing Normal University*—This study investigated the possible role of postselection inhibition in picture naming. Subjects repeatedly named pictures in blocks of semantically related or unrelated items. Set size was 4 or 12 items, and the response–stimulus interval (RSI) was 1,000 or 1,500 msec. As expected, naming latencies were longer in related than in unrelated blocks and were longer for the 1,000-msec RSI. There was an effect of RSI for the 4-item, but not the 12-item, blocks in the unrelated condition. For the 4-item sets, negative priming was observed for short lag repetitions, but this switched to positive priming at longer lags. Priming effects were more closely related to time between presentations than to lag. The results suggest that postselection inhibition occurs for lexical representations but dissipates over time. A model incorporating spreading activation and postselection inhibition is presented to account for the findings.

(4043)

**Semantic Representations in Healthy Adults and Persons With Schizophrenia.** KYONGJE SUNG, KERRY LEDOUX, ERIN J. PICKETT, SHAINA C. FIELDSTONE, TRACY D. VANNORS DALL, DAVID J. SCHRETLEN, & BARRY GORDON, *Johns Hopkins University*—It is frequently assumed that one source of the disordered speech and thought patterns of individuals with schizophrenia is their underlying semantic representations, but these have been difficult to characterize. We studied 102 treated outpatients with schizophrenia and matched healthy controls, using two semantic fluency tasks (animal, supermarket). Latent semantic analysis (LSA; Landauer & Dumais, *Psychological Review*, 1997) showed that the two groups produced different patterns of clustering of the words in 2-D semantic space. Moreover, the differences in semantic clustering patterns varied depending on category (*animal* or *supermarket*) of the words. This suggests that persons with schizophrenia have less coherent/efficient semantic representations of ordinary objects than do healthy adults and that the differences should be examined by task, not by category fluency as a whole. These results also support the utility of the LSA procedure for extracting more abstract information about the semantic representations responsible for verbal fluency.

(4044)

**Developing Early Semantic Networks and the Associative Structure of Child-Directed Speech.** THOMAS HILLS, *University of Basel*, BRIAN RIORDAN, *Aptima, Inc.*, JOSITA MAOUENE, *Grand Valley State University*, & LINDA B. SMITH, *Indiana University, Bloomington* (sponsored by Linda B. Smith)—The statistical properties of adult-generated free associates can predict the order of early word learning in children. Here, we investigate the hypothesis that this relationship is caused by an associative structure in child-directed speech. We present evidence for this hypothesis by analyzing the co-occurrence of words in the CHILDES corpus of child-directed speech. We find that a word's contextual diversity—its number of unique neighbors—predicts the order of early word learning and is highly correlated with a word's associative diversity in free association norms. Using longitudinal network analysis on developing early semantic networks from 15 to 30 months, we also find evidence for a specific growth process called *preferential acquisition*, in which words



with more diversity in the learning environment are learned earlier than less diverse words. Only adjectives support preferential attachment—a process based on the structure of known words.

(4045)

**Learning Writing Skills Using Feedback From Automated Essay Scoring.** RONALD T. KELLOGG & ALISON P. WHITEFORD, *Saint Louis University*, & THOMAS QUINLAN, *Educational Testing Service*—We examined whether an automated essay feedback system could improve the writing performance of college students. Students in a freshman composition course received no feedback or varying amounts of formative feedback on their first drafts of three practice essays (none, intermittent, or continuous). The students wrote a first and then a revised final draft of an essay in a writing lab held once per week. After a retention interval of 2 weeks, a test essay was written without the use of feedback to assess transfer of learning. Holistic scores showed no reliable gains, but the transfer test showed that students learned to reduce errors of mechanics, usage, grammar, and style. The benefit was found for continuous but not intermittent feedback.

• PSYCHOLINGUISTICS •

(4046)

**Semantic Integration During Metaphor Comprehension in Asperger Syndrome.** RINAT GOLD, ABRAHAM GOLDSTEIN, & MIRIAM FAUST, *Bar Ilan University* (sponsored by Miriam Faust)—The present study aimed to investigate the possibility that difficulties experienced by persons with Asperger syndrome (AS) in the comprehension of metaphors may be explained by deficient neurolinguistic mechanisms, in addition to pragmatic deficits. Specifically, we examined whether a deficient semantic integration process underlies difficulties in metaphor comprehension. Event-related potentials were used to examine brain responses to two-word expressions denoting literal, conventional metaphoric, and novel metaphoric meaning in 16 AS participants and 16 matched controls. The N400 amplitude served as an index for degree of effort invested in the semantic integration process of these expressions. The large N400 amplitudes found in the AS participants for both novel and conventional metaphors demonstrated the greater difficulties in metaphor comprehension in this group, as compared with controls. Findings thus suggest that a neurolinguistic deficiency underlies the difficulties experienced by persons with AS in comprehending both novel and conventional metaphors.

(4047)

**Working Memory Predicts the Magnitude of the Metaphor Interference Effect.** DAN CHIAPPE & RICK MACLAREN, *California State University, Long Beach*, RUSSELL S. PIERCE, *University of California, Riverside*, & WADAD ITANI, HENRY CUEVAS, & HENRI KOROVESH, *California State University, Long Beach*—We examined the role of working memory (WM) and vocabulary knowledge in the automatic activation of metaphorical meanings. To this end, 144 participants completed word span, PPVT, and literal truth/falsehood judgment tasks. The literal truth/falsehood judgment task provides an index of the metaphor interference effect (MIE). The MIE reflects the automatic activation of metaphorical meanings; metaphors, although literally false, take longer to reject than literally false scrambled metaphors. We found a main effect of WM. Higher WM was associated with faster literal truth/falsehood judgments. Furthermore, higher WM was associated with a lower magnitude MIE. Although PPVT predicted overall speed with which participants completed the task, it did not predict the magnitude of the MIE. The results suggest it is WM, and not verbal knowledge, that predicts extent of distraction produced by irrelevant metaphorical meanings.

(4048)

**The Specificity of Implied Movement Interference Effects.** WILLIAM LANGSTON, TYLER HUBBARD, & SAMANTHA EMERSON, *Middle Tennessee State University*—Glenberg and Kaschak (2002) found that responding was facilitated when the required movement to respond to a sentence matched the movement implied by the sentence (e.g., a sentence implying motion away from the body paired with movement away from the body). On the other hand, Kaschak et al. (2005) found that perceiving

motion interfered with judgments of sentences implying the same motion (e.g., perceiving motion toward the participant paired with a sentence implying motion toward the participant). They expected that this interference would be very specific. The purpose of our experiment was to evaluate the specificity of this interference. Participants responded with the name of a letter that either moved to a location or appeared in a location that was consistent or inconsistent with a motion sentence. The hypothesis was that interference would occur only for moving target letters.

(4049)

**Activation of Spatial Axes During the Comprehension of Text Involving Time Shifts.** ANDREA SELL & MICHAEL P. KASCHAK, *Florida State University*—We explored whether time shifts in text comprehension are represented spatially. Participants read sentences involving past or future events and made sensibility judgment responses in one of four ways: (1) moving toward and away from their body, (2) pressing the toward and away buttons without moving, (3) moving to the right and left of their body, and (4) pressing the left and right buttons without moving. Previous work suggested that spatial compatibility effects should be observed, where the future is mapped onto responses away from or to the right of the body, and the past is mapped onto responses toward or to the left of the body. We found these effects, but the toward/away effect emerged only when participants were moving, and the left/right effect emerged only when participants didn't move. The effects were present for larger time shifts (a month), but not for shorter time shifts (a day).

(4050)

**The Mental Timeline During Sentence Processing.** ROLF ULRICH & CLAUDIA MAIENBORN, *University of Tübingen*—According to metaphoric mapping theory, abstract concepts are grounded in concrete, experiential domains. For example, time is thought to be represented in terms of space. This theory receives support from several lines of research, ranging from psychophysics to cross-cultural studies. In particular, response time studies have reported congruency effects between the dimensions of time and space, indicating that words with a temporal connotation evoke spatial representations that facilitate spatially congruent responses and impede spatially incongruent responses. We conducted two experiments that examined this congruency effect when participants processed past- and future-related sentences. Response time was shorter when past-related sentences required a left-hand response and future-related sentences a right-hand response than when this mapping was reversed (Experiment 1). This result is consistent with the idea that time-space associations are mentally represented from left to right. The activation of these space-time associations, however, appears to be nonautomatic (Experiment 2).

(4051)

**Agreeing With Google: We Are Sensitive to the Relative Orthographic Frequency of Phrases.** CYRUS SHAOUL, CHRIS WESTBURY, & R. HARALD BAAYEN, *University of Alberta*—Much has been said about the power of the orthographic frequency of words to predict many psycholinguistic phenomena. The frequency of the written word is integral to most models of lexical representation and lexical processing. Does this sensitivity to orthographic frequency extend beyond single words to multiword phrases? To answer this question, we asked participants to judge the relative frequencies of carefully matched single words as well as two-, three-, four- and five-word phrases. For the majority of items, participants chose the word or phrase with the higher frequency more often than chance would allow (frequencies were taken from a one-trillion-word corpus of Web pages collected by Google). We also found that, for two- and three-word phrases, a model that included the Google frequency of the phrases successfully predicted the subject's responses. These results imply that phrasal frequency is available during language comprehension.

(4052)

**Advantage for Initially Incorrect Guesses in Cross-Situational Word Learning?** STANKA A. FITNEVA, *Queen's University*, & MORTEN H. CHRISTIANSEN, *Cornell University* (sponsored by Morten H. Christiansen)—Word-learning studies often require the learner to discover word-referent pairings within a single trial. In contrast, cross-situational learning involves tracking the co-occurrences of words and

potential referents across multiple situations in order to determine the appropriate mappings. Whereas correct initial guesses are crucial to single-trial learning studies, we explored the hypothesis that initially incorrect guesses may actually facilitate cross-situational learning by allowing for subsequent elimination of false candidate mappings. We examined this hypothesis in an artificial-language-learning study with adult English speakers, employing analyses of eye fixation data to identify participants' likely word-referent mappings during cross-situational learning. Participants who showed lower rates of accuracy of initial mappings, showed higher learning rates and performed better on a recognition test. These findings question the assumption that accurate fast mappings of words to referents are necessary for efficient word learning.

(4053)

**The Differentiation of Vision Verbs: A French Language Replication.** JOËL D. DICKINSON, *Laurentian University*—Dickinson and Szeligo (2008) explored the relationship between participant ratings of visual mental action verbs (e.g., *see*, *distinguish*) and the response times and accuracy that resulted when asked to perform them in a size discrimination task. Although it was found that the way that people differentiate the words did relate to observable behavior, a confound of word length was found to exist in the English language. The present study is a replication using the French language. First, multidimensional scaling of 14 French mental action verbs was performed. Words rated similar in meaning but different in length were sought. French words were differentiated in a fashion similar to that for previous English results. A two-dimensional solution was found and was thought to reflect "level of automaticity" and "level of processing." Four French mental action verbs were selected to be used in the size discrimination task.

(4054)

**Taking It to the Item Level: A Multilevel Mega-Study of Word Naming in Spanish.** FERNANDO CUETOS, *University of Oviedo*, ROBERT DAVIES, *Oxford Brookes University*, & ANALIA BARBÓN & JAVIER RODRÍGUEZ-FERREIRO, *University of Oviedo* (sponsored by M. Teresa Bajo)—A regular orthography like Spanish could be read aloud exclusively using sublexical mappings like grapheme-phoneme correspondences, but the need to read fluently predicts the use of lexical mappings. We investigated the effects of item characteristics—such as lexical frequency or age of acquisition (AoA), word class (verbs, nouns, adjectives), morphological complexity (inflections, derivations, simple), length in letters, and word-initial phoneme—across a large sample of Spanish words, presenting 2,776 words to 54 healthy adults for oral reading. We used multilevel statistical-modeling techniques to estimate effects more accurately. Reading in Spanish is affected by word frequency and AoA, demonstrating the involvement of lexical knowledge, and by length in letters, reflecting the importance of serial letter-by-letter phonological coding. These effects, in turn, are modulated by word type (class, morphological complexity) in a number of interactions. A mix of lexical and sublexical effects implies a cognitive architecture similar to that hypothesized for English.

• SPEECH PERCEPTION •

(4055)

**Lexical Perception and Segmentation of Words Beginning With Reduced Vowels: A Role for Timing Cues.** LOUIS N. VINKE, *Bowling Green State University*, LAURA C. DILLEY, *Michigan State University*, & ELINA BANZINA & MOLLY J. HENRY, *Bowling Green State University* (sponsored by Laura C. Dilley)—How are words beginning with reduced vowels identified and segmented from running speech, particularly when there is no phonetic marker (e.g., a glottal stop) at their onsets? We explored the hypothesis that temporal cues are critical for perception and segmentation of such words. A series of experiments using either a transcription task or an online word-monitoring task explored whether duration and context speech rate affect (1) lexical percepts, (2) word segmentation (i.e., perceived numbers of word boundaries and their implied locations in the speech signal), and (3) online processing, for words starting with reduced vowels. Consistent with the hypothesis, we found that duration and context speech rate affected all three spoken word recognition processes. The results suggest that timing

cues play an important role in recognition of spoken words and indicate that listeners form temporal expectations, on the basis of context speech rate, that affect their online processing of spoken words.

(4056)

**Lexicalizing Nonadjacent Dependencies.** STEVEN A. BERG, *University at Buffalo* (sponsored by Paul A. Luce)—Previous research (e.g., McLennan et al., submitted) has demonstrated that listeners are sensitive to discontinuous dependencies among consonants, vowels, and syllables in nonsense words. We extended this work by attempting to lexicalize nonwords containing discontinuous dependencies through a referent-matching paradigm. Our attempt at lexicalization was to determine the consequences of discontinuous dependencies at the lexical, rather than sublexical, level. We discuss our findings in terms of sublexical and lexical effects of phonotactics in spoken word recognition.

(4057)

**Diphthong Formant Movement As a Cue to the English Voicing Contrast.** ANNE PYCHA & DELPHINE DAHAN, *University of Pennsylvania* (sponsored by Delphine Dahan)—Duration is a correlate of many phonological contrasts. In a much-studied example from English, vowels before voiced consonants (as in "bide") are longer than those preceding voiceless consonants ("bite"). But vowel duration also depends heavily upon unrelated variables, such as speech rate, so the mechanisms by which listeners use it as a cue to consonant voicing are not well understood. We pursue the hypothesis that phonetic correlates that change concurrently with duration play a major role in cuing the voicing contrast. Formant movements in diphthongs like [ai] offer a good test case because they change concurrently with duration but also exhibit distinctive trajectories before voiced versus voiceless consonants. With data from lexical decision and eyetracking, we demonstrate that formant movements cue the voicing contrast independently of duration, thus offering a stable mechanism by which speakers can assess otherwise unstable duration cues.

(4058)

**Effects of Sine Wave Contexts on Compensation for Coarticulation.** NAVIN VISWANATHAN, JAMES S. MAGNUSON, & CAROL A. FOWLER, *University of Connecticut and Haskins Laboratories* (sponsored by Carol A. Fowler)—Both speech and nonspeech contexts affect the categorization of a following speech continuum (Lotto & Kluender, 1998). On one account, speech context effects reflect listeners' sensitivity to coarticulation (Fowler, 2006). Alternatively, both speech and nonspeech context effects have been interpreted to reflect spectral contrast (Lotto & Kluender, 1998). We tested these explanations by using sine wave speech contexts (which can be heard as either speech or nonspeech, depending on listeners' state of attunement) in Experiment 1. Sine wave speech contexts produced robust context effects, comparable to natural speech, irrespective of what they were heard as. In Experiment 2, we destroyed the dynamic information conveyed by this context, by temporally inverting F1 and F2 while retaining F3 (critical contrast bearing formant in this context). In this case, we obtained only weak trends that were significantly smaller than the original sine wave context. We discuss the implications of these findings for both accounts.

(4059)

**Fundamental Frequency As a Cue to Segmentation in Phonemically Identical Spoken Sequences.** ELSA SPINELLI, *University of Grenoble*, & NICOLAS GRIMAULT, FANNY MEUNIER, & PAULINE WELBY, *CNRS*—French listeners listened to phonemically identical sequences such as [sɛlafɪs], *C'est la fiche/l'affiche, It's the sheet/poster*. In Experiment 1, listeners performed a two-alternative forced choice task, and in Experiment 2, they performed a visual lexical decision task. We modified the *f*0 of the first vowel [a] of the natural consonant-initial production (*la fiche* [la#fɪs]), so that it was equal to that of the natural vowel-initial production (*l'affiche* [l#afɪs], equal condition) or was higher (up condition). We also lowered the *f*0 value from the natural consonant-initial production ([la#fɪs], down condition). We found that increasing the *f*0 in the [a] of ([la#fɪs], up condition) increased the percentage of vowel-initial (*affiche*) responses. In Experiment 2, participants made lexical decisions to vowel-initial targets (*affiche*) following

both the equal version of consonant-initial productions ([la#fiS]) and the natural consonant-initial production ([la#fiS]). Facilitation was found only for the equal condition, suggesting that raising  $f_0$  allowed online activation of vowel-initial targets.

(4060)

**Representation of Multiple Variant Forms in Spoken Word Recognition: Friends, Not Enemies.** LARISSA J. RANBOM, ELENI N. PINNOW, & CYNTHIA M. CONNINE, *Binghamton University* (sponsored by Cynthia M. Connine)—Prior research (Ranbom & Connine, 2007) showed that alternative variant forms of a word are represented in the lexicon as a function of variant frequency. Two experiments investigated whether these multiple representations conspire or compete during spoken word recognition of nasal flap variants. In Experiment 1, nasal flap productions of high (i.e., “counter”) and low (i.e., “enter”) variant frequency words, as well as a set of nonword controls (i.e., “penter”), were presented in a phoneme-monitoring task (detection of a [t] sound). The results showed higher “t” detection rates for words than for nonwords, and higher “t” detection for high than for low variant frequency words. Experiment 2 used truncated versions of the stimuli from Experiment 1 and showed comparable “t” detection rates across all conditions. The results suggest that coactivated, multiple representations of phonological variants conspire during spoken word recognition.

(4061)

**Allophonic Variation in Spoken Word Recognition.** MALTE C. VIEBAHN & PAULA A. LUCE, *University at Buffalo*—Models of spoken word recognition assume that in order to understand spoken language, listeners must map the continuous acoustic-phonetic input onto form-based lexical representations stored in long-term memory. This process is complicated by the fact that the phonetic realization of words varies due to allophonic processes such as nasal tapping. During nasal tapping, words such as “center” are pronounced as “cenner.” Recent studies suggest that the recognition of word forms that have undergone nasal tapping is associated with substantial processing costs. The present set of experiments explored potential causes that may contribute to this effect. The results suggest that when allophonic variants are produced and encountered under appropriate conditions, processing costs can be considerably reduced.

(4062)

**Information Structure Affects the Interpretation of Subphonemic Detail in Spoken Word Recognition.** ANNE P. SALVERDA, MEREDITH BROWN, WHITNEY GEGG-HARRISON, CHRISTINE GUNLOGSON, & MICHAEL K. TANENHAUS, *University of Rochester* (sponsored by Mary Hare)—Participants’ eye movements were monitored as they carried out instructions to move objects on a computer screen. The critical instruction contained a target word that had a monosyllabic word embedded at onset (e.g., “Now put the captain below the triangle”). The display included referents of both words (e.g., *captain* and *cap*) and two unrelated words (e.g., *shoe* and *star*). We manipulated the duration of the first syllable of the target word. With increased duration, participants made more fixations to the competitor, suggesting that segment duration cued a prosodic boundary. However, when the competitor was previously mentioned (e.g., “Put the cap below the shoe. Now put the captain below the triangle”), increased duration resulted in fewer competitor fixations. Therefore, a discourse-level factor, information structure, can influence expectations about fine-grained acoustic properties of an upcoming word, thus affecting how listeners interpret acoustic cues during the early moments of word recognition.

• COGNITIVE CONTROL •

(4063)

**Investigating Inhibitory Processes in Task Switching.** RUSSELL E. COSTA & FRANCES J. FRIEDRICH, *University of Utah*—Three experiments were conducted to investigate the role of inhibitory processes in task switching. Two experiments used variations of Mayr and Keele’s (2000) design; we found backward inhibition with univalent as well as bivalent target stimuli. The bivalent study allowed an additional evaluation of whether the recently abandoned task set was actively inhibited or whether it showed

residual activation/task set inertia (e.g., Allport et al., 1994). In the third experiment, we used explicit as well as transition cues (“repeat”/“switch”) with three tasks in order to separate activating a specific new task from disengaging the previous task. This design also allowed us to measure inhibition as it occurred, rather than measuring the cost of overcoming inhibition applied on previous trials. The results from all three experiments suggest that inhibitory processes associated with disengagement from old task sets play a significant role in the task-switching process.

(4064)

**Age Differences in Task Choice in Voluntary Task Switching.** KARIN M. BUTLER & CHRISTINA WEYWADT, *University of New Mexico*—Task choice processes in older (60+ years) and younger (18–30 years) adults were compared using a voluntary task-switching procedure (Arrington & Logan, 2004). Older adults switched less than younger adults, particularly at the longest response to stimulus interval (RSI; 5,000 msec). Switch costs were greater for older than for younger adults at shorter RSIs but were eliminated at the longest RSI. Previous task representations guide task choice more for older than for younger adults. These findings provide support for the hypothesis that older adults have difficulty abandoning previously executed task representations. We found no support for the view that older adults have more difficulty maintaining task-associated contextual representations.

(4065)

**The Inhibition of Prepotent Responses Under 40 h of Constant Wakefulness.** DANIEL BRATZKE, MICHAEL B. STEINBORN, BETTINA ROLKE, & ROLF ULRICH, *University of Tübingen* (sponsored by Rolf Ulrich)—A number of studies have shown that human cognitive functioning is influenced by fluctuations in an individual’s alertness. Usually, it is assumed that a circadian process that regulates the 24-h sleep–wake cycle contributes to these fluctuations. In the present study, we investigated whether the inhibition of prepotent responses is influenced by the circadian process. To this end, we assessed performance in the Stroop and the Simon paradigm in 11 young male participants every 3 h under 40 h of constant wakefulness. Whereas reaction times and error rates showed a clear circadian variation, no such variation was found for Stroop and Simon interference. These results suggest that the ability to inhibit prepotent responses is robust against circadian fluctuations in an individual’s alertness.

(4066)

**When Does Explicit Expectancy Affect Task Processing?** PETER A. FRENSCH, SABINE SCHWAGER, & ROBERT GASCHLER, *Humboldt University Berlin*, & DENNIS RÜNGER, *University of California, Santa Barbara*—Anticipation is a useful means for optimizing processing by preparing for an upcoming task. But is it obligatory that people prepare for what they are expecting? The series of experiments to be reported investigated the conditions that must be fulfilled for an explicit expectancy to cause behavioral effects. The experiments used choice response time tasks, during which participants were prompted to indicate an expectation about a certain feature of the upcoming trial prior to stimulus presentation. We propose that the processing costs resulting from a violation of an explicit expectancy depend on such factors as the subjective validity of the expectancy, the response relevance of the expectancy dimension to the current task, and the general extent of preparation strategically applied in a given task context. To this end, these factors were systematically manipulated. Preliminary data show that the occurrence of the Gambler’s fallacy might indicate subjective validity and, thus, signal the behavioral effectiveness of explicit expectancy.

(4067)

**Changes in a Simple Temporal Reproduction Task in Healthy Aging and Early Stage Alzheimer’s Disease.** ASHLEY S. BANGERT, JEREMY I. MISSUK, & DAVIDA. BALOTA, *Washington University*—Early stages of dementia of the Alzheimer’s type (DAT) are marked by deficits in attentional control. Attentional control is thought to influence people’s timing of supra-second durations (Fortin & Masse, 2000; Lewis & Miall, 2003). In the present study, young adults, healthy older adults, and individuals in the earliest detectable stages of Alzheimer’s disease (CDR .5) performed a simple continuous tapping task with 500-, 1,000-,



and 1,500-msec intervals. Both age and dementia status produced reliable changes in tapping, which were magnified at the more attention-demanding longer tap intervals. Personality factors modulated these changes in individuals with a genetic predisposition for DAT (Apolipoprotein e4 status). Patterns of long-range dependencies in the tapping data were also differentially associated with performance variance at certain intervals. Discussion focuses on changes in the ability to maintain a simple tap interval across time in both healthy aging and early stage DAT.

(4068)

**Can Implicit Knowledge Prime Explicit Knowledge of Key Locations on a Computer Keyboard?** XIANYUN LIU & GORDON D. LOGAN, *Vanderbilt University*—Previous research suggested that using implicit knowledge primed explicit knowledge of key locations on the computer keyboard. Two experiments were conducted by presenting primes that were different from the letters to be judged in order to examine three kinds of priming effect: location priming, angular priming, and direction priming. In Experiment 1, subjects typed single-letter primes that were either near to or far from the letter pairs to be judged before judging relative direction. In Experiment 2, subjects typed two-letter primes that were either near to or far from the letter pairs to be judged. The results showed that typing one letter can produce a location priming effect, and typing two letters can produce location priming, angular priming, and a direction priming effect on explicit direction judgments. A model with two hierarchical parts in the system controlling typewriting was proposed to explain these findings.

(4069)

**Cognitive Strategy and Task Difficulty Are Both Evident in Third-Party Observations of Visual Search.** ALLISON A. BRENNAN, MARCUS R. WATSON, ALAN KINGSTONE, & JAMES T. ENNS, *University of British Columbia* (sponsored by James T. Enns)—We recently reported that real-world visual search participants are influenced by instructions to “allow the target to pop into your mind” (passive strategy) or to “actively direct your attention in searching” (active strategy) (Brennan et al., 2009). The influence of instruction was seen in both search success (active searchers were faster) and in third-party observations (active searchers made more frequent head and eye movements). Here, we ask whether third-party observations are sensitive only to individual differences among search participants or whether they are also sensitive to the environmental factors that make search difficult? Participants rated 5- to 10-sec video clips of previous participants searching for common objects in a cluttered office on several scales (head motion, eye motion, joy in search success). The ratings showed sensitivity to both individual differences resulting from search strategy and task difficulty, demonstrating that third-party observation is sensitive to both sets of factors.

(4070)

**Assessing Cognitive Flexibility in Older Adults Using Multiple Location Inhibition of Return.** JANICE J. SNYDER, *University of British Columbia, Okanagan*, & WALTER F. BISCHOF, *University of Alberta*—Inhibition of return (IOR) purportedly increases search efficiency by biasing attention against previously examined locations. Although IOR is primarily an involuntary process, studies in adults with frontal brain damage (Snyder & Chatterjee, 2006) and children (MacPherson, Klein, & Moore, 2003) demonstrated that IOR is not observed if a central reorienting cue does not follow the peripheral cue. This suggests that attention must be voluntarily disengaged from the cued location for IOR to be manifested. Older adults did not differ from younger adults in terms of the number of locations inhibited or the magnitude of the inhibition when a reorienting cue occurred following five sequential cues. However, older adults often experience declines in cognitive flexibility. We examined IOR in older adults under conditions of uncertainty (one to three cues) in the absence of a central reorienting cue and found no deficits in their cognitive flexibility with respect to multiple location IOR.

(4071)

**Error Repetition and Time-of-Day Effects: Attention, Cognitive Control, and Aging.** ETSUKO T. HARADA, *Hosei University*, AKIHIRO ASANO, *Chuo University*, & SATORU SUTO, *Meiji University*—Error repetitions are frequently observed phenomena in daily life, when

IT-based equipment is used by older adults. Previous research revealed that this phenomenon is also exhibited by both younger and older adults with an experimental task (KANJI selection task), when they should maintain multiple goals—that is, under divided attention or in the task-switching condition. On the basis of these results, error repetitions appear to be related to cognitive control functions, and an experiment was done to see its relationship to time-of-day effects. Sixteen older and 33 younger adults participated in experiments; half of them were in the morning, and the others were in the afternoon. As in previous experiments, both age groups showed error repetitions when the task was switched every three trials, but few repetitions were observed without task switching. Time of day showed a significant effect only with older participants, showing more repetitive errors. The relationship between attention, goal, cognitive control, and error repetitions is discussed.

(4072)

**Eye Movements Clarify the Relation Between Task Perseveration and Inhibition.** DAVID KUHNS & ULRICH MAYR, *University of Oregon* (sponsored by Ulrich Mayr)—Task alternation response time costs arise when people return to a recently abandoned task (ABA vs. CBA task sequences) and are thought to indicate task set inhibition. Inhibition could occur either proactively to prevent perseveration on the postswitch trial (i.e., task B in ABA) or reactively, in response to perseveratory interference on the postswitch trial. As an indicator of perseveration, we analyzed the degree to which the eyes tracked preswitch targets on postswitch trials. Perseveration did occur, but only for the first half of blocks. In analyzing the relationship between perseveration and alternation costs, we found that, for this first half of the experiment and consistent with the reactive model, alternation costs occurred only on trial constellations with perseveration present. In contrast, for the second half of blocks, alternation costs were obtained only when perseveration was absent, suggesting the emergence of proactive inhibitory control as proficiency with the task increased.

(4073)

**Personality Traits Predict Cognitive Control Ability.** RANJANI PRABHAKARAN, DAVID J. M. KRAEMER, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania* (sponsored by Sharon L. Thompson-Schill)—The behavioral inhibition system (BIS) and the behavioral activation system (BAS) have been identified as two dimensions of personality related to motivational control of behavior (Carver & White, 1994; Gray, 1994). Several studies have suggested a relationship between individual differences in BIS and BAS and performance on working memory tasks (e.g., Gray, 2001; Gray & Braver, 2002). In the present study, subjects performed a series of cognitive control tasks, including verbal and nonverbal variants of the Stroop task. Subjects also completed the BIS and BAS scales (Carver & White, 1994). A significant relationship was found between reward responsiveness, a subscale of the BAS, and verbal Stroop conflict effects. In particular, those subjects reporting higher reward responsiveness demonstrated smaller verbal Stroop conflict effects. These results suggest an important role for reward sensitivity in impacting cognitive control abilities.

• AUTOMATIC PROCESSING •

(4074)

**Validating the Vector Model Assumptions: Extension to a Simon Task With Multidimensional Responses.** MOTONORI YAMAGUCHI & ROBERT W. PROCTOR, *Purdue University* (sponsored by Robert W. Proctor)—A vector model is proposed for representing the response selection processes underlying the Simon effect. The model is capable of quantitatively analyzing the contributions of separate stimulus dimensions involved in the task. Two central assumptions of the vector model are that (1) the influences of separate dimensions are independent and additive and (2) the influences of separate dimensions are attentionally controlled, contingent on the task goal and conditions. In the present study, the model was extended to a Simon task with multidimensional responses. In each of three experiments, the compatibility relations of the stimulus location with three spatial features of responses were orthogonally manipulated, with stimulus modality and task requirements varied across the experiments. The results supported additivity of the

three response dimensions and contingency of the influences of the response dimensions on task requirements. The relationships of the model with the existing accounts of the Simon effect are discussed.

(4075)

**Can Nonmonitored Words Be Processed Peripherally?** YAAKOV HOFFMAN & ARI ZIVOTOVSKY, *Bar Ilan University* (sponsored by Joseph Tzelgov)—In the gender congruency task (a Stroop-like task), participants are shown a male or a female stick figure appearing with either a congruent (“male” for a male picture) or an incongruent (“female” for a male picture) word. Participants were required to identify the stick figure by responding with a buttonpress as accurately and quickly as possible. Words appeared either separately (Experiment 1) or superimposed on the figure (Experiment 2). Figures appeared in one of five locations (at the center and six and three visual degrees to the right and left of fixation). Congruent stimuli were responded to faster than incongruent stimuli. Yet this congruency effect was impacted by the position of the stick figure relative to fixation, suggesting that the nonmonitored words are at least in part read and processed peripherally and that the conflict may be identified already at fixation.

(4076)

**When “Nothing” Captures Attention.** MATTHEW A. THOMAS, JAMES H. NEELY, PATRICK A. O’CONNOR, & JOSHUA QUAN, *University at Albany* (sponsored by James H. Neely)—When presented among multiple gapless distractor circles, a single gapped target circle captures visuospatial attention and “pops out” (Treisman & Souther, 1985). We show that a gap within a circle captures attention when the gapped circle is the only object in a nontarget display. Observers identified which of two target letters appeared among seven randomly and diffusely spaced distractor letters. A single gapless or gapped circle onset and offset at a 150-msec stimulus onset asynchrony before each target display, with the gap’s and target’s locations uncorrelated. The ratio of gapped to gapless circles was either 50:50 or 25:75. For both ratios, response times (RTs) to a target very near the gap were faster than RTs to a target at that same location near (1) the gapless circle or (2) a gapped circle when the gap was elsewhere. However, for gapped circles, RTs to targets that were not near the gap increased with distance from the gap only for the 25:75 ratio.

(4077)

**The Preview Effect in the Object-Naming Task: Evidence for Parallel Processing of Multiple Objects.** CHEN CHEN, MANIZEH KHAN, & JESSE SNEDEKER, *Harvard University* (sponsored by Yaoda Xu)—Previous research has shown that in object-naming tasks, participants’ gaze durations are longer when a peripheral object that is about to be fixated is replaced by a new object during the saccade than when such replacement does not take place (Morgan & Meyer, 2005). In the present study, we investigated whether this preview effect is due to the abrupt onset of the object’s attracting attention and, thereby, leading to its processing before the saccade (the onset account) or to the simultaneous processing of multiple objects (the simultaneous processing account). Participants saw numbers that either had abrupt onset (onset condition) or were revealed through figure 8 premasks (offset condition). A preview effect of similar magnitude was found in both conditions. This result supports the simultaneous processing account, suggesting that the preview effect arises due to parallel processing of multiple objects when the task does not consume all the attentional resources.

(4078)

**Can People Perceive Facial Attractiveness Automatically, While Thinking About Something Else?** KYUNGHUN JUNG, ERIC RUTHRUFF, & JOSHUA M. TYBUR, *University of New Mexico*—Are judgments of facial attractiveness automatic? Using locus-of-slack logic in a psychological refractory period (PRP) paradigm, we asked whether people can perceive facial attractiveness even while busy thinking about another task. Task 1 required a speeded judgment regarding the pitch of a tone (low vs. high), and Task 2 required a speeded judgment of whether a face was attractive or unattractive. To vary the difficulty of the attractiveness judgment, we used one sample of faces that were obviously attractive or unattractive and another sample of faces near the borderline. The key result is

that this difficulty manipulation interacted additively with stimulus onset asynchrony (the time between the stimuli for the two tasks). On the basis of locus-of-slack logic, this result suggests that participants did not perceive attractiveness while central attentional resources were still busy with Task 1. In other words, attractiveness judgments are not fully automatic.

(4079)

**Eyeing the Difference: Chinese Performance on Magnitude Comparisons and Simple Arithmetic.** NICOLE D. ROBERT, *Carleton University*, CANDICE M. JENSEN, *University of Waterloo*, & JO-ANNE LEFEVRE, *Carleton University*—Butterworth, Zorzi, Girelli, and Jonckheere (2001) and Verguts and Fias (2005) proposed that only one order of arithmetic facts is stored in memory (e.g.,  $5 + 3$  but not  $3 + 5$ ). These authors assume that the stored order is based on numerical magnitude. Thus, solvers must complete a magnitude comparison of the two digits prior to retrieving the arithmetic fact. This experiment sought to provide evidence for a magnitude comparison stage in arithmetic, using a size congruity manipulation. In number comparison, participants are faster and are more accurate for congruent trials (e.g., small “2,” large “9”) than for incongruent trials (e.g., large “2,” small “9”). Chinese participants, chosen because they store preferred orders of arithmetic facts (LeFevre & Liu, 1997), solved addition, multiplication, and magnitude comparison problems. Performance on these tasks and eyetracking results are discussed.

(4080)

**Direct/Indirect Processing Changes the Influence of Color in Natural Scene Categorization.** SACHIO OTSUKA & JUN KAWAGUCHI, *Nagoya University*—This study examined whether color and grayscale natural scenes presented peripherally and ignored were categorized, using a negative priming (NP) paradigm. We set up low- and high-attention-load conditions, based on the set size of the prime display (one and five). Participants were required to detect and categorize target object in natural scenes (central visual search task), ignoring peripheral natural images at both the prime and probe displays. The results showed that irrespective of attention load, NP was observed for color scenes, but not for grayscale scenes. In addition, we did not observe any effect of color information in central visual search, where participants directly responded to natural scenes. These results indicate that color information is critical to object categorization in natural scenes when participants process indirectly, but when scenes are processed directly, color information does not contribute to categorization.

#### • SELECTIVE ATTENTION •

(4081)

**Visual Search Using Cognitive and Visual Characteristics of Numbers.** PATRICK CONLEY, PADMANABHAN SUDEVAN, PETER E. GONZALEZ, SHANNON M. NARLOCK, & KEITH B. BAEHR, *University of Wisconsin, Stevens Point*—Visual search tasks are usually based on visual characteristics of the targets (color, shape, etc.). Our previous experiment demonstrated that abstract qualities of numbers, such as magnitude or parity, could assist in identifying a target in arrays of varying size. However, a concern remained: Were these abstract judgments actually shape judgments based on how the numerals “looked,” instead of what they represented? We tested this possibility in two ways. First, we combined magnitude and parity judgments with more traditional visual search qualities (color and shape) and found that, when present, subjects largely attended to visual characteristics. Second, we constructed the digit arrays to be similar to readouts of LCD calculators so that shape differences between digits were minimal. This second experiment replicated our earlier findings, suggesting that the abstract qualities of numbers—not their visual characteristics—are assisting in this type of visual search task.

(4082)

**The Effect of Autonomic Nervous System Activation on the Orienting of Attention in Exogenous and Endogenous Cuing Tasks.** JIM E. MCAULIFFE & MICHEL J. JOHNSON, *Nipissing University*, BRUCE WEAVER, *Lakehead University*, MIRANDA DELLER-QUINN, *University of Western Ontario*, GRAHAM SCHOLL, *Nipissing University*, & EVAN WALSH, *University of Ottawa*—The autonomic nervous system (ANS) has been found to affect cognitive processing (e.g., reaction

time and problem solving). One method to evoke a response in the ANS is to stimulate the vestibular system by having people lie prone with their head tilted down in a flexed position (HDNF). In the present experiments, the effect of ANS activation on volitional and reflexive orienting of visual attention was examined. Participants completed an exogenous cuing task (stimulus onset asynchronies [SOAs] = 100 and 800 msec) and an endogenous cuing task (SOA = 500 msec) while in three different positions: seated, lying prone, and HDNF. During HDNF, there was an attenuation of the cuing effect (i.e., less facilitation and inhibition) in the exogenous cuing task. However, there was no effect of HDNF in the endogenous cuing task. The results are discussed in terms of the dissociation between reflexive and volitional orienting of attention and activation of the ANS.

(4083)

**When the World Goes MAD: Visual Search With Complex Displays.** MELINA A. KUNAR & DERRICK G. WATSON, *University of Warwick* (sponsored by Zachary Estes)—Visual search in the real world is complex and can involve large numbers of static and moving elements, some of which may also change in luminance or disappear over time. To date, most visual search tasks have not examined the impact of these simultaneous dynamic effects on search performance. We investigate how participants search a complex environment in the laboratory by designing a multi-element asynchronous dynamic (MAD) visual search task that has (1) a high set size, (2) moving and static stimuli, (3) stimuli that change their luminance over time and (4) target uncertainty (the target was one of five possible letters). Under these complex MAD conditions, search for moving items was less efficient than search for static items; however, there was no effect of luminance change. Error rates were high overall (24% miss errors). Increasing the complexity of the display changes the way people perform a search task.

(4084)

**The Effect of Reward on Attentional Capture.** JUN-ICHIRO KAWAHARA & TAKATSUNE KUMADA, *AIST*—Accuracy for identifying a visual target is impaired by a temporally preceding distractor. This impairment, attentional capture, is known to be dependent on what kind of attentional set (i.e., feature search or singleton detection) observers choose. The present study examined whether reward affects the choice of attentional set by manipulating monetary feedback for every correct response. Observers searched for a red target letter in a rapid stream of gray nontarget letters. The results indicated that the low-reward group used the singleton detection mode, whereas the high-reward group tended to use the feature search mode, suggesting that reward improved tuning for a specific target feature. A similar shift in the choice of attentional set was found in spatial visual search: Spatial attentional capture by the color singleton was eliminated with high reward. These results suggest that reward reduces attentional capture by altering the choice of attentional set.

(4085)

**Specialized-Load Effects in Auditory Selective Attention.** KERSTIN DITTRICH & CHRISTOPH STAHL, *University of Freiburg*—For visual selective attention tasks, it has been found that distraction is increased when the type of concurrent working memory load overlaps with target processing, whereas distraction is decreased in the case of distractor-load overlapping (e.g., Park, Kim, & Chun, 2007). This so-called *specialized-load effect* supports the notion of material-specific attentional resources. The present study examined this effect in the auditory domain. In a series of experiments, the effect was partially replicated using two different auditory Stroop variants: For a nonverbal-auditory Stroop variant (Leboe & Mondor, 2007) and a verbal-auditory Stroop variant (Green & Barber, 1981), interference was increased under concurrent target-overlapping working memory load (as compared with a no-load condition). By contrast, and contrary to the visual domain, both Stroop effects were neither increased nor reduced under distractor-overlapping or task-irrelevant working memory load. These findings are discussed with respect to the notion of material-specific attentional resources and an alternative similarity account.

(4086)

**The Prevalence Effect in Tumor Search: Differences Between Experts and Novices.** RYOICHI NAKASHIMA & KAZUFUMI KOBAYASHI,

*University of Tokyo*, ERIKO MAEDA & TAKEHARU YOSHIKAWA, *University of Tokyo Hospital*, & KAZUHIKO YOKOSAWA, *University of Tokyo* (sponsored by Kazuhiko Yokosawa)—In a typical visual search task, target stimuli occur on half of trials, whereas targets are usually rare and often missed in screening tasks. The latter connotes the prevalence effect (e.g., Wolfe et al., 2007). Search experts (e.g., radiologists) must use appropriate strategies to detect rare targets—that is, to avoid missing them. In this study, visual search for tumors on computed tomography was conducted using experts and novices. The presentation ratios of target tumors in experimental displays were similar to those found in actual tumor searches; lower target prevalence corresponded to more serious target tumors. The results indicated that novices missed rare targets as often as the other targets. However, contrary to the prevalence effect, experts missed few rare targets. This indicates that a strong recognition of the importance and seriousness of tumors can be an effective strategy for avoiding missing rare target tumors.

(4087)

**The Role of Arousal When Noticing Changes in a Natural Scene.** SARAH E. CAVRAK & HEATHER M. KLEIDER, *Georgia State University* (sponsored by Michael J. Beran)—Research surrounding the effects of physiological arousal on attention and memory is ongoing (Mather, 2007). Arousal has been shown to increase both focused attention and object–feature binding. Increased attention focus is directed toward central (vs. peripheral) scene objects and improves the binding between these objects and their features. Focused attention has also been found to decrease susceptibility to change blindness. Many past studies have used words, single objects, or rapidly presented stimuli to test these associations; however, in the present experiment, we tested the influence of arousal when presented with a real-life event. We hypothesized that arousal would increase focused attention as well as object–feature binding, thereby inhibiting change blindness. Surprisingly, we found that aroused participants were more susceptible to change blindness (65%) than were those who were not aroused (39%). Preliminary results suggest that arousal may differentially influence attention and object–feature binding in natural scenes versus single-object presentations.

(4088)

**Working Memory and Contingent Involuntary Orienting.** BRYAN R. BURNHAM, MATTHEW T. SUDA, ANNE MARIE HARRIS, & ANTONY DELLITURRI, *University of Scranton*—The attentional set mediates shifting attention toward visual singletons, thereby moderating attentional capture, and is believed to be maintained by working memory. However, little to no research has been conducted to support this claim. In our research, observers completed a spatial-cuing task in which observers could maintain an attentional set for a target-specific visual feature or displaywide features. Consistent with previous studies, the attentional set moderated attentional capture for relevant versus irrelevant singletons. Observers also completed the operation span (OSPAN) task to measure working memory capacity. OSPAN scores were unrelated or slightly related to attentional capture by relevant singletons; however, OSPAN scores negatively correlated with attentional capture by irrelevant singletons, such that weaker working memory was associated with stronger attentional capture. However, this pattern was observed only when the attentional set could include target-specific features; OSPAN was unrelated to attentional capture when the attentional set could include displaywide features.

(4089)

**Evidence for Episodic Retrieval in Negative Priming Revealed by RT Distributional Analyses.** CHI-SHING TSE, *Chinese University of Hong Kong*, KEITH A. HUTCHISON, *Montana State University*, & YONGNA LI, *University at Albany*—Participants' response time (RT) data in a prime–probe flanker task (e.g., ABA–CAC) were analyzed in terms of the characteristics of RT distribution to examine possible mechanisms that produce negative priming. When the prime and probe were presented in the same context and the proportion of repetition–target trials (TRP) was 0.33, negative priming increased as a function of RT bin, supporting the episodic retrieval account (Neill, 1997). Manipulations that discourage the use of episodic retrieval (i.e., switching context between prime and probe and 0.00 TRP) eliminated the increase in negative



priming across RT bins, even though the overall effect remained significant. These data support a dual-mechanism account in which, depending on task demands, both selective inhibition and episodic retrieval can be involved in producing negative priming.

(4090)

**Visual Marking: Can We Ignore Realistic Emotionally Valenced Faces? Yes, We Can.** ELISABETH BLAGROVE & DERRICK G. WATSON, *University of Warwick* (sponsored by Derrick G. Watson)—Deprioritization of old (previewed) items enables increased search efficiency for new stimuli—the preview benefit (Watson & Humphreys, 1997). Previous work with schematic faces (showing positive or negative affect) demonstrated a robust, but partial, preview benefit, with differential valenced-based processing of faces evident at short preview durations (250–750 msec). The present study examined the preview benefit using photographic face stimuli (Ekman & Friesen, 1976). As with schematic faces, a robust partial preview benefit was obtained for ignoring both positive and negative faces. However, an overall search advantage for negative (sad) target faces was abolished. These results extend our understanding of processing and ignoring valenced face stimuli, using more ecologically valid stimuli, and are interpreted in terms of the adaptive properties and constraints of time-based visual selection.

(4091)

**Losing the Big Picture: How Religion May Control Visual Attention.** LORENZA S. COLZATO, *Leiden University*, WERY P. M. VAN DEN WILDENBERG, *University of Amsterdam*, & BERNHARD HOMMEL, *Leiden University*—Despite the abundance of evidence that human perception is penetrated by beliefs and expectations, scientific research so far has entirely neglected the possible impact of religious background on attention. Here, we show that Dutch Calvinists and atheists, brought up in the same country and culture and controlled for race, intelligence, sex, and age, differ with respect to the way they attend to and process the global and local features of complex visual stimuli: Calvinists attend less to global aspects of perceived events, which seems to fit with the idea that people's attentional processing style reflects possible biases rewarded by their religious belief system.

(4092)

**Cross-Cultural Differences in Directed Attention to Meaning in a Stroop Task Under Simulated Social Presence.** EMRE DEMIRALP, *University of Michigan*, KEIKO ISHII, *University of Hokkaido*, & SHINOBU KITAYAMA & JOHN JONIDES, *University of Michigan* (sponsored by John Jonides)—We report cross-cultural data from a task in which subjects judge the meaning of words in the face of possibly conflicting emotional tone. We tested the effect of the presence of social context (a schematic face that was presented prior to each trial) on performance in this task. The data suggest that Japanese individuals are sensitive to and experience interference due to emotional prosody of a word, regardless of social context. American males display performance similar to that of the Japanese; however, American females are able to completely block the emotional prosody of a word in the absence of simulated social presence. When social presence is induced, however, American female subjects become sensitive to and experience interference due to emotional prosody, just like the Japanese. These effects appear regardless of whether the social context is presented supraliminally or subliminally for the Michigan subjects.

• HUMAN LEARNING AND INSTRUCTION •

(4093)

**Is It Better to Cram or Practice? The Testing Effect As a Function of Item Difficulty.** YOONHEE JANG, JOHN T. WIXTED, & DAVID E. HUBER, *University of California, San Diego*, & DIANE PECHER & RENÉ ZEELENBERG, *Erasmus University Rotterdam*—In the testing effect, retrieval practice enhances performance for delayed testing. However, students often cram until the last minute before a test. We shed light on this paradox, demonstrating that difficult items do not gain from retrieval practice but benefit greatly from last minute study. In contrast, easy items reveal typical testing effects. Item difficulty was

assessed by preliminary cued recall testing after initial study of word pairs. Subsequently, one group performed additional study or testing only for easy items, whereas another group did so only for difficult items. These groups were further divided into one that received a final test immediately, whereas another received a final test at a 1-week delay. Our results suggest that the classic crossover interaction between study/test and delay is due to mixing items of varying difficulty. This leads to the provocative conclusion that last minute cramming is an optimal rehearsal method for difficult tests.

(4094)

**Working Memory Mediates the Effect of Mathematics Anxiety on Counting.** ERINA A. MALONEY, *University of Waterloo*, EVAN F. RISKÓ, *University of British Columbia*, DANIEL ANSARI, *University of Western Ontario*, & JONATHAN A. FUGELSANG, *University of Waterloo* (sponsored by Jonathan A. Fugelsang)—Previous studies have revealed that individuals with mathematics anxiety differ from their nonanxious peers on measures of higher level mathematical processes. The present research examines differences between mathematics-anxious and non-mathematics-anxious individuals in basic numerical processing. High-mathematics-anxious, and low-mathematics-anxious participants performed a visual enumeration task requiring the verbal enumeration of one to nine visually presented objects. Mathematics-anxious individuals, relative to non-mathematics-anxious individuals, showed a deficit in the counting (five to nine items), but not in the subitizing range (one to four items). Furthermore, an independent assessment of working memory was found to mediate the group difference in the counting range. These findings demonstrate that differences between mathematics-anxious and non-mathematics-anxious individuals exist on basic enumeration tasks, thereby indicating that the problems associated with mathematics anxiety exist at a level of numerical processing that is lower than was previously thought.

(4095)

**Cognitive Load Influences Multimedia Presentation Effectiveness.** ERIC DURRANT, CHRIS TEETER, & BRETT BESTON, *McMaster University*, JASON M. TANGEN, *University of Queensland*, & JOSEPH A. KIM, *McMaster University* (sponsored by Lee R. Brooks)—Although multimedia slideshow presentations are ubiquitous in higher education classrooms, instructors often fail to consider the effectiveness of their presentation style. Here, we modified the visual template of a sample introductory psychology lecture to demonstrate that established principles of multimedia design translate into improved student comprehension and confidence in understanding of the presented content. The results are presented with respect to cognitive load theory, which considers information processing in relation to the finite capacity of the working memory system. Effective presentations are considered to minimize unnecessary resource demands to improve learner performance.

(4096)

**Learning a New Arithmetic Algorithm.** PATRICIA BAGGETT, *New Mexico State University*, & ANDRZEJ EHRENFEUCHT, *University of Colorado, Boulder*—Students taking math classes for future teachers at a university in the southwestern United States learned in one semester a novel multiplication algorithm for multidigit numbers. To execute this algorithm, students do not need to know the products of one-digit numbers, such as  $7 \times 8$  equals 56. But the actual written computation is approximately twice as long as that for the standard multiplication algorithm. The new algorithm is flexible. It gives the user options about how to proceed, and therefore it never becomes automatic; that is, it cannot be executed without thinking. The students' progress and the amount they practiced were monitored. We present the novel algorithm, the level of mastery students attained, the types of errors they made, and their evaluation of the difficulty and usefulness of the new algorithm. The results challenge the common belief that a large amount of practice is needed in order to learn arithmetic algorithms.

(4097)

**Interleaving As the Friend of Induction.** MONICA BIRNBAUM, *UCLA*, NATE KORNEILL, *Williams College*, & ROBERT A. BJORK, *UCLA* (sponsored by Robert A. Bjork)—Using a task that required participants to

learn the styles of 12 painters from six paintings by each artist, Kornell and Bjork (2008) found, surprisingly, that interleaving artists' paintings, versus blocking the paintings by artist, optimized induction of the painters' styles. We hypothesized that the advantage would shift to blocking when exemplars of a category offer a range of features that might define the category, because interleaving makes recalling previous instances of a category and, hence, deciphering the category's defining features more difficult. We tested this hypothesis using images of 16 species of butterflies, in which a given species was defined by a broad or narrow range of exemplars. Contrary to our hypothesis, and to the participants' metacognitive judgments, interleaving was more effective than massing for both narrow and broad categories. These results are evidence that for natural categories, interleaving is often, if not always, the friend of induction.

(4098)

**Retest Learning in the Absence of Item-Specific Effects: The Young-Old Versus the Oldest-Old.** LIXIA YANG & MAUREEN REED, *Ryerson University*—To examine whether non-item-specific retest learning (i.e., performance improvement through retest practice in the absence of memorizing specific items) extends to the oldest-old in their 80s, we adopted an eight-session self-guided retest program to measure retest learning effects in two ability domains, processing speed and inductive reasoning, with a sample of 30 young-olds (ages = 70.70, range = 60–79) and 22 oldest-olds (ages = 83.00, range = 80–89). To eliminate item-specific effects, parallel versions of representative psychometric measures were developed and administered across retest sessions. The results show persistent learning effects, although reduced in the oldest-old relative to young-old, in both ability domains. This suggests that non-item-specific retest learning is still available to the oldest-old adults.

• METAMEMORY/METACOGNITION •

(4099)

**Exploring Ease of Processing in Judgments of Learning in Younger and Older Adults.** SARA H. HALCOMB & JESSICA M. LOGAN, *Rice University*—The present experiment explored the differences between younger (18–25) and older (65+) adults on a judgment of learning task using images that had differing levels of ease of processing. In summary, both groups were more likely to remember intact images, with older adults having lower memory performance than did younger adults for scrambled images. Younger and older adults could better predict memory performance when presented with intact images. Both groups were able to predict their memory performance equally as well for these intact images; however, it seems that younger adults were better calibrated for scrambled images. Additionally, older adults underestimated their performance for scrambled images, since they were more likely to respond “will forget” but actually remember these items, when compared with younger adults. The results are discussed in reference to monitoring and encoding strategy differences in younger and older adults and are related to ease-of-processing theories.

(4100)

**Metacognitive Errors of Signed-Language Interpreters: Role of Education and Experience.** KIM A. PURDY, *University of South Carolina Upstate*, & STEPHEN B. FITZMAURICE, *South Carolina State Department of Education* (sponsored by Susan J. Lederman)—Simultaneous interpreting requires that the interpreter concurrently perceive the source message, process meaning, formulate appropriate grammar, and then immediately produce the message in the target language. Effective interpreters must have strong metacognitive skills in order to monitor, evaluate, and revise their work to guard against errors (Macnamara, 2008). The present study investigated 84 signed-language interpreters' ability to predict and reflect upon their performance on the Educational Interpreter Performance Assessment (EIPA) to determine the contributions that education and experience make to these metacognitive skills. Initial analyses indicate that experience affects predictive metacognition. Experienced interpreters were more likely to overestimate their performance prior to taking the EIPA, suggesting that their years of experience created an illusion of competence. Education, however, appears to play a role in reflective metacognition. After completing the assessment,

individuals with less education underestimated their performance. Interpreters with smaller knowledge bases may devote more resources to source message comprehension than to metacognition.

(4101)

**Learning Strategy and Monitoring for Patients With Schizophrenia.** MARIE IZAUTE, *LAPSCO UMR 6024, CNRS*, ELISABETH BACON, *INSERM U666*, & FLAVIEN THUAIRE, *LAPSCO UMR 6024, CNRS*—Metamemory functions are impaired in schizophrenia at the times of both memory acquisition and retrieval (Danion et al., 2001; Bacon et al., 2007). The difficulty of to-be-learned material was varied (associated vs. nonassociated word pairs). Twenty-one patients and 21 comparison subjects participated in the study. Both memory control (study time allocation) and memory monitoring (judgments of learning [JOLs]) were assessed. Patients, like normal participants, spent more time learning the difficult than the easy pairs. However, the patients' JOLs did not differ from those for the controls for the easy items, but they were lower for the difficult items. Moreover, the patients' gamma coefficients of their JOLs were accurate and not different from those for the controls. This reveals that schizophrenia patients may display intact ability to take into account the intrinsic characteristics of to-be-learned material and may have a relatively preserved awareness of their own efficiency in a learning task.

(4102)

**Source Memory for Multiple Web Texts About Scientific Topics.** RYUTA ISEKI & TAKASHI KUSUMI, *Kyoto University*—Source memory for information is important for evaluating the trustworthiness of information in Web communication. We asked undergraduates to read six texts about one topic (genetically modified foods or outer space development), including source information. Texts were from Web sites that varied in speciality (expert or layperson) and attitude to the topic (positive, neutral, or negative). After reading the texts, undergraduates were presented various sentences from the texts and had to choose the correct source from a list. Accuracy of source attribution was very poor, but the errors showed some consistent patterns: More sentences were attributed to expert texts than to layperson texts, and this pattern was clearer for genetically modified food texts than for outer space development texts. Genetically modified foods were rated more important and verified more accurately than outer space development. Thus, the results suggest that source memory for Web texts is affected by importance and difficulty of the topic.

(4103)

**Applying Type 2 Signal Detection Theory to Decision Making and Gambling.** SARA E. LUEDDEKE & PHILIP A. HIGHAM, *University of Southampton* (sponsored by Philip A. Higham)—Two experiments compared sensitivity to bias manipulations between regular (social) gamblers and nongamblers in a probability-based gambling task. Type 2 signal detection theory was applied to the data to separate three main performance parameters: accuracy, metacognitive monitoring, and bias. The results indicated that both regular gamblers and nongamblers responded to the difficulty of the task and penalties for errors in setting their gambling criteria, but that regular gamblers were more sensitive to these manipulations of bias. Regular gamblers also set gambling criteria that were more optimal. The results are discussed in terms of tolerance-based versus expertise-based accounts of the effects of gambling experience on betting control.

(4104)

**What You Know Can Hurt You: Effects of Age and Prior Knowledge on JOL Accuracy.** KAREN A. DANIELS, JEFFREY P. TOTH, & LISA A. SOLINGER, *University of North Carolina, Wilmington* (sponsored by Jeffrey P. Toth)—How do aging and prior knowledge affect memory and metamemory? We explored this question in the context of a dual-process approach to judgments of learning (JOLs; Daniels, Toth, & Hertzog, in press). Young and older adults studied the names of actors that were famous in the 1950s or 1990s, providing a JOL for each. Memory for studied and unstudied names was then assessed with a remember/know recognition task. The results showed that prior knowledge increased recollection in both age groups, such that older adults significantly outperformed the young for 1950s actors. In contrast, whereas the young showed benefits of prior knowledge on JOL accuracy, older adults did

not. Overall, the data suggest that prior knowledge can be a double-edged sword, increasing the availability of details that can be used for later recollection, but also increasing general feelings of familiarity that can indiscriminately elevate predictions about future memory performance.

(4105)

**Interpreting Encoding Fluency: How Naive Theories of Intelligence Influence JOLs.** DAVID B. MIELE, *Columbia University*, BRIDGID FINN, *Washington University*, DANIEL C. MOLDEN, *Northwestern University*, & JANET METCALFE, *Columbia University* (sponsored by Janet Metcalfe)—Experiences of increased ease during the encoding of new information generally lead to higher judgments of learning (JOLs; Koriat & Ma'ayan, 2005). However, the inferences people draw from their experiences of encoding fluency should also depend on their naive theories about why information is easy/difficult to process (Schwarz, 2004). Entity theorists believe that intelligence is fixed and low effort signals high ability, whereas incremental theorists believe that intelligence is malleable and low effort signals insufficient learning, especially when task difficulty is high (Dweck, 1999). Across two studies, when study time was self-paced, entity theorists inferred greater learning from internal cues of low effort than did incremental theorists, as demonstrated by higher JOLs for easy-to-process items, but not for difficult-to-process items; however, when study time was experimenter controlled (and very short), entity theorists inferred greater learning from external cues of task difficulty, as demonstrated by higher JOLs for difficult-to-process items, but not for easy-to-process items.

(4106)

**Learning to Diminish Proactive Interference: Educating Metamemory.** CHRISTOPHER N. WAHLHEIM & LARRY L. JACOBY, *Washington University* (sponsored by Larry L. Jacoby)—Two rounds of experience with proactive interference (PI) in a paired-associate learning task diminished PI effects on accuracy. Metamemory measures provided insight into the bases of this increased resistance to PI. Changes in the allocation of study time revealed qualitative and quantitative shifts in encoding processes. Changes in retrieval processes were revealed by confidence judgments made at the time of test. Monitoring resolution for interference items improved, whereas control items showed decreased resolution across rounds, suggesting a shift away from familiarity toward the ability to recollect as a basis for confidence. The results from a retrieve-and-report procedure provided further evidence of a shift toward reliance on recollection as a basis for responding. Experience with PI resulted in retrieval processes being further constrained so as to reduce the probability of a competing response's coming to mind for interference items.

#### • WORKING MEMORY •

(4107)

**Performance Gains in an Adaptive *n*-back Working Memory Training Task.** J. ISIAH HARBISON, SHARONA M. ATKINS, JARED M. NOVICK, SCOTT WEEMS, ERIKA K. HUSSEY, & SUSAN TEUBNER-RHODES, *University of Maryland, College Park*—Performing adaptive and challenging working memory (WM) training tasks can improve performance not only on WM tasks not included in the training, but also for WM-dependent cognitive processes. The *n*-back task is a commonly used WM training task. We present new data from a performance-adaptive version of the *n*-back task that served as part of battery of WM training tasks. Task difficulty was modified by changing *n* and, therefore, the number of items participants had to monitor at any given time. Difficulty was also modulated by adding or subtracting lures—that is, repetitions immediately preceding (*n* + 1) or following (*n* – 1) the target. Over time, participants showed substantial progress in the task. With practice, they were able to perform the task at high levels of *n* and in the presence of lures. Also consistent with previous research, the lures significantly impacted performance. The specific nature of this performance change is explored.

(4108)

**The Relationship Between Working Memory Capacity and Sensorimotor Skill Learning.** NEIL B. ALBERT, *University of Chicago*, MARCI S. DECARO, *University of Miami*, & SIAN L. BEILOCK, *University*

*of Chicago*—Working memory (WM) capacity supports the learning of complex cognitive tasks that require the integration of information over time (e.g., categorizing of complex stimuli). Sensorimotor skill learning often demands integrating information that emerges over time as well. Accordingly, individual differences in WM may support sensorimotor skill formation. Here, 20 right-handed individuals completed the serial reaction time task (SRTT) in two contexts; both involved the presentation of a recurring 12-item sequence that was preceded and followed by randomly ordered items. In one context the onset and offset of the sequence was cued, and in the other it was not. WM capacity was tested using the operation span task. Sensorimotor skill learning was evident (cued, 87-msec speedup over time; uncued, 32 msec; each  $p < .01$ ). Moreover, the extent of sensorimotor skill learning was significantly correlated with individual differences in WM (cued,  $r^2 = .35$ ; uncued,  $r^2 = .33$ ). Individual differences in WM capacity drive sensorimotor skill learning.

(4109)

#### **Does Unconscious Interference Activate Prefrontal Control Areas?**

JULIE A. HIGGINS & MARCIA K. JOHNSON, *Yale University*—Selectively thinking of (refreshing) a just-seen word is slower when the seen word is flanked by briefly flashed, immediately masked words if these words are semantically related than if they are semantically unrelated to the seen word (Higgins, Tai, & Johnson, 2008, *Abstracts of the Psychonomic Society*). In a follow-up study, we examined the effects of unconscious semantic competition on refreshing versus reading a word, using fMRI. Participants read a word that was flanked by briefly flashed, immediately masked words. Participants then refreshed the just-seen word or read a new word. Activity in the left lateral prefrontal cortex (PFC) was influenced by whether the masked words were related or unrelated to the target word. Specifically, there was greater PFC activation on related than on unrelated trials when refreshing but not reading the target word. This suggests that prefrontal control areas are recruited during acts of selective reflective attention even when competition is unconscious.

(4110)

#### **Measures of Working Memory, Hemispheric Interaction, and Cognitive Style: A Latent Variable Analysis.**

ROBIN D. THOMAS, KASEY COLLINS, JESSICA PARKER, & KRISTA D. CARLSON, *Miami University*—We collected data from (1) three working memory measures of Engle and others, (2) clinical assessments of frontal functioning combined into a composite used by Glisky and others in cognitive aging research, (3) spatial forward and backward span, (4) an assessment of the cognitive style, and (5) the Edinburgh inventory of handedness. Two of the Engle working memory measures (Rspan and Ospan) and the Glisky battery are verbal, whereas the third (symmetry span) and the spatial span tasks are visual. Handedness is an indicator of the hemispheric interaction construct, as suggested by Christman recently in memory research and corroborated by Roediger and his colleagues. We suggest that cognitive style may load on hemispheric interaction as well. We perform confirmatory factor analysis to test these relationships with verbal working memory, visual working memory, and hemispheric interaction as latent constructs. The model fits well with factor loadings that confirm the hypothesized construct relations.

(4111)

#### **Individual Differences in Working Memory Capacity Correlate With Task-Switching Strategies.**

ROY LURIA & EDWARD VOGEL, *University of Oregon* (sponsored by Douglas Hintzman)—In four experiments, participants switched between parity and magnitude judgments, and their task-switching ability was evaluated by calculating the reduction in switching cost due to active preparation. In Experiment 1, switching probability was 50%, and the results indicated that individuals with high working memory capacity (WMC) were worse than low-WMC individuals in reducing switching cost, leading to a negative correlation between WMC and task switching. In Experiment 2, switching probability was 25%, and WMC correlated positively with task switching. In Experiment 3, switching probability was 75%, yielding a negative correlation between task switching and WMC. Experiment 4, replicated the design of the second experiment and showed that the correlation between WMC and task switching was evident when each task had eight



stimulus-to-response rules but was absent when the tasks employed only four stimulus-to-response-rules. The results support the idea that high-WMC individuals chose different and more adaptive strategies, relative to low-WMC individuals.

(4112)

**Resolution of Representations in Spatial Short-Term Memory.** AYŞECAN BODUROĞLU, *Boğaziçi University*, PRITI SHAH & RICHARD GONZALEZ, *University of Michigan*, & TAHA BILGE & M. ÇELİK ÖZDEŞ, *Boğaziçi University*—Even though recent research has focused on the nature of representations in visual short-term memory, the nature of spatial representations has not been thoroughly investigated. This study specifically addressed whether resolution of spatial representations changes with increases in study load. We presented viewers with one, three, or six colored squares, representing different spatial targets. Then a central color cue appeared, indicating which spatial target was to be recalled. The Euclidean error recalling each cued location increased with list length. When trials were categorized as “correct” and “incorrect” on the basis of whether the recalled target was closest to the cued or another studied location, we found that the Euclidean errors for the correct trials were equal for list lengths of three and six, suggestive of fixed resolution representations in spatial short-term memory, as in visual short-term memory (Zhang & Luck, 2008). These findings are presented along with modeling findings utilizing maximum likelihood estimation.

(4113)

**The Influence of Location and Visual Features on Visual Object Memory.** HSIN-MEI SUN & ROBERT D. GORDON, *North Dakota State University*—In a previous study, Sun and Gordon (in press) demonstrated that changes to either contextual objects’ locations or identities affect visual memory for a target object. In the present study, we further investigated how changes to contextual objects’ locations and visual features affects visual object memory, as assessed using an orientation change detection task. The influence of contextual objects’ color and orientation was examined in Experiment 1 and Experiment 2, respectively. Moreover, in both experiments, the influence of contextual objects’ location was examined by either retaining or changing their original positions in the test image. Both experiments showed that change detection performance was better when contextual objects stayed in the same locations. In addition, change detection performance was improved when contextual objects’ orientation remained the same from study to test. In contrast, maintaining contextual objects’ color from study to test did not improve performance. Theoretical implications are discussed.

(4114)

**Impact of Item Familiarity on Short-Term Consolidation in Visual Working Memory.** LISA D. BLALOCK & BENJAMIN A. CLEGG, *Colorado State University*—The process of turning a transient perceptual visual representation into a durable, stable visual working memory (VWM) representation has been termed *short-term consolidation* (Joliceur & Dell’Acqua, 1998; Vogel, Woodman, & Luck, 2006). Prior research has shown that VWM performance drops when a visual mask is presented shortly following the initial study array, especially at larger set sizes, disrupting consolidation (e.g., Vogel et al., 2006). The present experiment compared short-term consolidation in VWM between familiar (colored squares) and unfamiliar (complex polygons) stimuli in order to examine the influence of long-term representations on short-term VWM consolidation. Participants studied arrays of one to four colored squares or polygons, with the presentation of a mask at each studied location at varying delays following the study array. The results show evidence for consolidation for both familiar and unfamiliar stimuli but indicate that consolidation differs depending on the familiarity of the stimuli.

(4115)

**Posterior Parietal Cortex Mediates Encoding Processes in Change Blindness.** PHILIP TSENG, CASSIDY STERLING, ADAM COOPER, & BRUCE BRIDGEMAN, *University of California, Santa Cruz*, NEIL G. MUGGLETON, *University College London*, & CHI-HUNG JUAN, *National Central University, Taiwan* (sponsored by Bruce Bridgeman)—Neurological studies using fMRI have found a correlation between right

posterior parietal cortex (rPPC) activity and successful change detection. Furthermore, disruption of rPPC activity, using transcranial magnetic stimulation (TMS), increases the occurrences of change blindness, thus suggesting a causal role for the rPPC in change detection (Beck et al., 2006, *Cerebral Cortex*). Here, we applied repetitive TMS pulses during different time intervals to elucidate the precise involvement of the rPPC. While subjects attempted to detect changes in a one-shot detection paradigm, TMS was applied during the presentation of either Picture 1, when subjects were encoding information into and maintaining it in visual short-term memory, or Picture 2, when subjects were retrieving information from Picture 1 and comparing it with Picture 2. Our results show that change blindness occurred more often when TMS was applied during the viewing of Picture 1, which implies that the rPPC plays a crucial role in the processes of encoding information into visual short-term memory.

#### • EXPLICIT MEMORY •

(4116)

**Top-Down Constraint in Recognition Memory.** JUSTIN KANTNER & D. STEPHEN LINDSAY, *University of Victoria*—Although top-down influences on recognition judgments have not traditionally been emphasized in theories of recognition memory, Jacoby and his colleagues have argued that such judgments may be supported in part by a process of “constrained retrieval” whereby individuals selectively search memory for items from a particular contextual source. We have developed a task designed to detect effects of constrained retrieval and have found little evidence of such constraint when source memory alone differentiates items to be included in the search from those to be excluded. By contrast, when the perceptible cue of word length is available to guide the search, participants show substantial evidence of constrained retrieval. In new experiments, we demonstrate that not all perceptible cues support constrained retrieval. We assume that perceptible cues should promote constrained retrieval only when they can be used to preempt thorough processing of nontargets.

(4117)

**Mnemonic Costs and Benefits of Orienting to Goal-Relevant Information.** STEVEN B. MOST & HYUN-YOUNG PARK, *University of Delaware*—We examined how goal-related prioritization of information affects memory for other information within the same context. Participants listened to a passage about a fictional man whom they would then choose to bet on or against in a tennis tournament. All participants heard the same passage, except for one critical word: Halfway through, one group of participants heard that the man excelled at “tennis”; a second group heard that he excelled at “singing.” Thus, only the former group ever heard information relevant to their bet. A subsequent surprise memory test revealed that participants who heard the goal-relevant, relative to the goal-irrelevant, critical word had significantly poorer memory for words appearing after it; in contrast, these participants had significantly better memory for words that had appeared before it. We discuss these findings in light of research highlighting the multifaceted effects of attention on perception and address the implications for message design.

(4118)

**The Perceptual Switch: Toward an Objective Measure of Unitization in Associative Recognition.** IAIN M. HARLOW, *University of Edinburgh*, & DAVID I. DONALDSON, *University of Stirling*—Recent accounts of associative recognition argue that familiarity supports performance when stimulus pairs are “unitized” (treated as a single item). Judging when stimuli are unitized can, however, be highly subjective. Here, we suggest the “perceptual switch” as an experimental procedure for assessing unitization. We tested memory for three types of stimulus pairs (presented one above the other in central vision), using names and images. Overall performance was best for between-domain (name–image), as compared with within-domain (name–name; image–image), pairs, an effect reflecting increases in familiarity (based on receiver-operating characteristic curves and remember/know judgments). To test whether unitization might explain the results, we reran the experiment, switching the spatial positions of items in half the pairs at test. For perceptual switch trials, performance and familiarity were more robustly reduced for between-domain than for within-domain pairs. The results

provide further evidence that familiarity can support associative recognition but also provide a meaningful, objective measure of unitization.

(4119)

**Dual-Process Accounts of an Effect of Semantic Priming in Episodic Recognition.** STEPHEN C. DOPKINS & HYOUN K. PYOUN, *George Washington University*—In a verbal episodic recognition task, correct negative responses are impeded if the recognition judgment to the test word is preceded by a recognition judgment to a semantically related word. We tested four dual-process models of recognition against this pattern. The conjoint recognition model was most capable of accounting for the pattern. The source of activation confusion, dual-process signal detection, and complementary learning systems models fared less well.

(4120)

**Testing a Single-System Model of Recognition, Priming, and Fluency.** DAVID R. SHANKS & CHRISTOPHER J. BERRY, *University College London*, & RICHARD N. HENSON, *MRC Cognition and Brain Sciences Unit*—We present tests of a single-system signal detection model of recognition, priming, and fluency (Berry et al., 2008) in a continuous identification with recognition paradigm. This paradigm allows a recognition judgment and an identification reaction time (RT, the basis of priming and fluency measures) to be obtained for each item in a memory test. The model predicts that recognition judgments will be related to identification RTs. This prediction was confirmed in two experiments. In Experiment 1, identification RTs decreased as recognition confidence (1–6 ratings) increased. In Experiment 2, recognition was measured with remember-know judgments. Identification RTs for remember judgments were shorter than those for know judgments. The results support the notion that the same strength variable drives recognition, priming, and fluency and are also consistent with the notion that remember and know judgments index memories of high/low strength. Other versions of the model (e.g., a multiple-systems version) are also considered.

(4121)

**Relational and Item-Specific Influences on Generate-Recognize Processes in Recall.** MELISSA J. GUYNN, *New Mexico State University*, & MARK A. MCDANIEL, *Washington University*—The generate-recognize model and the relational/item-specific distinction are two approaches to explaining recall, and we consider the two approaches in concert. Following Jacoby and Hollingshead (1990), we implemented a production task and a recognition task following production in order (1) to evaluate whether generation and recognition components were operative in cued recall and (2) to gauge the effects of relational and item-specific processing on these components. An encoding task designed to augment item-specific processing (anagram-transposition generation) produced a benefit on the recognition component but no significant benefit on the generation component, in the context of a significant benefit to cued recall. By contrast, an encoding task designed to augment relational processing (category sorting) did produce a benefit on the generation component. These results converge on the idea that in recall, item-specific processing impacts a recognition component, whereas relational processing impacts a generation component.

(4122)

**Beneficial to All: Feedback-Induced Improvements in Source Monitoring Require Few Executive Resources.** STEPHANIE GROFT, SEAN M. LANE, & TANYA KARAM, *Louisiana State University*—Receiving feedback about the accuracy of test decisions during a training period dramatically reduces source-monitoring errors on subsequent items (Lane et al., 2007). Little is known about how subjects change their source decisions as a result of receiving feedback. One possibility is that feedback changes decisions through a resource-intensive process that involves identifying and maintaining corrections to decision criteria after making an error. Another possibility is that subjects learn to change their criteria in a less resource-intensive implicit process. To address this question, we had high and low working memory capacity (WMC) subjects view an eyewitness event and complete a postevent questionnaire that included misinformation. Half of each group received feedback on the training source memory test. Performance on the subsequent no-feedback

target test revealed that high- and low-WMC subjects benefited equally from feedback. These findings suggest that feedback may improve source memory accuracy without requiring substantial executive resources.

(4123)

**Cross-Language Effects on Bilingual Reading: Evidence From Eye Movements.** MAYA LIBBEN, JULIE MERCIER, VERONICA WHITFORD, & DEBRA A. TITONE, *McGill University* (sponsored by Debra A. Titone)—We recently demonstrated that cross-language activation during bilingual L2 reading is sensitive to semantic constraint (Libben & Titone, 2009). Specifically, cognate facilitation and interlingual homograph interference occurred for both early (FFD, GD, skipping) and late (go-past, total reading time) measures in low-constraint sentences, but only for early measures in constraining sentences. We report two new experiments examining bilingual L1 (English) reading. Experiment 1 showed no cognate facilitation or interlingual homograph interference at any reading stage. Experiment 2, which included filler sentences to boost L2 (French) activation, also showed no effects for early measures. For late measures, cognate facilitation and interlingual homograph interference occurred for low-constraint sentences, whereas both cognate and interlingual homograph interference occurred for constraining sentences. Post hoc analyses revealed that cross-language phonological overlap modulated interference. These results cohere with bilingual processing models (BIA+) and distributed models of word representation, and emphasize the importance of phonology in bilingual reading.

(4124)

**Contributions of Recollection and Familiarity to Errorless and Trial-and-Error Learning.** ANDRÉE-ANN CYR & NICOLE D. ANDERSON, *University of Toronto and KILARU Baycrest* (sponsored by Nicole D. Anderson)—Errorless learning (EL) has been shown to enhance memory, relative to trial-and-error learning (TEL). This study examined the contributions of recollection and familiarity to these learning conditions. Young and older adults were shown semantic cues and generated a target associate either without error or with errors. For both groups, TEL was associated with lower familiarity-based memory, relative to EL. In addition, TEL was associated with higher recollection-based memory, relative to EL, an effect that was more marked for older than younger adults. We argue that TEL can confer memorial benefits when recollection-based processes are required for task performance.

(4125)

**The Persistence of Recency: Extending Context-Based Models of Free Recall.** SEAN M. POLYN, *Vanderbilt University*, & MICHAEL J. KAHANA, *University of Pennsylvania* (sponsored by Michael J. Kahana)—The context-maintenance-and-retrieval (CMR) model of memory search is a generalized version of the temporal context model of Howard and Kahana (2002), which proposes that memory search is driven by an internally maintained context representation composed of stimulus-related and source-related features. CMR suggests that organizational effects (the tendency for related items to cluster during the recall sequence) arise as a consequence of associations between active context elements and features of the studied material. The CMR model has been successful in accounting for organizational phenomena, as well as serial position effects and interresponse latencies, in both classic and new data sets (Polyn et al., 2009). In the present work we extend the CMR model to account for the puzzling finding of persistent recency following a lengthy period of distracting mental activity (Watkins & Peynircioglu, 1983).

(4126)

**False Memory Produced by Self-Generation: Investigating the Relation Between Recall and Recognition.** ANDREW M. MCCULLOUGH & JEFFREY P. TOTH, *University of North Carolina, Wilmington*—An important issue in memory research is understanding the relation between recall and recognition. Although both can be characterized as explicit expressions of memory, recall and recognition appear to engage distinct retrieval processes, show a wide range of correlation, and can be dissociated as a function of experimental variables. The present research used a novel paradigm to compare the two forms of memory; following a study list, participants took a memory test containing both

recognition and cued-recall trials, making either subjective (recollect/familiar) judgments about their test responses or confidence judgments based on Type 1 or Type 2 signal detection theory (thus producing measures of memory and metamemory, respectively). The results showed that, relative to recognition, self-generation of memory candidates in cued recall consistently increased false memory. Additional analyses focused on assumptions underlying signal detection parameters, as well as relations between Type 1 and Type 2 results.

(4127)

**Dissociating Between the Processes Mediating Recall and Recognition Using Neuronal Signatures of Item and Context Information.** TALYA SADEH, *Tel Aviv University*, ANAT MARIL, *Hebrew University of Jerusalem*, & YONATAN GOSHEN-GOTTSTEIN, *Tel Aviv University*—In recall, successful performance requires retrieving items presented in a given context, with interference arising from other items (i.e., an “item-noise process”). Traditionally, also recognition was conceptualized as an item-noise process. Recent evidence suggests, however, that recognition follows a context-noise process, which requires distinguishing between the context in which the item was presented and other contexts in which that item had appeared (a “context-noise process”; e.g., Dennis & Humphreys, 2001). To the extent that recognition is indeed a “context-noise process,” one might expect that, at encoding, enhanced neural activity in areas associated with contextual information could be used to predict performance in a subsequent recognition test. Likewise, because recall is an “item-noise process,” enhanced activity, at encoding, in areas associated with item information could be used to predict performance in a subsequent recall test. An fMRI study confirmed these hypotheses, providing a dissociation between the processes mediating recall and recognition.

(4128)

**The Picture Superiority Effect Is Diminished in Single-Character Chinese Words.** MAN-YING WANG, *Soochow University* (sponsored by Yei-Yu Yeh)—The distinctiveness account of the picture superiority effect (PSE) explains PSE by assuming that pictures are more distinctive than words perceptually and/or conceptually (Geraci & Rajaram, 2006; Nelson, 1979; Weldon & Coyote, 1996). Unlike alphabetic scripts, Chinese characters may be as distinctive as pictures, since each character can be encoded at either the radical or the whole-character level. The restriction of this “dual” coding to one-character words predicts a difference in PSE between one- and two-character words. This prediction was verified in recognition performance in Experiment 1. PSE remained reliable in two-character words with either naming or category judgment as the orienting tasks in Experiment 2. The effect was exhibited in remember responses, but not in know responses. One-character words were used in Experiment 3, and the PSE was no longer reliable with one exception—the remember responses with naming orienting task. The results support the distinctiveness account for the PSE.

(4129)

**The Inverse List Length Effect in Recognition Memory.** SIMON J. DENNIS & ALLISON CHAPMAN, *Ohio State University*—Item noise models attribute interference that occurs in recognition memory to the other items that appeared on the study list. Context noise models attribute interference to the other contexts in which an item appears. With appropriate controls, word stimuli show no list length effect (Dennis & Humphreys, 2001; Dennis, Lee, & Kinell, 2008) favoring the context noise approach. In a series of two studies, we found that the list length effect can be inverted, so performance on long lists is better than that on short lists, when list length is manipulated by changing the number of exemplars from a fixed number of taxonomic categories. We show that such a result cannot be accommodated by the featural overlap account of category effects typically employed by item noise models but can be captured naturally by a context noise approach.

(4130)

**Memory for Object Details in Self- and Other-Referencing.** SARAH J. SERBUN & ANGELA H. GUTCHES, *Brandeis University*—Self-referencing benefits item memory, but few studies have investigated the level of detail accurately encoded in these memories. The present study

tested the hypothesis that self-referencing would enhance not only general memory for objects, but also memory for specific details of objects encoded with the self. Thirty-two participants encoded objects in reference to either the self, a close other, or an unfamiliar other. Following a 2-day retention interval, participants indicated whether objects were the same as a previously encoded object, similar to an encoded object (same verbal label but with slightly different details), or new. Main effects of encoding condition emerged for both specific and general memory. Specific memory for self-referenced objects was significantly greater than memory for unfamiliar other encoded objects; however, no significant differences emerged for the self and familiar other conditions. We conclude that self-referencing is a beneficial strategy for enhancing memory for specific details of objects.

(4131)

**The Role of Knowledge Accessibility in Episodic Future Thought.** KARL K. SZPUNAR, *University of Toronto*—The capacity to think about specific events that one might encounter in the future—episodic future thought—involves the flexible (re)organization of knowledge. However, little is known about the cognitive mechanisms that guide this process. The reported experiments demonstrate evidence for the role of knowledge accessibility as one such mechanism. Specifically, three experiments ( $N = 270$ ) provided direct tests of whether accessible knowledge becomes incorporated into episodic future thought. In Experiments 1 and 2, priming knowledge relevant to an upcoming episode generation task shaped the content of thoughts about the future. Experiment 3 revealed that, as with other open-ended production tasks, primed knowledge must be processed in a meaningful manner in order for it to exert an influence on the content of episodic future thought. These results further understanding of episodic future thought and suggest important avenues for future research.

(4132)

**Global Processing in a Lineup Task.** JOSHUA A. ARDUENGO, PAMELA ROYAL, AMY BOGGAN, & JAMES C. BARTLETT, *University of Texas, Dallas* (sponsored by James C. Bartlett)—Several studies of lineup identification have examined whether a global-processing task administered prior to a lineup can improve eyewitness accuracy, presumably by increasing the encoding of configural information in the faces. The findings have been inconsistent, leading us to question whether a more direct manipulation of global processing might be more effective. In two experiments, we compared a standard simultaneous lineup condition with an experimental condition in which the lineup faces were initially presented in blurred focus, followed by an incremental progression from blurred to sharp focus. In Experiment 1, in which the experimental group viewed the blurred lineups passively, experimental group performance was numerically but not significantly higher than control group performance. In Experiment 2, in which the experimental group made an identification or “not-there” judgment in response to each successive lineup, the effect attained significance ( $p < .05$ ). The findings indicate that active processing of the global information in blurred facial photographs can improve lineup performance, but it is critical to confirm this hypothesis in further research using a broader range of lineups, including target-absent lineups in which all faces are foils.

(4133)

**Support for a Dual-Process Model of Directed Forgetting: Differential Forgetting of Details in a Complex Visual Scene.** AVERY A. RIZIO, MARK A. OAKES, & PENNY L. YEE, *Hamilton College*—Recent research suggests that recognition tests that target item details (e.g., font, size, case), rather than the gist, produce reliable recognition differences in list method directed forgetting (DF). Specifically, participants receiving a forget instruction showed a reduced ability to distinguish between previously presented items and detail-altered foils. One explanation is that the forget instruction terminates learning before the detail information is fully encoded. In order to explore this explanation more completely, we systematically varied the number of details that made up visual scenes. If the forget instruction terminates encoding prematurely, participants should have more difficulty determining whether an image has been previously presented when it consists of fewer details (as compared with more details) than does the original presentation. Our results provide further evidence for a dual-process model of DF



that emphasizes the importance of differential encoding in addition to retrieval inhibition.

(4134)

**Memory Systems Interact: Rapid and Nonconscious Effects of Recollection on Priming.** SIGNY SHELDON & MORRIS MOSCOVITCH, *University of Toronto* (sponsored by Morris Moscovitch)—Recent evidence suggests that the relationship between implicit and explicit memory is more interactive than was previously believed. The present study examines this claim by investigating how recollection, a process thought to be exclusive to explicit memory, may benefit performance on two implicit memory tasks, lexical decision and word stem completion. For both tasks, participants studied a list of words, performed the required implicit task on studied words and new words, and then completed a recognition task using the remember-know process (Tulving, 1985). Studied words that were labeled as recollected were associated with greater priming (faster performance to previously studied items) than were studied words that were later labeled as familiar (know response) or words that had been studied but not recognized (misses). These results are taken as evidence for Moscovitch's (2008) proposal that recollection is a two-stage process, one rapid and unconscious and the other more effortful and conscious.

(4135)

**Forgetting Each Other's Personal Past Through Conversation: Socially Shared Retrieval-Induced Forgetting for Autobiographical Memories.** CHARLES B. STONE, AMANDA J. BARNIER, & JOHN SUTTON, *Macquarie University*, & WILLIAM HIRST, *The New School* (sponsored by Matthew S. Finkbeiner)—Researchers have established that selective retrieval can induce forgetting for unmentioned but related memories. More recently, this effect has been extended to social settings, with the selective recounting of a speaker inducing forgetting in a listener, a phenomenon known as socially shared retrieval-induced forgetting (SS-RIF). To date, however, the work on SS-RIF has involved memories of experimenter-contrived material. We followed the standard SS-RIF procedure but employed as the stimulus material autobiographical memories. In one experiment, we showed that SS-RIF occurred in the course of a free-flowing conversation when the participant's own memories were discussed. More interesting, by discussing the memories of a stranger, the other participant exhibited SS-RIF for the stranger's memories and related aspects of their own autobiographical memories. The role of silences and the mechanisms behind the formation of collective memories are discussed.

(4136)

**Failure to Obtain Evidence for Covert Cuing in RIF.** MACIEJ HANCAZAKOWSKI & GIULIANA MAZZONI, *University of Hull* (sponsored by Giuliana Mazzoni)—Retrieval-induced forgetting (RIF) occurs when retrieval of information from memory impairs memory access to related nonretrieved information. Mechanisms of inhibition and interference have been proposed to account for RIF. The argument for the inhibitory account of RIF is cue independency of the effect. However, in a recent study, Camp, Pecher, and Schmidt (2007) have shown that RIF is not obtained when item-specific independent cues are used. Hence, it is possible that in previous studies, RIF was due to covert cuing—that is, independent cues becoming associated with study cues. In two experiments, this hypothesis was tested by associating half of item-specific independent cues with study cues in a separate phase of the procedure. Pairing independent cues with study cues before the study session led to increase in performance in all conditions but failed to elicit RIF. The experiments failed to provide evidence for the covert cuing hypothesis.

(4137)

**A Look at Spreading Inhibition: Retrieval-Induced Forgetting in a Three-Level Hierarchy.** TANYA R. JONKER, WAYNE PODROUZEK, & ANDREA HUGHES, *University of the Fraser Valley* (sponsored by Daniel M. Bernstein)—The retrieval-induced forgetting paradigm is extended to a three-level hierarchy (superordinate–intermediate–exemplar; e.g., FOOD–Fruit–apple) in order to examine whether retrieval-induced forgetting occurs on more than one level of the hierarchy, or if an additional level moderates the effect. Four experiments employed retrieval practice at either the intermediate or the exemplar level of the hierarchy and examined

final recall of intermediate or intermediate and exemplar items. The results support an inhibition explanation of retrieval-induced forgetting (Anderson, 2003) and demonstrate that the impairment may spread from the practiced hierarchical level to a nonpracticed hierarchical level.

(4138)

**Adaptive Memory in a Directed Forgetting Task.** KRIS GUNAWAN & DAVID E. COPELAND, *University of Nevada, Las Vegas*—Processing words on the basis of survival relevance has been shown to produce better retention than do other mnemonic devices (Nairne, Thompson, & Pandeirada, 2007). Our memory systems may be biased in remembering information in the context of a survival situation, due to its adaptive function. In the present study, we further examined the strength of survival processing by incorporating the list method of directed forgetting. Participants were presented with lists of concrete nouns, which they rated for either survival or pleasantness. The forget group was instructed to forget the first list and remember the second list only, whereas the remember group was instructed to remember both lists. On the basis of a free recall test, words rated for survival were more resistant to forgetting than were words rated for pleasantness. This finding demonstrated that remembering words associated to survival can generate a deeper level of processing, capable of eliminating inhibition or context effects.

(4139)

**Collaborative Inhibition and Facilitation in Memory for Categorical Word Lists.** IRA E. HYMAN, BRITTANY A. CARDWELL, REBECCA A. ROY, & ALEXANDER J. SCHILLER, *Western Washington University*—Collaborative inhibition is the finding that collaborative dyads recall fewer words than do nominal dyads (the combined output of two individuals working separately). One possible explanation of collaborative inhibition is that rather than doing each other, pairs working together interrupt each other's retrieval strategies by recalling words on the basis of differing organizations. In a series of studies, we investigated the role of retrieval interference and other cognitive explanations of collaborative inhibition. In our studies, we asked collaborative and nominal dyads to recall lists of categorized exemplars. We found that in addition to retrieval interference, collaborative inhibition may also result from other factors, including more limited exploration by dyads, different goals in remembering, and the delay interval for recall. In addition, we also found instances of collaborative facilitation such that collaborative dyads made fewer errors and demonstrated more clustering of recall than did nominal dyads.

• SPATIAL COGNITION •

(4140)

**Blindness and the Representation of Space.** TOMASO VECCHI, *University of Pavia*, ZAIRA CATTANEO, *University of Milan*, CARLA TINTI, *University of Torino*, & CESARE CORNOLDI, *University of Padua* (sponsored by Cesare Cornoldi)—Blindness has a severe effect on the representation of external space and multisensory interactions in the remaining sensory modalities. Here, we present a number of studies investigating how the congenital absence of vision modulates the internal representation of the surrounding space. The facilitating effect of symmetry in pattern perception and memory, the attentional asymmetry in the allocation and control of spatial attention (pseudoneglect), the relationships between internal representation of numbers (mental number line), and external representation of space have been investigated in blind and sighted blindfolded controls, using different haptic and auditory tasks. Overall, results indicated that the absence of vision did not prevent the internal representations of external space acquired through haptic perception. Furthermore, cross-modal interactions determined similar effects in blind and sighted participants, suggesting that the general principles of space organization can be acquired through haptic perception and on the basis of a common amodal internal representation.

(4141)

**Brain Activation for Mental Rotation Tasks: Sex-Dependent Strategies?** HEATHER R. COLLINS, MYTHILI VISWANATHAN, CHRISTINE R. CORBLY, TOM H. KELLY, & JANE E. JOSEPH, *University of Kentucky College of Medicine*—Using fMRI, we sought to identify

brain regions that are modulated by mental rotation task performance in men and women and to identify any unique regions that men recruit to achieve superior performance on difficult mental rotation tasks. Seventeen women and 20 men performed a mental rotation task of 3-D and 2-D shapes while in the MRI scanner. Several performance-related regions of interest were identified. Women showed inefficient processing in the right superior parietal region for the 3-D task. Men showed efficient processing in the right superior frontal region for the 3-D task. Men and women appear to recruit similar regions while performing mental rotation tasks, but they use these regions differently. When directly comparing men and women, women show unique activations in four regions, indicating that women are recruiting additional resources when performing 3-D rotations. This suggests possible sex differences in strategies used for performing spatial manipulation tasks.

(4142)

**Explaining the Sex Difference in Children's Mental Rotation Performance.** KRISTIN R. RATLIFF, SUSAN C. LEVINE, & JESSICA SAUNDERS, *University of Chicago*—Males typically outperform females on tasks requiring mental rotation. However, many have argued that this reflects not a difference in ability, but rather that men and women approach spatial problems in different ways (Newcombe et al., 2002; Pezaris & Casey, 1991). In the present study, first grade boys and girls performed a mental rotation task while concurrently engaging in either a spatial or a verbal interference task. Boys' mental rotation performance was not affected by verbal interference but was significantly decreased by spatial interference. In contrast, girls' mental rotation performance was not affected by spatial interference but was significantly decreased by verbal interference. These results support the claim that males and females utilize different strategies while solving mental rotation problems and that this strategy difference emerges quite early. Furthermore, these results suggest that the male advantage in mental rotation might be decreased or eliminated by encouraging girls to adopt a spatial strategy.

(4143)

**Developmental Continuity in Numerical Estimation: A Proportion Judgment Account.** HILARY C. BARTH, ANNIE M. PALADINO, & JESSICA L. SULLIVAN, *Wesleyan University*—How do our mental representations of number change over development? The dominant view holds that children (and adults) possess multiple representations of number and that age and experience lead to a shift from greater reliance upon logarithmically organized number representations to greater reliance upon more accurate, linear representations. Here, we present a new theoretically motivated and empirically supported account of the development of numerical estimation, based on the idea that many numerical estimation tasks entail judgments of proportion. We extend existing models of perceptual proportion judgment to the case of abstract numerical magnitude, presenting two experiments that provide support for these models. This work demonstrates that proportion judgment models provide a unified account of estimation patterns that have previously been explained in terms of a developmental shift from logarithmic to linear representations of number.

(4144)

**Contextual Information in the Firing Patterns of Single Neurons in the Human Brain.** CHRISTOPH T. WEIDEMANN, *University of Pennsylvania*, ALEC SOLWAY, *Princeton University*, MICHAEL J. KAHANA, *University of Pennsylvania*, & ITZHAK FRIED, *UCLA*—We recorded single-neuron activity from the brains of human participants while they navigated through a large and unconstrained virtual environment toward previously learned goal locations. We identified neurons that responded significantly to participants' location, goal, and direction. Some spatial representations were specific to the current goal or heading direction, and some of these firing patterns remapped when goal location and identities were changed. These results demonstrate a strong and flexible dependence of neural firing patterns on current task context.

(4145)

**Memory for Location: A Comparison of Intercollegiate Athletes and Nonathletes.** SUSAN T. DAVIS & JONATHAN A. HENTZ, *University of Dayton*—Documented transfer of pattern recall skills across sports

domains supported the expectation that a moving athlete's ability for recalling the location of a moving target would be demonstrated in a computer task similar to a sport in progress. Number of distractors (5, 13, or 21), presence of a landmark, and target location probed (starting, ending) were examined by recall and reaction time (RT) tasks. Athletes were more accurate than nonathletes in remembering the target's starting location when a landmark was present and the number of distractors was large. The presence of a landmark failed to distinguish between athletes and nonathletes when the number of distractors was small and when the ending location of the target was probed. RT for correct responses was faster for athletes, regardless of number of distractors, landmark's presence, or target location probed. In contrast, athletes demonstrated no greater memory span than did nonathletes.

(4146)

**Where Is the Store? Age-Related Changes in Spatial Information Recall.** BAILEY BONURA, AYANNA K. THOMAS, & HOLLY A. TAYLOR, *Tufts University*, & JOHN B. BULEVICH, *Rhode Island College*—Although many studies have explored memory resulting from map learning (for a review, see Tversky, 2000), few have examined age-related changes in map memory. The present study examined younger and older adults' memory for maps when learning goals focused on different spatial perspectives: learning specific routes (route perspective) or attending to relative landmark locations (survey perspective). The maps had 12 landmarks divided equally into three semantic categories. Semantically related landmarks were either spatially clustered (organized) or spatially distributed (unorganized). The results showed that neither older nor younger adults used the semantic organization to aid recall when they had a more cognitively taxing learning goal (route perspective). When landmarks were spatially distributed, older adults clustered semantically related landmarks during free recall, whereas younger adults clustered landmarks, using spatial relations. These results demonstrate an age-related strategy shift in recall for spatial information.

(4147)

**Perceiving and Representing the Orientation of Objects: Evidence From A.H.'s Developmental Deficit.** EMMA GREGORY & MICHAEL MCCLOSKEY, *Johns Hopkins University* (sponsored by Barbara Landau)—Perceiving the orientations of objects is important for interacting with the world, yet little is known about how the visual system represents object orientation. We describe a framework that conceives of orientation as a relationship between reference frames. The coordinate-system orientation representation (COR) framework assumes that object orientation representations map an object-centered reference frame onto a reference frame external to the object, which may in turn be related to additional external frames. We present new data from A.H.—a woman with a developmental deficit in perceiving the locations and orientations of objects—in support of COR assumptions. A.H.'s systematic pattern of orientation errors in copying pictures of objects provides evidence for the role of object-centered frames and mappings between external frames in representation of orientation. A.H.'s orientation errors in reaching for objects further suggests that the hypothesized representations play a role in visually guided action.

(4148)

**Transforming and Reconstructing Space: Multiple Tasks Elucidate Skills and Strategy.** SUSAN J. NAYLOR-EMLÉN, KYLE HANEY, & CHRISTOPHER BENNETT, *Villanova University*—Object rotation tasks can reveal the cognitive processes underlying imagined spatial transformation and findings support both imagistic and analytic processing strategies (Bilge & Taylor, 2008; Hegarty, DeLeeuw, & Bonura, 2008). The present study examined the cognitive processes of high, low, or non-rotators (Geiser, Lehmann, & Eid, 2006) on spatial transformation tasks without and then with lateralized interference designed to disrupt holistic or analytic processing. Additionally, participants' processing style (analytic, holistic, or synthetic; Rozenzweig & Corroyer, 2002) on a computerized block design task was related to object transformation performance. The results suggest that rotator groups employ consistent strategies across spatial tasks. Furthermore, block design strategy may help explain two common mental rotation response time differences seen

in the literature. Findings are discussed in the context of lateralized processing for high/low spatial ability performers.

(4149)

**One or Two Core Systems for Number Representation? A Computational Investigation.** QI CHEN & TOM VERGUTS, *Ghent University* (sponsored by Tom Verguts)—The representation of number is a topic of great interest in recent cognitive neuroscience and psychology, studied with methodologies as diverse as single-cell recording (e.g., Nieder & Miller, 2004), neuroimaging (e.g., Piazza, Izard, Pinel, Le Bihan, & Dehaene, 2004), and behavioral data from infants (e.g., Xu, Spelke, & Goddard, 2005). On the basis of these accumulating data, two core systems of number representation have been distinguished (Feigenson, Dehaene, & Spelke, 2004): an approximate system for large number representation and a more precise object file system for dealing with small numbers. However, the nature of these two core systems of numbers has remained unspecified. In the present study, we extend previous computational models (Verguts & Fias, 2004) by incorporating a habituation mechanism. We present computer simulations showing that a unified computational model can account for different data from a series of studies.

(4150)

**M1 Activation in Two Egocentric Mental Transformations Involving Nonbody Stimuli.** HOLLY BOYLE, CATHERINE M. FLYNN, & MARYJANE WRAGA, *Smith College*—We used functional magnetic resonance imaging (fMRI) to investigate the degree to which recruitment of the body percept, the online awareness of one's body, contributes to activation of low-level cortical motor areas within egocentric mental rotation tasks. Stimuli consisted of single, 3-D Shepard–Metzler objects situated within a sphere. Participants used buttonpresses serving as virtual pointers to locate (“right/left”) parts of the object, after imagining rotating the object in the hand (hand task) or imagining rotating themselves around the object (viewer task). As predicted, M1 activation was found in both tasks. In the hand task, activation corresponded roughly to the arm region of the motor cortex map; in the viewer task, motor activation corresponded roughly to the face and head region of the motor map. These results are discussed in the context of recent hypotheses regarding the role of the body percept in imagined egocentric transformations.

(4151)

**Comparing Spatial Perception/Cognition in Real Versus Immersive Virtual Environments: It Doesn't Compare!** BERNHARD E. RIECKE & DINARA MOURA, *Simon Fraser University*—Virtual reality (VR) is increasingly used in psychological research and applications, but does VR really afford natural human spatial perception/cognition, which is a prerequisite for effective spatial behavior? Using judgment of relative direction (JRD) tasks, Riecke and McNamara (2007, *Abstracts of the Psychonomic Society*) demonstrated orientation-specific interference between participant's actual orientation in an empty rectangular room and their to-be-imagined orientation in a previously learned room. To test whether VR yields similar interference, we replicated their study using a modified condition: We used an empty virtual (instead of real) test room presented on a  $180^\circ \times 150^\circ$  video projection. After learning 15 target objects in a rectangular office, participants performed JRD tasks (“imagine facing X, point to Y”) while facing different orientations in the virtual test room. Despite using identical procedures, seeing the virtual environment did not produce the same interference as a comparable real-world stimulus, suggesting qualitative differences in human spatial perception/cognition in real versus computer-simulated worlds.

(4152)

**Target Object Distance in Spatial Relations Affects Spatial Stroop Interference.** DALE S. KLOPFER & BRANDI A. KLEIN, *Bowling Green State University*—When determining the spatial relation between two objects—whether a ball is *above* a table—does the distance between the objects matter? The results from sentence–picture verification tasks (i.e., where observers verify that a picture depicts a specific spatial relation) are mixed (cf. Carlson & Van Deman, 2004; Logan & Compton, 1996). Studies where participants rate how well layouts depict spatial relations suggest that the distance between the objects is not relevant. In

our Stroop task, spatial words (*above*, *below*, *left*, *right*) were placed at three distances above, below, and to the left and right of a central point; participants named the location of the words. We found preferred or prototypical distances for spatial relations, with response times (RTs) to neutral words being shortest at those distances. In addition, Stroop interference (RTs to incongruent words) was greatest at the prototype positions. Prototypical distances seem to be inherent in spatial relations.

(4153)

**Stimulus Length Differently Affects the Visual Bisection of Lines and Orthographic Material.** LISA S. ARDUINO, *University of Urbino*, & PAOLA PREVITALI & LUISA GIRELLI, *University of Milan* (sponsored by Lucia Colombo)—Neurologically normal subjects systematically bisect solid lines to the left (pseudoneglect). Even the spatial extent of written words is misperceived, and a left bias in the bisection of orthographic material has been reported. Besides, eye movements studies reported an opposite asymmetry in visual exploration of continuous (lines) and discrete (orthographical) material. The present study explored the impact of visuo-perceptual factors (i.e., length) and of different material on this attentional distortion. Five experiments were conducted in which lines, words, pseudowords, consonant strings, and graphic strings were submitted to a computerized bisection task. The stimulus length was confirmed as a critical factor in the bisection performance across experiments, although stimulus type was highly critical: Whereas lines always yielded a left bias, discrete strings induced a left bias only when they were long and a right bias when short. Overall, these findings suggest that visuospatial exploration differs for continuous and discrete material.

(4154)

**When Is an Object Just an Object? How Attention and Task Relevance Affect Memory for Objects and Their Spatial Locations.** XUE HAN, *McMaster University*, PATRICK BYRNE, *York University*, MICHAEL J. KAHANA, *University of Pennsylvania*, & SUZANNA BECKER, *McMaster University* (sponsored by Suzanna Becker)—We conducted five experiments using a virtual driving task to elucidate the conditions under which objects would be encoded as part of an allocentric spatial map versus an egocentric visual snapshot memory. We found that the spatial locations of objects at navigationally relevant points (i.e., decision points) were generally better remembered than were the locations of other objects (i.e., nondecision points). In addition, our results showed that the participants were more likely to have employed egocentric representations to encode the non-decision-point objects and allocentric representations to encode the decision-point objects. With different attentional manipulations (attend to objects' appearance vs. attend to objects' locations), our results suggested that by remembering objects' appearance, the objects might be treated as independent objects and processed within the ventral visual stream; in contrast, by remembering objects' location, objects might be treated as landmarks and processed within the dorsal visual stream.

(4155)

**Effects of Number Magnitude on Spatial Attention and Response Bias.** KIKI ZANOLIE, JAN W. VAN STRIEN, & DIANE PECHER, *Erasmus University Rotterdam* (sponsored by Jan W. Van Strien)—In our daily visual world, we encounter many number symbols. Fischer et al. (2003) showed that merely perceiving numbers can shift covert attention to the right or left side, depending on the magnitude of the number. However, is this effect due to better processing or the bias to respond congruently? We adopted the paradigm of Fischer and presented participants with two lateral placeholders, one on each side of fixation. Following the fixation, a digit (1, 2, 8, or 9) was presented and remained on the screen for 300 msec. On 50% of the trials, a target (a white circle) was presented for 15 msec; on the other trials, no target was presented. Both target and nontarget trials were followed by the presentation of a metamask (on side of target). The participants were instructed to respond as quickly and accurately as possible when a target was detected. The results are discussed.

(4156)

**Quantity in Different Contexts: The Role of Verticality.** INGE BOOT & DIANE PECHER, *Erasmus University Rotterdam* (sponsored by Diane Pecher)—We examined whether *quantity* is represented by



*verticality*. In Experiment 1, participants read sentences in which the quantity was a little or a lot in the sentence context and identified the letter *p* or *q* presented at the top or bottom of the screen. Letters were identified better at the top when the participants read a sentence in which the quantity was a lot, as compared with a little, whereas performance was better on letters at the bottom when they read a sentence in which the quantity was a little, as compared with a lot. In Experiment 2, we used numbers instead of sentences. We only found a distance effect. These results show that verticality is active during decisions over quantity only when presented in a sentence context. Numbers seem to be represented by space, but this space is not necessarily vertical.

(4157)

**Sketches of Thought: Using Verbal Descriptions and Sketching As Indices of Causal Knowledge in Geoscience.** BENJAMIN D. JEE, DEDRE GENTNER, KENNETH FORBUS, BRADLEY SAGEMAN, & DAVID H. UTTAL, *Northwestern University* (sponsored by Dedre Gentner)—Geoscience requires learning about complex causal processes that occur over large ranges of space and time. How do geoscientists represent their knowledge of geologic processes? We examined this question, using two distinct methods. Participants with differing levels of geoscience experience were presented with a series of geoscience-related and -unrelated diagrams and were asked to (1) provide written descriptions of the diagrams and (2) sketch the diagrams using the CogSketch software (Forbus et al., 2008). CogSketch records both the spatial-relational structure of the sketches and the process through which sketches were constructed, affording an examination of the convergence and uniqueness of participants' written descriptions and their sketches. If geoscience experience leads to the development of causal mental models for geological processes, more experienced students' descriptions and sketches should reflect the diagrams' causal sequence. We discuss our results with respect to CogSketch as a general measure of causal knowledge.

(4158)

**Development of the Interaction Between Language and Vision.** BARBARA LANDAU, *Johns Hopkins University*, & BANCHIAMLACK DESSALEGN, *University of Chicago*—Language and vision interact, allowing us to talk about what we see (Jackendoff, 1987). What is the developmental trajectory of this interaction between language and vision? In several experiments, we investigated the effect of linguistic labels on children's and adults' ability to remember bound visual features (color–location conjunctions). We found that asymmetric linguistic labels (e.g., “the red is to the left of/prettier than the green”) help form robust spatial representations at 4 years of age but not at 3 years. Furthermore, we found that adults and, to a certain extent, 6-year-olds automatically deploy language to help them establish stable spatial representations. These findings show that language and vision operate independently of each other early in development and gradually become linked to the point where language is automatically activated in nonlinguistic tasks. We develop a theoretical framework to account for the present findings and similar findings in the literature.

(4159)

**Insights Into Mental Transformations: Combining Gesture, Speech, and Eye Movements to Understand Mental Rotation.** SHANNON L. FITZHUGH & TILBE GÖKSUN, *Temple University*, SUSAN GOLDIN-MEADOW, *University of Chicago*, & NORA S. NEWCOMBE & THOMAS F. SHIPLEY, *Temple University* (sponsored by Thomas F. Shipley)—Gestures reflect thought processes when people talk about spatial information, such as giving directions or describing motions, and reveal information about problem-solving strategies (e.g., Chu & Kita, 2008; Hegarty et al., 2005). In this study, 15 adults explained their solution strategies for a mental rotation task. Three groups were tested: high ability (>50% correct), low ability (<50%), and nonrotators, who had an item-specific response pattern (Geiser et al., 2006). Previous research from our lab has shown that these groups differ in how they perform mental rotation. We analyzed verbal reports, accompanying gestures, and eye movements to determine solution strategies. High- and low-ability groups both reported using mental rotation, yet only low-ability rotators produced rotation-related gestures. These findings suggest that

gestures support cognitive processes used in mental transformations, but only when the spatial task is demanding for the individual.

(4160)

**The Acquisition of Spatial Knowledge in an Unfamiliar Campus Environment.** VICTOR R. SCHINAZI & RUSSELL A. EPSTEIN, *University of Pennsylvania*, & DANIELE NARDI, NORA S. NEWCOMBE, & THOMAS F. SHIPLEY, *Temple University* (sponsored by Daniel R. Montello)—We examined the acquisition of spatial knowledge of an unfamiliar university campus over three visits. In their first visit, subjects learned two routes located at different areas of the campus and were asked to remember the name and position of buildings on each route. During the following weeks, subjects learned these routes for a second and third time, together with a connecting route. At each stage, their integrated configurational knowledge was probed by asking them to complete a variety of tasks, including direction estimation, distance estimation, and sketch mapping. Preliminary results reveal at least three different learning patterns. Whereas the majority of subjects exhibited a typical stage-like development, others quickly developed an accurate cognitive map after one or two sessions, and a third group never developed an integrated representation. These individual differences are discussed in relation to Siegel and White's (1975) framework and Montello's (1998) continuous framework.

# • PICTURE PROCESSING •

(4161)

**Gist Perception: Early Effects in Scene Recognition.** FRANK OPPER-MANN, *University of Leipzig*, THOMAS GRÜBER & UWE HASSLER, *University of Osnabrück*, & JÖRG D. JESCHENIAK, *University of Leipzig* (sponsored by Jörg D. Jescheniak)—The gist of visual scenes depicting coherent object configurations is extracted in a split second. For objects that are not embedded in a coherent context, such processing is not feasible. The present EEG study compared line drawings of two objects that were conceptually related (coherent context; e.g., a mouse and a cheese) or were completely unrelated (e.g., a crown and a mushroom). The question was at which time neural correlates would reflect the different processing. We hypothesized that oscillatory gamma band responses (above 20 Hz), which are assumed to reflect a match of incoming sensory information to existing memory traces, would be enhanced in the coherent condition. In fact, we obtained increased activation in the early evoked gamma band response (70–120 msec after stimulus onset) for coherent, as compared with unrelated, object configurations. This effect suggests a very early influence of knowledge-based information on object processing.

(4162)

**The Relationship Between Encoding and Recall for Objects in Scenes.** DAVID CORCK-ADELMAN & SHUI-I SHIH, *University of Southampton*, ALEXANDER POLLATSEK, *University of Massachusetts, Amherst*, & SIMON P. LIVERSEDGE, *University of Southampton* (sponsored by Simon P. Liversedge)—We report data from a paradigm, first reported in Corck-Adelman et al. (2009), investigating memory for objects in scenes. Eye movements were recorded as participants viewed a photograph (a room with 12 objects) for 5 sec in anticipation of a memory test. To encourage differential viewing, each of 6 objects was boxed in bright green outlines, and the remaining 6 were unboxed. Despite no instructions concerning the outlines, boxed objects were viewed before unboxed and were fixated longer than unboxed. At test, participants entered the photographed room and were presented with the 12 viewed and 12 distractor objects. They were required to select the 12 viewed objects and place each in the viewed position. Both identity accuracy and location accuracy were greater for boxed than for unboxed objects. The results suggest a strong relationship between eye movements during encoding a scene and memory for both object identity and location within that scene.

(4163)

**Eyes Down! (And Other Asymmetries in the Direction of Saccades During Scene Perception).** TOM FOULSHAM & ALAN KINGSTONE, *University of British Columbia*—How are the eyes guided when scanning real-world scenes? Most attempts to answer this question look

for commonalities in the regions that are fixated, assuming that eye movements are equally likely to move in each direction. However, in several studies, we have shown strong biases in saccade direction that indicate a tendency to scan scenes in a particular way. Here, we confirmed that the modal saccade direction changed systematically as the scene was rotated, indicating that these tendencies are scene centered. We also found a robust pattern for fast-latency, initial saccades to move to the lower half of a scene, even when this region was at the top of an inverted image. These patterns were not observed in a control condition with computer-generated fractals. As a result, we suggest that the eye movement system is relying on an early percept of scene layout that is acquired with gist.

(4164)

**Manipulation of Object-Context Congruency to Study Cross-Cultural Differences in Attention Allocation.** MARTHA E. ARTERBERRY, KAITLYN E. BILLINGTON, & ANETH S. LABAN, *Colby College*—Drawing on research suggesting cross-cultural differences in attention allocation, eye fixations to focal objects in varying backgrounds were investigated in East Asians, Caucasians, and Asian American participants. Animal and vehicle images were presented in (1) homogeneous contexts (plain white background), (2) congruent contexts (animals in fields, vehicles on streets), and (3) incongruent contexts (animals on streets, vehicles in fields). Eyetracking technology allowed for the monitoring of the location and duration of fixations to the object and the background. The results showed no significant differences in attention allocation among the three cultural groups; however, significantly more attention was paid to the focal object when the context was homogeneous and congruent, as compared with incongruent. In the incongruent context, attention was allocated to the background more so than to the focal object. The findings suggest that expectations about where objects are typically found guide attention allocation.

(4165)

**Effects of Concurrent Task Performance on Visual Object Identification.** GABRIELA DURAN, *University of Texas, El Paso, and Universidad Autónoma de Ciudad Juárez*, & WENDY S. FRANCIS & BETSABEE LARA, *University of Texas, El Paso* (sponsored by Wendy S. Francis)—Most research on visual object identification have focused on the bottom-up processes of the visual “what” pathway. The potential influences of top-down processing have been relatively unexplored. However, Bar (2003) proposed a model in which the prefrontal cortex helps in the later stages of object identification and also impacts priming for repeated objects. Evidence was obtained using neuroimaging techniques (e.g., Bar et al., 2006). Three new experiments used a concurrent *n*-back task to occupy prefrontal processing and tested its effects on object identification, relative to a control task. Experiment 1 examined identification of briefly presented pictures. Experiment 2 examined short-term priming of object identification based on a briefly presented prime picture. Experiment 3 examined long-term priming of visual object identification based on a briefly presented prime picture. Both object identification and short-term priming showed robust effects supporting the involvement of top-down processing, but results were less conclusive for long-term priming.

(4166)

**Recognizing People From Dynamic Video: Dissecting Identity With a Fusion Approach.** ALICE J. O'TOOLE, *University of Texas, Dallas*, P. JONATHON PHILLIPS, *National Institute of Standards & Technology*, & SAMUEL B. WEIMER, ROBERT B. BARWICK, & JULIANNE AYYAD, *University of Texas, Dallas*—We compared identification accuracy in natural videos of people walking and conversing. In Experiment 1, participants matched identity in stimulus pairs consisting of “gait videos” (a person approaches and passes) and “conversation videos” (two people converse). Stimulus-match type varied by condition, with participants matching identity in two gait videos (gait-to-gait), two conversation videos (conversation–conversation), or across a conversation and gait video (conversation–gait). In three additional experiments, participants matched identity using the “best” static face image extracted from the video (Experiment 2), the best static body image (with face obscured) from the video (Experiment 3), and body motion information with the face obscured (Experiment 4). Performance was best with the full video

(Experiment 1), and in all experiments the gait–gait condition was most accurate. Computational fusion of participants’ identity judgments across static and video conditions improved accuracy, but there was no gain from fusing identity estimates for two static presentation types.

• VISION •

(4167)

**Subordinate Recognition Without Viewpoint Invariance Following Bilateral Occipito-Parietal Damage.** JANE RIDDOCH & GLYN W. HUMPHREYS, *University of Birmingham* (sponsored by Glyn W. Humphreys)—Many theories of object recognition hold that viewpoint invariance is computed prior to object recognition’s taking place. We present data from a patient, R.B., who suffered bilateral occipito-parietal damage and presented with a range of visuo-perceptual impairments. R.B. showed a reasonably preserved ability to recognize line drawings of familiar objects but was markedly impaired when presented with overlapping figures and figures shown from unusual views. Interestingly, his ability to identify drawings of objects at a subordinate level was also relatively preserved. R.B.’s case indicates that subordinate object recognition can be achieved even when the processes subserving viewpoint invariance are markedly impaired. This supports the argument that viewpoint invariance is not a prerequisite for visual object recognition.

(4168)

**Seeing the World in Pieces: How Do Simultanagnosics Scan Social Scenes and Why?** KIRSTEN A. DALRYMPLE, *University of British Columbia*, ELINA BIRMINGHAM, *California Institute of Technology*, WALTER F. BISCHOF, *University of Alberta*, & ERIC EICH, JASON J. S. BARTON, & ALAN KINGSTONE, *University of British Columbia* (sponsored by Eric Eich)—Simultanagnosia is a disorder of visual attention defined as an inability to see more than one object at once, due to a constriction of the visual “spotlight” of attention. We created a simultanagnosia-like viewing paradigm for healthy subjects, using a gaze-contingent aperture, restricting vision to a small portion of the stimulus around fixation. Subjects described social scenes while their eye movements were monitored. Data were compared with those from a simultanagnosic patient (S.L.) who performed this task under natural viewing conditions. S.L. showed unusually low proportions of fixations to the eye region of scenes. Subjects in the gaze-contingent and in a mouse-contingent paradigm closely mimicked this behavior. A spatially constricted window of visual processing has important consequences for how people explore their world. Our paradigm’s capacity to mimic simultanagnosic behavior supports its validity as a model of simultanagnosia. Our results have implications for how and why we acquire information about complex scenes.

(4169)

**The Attractor Illusion.** TAL MAKOVSKI, KHENA M. SWALLOW, & YUHONG V. JIANG, *University of Minnesota*—In many visual illusions, the perceived features of an object, such as its size, convexity, and luminance, are influenced by the object’s immediate surroundings. We present a new type of visual illusion in which an object’s perceived location, rather than its features, is biased toward the location of a co-occurring irrelevant stimulus. Participants localized the edge of a briefly presented and masked unfilled square. Localization was accurate when the box was presented in isolation. However, when an irrelevant stimulus concurrently appeared with the box, participants’ localization of the square deviated toward the irrelevant stimulus—an “attractor illusion.” The attractor illusion is modulated by the size of the irrelevant stimulus and is stronger when the irrelevant stimulus is an object rather than random noise. The illusion is eliminated when the box is not backward masked. We discuss attentional and signal-averaging mechanisms that might underlie this illusion.

(4170)

**The Passive Advantage in Visual Search Is Associated With a Calmer Eye.** MARCUS R. WATSON, ALLISON A. BRENNAN, ALAN KINGSTONE, & JAMES T. ENNS, *University of British Columbia* (sponsored by Lawrence M. Ward)—Visual search can be more efficient when viewing a display passively, allowing the target to pop into view, than when actively directing attention in a deliberate effort to locate a target (Smilek et al.,

2006). This finding is counterintuitive, since efficient search on the same type of displays is characterized by shorter and more frequent visual fixations to different locations (Watson et al., 2009). Here, we replicated the passive advantage in visual search, while simultaneously recording eye position during search for both actively and passively instructed participants. The results showed that there are two qualitatively different ways to search efficiently: One involves making frequent fixations to different locations, as previously reported (Watson et al., 2009); the other involves fixating longer in fewer locations, presumably giving more time for peripheral visual information to accumulate before being overwritten by a new fixation.

(4171)

**Associative Learning in Human Natural Image Categorization.** FABIAN A. SOTO & EDWARD A. WASSERMAN, *University of Iowa* (sponsored by Edward A. Wasserman)—A model hypothesized that different stimulus attributes compete for control of behavior in natural image categorization can account for a large body of animal data. Thus, simple associative learning processes may underlie natural image categorization by animals. The present experiment tested whether the same learning principles can predict human behavior in natural image categorization. Two groups (Blocking and Control) were first trained in a categorization task and later tested with novel exemplars from each category. But, only the Blocking group received pretraining with the categorization task, plus training in which different exemplars of the same categories entailed the opposite assignment of response keys. There was less discriminative transfer during testing for subjects in the Blocking group, suggesting that learning about properties specific to each image during pretraining blocked learning of an open-ended category. Therefore, the same associative learning principles may underlie natural image categorization in animals and people.

(4172)

**Generalized Mass at Chance Models: Testing for Thresholds.** RICHARD D. MOREY, *University of Groningen*—The concept of a threshold, a minimum stimulus intensity that can be perceived or processed, goes back to at least the 19th century. In modern psychological research, researchers in the field of subliminal priming assume that certain stimuli are not intense enough to rise to conscious awareness, and identification of these stimuli are at chance. The half-probit mass at chance model (Morey, Rouder, & Speckman, 2008) was designed to allow measurement of at-chance performance, but the model assumes that thresholds exist. This assumption is relaxed, and models both with and without thresholds are competitively tested.

(4173)

**The Life Span of Temporal Information in Reference Memory.** PIERRE-LUC GAMACHE & SIMON GRONDIN, *University of Laval* (sponsored by Richard Ivry)—To further explore how memory influences time judgments, we manipulated the mixing mode of auditory/visual signal presentations. In Experiment 1, signals from the same modality were either grouped by blocks of 60 trials or randomized within blocks. The results showed that the auditory/visual difference decreased but remained present when modalities were grouped by blocks. In Experiment 2, we modified the classic bisection task in order to facilitate the analysis of short blocks of trials. The results showed that, after a training block was performed in one modality, the perceived duration of signals from the other modality was distorted for at least 30 trials and that the magnitude of the distortion decreased gradually as the block went on. The results of both experiments highlight the determining influence of memory on time judgments, providing empirical support to a quantitative portrayal of the memory-mixing process.

• TOUCH •

(4174)

**The Visual and Haptic Horizontal-Vertical Curvature (Saint Louis Arch) Illusion.** MORTON A. HELLER, RITA SCHNARR, BRETT LITWILLER, CHELSEA YOUNG, AMY SMITH, & ANNE WALK, *Eastern Illinois University*—Independent groups of subjects made judgments about the heights and widths of curves using vision or touch.

Prior research has demonstrated a horizontal-vertical illusion with curves, involving overestimation of their height, as compared with their width. The aim was to determine whether the illusion would occur in equal strength in the two modalities and whether pattern rotation would influence illusory misperception in a similar fashion. Subjects overestimated the verticals, as compared with the horizontal, in both modalities, and the illusion was diminished somewhat when patterns were rotated + 90°. The illusion was significantly stronger in touch than in vision. The theoretical implications of the results are discussed.

(4175)

**The Horizontal-Vertical Illusion in Touch: A Study With Adolescents, Young Adults, and Older Adults.** SOLEDAD BALLESTEROS, JULIA MAYAS, MANUEL SEBASTIAN, & JOSE M. REALES, *UNED, Madrid*, & MORTON A. HELLER, *Eastern Illinois University*—Previous studies have shown that the horizontal-vertical illusion for tactually explored raised-line shapes is independent of visual status or visual imagery, since similar illusory overestimation of the vertical occurs in early blind, later blind, and low-vision participants (Heller et al., 2003) and occurs with curves (Heller et al., 2008). In the present study, we investigated whether this spatial misperception changes from adolescence to old age. In the study, participants explored a series of horizontal and vertical raised-line curves of different sizes. Exploration was unimanual or bimanual in counterbalanced order. Curve height was always equal to width at the base. The task consisted of judging the size of the curves (horizontal/vertical), using two sliding rulers. The results suggest that the illusion is independent of age, and participants overestimated the vertical in tangible curves.

(4177)

**Haptic Perception in Minimally Invasive Surgical Tasks: An Investigation of Tumor Detection.** DANIEL GREENWALD, CAROLINE CAO, & EMILY W. BUSHNELL, *Tufts University*—Although minimally invasive surgery (MIS) reduces patients' scarring and recovery time, constraints on haptic perception inherent in MIS may compromise a surgeon's identification and differentiation of normal tissues and abnormal tumors. To examine these constraints, untrained participants were asked to search for artificial tumors in simulated abdominal tissue (silicone gels), using three methods of exploration: with free movement of the hand, with free movement of a surgical tool, and with a surgical tool inserted through a port, as in MIS. Participants were faster and more accurate at tumor detection with the hand than with the other two methods of exploration, which did not differ from one another. Perceivers were also faster and more accurate at detecting harder tumors than at detecting softer ones. The results highlight the difficulty of tissue differentiation in MIS and have implications for the design of surgical tools, training procedures, and alternative techniques for tumor detection.

(4178)

**Outline, Mental States, and Drawings by a Blind Woman.** JOHN M. KENNEDY, *University of Toronto, Scarborough*—Outline pictures depict surface edges, and via extensions from this base, they can represent sensory and psychological referents. Outline drawings standing for edges of surfaces are relatively ancient, and lines for actions, sounds, and psychological states are quite recent—mostly little more than a century. The novel finding here is that lines for psychological states of several kinds have been invented by a blind woman, E.W., who began making raised-line drawings as an adult. Notably, she invented novel devices representing thoughts and emotional impressions. If lines depict surface edges literally, they depict motion, sensory effects, impressions, and thoughts metaphorically.

(4179)

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

(4180)

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**Poster Session V  
Saturday Evening  
Hynes Convention Center, Ballrooms A, B, and C  
Viewing 3:00–7:30, Author Present 6:00–7:30**

• DIVIDED ATTENTION •

(5001)

**The Role of Working Memory in the Search for Multiple Targets.** HYEJIN YANG & GREGORY J. ZELINSKY, *Stony Brook University* (sponsored by Gregory J. Zelinsky)—To investigate the relationship between working memory and search, we used a retro-cue to manipulate the number of search targets (one, two, or four) held in memory. Targets were teddy bears, butterflies, cars, or fish, and distractors were random objects. We found that search was guided less efficiently to a target as the number of potential targets increased from one to four and determined that this reduced guidance was due to both target feature overspecification (primarily) and working memory limitations (secondarily). In a separate experiment, we asked whether subjects searching for multiple targets pick only one to guide their search or whether their search is guided by features from all of the potential targets. Analyses of initial fixations on targets found no meaningful differences in guidance between the target types, providing converging evidence for our conclusion that subjects use multiple working memory representations of targets to simultaneously guide their visual search.

(5002)

**Dual-Task Processing When Task 1 is Hard and Task 2 is Easy: Reversed Central Processing Order?** TANJA LEONHARD, SUSANA RUIZ FERNÁNDEZ, & ROLF ULRICH, *University of Tübingen*, & JEFF MILLER, *University of Otago* (sponsored by Jeff Miller)—A psychological refractory period (PRP) experiment was conducted with an especially time-consuming first task (mental rotation) and equal task emphasis. The standard design with varying stimulus onset asynchronies (SOAs) was extended by a condition with blocked SOAs. On the basis of the optimization account (Miller, Ulrich, & Rolke, 2009), we expected that participants would—at short but not at long SOAs—tend to process the central stage of Task 2 before the time-consuming central stage of Task 1 and, consequently, emit the response to Task 2 before the response to Task 1. The data supported this prediction. The study indicates that preparation and total reaction time optimization are—among others—factors influencing central processing order in PRP tasks.

(5003)

**The Attentional Boost Effect Depends on Temporal Synchrony.** KHENA M. SWALLOW & YUHONG V. JIANG, *University of Minnesota*—Memory for images that are concurrently presented with unrelated targets (e.g., white squares among black square distractors) is better than memory for images presented with distractors (the attentional boost effect; ABE). We propose that the detection of occasional targets triggers attentional orienting to a specific moment in time, opening an attentional “gate” to concurrently presented scenes. To characterize the gate, we examined the temporal specificity of the ABE. Participants encoded briefly presented images while monitoring a second stimulus stream for occasional targets. Experiment 1 showed that when the images and targets are synchronized, the ABE is observed for images presented within approximately 500 msec after a target appears. Experiment 2 demonstrated that the ABE is eliminated when the onsets of the targets and images are desynchronized by 100 msec, suggesting that the gate opens only when the image and target onset together. We conclude that temporal synchrony is critical for the ABE.

(5004)

**Assessing Automatic Emotion Perception Using Event-Related Brain Potentials.** KATHLEEN SHAW & MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & PHILIP A. ALLEN, *University of Akron* (sponsored by Philip A. Allen)—Can emotions be perceived automatically (i.e., without central attentional resources)? We used a dual-task paradigm to examine whether people can perceive emotion while they are busy selecting a response to another

task. Task 1 required an auditory discrimination (low vs. high pitch). For Task 2, one happy face and one angry face were presented adjacent to each other. Participants indicated the gender of the face expressing a prespecified emotion (happy or angry). To determine which face was attended, we used an electrophysiological measure of attention known as the N2pc component of the event-related brain potential. The face with the target emotion elicited an N2pc effect, indicating attentional capture, even when participants were still busy performing Task 1. Thus, it appears that emotion perception can (to some degree) occur automatically, without central attentional resources.

(5005)

**1, 2, 3. Do You Count Sheep? An Investigation of Attentional Biases in Individuals With Sleep Disturbances.** BONNIE L. ANGELONE & D. J. ANGELONE, *Rowan University*—Attentional bias refers to people's propensity to allocate attention to objects of interest in their visual world. What determines interest can range from information important to many (e.g., negative/emotional stimuli) to information pertinent to only some (e.g., stimuli related to psychological disorders). Prior research has investigated attentional biases in several psychological disorders, and it has been demonstrated that concern-related stimuli capture attention more than do neutral stimuli. These studies have used Stroop and dot-probe paradigms to assess information processing, and only recently has the flicker paradigm been employed. Participants completed a flicker change detection task with sleep-related and neutral images followed by an assessment of sleep quality. Using improved methodology, clinical sleepers were slower detecting changes in sleep-related images than in neutral images, whereas nonclinical sleepers showed the opposite pattern. For clinical sleepers, sleep images may capture attention, but those individuals have difficulty disengaging attention, leading to slower visual processing.

(5006)

**Does GPS Information Interfere With Target Search in Automobile Driving Scenes?** FRANÇOIS MAQUESTIAUX, *Université Paris-Sud 11*, ANDRÉ DIDIERJEAN, *University of Franche-Comté*, ERIC RUTHRUFF, *University of New Mexico*, & ALAN A. HARTLEY, *Scripps College*—Involuntary capture of attention by irrelevant information (e.g., singletons) has mainly been demonstrated using abstract visual-search displays. Does this phenomenon also occur in more ecologically valid displays, even if the singleton occurs in a zone where the target could never occur? To address this question, we conducted two experiments in which young and elderly adults searched for a visual target (a letter) positioned in a driving scene, while the singleton occurred in a GPS information screen located at the forefront of the display. Evidence for involuntary capture of attention was observed when available resources to perform the search task were reduced either by a noisy environment or by the simultaneous execution of a concurrent auditory task. In addition, interference was amplified when the target and the singleton had the same color. However, attention capture effects were identical between the two age groups, suggesting that these interfering attentional processes were unaffected by age.

• COGNITIVE CONTROL •

(5007)

**Preparation and Decay in Voluntary Task Switching.** BAPTIST LIEFOOGHE & FREDERICK VERBRUGGEN, *Ghent University*—Recently, Liefooghe et al. (2009) claimed that the reduction in switch cost (or RISC-effect) in the voluntary task-switching procedure reflects the presence of preparation processes mediated by executive control. Yet, the RISC-effect in imposed task switching has also been attributed to a decay in task-set activation. Accordingly, we tested whether this would equally hold for voluntary task switching. To this end, a voluntary task-switching procedure was used in which participants selected a task when a probe was presented prior to the stimulus onset. In this procedure, different time intervals were manipulated, and we observed evidence indicating the presence of task preparation but also of task-set decay in voluntary task switching. In addition, the average amount of task-set decay correlated with participants' average task-choice behavior. We conclude that the RISC-effect in voluntary task switching cannot only

be attributed to task preparation and that task-set decay influences the selection of upcoming tasks.

(5008)

**Adult Age Differences in Transfer of Task-Switching Training.** MEREDITH E. MINEAR, *College of Idaho*, & PRITI SHAH, *University of Michigan*—In this study, we tested the extent to which training on switching between pairs of tasks using one type of cue would show transfer to an unpracticed set of tasks using a different type of cue. Older and younger adults were tested using a pretest/posttest design. At pre- and posttest, both a textual cue (words indicating the task to be performed) and a spatial cue (the stimuli appearing above or below a line) were used. Participants in the training group were then given practice on three new sets of tasks using both the spatial cue seen at pretest and a color-based cue, whereas participants in the control group received repeated practice on the six corresponding single-task versions. We found that whereas younger adults showed transfer to both an unpracticed as well as the practiced cue, older adults only showed evidence of transfer to the cue used during training.

(5009)

**Contextual Cuing of Response, Stimulus, Task, and Switch: A Task-Switching Analysis.** MATTHEW J. C. CRUMP, *Vanderbilt University*—A number of recent findings in the task-switching, Stroop, and flanker literatures have demonstrated a role for contextual cues to rapidly update attentional control settings during online performance. In task-switching, location cues associated with task (Mayr & Bryck, 2007), or likelihood of receiving a task switch (Leboe, Wong, Crump, & Stobbe, 2008), are known to modulate switching costs. We follow up on these findings in four experiments by systematically manipulating whether location cues were associated with response (E1), stimulus (E2), task (E3), and likelihood of switch (E4). Furthermore, we examined both cue repetition and cue switch trials to determine whether contextual control effects could be isolated to cue-switching rather than task-switching costs. We demonstrate no contextual modulations when cues are associated with particular responses or stimuli, but we do find modulations specific to the cue repetition cost when contexts are associated with task and likelihood of switch.

(5010)

**Performance Monitoring and Forms of Control in Routine Cognitive Performance.** LESLIE A. ADERHOLD & RICHARD A. CARLSON, *Pennsylvania State University*—In skilled activity, the conscious and effortful process of explicit performance monitoring is often abandoned in favor of more automatic, implicit monitoring, likely based on fluency cues. Here, we considered whether certain forms of task control that enhance performance fluency and accuracy might come at the cost of successful error detection. Participants in several experiments performed routine cognitive tasks such as mental arithmetic. Their control of events in these tasks varied in terms of the types of display changes (e.g., event onsets vs. event offsets) evoked by keypresses and in the delay between keypress and display change. These manipulations affected the speed and accuracy of performance. Depending on the details of the task, better performance was sometimes associated with better monitoring and sometimes with worse monitoring. We interpret these results in terms of a fluency-cue account of metacognition and consider their implications for real-life skilled performance.

(5011)

**Enhancements Can Accompany Impairments Across Blocks of Different Cognitive Control Tasks.** TYLER A. YOST & CHAD J. MARSOLEK, *University of Minnesota*—Performance in self-control tasks can be impaired due to previous performance of other difficult self-control tasks. Existing social cognitive theories attribute this deficit to the depletion of a limited cognitive (or self) control resource. However, another possibility is that learning and practice of one task may cause interference on other, subsequent tasks. We tested this by having participants perform alternating blocks of Stroop and flanker tasks (i.e., A B A' B'). Resource depletion theory predicts that the difficult nature of the first blocks should deplete self-control resources available for subsequent blocks, resulting in declining performance. We found such decrements in performance (i.e., from A to B and from A to A'), replicating resource

depletion findings, but we also found a significant improvement between the second and fourth blocks (i.e., B to B'). We relate these results to findings of accelerated relearning following antiprime and following retrieval-induced memory impairments.

(5012)

**Individual Differences in Working Memory Capacity and the Distinction Between Proactive and Reactive Control.** THOMAS S. REDICK & RANDALL W. ENGLE, *Georgia Institute of Technology*—The dual-mechanism theory of cognitive control (Braver, Gray, & Burgess, 2007) distinguishes between proactive and reactive control modes and provides a concrete framework for explaining behavior across various conditions. Importantly, while proactive and reactive control have been theorized to apply to differential performance observed in various clinical and aging populations, no empirical work has been conducted examining how this theory may apply to individual differences in cognitive abilities within a young, healthy population. The present research directly assessed proactive versus reactive control by administering three versions of the AX-CPT to individuals varying in working memory capacity. Individuals low in working memory capacity exhibited specific performance deficits, relative to the individuals high in working memory capacity. The results extend the application of the dual-mechanism theory to individual differences in working memory capacity and provide a theoretical framework to explain previous findings in the working memory capacity literature.

(5013)

**Chronic Partial Sleep Deprivation in Young Parents Affects Executive Functions in a Task-Switching Setting.** FRANZISKA PLESSOW, *Dresden University of Technology*, ANDREA KIESEL, *University of Würzburg*, & CLEMENS KIRSCHBAUM, *Dresden University of Technology* (sponsored by Rico Fischer)—Although there is evidence that short-term total or partial sleep deprivation impairs executive functions, little is known about the effects of chronic partial sleep deprivation. In the present study, we investigated effects of chronic partial sleep deprivation on executive functions in a task-switching setting. Young parents with children between the ages of 6 and 23 months were assigned to either a sleep-deprived group (<7 h sleep per night) or a control group (≥7 h) on the basis of their self-reported night sleep within the last 6 months. Task-switching performance was assessed by switch costs and target-congruency effects (TCEs). Although the sleep-deprived group showed increased switch costs, as compared with the control group, the TCE did not differ between groups. We conclude that even moderate chronic partial sleep deprivation selectively reduces flexibility in shifting between tasks, whereas the ability to shield an ongoing task against competing response tendencies remains unaffected.

(5014)

**Stimulus Set or Response Set: What is Retrieved in Episodic Task-Set Retrieval?** HIMEH HOROUFCHIN, ANDREA M. PHILIPP, & IRING KOCH, *RWTH Aachen* (sponsored by Ronald Hübner)—In the cued task-switching paradigm, decreasing switch costs with increasing response-cue interval (RCI) is a typical finding. We suggest that these effects are due to the influence of temporal distinctiveness, which modulates episodic task-set retrieval. In this study, we explored which part of the task set is retrieved. According to the idea that a task set consists of a response set and a stimulus set, we manipulated response-set overlap in Experiment 1. The results for both overlapping and nonoverlapping response sets comparably showed that lengthening the RCI leads to a loss of repetition benefit, mainly when the RCI changed from the previous to the current trial. In Experiment 2, the stimulus set was manipulated. The results revealed stronger RCI effects with overlapping, as compared with nonoverlapping, stimulus sets. Taken together, the data suggest that the influence of RCI on episodic retrieval is linked to stimulus set rather than to response set.

(5015)

**Development of Verbal and Nonverbal Inhibitory Control Tasks for Chinese Speakers.** SAM-PO LAW, *University of Hong Kong*, WINSY WONG, *Quality Therapy and Education Centre*, & OLIVIA YEUNG, *University of Hong Kong*—The ability to suppress irrelevant information or prepotent or overlearned responses—that is, inhibitory control—is

one of the core components of executive functions. Recent studies have shown that inhibitory control deficits may result in short-term memory impairment (e.g., Allen & Martin, 2009) and may adversely affect the efficacy of treatments of word retrieval (Yeung, Law, & Yau, in press). Given the significance of inhibitory control in verbal processing, Chinese recent negatives tasks, verbal and nonverbal, identical in format to that in Hamilton and Martin (2007), were developed and administered to participants of different age groups. The overall results revealed proactive interference effects of semantic relatedness and visual similarity. However, the absence of interference of phonological relatedness and the chance level performance on the recent negative trials in the nonverbal task require further consideration and modifications to be made. Adjustments of the list length in the two tasks are initially suggested.

(5016)

**The Effect of Working Memory Capacity on Conflict Monitoring.** REBECCA WELDON & MYEONG-HO SOHN, *George Washington University* (sponsored by Myeong-Ho Sohn)—Conflict monitoring has been extensively researched in behavioral and neuroimaging domains, but the existence of individual differences in conflict monitoring has not yet been investigated. The present study grouped individuals by working memory (WM) span scores and aimed to investigate whether high and low WM span groups demonstrate a difference in performance on a Simon task. We found significant differences in the modulation of the Simon effect in low versus high WM groups, suggesting that individual differences do exist in conflict monitoring. This study contributes to current theories on the nature of individual differences, cognitive control, and conflict monitoring.

(5017)

**The Moderating Effects of Emotional Eating on Conflict Monitoring.** DINKAR SHARMA & SARAH HOTHAM, *University of Kent* (sponsored by Dinkar Sharma)—This study attempted to establish whether sequential modulation effects can be moderated by individual differences in eating behavior. Sixty-six participants completed a Stroop task in which color words were embedded onto images of disorder-relevant (high-fat foods) or nonfood images. Two types of sequential trials were analyzed: complete alternation trials (adjacent trials do not repeat the color or word) versus repetition trials (complete and partial repetition). Sequential modulation effects were observed in complete alternation and repetition trials, replicating previous findings suggesting the presence of conflict monitoring and priming. In complete alternation trials, the effects were also moderated by emotional eating levels in the food image condition. These findings suggest that conflict monitoring can be moderated by an attentional bias in high emotional eaters toward disorder-relevant cues.

#### • SELECTIVE ATTENTION •

(5018)

**Switching Attentional Settings for Visual Search: Is Inhibition Applied?** AARON THOMPSON & MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & JAMES C. JOHNSTON, *NASA Ames Research Center* (sponsored by Mei-Ching Lien)—People are remarkably good at switching attentional settings for visual search (e.g., looking for red objects then for green objects; Lien, Ruthruff, & Johnston, in press). They can quickly and fully establish a new set and eliminate any residue of previous attentional sets. The present study examined whether this success in switching is due in part to strong inhibition of the previous (no longer relevant) attention setting. In different experiments, participants switched between different features along the same dimension (e.g., red then green) or between different dimensions (e.g., green then diamond then red). The inhibition hypothesis predicts slower performance on the third trial of an ABA sequence than of a CBA sequence (the “ $n-2$  repetition cost”). We found no evidence for an  $n-2$  repetition cost, regardless of whether people switched within or between dimensions. These findings suggest that people do not inhibit the old attentional setting when switching to a new attentional setting.

(5019)

**Does Inhibition of Return Reflect Environmental Regularity?** CORY A. RIETH & DAVID E. HUBER, *University of California, San*

*Diego* (sponsored by David E. Huber)—Inhibition of return (IOR) experiments find facilitated spatial cuing at short delays (<150 msec) but deficits at long delays (>300 msec). This is thought to be an automatic process within the attention or oculomotor systems. We consider the hypothesis that this reflects environmental regularity for the appearance of objects: It is likely that the appearance of an object (the cue) signals interesting nearby objects (the target), but if none are found, then it is unlikely another interesting object will appear at that location. To test this hypothesis, we trained participants in an environment where the target was likely to appear opposite the cue at short delays or at the cued position with long delays. This reverse training eliminated the IOR. Other participants revealed enhanced IOR when trained in an environment that mimicked the IOR pattern. Collectively, these results suggest that IOR is learned in response to environmental regularity.

(5020)

**A Diffusion Model Account of Processing in the Flanker Task.** COREY N. WHITE, ROGER RATCLIFF, & JEFFREY STARNES, *Ohio State University* (sponsored by Roger Ratcliff)—The flanker task has been extensively used to investigate spatial attention. In the task, a central target must be identified in the presence of flanking stimuli that are either congruent or incongruent with the target. The present study tests a single-process account of flanker processing in which a diffusion decision process is driven by the interplay between attention and the perceptual representation of the stimulus. In the model, each stimulus is assumed to have a distribution of spatial uncertainty, leading to overlapping spatial representations. Over time, attention builds on the center of the perceptual representation, minimizing the impact of the flanking stimuli. This process provides the evidence (drift rate) for the diffusion process. To test the model, several experiments were performed that included the standard conditions, congruent (> > > >) and incongruent (> > < > >), as well as two intermediate incongruent conditions (> < < < >) and (< > < > <). The results are discussed in relation to existing models.

(5021)

**Selective Distractor Processing in the Flanker-Compatibility Task.** JI HYUN SUH & YANG SEOK CHO, *Korea University*—According to the load theory, the locus of selection is determined by perceptual load. Because early selection occurs under high perceptual load and late selection in low perceptual load, the flanker-compatibility effect is evident only when perceptual load is low. Two experiments were conducted to investigate whether the probability of a distractor's capturing visual attention modulates the flanker-compatibility effect. In Experiment 1, in which the number of distracting flankers was manipulated, the flanker compatibility effects increased as the number of distracting flankers increased, regardless of perceptual load. In Experiment 2, the ratio of the distracting flanker number to the total flanker number was manipulated. The compatibility effect increased as the ratio of the distracting flankers increased, even when perceptual load was high. These findings imply that the probability that the distracting flanker will capture visual attention, rather than perceptual load, determines the magnitude of the flanker compatibility effect.

(5022)

**Capture by Salient Objects: Evidence From a Go/No-Go Paradigm.** NATHAN HERDENER & MEI-CHING LIEN, *Oregon State University*, & ERIC RUTHRUFF, *University of New Mexico*—Using a go/no-go paradigm, we examined whether attentional capture is driven by object saliency or is contingent on top-down control setting. We measured the N2pc effect, thought to reflect attentional allocation to the left or right visual field. Participants were told to search the target display for a letter in a specific color and indicate its identity. The target display could contain a letter in the specified color (“go” trials) or not (“no-go” trials). On every trial, this target display was preceded by a noninformative cue display containing a color singleton. The key manipulation was whether this irrelevant singleton had the target color that participants were looking for. N2pc effects were obtained for all color singletons in the cue displays, even those that did not have the target color. Implications for attentional control and theories of attentional capture are discussed.



(5023)

**Stroop Interference and Goal Neglect.** JONATHAN D. JACKSON & DAVID A. BALOTA, *Washington University* (sponsored by Janet M. Duchek)—One factor hypothesized to contribute to standard Stroop-type interference effects is an inability to maintain the task goals across trials. De Jong, Berendsen, and Cools (1999) eliminated interference by reducing the response-to-stimulus intervals (RSIs) to 200 msec in a two-response spatial Stroop paradigm, suggesting that a short RSI engages more focused attention. RT analyses indicated that this effect was localized in the slow tail of the RT distribution. We attempted to extend De Jong et al. by investigating the consequences of RSI on the more standard vocal and buttonpress versions of the Stroop color interference task. The results from both versions indicated a larger Stroop interference effect at a short (200-msec) RSI than at a long (4,500-msec) RSI, and this influence was primarily reflected in the slow tail of the RT distribution. Discussion focuses on experiment-wide and stimulus task constraints that can modulate the RSI effect.

(5024)

**The Conflict Theory of the N200–P300 Complex, the Locus Coeruleus–Norepinephrine System, and the Attentional Blink.** CHRISTOPHER M. WARREN & CLAY B. HOLROYD, *University of Victoria* (sponsored by D. Stephen Lindsay)—The locus coeruleus is a norepinephrine-releasing neuromodulatory nucleus. We suggest that two event related potential components, the N200 and the P300, are the electrophysiological manifestations of first the abundance, then the depletion of norepinephrine due to target-elicited phasic bursts of locus coeruleus activity followed by auto-inhibition. We combine an attentional blink task with an Eriksen flanker task, exposing subjects to triplets of characters in a rapid serial visual presentation (RSVP). Incongruent triplets (DTD, where D is a distractor and T is a target; vs. congruent triplets: TTT) elicited a smaller N200–P300 when displayed within the RSVP normally, but a larger N200–P300 when the RSVP item following the target triplet was removed. In both cases, conditions that led to a larger N200–P300 to the first target resulted in a greater deficit during the period of the attentional blink. We propose that conflict between targets and distractors recruits the locus coeruleus phasic response.

(5025)

**An Empirical Investigation of the Capture of Attention by Urgent and Nonurgent Alarms.** JESSICA K. LJUNGBERG, *Luleå University of Technology*, FABRICE B. R. PARMENTIER, *University of the Balearic Islands*, & JANE V. ELSLEY, *University of Plymouth* (sponsored by Fabrice B. R. Parmentier)—Studies aiming to establish what constitutes an efficient auditory alarm have used subjective ratings to measure perceived urgency. Such studies have suggested that words spoken urgently are rated as more urgent than words spoken nonurgently. The present study aimed to measure objectively the potency of alarms to capture attention away from a focal task, using a cross-modal oddball paradigm. Participants judged the parity of visual digits while ignoring task-irrelevant sounds. On most trials, a sine wave tone (standard) preceded each digit. On rare trials, the standard was replaced by a spoken word (novel). All novel words distracted participants from the visual task, with urgent alarms yielding faster response latencies than did nonurgent alarms. Subjective ratings confirmed that participants rated urgently spoken words as more urgent. Future work should examine whether our findings reflect perceptual differences between urgent and nonurgent novel words, or the speeding up of visual targets by urgent novel words.

(5026)

**Examining Exogenous and Endogenous Mechanisms of Temporal Attention.** MICHAEL A. LAWRENCE, RAYMOND M. KLEIN, & VINCENT M. LoLORDO, *Dalhousie University*—The differential allocation of information-processing resources over time, here termed “temporal attention,” may be achieved by relatively automatic “exogenous” or controlled “endogenous” mechanisms. Where past research has confounded these theoretically distinct dimensions of temporal attention, the present work seeks to ameliorate this oversight. Using a novel application of Rescorla’s “truly-random control” procedure, the present work examines the operation of exogenous temporal attention

while minimizing the contribution of endogenous processes. Using a novel application of interaural correlation, the present work also examines the operation of endogenous temporal attention while minimizing the contribution of exogenous processes.

(5027)

**Selective Attention in the Immediate Future Based on the Recent Past.** THOMAS G. HUTCHEON & DANIEL H. SPIELER, *Georgia Institute of Technology* (sponsored by Daniel H. Spieler)—Stroop congruency effects are influenced by variations in the proportion of congruent and incongruent trials. Congruency effects, defined as the difference in performance between incongruent and congruent conditions, increase as the proportion of congruent trials increases. When the proportion of congruent trials is manipulated for specific colors within a block of trials, while holding constant the proportion of congruent trials for the overall block of trials, a similar effect of condition proportions is found (Jacoby, Lindsay, & Hessels, 2003; Schmidt & Besner, 2008). That is, increasing the proportion of congruent trials a color is presented in is associated with increasing the congruency effect for that color. We use the exemplar-based random walk model (Nosofsky & Palmeri, 1997) to model the influence of such variations in condition proportions, and we extend this model to consider how local variations in stimulus experience is associated with local variations in performance.

(5028)

**Hand-Based Effects on Visual Attention: An ERP Study.** JOHN P. GARZA, *University of Denver*, CATHERINE L. REED, *Claremont McKenna College*, & KELLY A. SNYDER, *University of Denver*—Recent behavioral studies have investigated the importance of hand and arm position in visual attentional processes. Reed et al. (2006) found facilitated (faster) detection for targets that appear in the space near the hand, relative to targets appearing on the opposite side of a monitor display. In the present study, we replicate this effect in an ERP paradigm to examine possible neural mechanisms underlying this effect. Using a standard, nonpredictive visual-cuing paradigm, we compare ERPs to target presentations in a condition in which one hand is held up near a target with those in a condition in which the hand is just resting on the table. Early analyses suggest that validity effects in early visual components (P1, N1) are modulated by the positioning of the hand near the target. These results suggest that hand position can bias visual attention, consistent with a biased-competition model of attention.

(5029)

**Faster Moving Targets Are Detected Efficiently in Visual Search.** DAVID E. FENCSEK & LEIGHA V. WENDEL, *California State University, East Bay*, & JEREMY M. WOLFE & TODD S. HOROWITZ, *Harvard Medical School*—In a visual search among moving items, how does speed guide the deployment of attention? According to the absolute speed hypothesis, the fastest moving object in the environment is the most salient (Ivry & Cohen, 1992). According to the relative speed hypothesis, an object’s salience depends on the absolute difference between its speed and the average speed in the environment (Rosenholtz, 1999). We present a series of new experiments in which we test these two hypotheses. We presented participants with a display of drifting square-wave gratings that all moved in one direction. The search target moved either slower or faster than the other stimuli. Our results showed that the fastest moving object in the environment was the easiest to detect, supporting the absolute speed hypothesis over the relative speed hypothesis. The visual system appears to be biased toward faster moving objects at the expense of slower moving ones.

• ASSOCIATIVE PROCESSING •

(5030)

**Suggestion Modulates Cognitive Conflict.** IRVING KIRSCH, GIULIANA MAZZONI, & LINA AIMOLA, *University of Hull* (sponsored by Albrecht Inhoff)—We examined the effects of suggestion on the flanker compatibility effect. Participants screened for high levels of suggestibility performed the flanker compatibility task with and without a suggestion aimed at increasing the target’s discriminability from the flankers. Half

the participants were given this suggestion in hypnosis, and half were given the suggestion without the induction of hypnosis. Previous studies indicated that suggestions for perceptual alterations can reduce the Stroop effect in or out of hypnosis. In contrast, suggestion has been reported to modulate the flanker compatibility task only when the suggestion is given in hypnosis. Our present data show that suggestion substantially reduces the flanker compatibility effect both in and out of hypnosis, accounting for 25% of the variance in reaction times. These data indicate that hypnosis is not needed for suggestive modulation of cognitive conflict.

## (5031)

**Prospective Memory: Is Monitoring Necessary?** TYLER L. HARRISON & GILLES O. EINSTEIN, *Furman University*—On the basis of finding significant costs or slowing on an ongoing task with a highly salient target event (e.g., the person's name), Smith, Hunt, McVay, and McConnell (2007) concluded that prospective memory retrieval always requires capacity-consuming monitoring processes and cannot occur spontaneously. We replicated Smith et al.'s experiment but, in addition, included a condition in which we deemphasized the importance of the prospective memory task and emphasized the importance of the ongoing task. We found high prospective memory in the absence of costs or preparatory attentional processes in this condition, thereby arguing for the existence of spontaneous retrieval processes.

## (5032)

**Does Reflexive Attentional Orienting Speed Visual Processing by Biasing Visual Working Memory?** NASEEM AL-AIDROOS, MAHA ADAMO, SUSANNE FERBER, & JAY PRATT, *University of Toronto* (sponsored by Jay Pratt)—Recently it has been shown that one effect of volitional attention is to speed the encoding of stimuli into visual working memory (VWM; Brisson & Jolicoeur, 2008, *PLoS ONE*). In the present study, we examine whether reflexive attention can also produce this VWM bias. Reflexive visuospatial attention is measured through stimulus-driven cuing effects on reaction time (RT): Visual targets are reported more quickly when they appear at locations cued by irrelevant visual stimuli. Thus, in our study, we first tested whether individual differences in RT cuing effects are predictive of individual differences in VWM, as measured through a change-detection task. Second we used event-related potentials to test at what point during target processing RT cuing effects would emerge. On the basis of the results of these two tests, we conclude that reflexive attention speeds target processing by speeding VWM encoding.

## (5033)

**Endogenous Shifts of Attention Require Clearly Visible Cues.** WILFRIED KUNDE, *Dortmund University of Technology*, & HEIKO REUB & ANDREA KIESEL, *University of Würzburg*—Executive functions are thought to require consciousness and, therefore, should not be affected by unconsciously perceived stimuli (Jack & Shallice, 2001). We studied the effect of cue validity on endogenous shifts of attention while varying cue visibility and cue–target stimulus onset asynchronies in a visual search as well as a Posner cuing paradigm. In both experiments, a cue informed participants with a validity of 80% about the likely location of the target. In half of the trials, the cue was masked and presented for only 30 msec so that it did not reach consciousness. Significant effects of cue validity on reaction time were evident only with visible cues, but not with masked cues. Although recent studies using masked stimuli cast doubt on the exclusively conscious nature of executive functions (Lau & Passingham, 2007, van Gaal et al., 2008), this finding supports the view that endogenous shifts of attention depend on conscious processes.

## (5034)

**Selective Impairment of Masked Priming in Dual-Task Performance.** ANDREA KIESEL, *University of Würzburg*, RICO FISCHER, *Dresden University of Technology*, WILFRIED KUNDE, *Dortmund University of Technology*, MICHAEL P. BERNER, *University of Würzburg*, & TORSTEN SCHUBERT, *Ludwig Maximilian's University Munich*—Subliminal primes influence target processing in different ways. Primes that were also presented as targets activate responses according to acquired stimulus–response (S–R) links. Primes that were never presented as targets are supposed to activate responses because of

action triggers or semantic prime processing. Here, we investigated the impact of additional task load in a dual-task context on these two forms of masked priming. In a dual-task setting, target primes induced priming effects irrespective of whether the masked priming task was performed as a secondary task (Experiment 1) or as a primary task (Experiment 2). In contrast, in both experiments, novel primes were essentially ineffective. In a task-switching setting, in which both tasks were performed consecutively, novel and target primes revealed priming effects of equal size (Experiment 3). We conclude that dual-task-specific interference processes (e.g., simultaneous coordination of multiple S–R rules) selectively impair priming by novel prime stimuli.

## (5035)

**The Impact of Masked Primes When Learning Artificial Category Sets.** JASON R. PERRY & STEPHEN J. LUPKER, *University of Western Ontario*, & COLIN J. DAVIS, *Royal Holloway, University of London*—Participants learned to classify either four- or six-dimensional targets into one of two artificial categories. During learning, each target was preceded by a masked prime, either its own category prototype or the prototype of the opposite category. Subliminal priming effects emerged such that accurate responses were faster when the target was preceded by its own prototype. These results challenge Kiesel et al.'s (2009) claim that considerable expertise with the stimulus domain is a prerequisite for obtaining subliminal priming. These results also demonstrate that the masked category learning paradigm can contribute to on-going debates in both categorization and subliminal perception research. With respect to categorization research, the obtained priming effects support the view that early category learning performance involves prototype-based representations. With respect to subliminal perception research, this paradigm provides a means of investigating the mechanisms governing subliminal priming when any subliminal priming effects must be due solely to stimulus–response associations.

## • EXPLICIT MEMORY •

## (5036)

**The Cost of Remembering to Remember in a Nonverbal Task.** ANNA-LISA COHEN, *Yeshiva University*, ALEXANDER JAUDAS, *University of Konstanz*, EVAN HIRSCHHORN & YONI SOBIN, *Yeshiva University*, & PETER M. GOLLWITZER, *New York University and University of Konstanz*—A current focus in the prospective memory (PM) literature is the extent to which a prospective memory task interferes with ongoing activities. Cohen et al. (2008) revealed that participants treat an ongoing lexical decision task (LDT) very differently depending on whether they need to detect a PM word or a PM nonword target. Specifically, when a PM target was a word, reaction time costs were observed only on LDT word trials, and similarly, when a PM target was a nonword, reaction time costs were observed only on LDT nonword trials. In a recent experiment, we investigated whether the previous results could be replicated using nonverbal stimuli. Participants categorized figures as shapes or nonshapes. The results were in line with those from Cohen et al. exhibiting reaction time costs solely for shape trials when the PM target was also a shape (and the same for nonshape stimuli). Implications are discussed.

## (5037)

**Repeated Photo Refreshing and Product Identification.** TRENT TERRELL, *University of Mary Hardin-Baylor*—The efficacy of photo refreshing as a tool for “jogging” eyewitness memories continues to be an important topic for both criminal and civil law. Previous work from our lab has demonstrated that photo refreshing in product identification situations often produces inaccurate recollections—in some cases, identifications of digitally manipulated products that do not exist. The present research explored the effects of multiple refreshing and identification sessions, as might be experienced by plaintiffs while meeting with attorneys. Although the hypothesis that witnesses will identify whatever product was most recently refreshed was not wholly supported, initial refreshing with inaccurate products strongly diminished the ability for refreshing with correct products to jog true memories. This reinforces previous findings that photo refreshing in product situations improves performance only when photos are presented almost immediately with few distractors.

(5038)

**Memory and Identification Accuracy for Individuals From Missing Person Flyers.** MICHELLE M. ARNOLD, *University of St Andrews* (sponsored by Ines Jentzsch)—Missing person identification has been largely overlooked, but examining memory for missing individuals is essential because (1) the majority of cases are publicized exclusively through the use of flyers, and (2) the context surrounding this type of identification is markedly different from existing memory/identification paradigms. Two experiments were conducted to explore whether identification accuracy would be affected by the type classification label given on the missing person flyer (abduction, voluntary missing, or no label) and the placement of this label (under picture vs. bottom of flyer). Participants rated several missing person flyers on various dimensions (e.g., “Overall, how informative do you think this particular flyer is?”) and subsequently completed a surprise memory test for the individuals from the flyers. The results demonstrated that the type of label affected identification accuracy, but that this effect was moderated by gender of the missing person and placement of the label.

(5039)

**Analogical Resemblance Can Cue Recognition Without Recall of Source Analogies.** BOGDAN KOSTIC & ANNE M. CLEARY, *Colorado State University*—Prior research suggests that analogical resemblance can cue recall of the source analogy (Wharton, Holyoak, & Lange, 1996). The present study examined whether analogical resemblance can cue recognition in the absence of recall (Cleary, 2004). Three experiments examined whether analogical relationships between pairs of words (e.g., ROBIN:NEST::BEAVER:DAM) would produce recognition without recall of the source analogy. In Experiment 1, pairs of words with specific relationships (e.g., ROBIN:NEST) were presented at study. At test, participants were presented with mixtures of “old” word pairs that analogically mapped onto studied pairs (e.g., BEAVER:DAM) and “new” word pairs that did not. Experiments 2 and 3 examined the effects of explicitly stating the relationships at study or at test. In all three experiments, recognition without recall was obtained, such that even when cued recall of analogically similar pairs failed, participants discriminated between test pairs that mapped onto studied pairs and test pairs that did not.

(5040)

**Collaboration and Category Size: Benefits on Individual Recognition.** LUCIANE P. PEREIRA-PASARIN, *Caldwell College*, & SUPARNA RAJARAM, *Stony Brook University*—The present study examined the effects of collaboration on individual veridical recognition. Building on previous work (Rajaram & Pereira-Pasarin, 2007), the goal was to determine whether collaboration is harmful or beneficial when study information varies from conditions that produce low error (small categorized lists) to high error (large categorized lists) without using confederates or materials that induce false memory for specific items. Participants studied lists of equal item length that varied in category size for the targets (large, 12 exemplars; small, 2 exemplars). Collaboration improved individual recognition, and large category size decreased it. Critically, the benefit of collaboration on individual recognition extended to both the small and large category size conditions, and it was driven by a significant reduction in false alarms. This study provides the novel contribution that under conditions of both low and high association among events, collaboration boosts individual recognition by curbing the propensity for false alarms.

(5041)

**Assessing Episodic and Semantic Contributions in Serial Recall.** PERNILLE HEMMER, MARK STEYVERS, & BRENT MILLER, *University of California, Irvine* (sponsored by Mark Steyvers)—Prior knowledge and expectations about events exert a strong influence on recall for the order of events. In one experiment, we tested serial recall using both highly stereotyped and novel idiosyncratic event sequences. In a separate experiment, we measured the prior knowledge that people have about the order of events in these sequences. This norming information allows us to estimate the degree to which people rely on prior knowledge in episodic serial recall. We find that for some event sequences, performance is driven primarily by prior knowledge. We applied a number of existing serial recall models to the data. We also developed some

modeling extensions that integrate episodic information as well as prior knowledge for serial recall. These models demonstrate how prior knowledge can be used to eliminate a large number of candidate orderings, which allows the memory system to focus on the plausible orderings.

(5042)

**It's Not Who You Are, But What You Have: Survival Processing for Nouns Versus Traits.** J RUDINE, CURTIS CRAIG, RANDY W. OVERBEEK, & KYLE GREEN, *Texas Tech University* (sponsored by Ruth H. Maki)—The present study further examined the recent adaptive processing findings in which processing words with a survival scenario results in enhanced memory for those words. Participants were asked to rate three lists of words using a survival, self-description, and pleasantness rating task. For half of the participants, the lists were composed of nouns (as in previous studies of adaptive processing), whereas the other half of participants rated lists of traits. Afterward, participants received a surprise recall test over the previously rated words. In line with previous studies on adaptive processing, the survival processing task produced significantly better memory when nouns were used. Contrary to previous findings, however, there were no differences in recall between the three rating tasks when participants were rating traits. These results suggest potential limits on survival processing, and implications of the findings for adaptive processing will be discussed.

(5043)

**The Pupil Old/New Effect in Veridical and False Recognition Memory.** SAMUEL B. HUTTON, SAMANTHA OTERO, & BRENDAN S. WEEKES, *University of Sussex* (sponsored by Brendan S. Weekes)—Research has identified a pupil old/new effect: Our pupils dilate to a greater extent when we are presented with previously studied (old) items, as compared with new items. It is not yet clear what specific memory processes give rise to this effect. Using the remember-know procedure, we found that the effect was greater for items that were consciously recollected, as opposed to those that were known. We replicated the effect for auditory stimuli, ruling out any explanation of the effect based purely on visual processing. In addition, the pupil old/new effect was greatest for items that were initially encoded with a semantic orienting instruction, as compared with those encoded with a more surface orienting instruction. Using a modified Deese/Roediger-McDermott task, pupil size also increased when participants made false *old* responses. We conclude that the pupil old/new effect reflects a combined strength of memory signal.

(5044)

**The Eyes Have It: Using Eye Movements to Measure Eyewitnesses' Relative Judgment Behavior.** MATTHEW P. GERRIE & THOMAS HUTHWAITE, *Victoria University of Wellington* (sponsored by Todd C. Jones)—Eyewitness identification errors are the leading cause of wrongful conviction. The primary explanation for these errors is that eyewitnesses rely on relative judgments; they pick the person from the lineup that most resembles the offender, relative to the others in the lineup (Wells, 1984; Wells & Loftus, 2003). These relative judgments are characterized by comparing the faces in the lineup. In three experiments, we present data suggesting that people's eye movements can be used as a proxy measure of relative judgment behavior. We measured subjects' eye movements while we showed them photos of offenders, then asked the subjects to pick the offenders out of lineups. Using eye movements, we could directly observe the subjects comparing among the faces in the lineup. Furthermore, these comparisons were negatively correlated with identification accuracy. These data provide a novel method for investigating eyewitness identification strategies.

(5045)

**Part-Set Cuing Effects Suggest Limitations on Eyewitness Interviewing Techniques.** WILLIAM A. COKER & DANIEL R. KIMBALL, *University of Oklahoma* (sponsored by Daniel R. Kimball)—The cognitive interview attempts to optimize eyewitness recall by applying cognitive principles. One of its suggestions is to ask direct, closed-ended questions following an initial free recall attempt. Such questions resemble part-set cues—element(s) of the to-be-recalled set that are provided as cues during recall. However, part-set cuing of word lists tends to impair



recall. The present experiment uses part-set cuing of scenes to explore the mechanisms underlying this aspect of the cognitive interview. Participants studied six real-world scenes and attempted free recall. Half the participants then attempted free recall again; the other half was given a part-set cue from each studied scene during this second recall session. Three key findings emerged: Cuing facilitated or impaired recall, depending on whether the cue provided access to a previously unrecalled scene or not; cuing increased overall intrusions; and cuing reduced overall accuracy. These findings suggest limitations on postrecall, closed-ended questioning of eyewitnesses.

(5046)

**Presentation Rate and False Recall: The Roles of Attentional and Rehearsal Limitations.** TROY A. SMITH & DANIEL R. KIMBALL, *University of Oklahoma*, & MARTHA MANN, *University of Texas, Arlington*—For associative lists, as the presentation rate during study slows, veridical recall increases monotonically, whereas false recall increases across rapid presentation rates and then decreases across slower presentation rates. McDermott and Watson (2001) interpreted this dissociation as key evidence favoring the activation-monitoring account of false memory, with automatic spreading activation being initially unchecked, then countered by improved monitoring as presentation slows. Research using rapid serial visual presentation suggests an alternative explanation for this dissociation based on attentional and rehearsal limitations. In three experiments, we presented associative lists at rates varying from 60 to 1,050 msec, in steps of 90 msec. We observed the expected dissociation between veridical and false recall, but serial position effects and conditional recall probabilities were more consistent with attentional blink and rehearsal limitations than with activation monitoring. These findings are consistent with predictions of the fSAM model of recall (Kimball, Smith, & Kahana, 2007).

(5047)

**The Costs and Benefits of Repeated Testing: Repeated Retrieval Enhances Eyewitness Suggestibility.** JASON C. K. CHAN & JESSICA KLOEPPEL, *Iowa State University*—Eyewitnesses typically recount their experience many times before trial. Such repeated retrieval can enhance memory retention of the witnessed event (Wheeler & Roediger, 1992). However, a recent study by Chan, Thomas, and Bulevich (2009) found that encountering misleading postevent information after initial retrieval can increase eyewitness suggestibility. But what are the implications of multiple retrieval attempts on subsequent eyewitness susceptibility to misinformation? In three experiments, we systematically varied the number of initial tests taken, the amount of delay between initial testing and misinformation exposure, and whether initial testing was manipulated between or within subjects. Overall, we found an increase in eyewitness suggestibility as the number of initial tests increased.

(5048)

**Characterizing Age-Related Differences in Remembering the Past and Imagining the Future.** BRENDAN GAESSER & DANIEL SACHETTI, *Harvard University*, DONNA ROSE ADDIS, *University of Auckland*, & DANIEL L. SCHACTER, *Harvard University* (sponsored by Daniel L. Schacter)—Addis, Wong, and Schacter, (2008) recently reported strikingly similar age-related deficits for remembering past events and imagining future events. It is unknown, however, whether these effects reflect age-related changes in memory or in more general processes such as narrative style. We conducted two experiments using an adapted version of the Autobiographical Interview in which young and older adults imagined future events, remembered past events, or described complex pictures of people engaged in a set of activities. Consistent with previous findings, older adults produced fewer episodic details than did younger adults in both the memory and imagination conditions. However, they showed a similar deficit in the picture description condition. Moreover, after controlling for picture description ability, age-related deficits in memory and imagination were small. These results suggest that age differences in constructing past and future events on the Autobiographical Interview are not specifically attributable to age-related memory deficits.

(5049)

**Context-Dependent Effect of False Memory.** TOMOHIRO NABETA, *Kyoto University*—The present study investigated the effect of background context on false recognition. Sixty participants learned 12 lists of 15 words associated with a critical lure not presented during the learning phase. The words were presented in the context of a background that changed according to the list. The background context of the critical lure was manipulated across different participants: (1) same context test, in which critical lures were presented within the same context as the list to be learned; (2) different context test, in which critical lures were presented within the context of different lists to be learned; and (3) new context test, in which critical lures were presented within a new context. The results showed that false recognition in the same context test was greater than in the other two conditions, suggesting that participants formed and recollected memory traces, in which the critical lure was integrated into the background context of the learning list.

(5050)

**Testing During Learning Facilitates Encoding of New Information.** BERNHARD PASTÖTTER & KARL-HEINZ BÄUML, *University of Regensburg*—In multiple-list learning, immediate testing of a previously studied item list enhances retention of a subsequently studied list. To account for this finding, immediate testing has been suggested to promote list segregation, thus reducing cue overload and proactive interference at final testing. Employing electrophysiological measurements of brain activity, we examined whether immediate testing already affects the encoding of subsequently studied information. Consistent with prior work, we found beneficial effects of immediate testing on retention of newly encoded information. Going beyond the prior work, we found effects of immediate testing on neural activity during the encoding of new information. This neural effect was predictive of the beneficial effect of immediate testing. The results suggest that effects of immediate testing are not restricted to the retrieval stage but are already present at encoding.

(5051)

**I Remember Him (But Not Her) Being Funny.** LAURA MICKES, JASON J. JONES, DREW E. HOFFMAN, & JOHN T. WIXTED, *University of California, San Diego* (sponsored by John T. Wixted)—There is a common conjecture among the lay public that females are not as funny as males. To test whether a memory bias might contribute to this impression, we tested source memory for the gender of a joke teller. Subjects read 24 jokes, 12 told by an imagined female and 12 by an imagined male, and the funniness of each was rated on a 7-point scale. Overall, funniness ratings were similar for male and female joke tellers. On a later memory test, subjects rated the confidence of their memories for the source (was the joke teller male or female?) on a 6-point scale. At retrieval, male subjects (but not female subjects) tended to remember the least funny jokes as having been told by a female. This apparent retrieval bias on the part of males may help to explain why some believe that females are not as funny as males.

(5052)

**A Review of Supranormal Aging Effects in Amnesic Patient H.M.** LORI E. JAMES, *University of Colorado, Colorado Springs*, & DONALD G. MACKAY, *UCLA*—We review results from several longitudinal and cross-sectional experiments testing relations between aging and memory in amnesic H.M. Control participants included memory-normal adults carefully matched with H.M. for age, IQ, and background. Tasks involved lexical decisions, providing definitions, reading aloud, picture naming, and spelling. For all tasks, H.M. exhibited deficits relative to controls in processing low-frequency (LF) but not high-frequency information. To evaluate effects of aging, we compared H.M.'s deficits with those found in earlier studies using similar or identical stimuli. H.M. experienced exacerbated effects of aging from age 57 to 73. H.M. exhibited supranormal (i.e., greater-than-normal) age-linked retrograde amnesia for previously familiar LF phonological, orthographic, and lexical-semantic information, consistent with interactions between aging and amnesia predicted under binding theory.

(5053)

**The Hippocampus Is Involved in Mental Navigation for Recently Learned, but Not Highly Familiar Environments.** MARNIE HIRSH-HORN & MORRIS MOSCOVITCH, *University of Toronto and Rotman Research Institute*, CHERYL GRADY, *Rotman Research Institute*, R. SHAYNA ROSENBAUM, *York University and Rotman Research Institute*, & GORDON WINOCUR, *Rotman Research Institute* (sponsored by Meredyth Daneman)—Functional magnetic resonance imaging was used to investigate the hypothesis that memory for a large-scale environment is initially dependent on the hippocampus but is later supported by extra-hippocampal structures (e.g., precuneus, posterior parahippocampal cortex, lingual gyrus) once the environment is well-learned. Participants were scanned during mental navigation tasks initially when they were newly arrived to the city of Toronto, and later after having lived and navigated within the city for 1 year. In the first session, activation was observed in the right hippocampus, precuneus, and medial frontal gyrus. The second session revealed activation in the precuneus and medial frontal gyrus, but not in the right hippocampus; additional activation was instead observed in the posterior parahippocampal cortex and lingual gyrus. These findings suggest that the right hippocampus is required for the acquisition of new spatial information but is not needed to represent this information when the environment is highly familiar.

(5054)

**Does Item Typicality Affect Memory for Life Script Events?** JUSTIN T. COLEMAN & ROBERT F. BELLI, *University of Nebraska, Lincoln* (sponsored by Robert F. Belli)—Recently, a life scripts account has increasingly been utilized to explain the structure of autobiographical memory recall. However, it has never been directly tested whether life scripts exist. If individuals possess life scripts for the normative timing and order of life events, then ostensibly, the classical effects found in memory experiments for other types of scripted information should generalize to that for life scripts. The present research examines the effect of typicality on memory for life script events. Participants listened to scripted stories outlining events in the lives of two characters—one young and one old. Recognition memory was tested immediately and 24 h later. Participants were more likely to correctly recognize atypical items than typical items and more likely to recognize falsely typical items than atypical ones. These results demonstrate that as with other types of scripted information, item typicality affects memory for life script information, and that life scripts are represented in memory.

(5055)

**Interruptions in the Emergency Room.** BENJAMIN SWETS, *Grand Valley State University*, & NANCY FRANKLIN, *Stony Brook University*—Although interruptions are generally regarded as disruptive—especially those requiring individuals to disengage from a task—it is possible that in highly complex task environments, both task-relevant and task-irrelevant interruptions serve an adaptive function to supplement limited memory resources. For example, ER physicians juggling several patients might need interruptions to serve as timely reminders to reengage with suspended tasks. We present data from the first phase of a multiphase project aimed at understanding how interruptions affect performance of physicians in ER environments. In this first phase, experimenters shadowed 15 doctors as they made rounds throughout a busy ER unit. We noted all task-relevant and task-irrelevant interruptions, sources of interruptions, and experience levels of physicians. Interruptions were frequent and typically diverted the physicians' attention to issues that did not concern the case in which he or she was immediately engaged. The potential necessity of such interactions will be discussed.

(5056)

**Adaptive Memory Advantage for Ancient Versus Modern Phobias.** SERGE V. ONYPER, ALAN SEARLEMAN, AMANDA B. PENDERGRASS, & RACHEL MANCHESTER, *St. Lawrence University*—Evolutionary psychologists argue that our memory processes have evolved to be sensitive to aspects of the environment that would help increase reproductive fitness—a concept known as adaptive memory. Recently, several studies have reported that participants are more likely to recall words previously related to a survival scenario when compared with many other

well-known encoding techniques. The present experiment extended the phenomenon of adaptive memory to ancient and modern phobia situations. Participants rated 30 common nouns for their relevance to a phobia scenario. The mean number of words recalled in a surprise memory test revealed a significant memory advantage for the ancient phobia conditions (the snake and heights/falling scenarios), as compared with the modern phobia of public speaking. In addition, significantly more words were recalled for those who also saw a phobia-related picture when rating the words for relevance to a particular scenario.

(5057)

**Prospective Memory Across Sleep and Wake Delays.** MICHAEL K. SCULLIN & MARK A. McDANIEL, *Washington University* (sponsored by Gilles O. Einstein)—Laboratory-based prospective memory tasks have rarely examined the effect of retention interval on later remembering. In the present study, participants had to remember to perform an intended action after a short delay (approximately 20 min), a 12-h wake delay, or a 12-h sleep delay. The results demonstrated a large decline in prospective memory performance after a 12-h wake delay (relative to the short-delay condition). Interestingly, not only was prospective remembering better following a 12-h sleep delay than following a 12-h wake delay, but performance in this condition did not differ significantly from performance in the short-delay condition. Similar results obtained for a free recall test but not for a test of working memory. The results are discussed in relation to theories of prospective memory retrieval and sleep-dependent memory consolidation.

(5058)

**Memory and Interference in a Value-Based Encoding Task.** MICHAEL C. FRIEDMAN & ALAN D. CASTEL, *UCLA*—It is often necessary to remember important information while directing attention away from encoding less relevant information. This is critical in various memory tasks, in which remembering high-value items can enhance performance, and this requires goal maintenance. To test this, participants studied words paired with the same high and low point values for three similar study–test cycles, but on the fourth and subsequent cycles, the value–word pairings were switched such that the lowest value pairs became the highest values (and vice versa). Participants displayed value-based switch costs, such that interference from the previous pairings impaired performance on the first switched list, but also eventually showed recovery. This was also shown in a second experiment, in which positive and negative values were used to determine how participants monitored retrieval. The findings are interpreted in a value-directed remembering framework, emphasizing the role of value-based encoding operations and interference in memory.

(5059)

**Retroactive Interference: Evidence of Elicited Effects and Strategic Coping With Divided Attention at Retrieval.** DENNIS J. DELPRATO, *Eastern Michigan University*—Frontal-lobe-damaged patients and elderly persons seem to be even more susceptible than students to memorial interference, although interference effects are rarely complete. When a cue's initial target is replaced by a second target for study and participants are subsequently tested for how well they remember the cue's first target in a retroactive interference (RI) experiment, substantial retention of the first-studied cue–target pair is obtained. A compound hypothesis was tested: (1) Elicited (“automatic”) processes/responses at test are significant sources of interference, (2) students, more so than frontal patients and older persons, use self-initiated strategies to override at least some elicited interference, and (3) divided attention (DA) functionally detracts from students' ability to use coping strategies that require prefrontal participation. RI of students' cued recall under full attention was amplified by concurrent tone-tracking DA tasks at test. Two different forms of the DA task impaired retrieval under both low- (baseline) and high-interference conditions.

(5060)

**Arousal-Enhanced Recollection and Familiarity: Evidence From ROCs and Remember–Know Judgments.** HOLLY J. BOWEN, RONAK PATEL, & JULIA SPANIOL, *Ryerson University*—Recent research suggests that enhanced recognition of emotional information

reflects response bias rather than enhanced memory (Dougal & Rotello, 2007; Kapucu et al., 2008). However, this research has focused on the valence dimension of emotion, on immediate rather than delayed recognition, and on low-arousing verbal stimuli. The goal of the present study was to examine whether response bias would also account for the effects of emotional arousal on delayed recognition of pictorial stimuli. Participants viewed 180 high-arousing and 180 low-arousing images. Twenty-four hours later, they completed a recognition test, providing confidence ratings and remember-know judgments. Arousal boosted hit rates and “remember” rates but not false alarm rates. Model-based analyses of confidence receiver-operating characteristics and remember-know responses revealed that arousal enhanced both recollection and familiarity, without inducing a more liberal response bias. These findings suggest that emotional enhancement of delayed recognition memory is “real,” at least when stimuli are highly arousing.

#### • WORKING MEMORY •

##### (5061)

**Probabilistic Models of Change Detection and Multiple-Object Tracking: How Is Working Memory Allocated in Attentionally Demanding Tasks?** TIMOTHY F. BRADY, EDWARD VUL, & JOSHUA B. TENENBAUM, *MIT*—Memory is limited and therefore must operate strategically in the context of specific tasks. In multiple-object tracking, the role of memory is to maintain a record of previous object locations and trajectories, but all of this information cannot be recorded with infinite precision; therefore, some objects should be remembered more precisely than others, depending on predicted future task demands. We show that an optimal, strategic allocation of a limited memory resource can account for the trade-off between object speed and the number of objects that humans can track. We also present a probabilistic model of change detection that formalizes the encoding of items into visual working memory. Our model suggests that observers encode both specific items and higher order information about a display and allows us to predict the difficulty of detecting changes in particular visual working memory displays. Both models help formalize the need to allocate memory space to task-relevant items to take advantage of limited memory resources.

##### (5062)

**Accessing Large Capacity and Durable Representations During Change Detection.** MELISSA R. BECK & AMANDA E. VAN LAM-SWEERDE, *Louisiana State University*—Change detection tasks may underestimate the capacity of visual working memory (VWM). Recent research supports the possibility of a large capacity, volatile representation in VWM based on improved change detection performance when a retro-cue is presented during the interstimulus interval between the study and test image, but not when the retro-cue is presented concurrently with the test image. The present research demonstrates that with longer encoding times, a retro-cue concurrent with the test image can lead to improved change detection performance. A retro-cue effect was found with a 2,000-msec presentation of the study image, but not with a 500-msec presentation. Furthermore, the increase in presentation time improved performance on retro-cue trials preferentially to performance on no-retro-cue trials. This demonstrates that there is a larger capacity, durable representation formed with increased encoding time. Furthermore, the extra capacity gained from increased encoding time is less accessible than the representations formed during the shorter encoding time.

##### (5063)

**Math, Working Memory, and Math Anxiety Effects.** JEREMY A. KRAUSE, NATHAN O. RUDIG, & MARK H. ASHCRAFT, *University of Nevada, Las Vegas* (sponsored by Mark H. Ashcraft)—We continue to investigate the extent to which math anxiety disrupts performance in arithmetic and math tasks. In Experiment 1, participants solved two-column subtraction problems in a dual-task setting. As the load on working memory increased, due to borrowing and the secondary task, errors increased especially strongly for the high math anxiety group. In Experiment 2, multistep arithmetic problems were presented. Again, the higher anxiety groups' performance suffered (response times and errors) as problem size and the number of problem steps increased. Experiment 3

tested a novel, difficult math task (modular arithmetic). High-anxious participants required eight blocks of practice to achieve the speed and accuracy demonstrated by the low group on Block 1. All math anxiety effects were consistent with the explanation that math anxiety consumes working memory resources during problem solving.

##### (5064)

**Working Memory Span Predicts Focal and Nonfocal Prospective Memory Performance Equally.** BENJAMIN A. MARTIN, *Louisiana State University*, JILL T. SHELTON, *Washington University*, & NOELLE L. BROWN, EMILY M. ELLIOTT, & JASON L. HICKS, *Louisiana State University*—We studied working memory (WM) span as a predictor of event-based prospective memory (PM). Participants received either categorical PM instructions (press a special key when you encounter an animal word) or specific instructions (press a special key when you encounter the words SHEEP or RABBIT). A visual lexical decision task was used as the ongoing task and represented the primary focus of attention. In addition, words were presented over headphones simultaneously with the presentation of visual stimuli. Visual PM cues under the specific instruction (i.e., focal intentions) were predicted to rely less on WM span, as opposed to auditory cues under the categorical instruction (i.e., nonfocal intentions). Visual cues were detected more frequently than auditory cues. Those with higher WM spans detected more cues than did those with lower WM spans, but regardless of both instruction and modality. WM span was an equally good predictor of focal and nonfocal PM performance.

##### (5065)

**The Effect of Dehydroepiandrosterone (DHEA) on Verbal Short-Term Memory.** BETHANY STANGL, *George Washington University*, ELLIOT HIRSHMAN, *University of Maryland, Baltimore County*, & JOSEPH VERBALIS, *Georgetown University*—This experiment investigated the effects of dehydroepiandrosterone (DHEA) on verbal short-term memory in postmenopausal women. We used a double-blind, placebo-controlled, within-participants crossover design in which participants were assigned to receive DHEA or a placebo. We administered 50 mg of oral DHEA or placebo daily for 4 weeks to manipulate steroid levels. Participants were 46 healthy postmenopausal women, 55–80 years old, who met the World Health Organization's criterion for postmenopausal status. These women were not currently on hormone replacement therapy. The results of our study demonstrated significantly higher serum levels of DHEA, DHEAS, androgens and estrogens in the DHEA condition relative to the placebo condition. However, there were no beneficial effects of DHEA on verbal short-term memory tests. In contrast to anecdotal reports of DHEA's beneficial effect on short-term memory functioning, these results raise significant questions regarding the efficacy of DHEA administration in enhancing verbal short-term memory in postmenopausal women.

##### (5066)

**Dual-Task Interference in Working Memory Is Asymmetric.** CANDICE C. MOREY, ANDREA WINKENS, & MADELEINE VAN DER REIJDEN, *University of Groningen*—Previous research shows that interference between the storage of verbal and visuospatial information can occur even though separate storage resources are posited for these materials. A challenging verbal memory load can impair performance on a visuospatial task (Morey & Cowan, 2004, 2005), but is there a comparable effect of increasing visuospatial memory loads on a verbal memory task? In a series of experiments, we manipulated the size of the memory load in concurrent verbal and visuospatial tasks, using Cowan and Morey's (2007) cuing procedure to isolate the sources of interference. We consistently observed decreases in accuracy on visuospatial memory tasks as verbal memory load increased, but verbal memory performance did not significantly decrease with increased visuospatial memory load in either serial recall or cued recognition tasks. These findings suggest that domain-specific verbal and visuospatial components of working memory differ in their reliance on domain-general resources.

##### (5067)

**Collaborative Recall of Social Information.** MATTHEW R. KELLEY, *Lake Forest College*, MATTHEW B. REYSEN, *University of Mississippi*, & AMIE JONES, MURA DOMINKO, & NATALIE TALBERT,



*Lake Forest College*—Two experiments explored the influence of social information on individual and collaborative memory performance. A recent pilot study, using passages by Mesoudi, Dunbar, and Whitten (2006), suggested that collaborative inhibition may have been eliminated when the participants were asked to recall social information. However, near-ceiling performance and confounds in the passages made the pilot inconclusive. Experiment 1 addressed both problems and showed that although gossip recall exceeded nongossip recall, collaborative inhibition remained. Experiment 2 explored the influence of gossip and interest in collaborative recall. The results and implications are discussed.

(5068)

**What Is Lost, and What Is Retained, When Memory Is Overloaded?** PHILIP BEAMAN, *University of Reading* (sponsored by Ian Neath)—Three experiments examined the retention of different types of information in immediate verbal recall tasks. Experiments 1A and 1B showed that measures of the mean item information recalled increase with memory load, whereas proportion measures of item information decrease. Mean serial position information initially increases and then remains stable. Experiment 2 showed that mean recall of relative order information, like item information, increases with memory load, and Experiment 3 demonstrated that increased rehearsal does not account for the increase in item information retained with free recall. Rather, in free recall, the list-length effect is predicted by temporal discriminability in the absence of rehearsal. It is concluded that temporal discriminability is used to distinguish items in longer lists but is insufficient to allow reconstruction of exact positional information, resulting in the relative retention of item and relative order information and the loss of serial position information when memory is overloaded.

(5069)

**Do Verbal and Visuospatial Processes Share a Domain-General Resource?** EVIE VERGAUWE & PIERRE BARROUILLET, *University of Geneva*, & VALÉRIE CAMOS, *Université de Bourgogne and Institut Universitaire de France* (sponsored by Valérie Camos)—Many theories propose that human information processing is supported by domain-specific resources, with the extent to which two activities can be performed concurrently depending on the nature of the information involved in both activities. In particular, distinct resources are assumed to underlie verbal and visuospatial activities, resulting in interference between two verbal or two visuospatial activities, but in little or no interference between verbal and visuospatial activities. The present study examined trading relations in dual-task situations in which participants maintained verbal or visuospatial information while concurrently processing either verbal or visuospatial information. The cognitive load of concurrent processing was manipulated, and results revealed that both verbal and visuospatial recall performance decreased as a direct function of increasing cognitive load, regardless of the nature of the information concurrently processed. The observed trade-off relations suggest strongly that verbal and visuospatial activities compete for a common domain-general pool of resources.

(5070)

**A Mechanistic Role of Attention in Working Memory in Posterior Parietal Cortex.** INGRID R. OLSON & MARIAN BERRYHILL, *Temple University*—Converging evidence from single-unit recordings, neuroimaging, and neuropsychology indicates that the posterior parietal cortex (PPC) plays a role in working memory (WM). However, the mechanistic role of this region in WM remains elusive, with suggested functions ranging from modality-specific buffers to WM manipulation. Here, we present lesion data from a large number of studies, varying stimuli, delay, and other task conditions. The results show that when patients with PPC lesions were prohibited from using an active strategy to sustain the memory trace (e.g., rehearsal), memory performance became abnormal. When the patients could use active rehearsal, WM was normal. These findings indicate that the PPC does not have a critical role in WM encoding or as a limited capacity store but, rather, is critically involved in a type of memory maintenance that relies on central attention or attentional shifting.

(5071)

**The Phonological Similarity Effect: A Hint for Maintenance Mechanisms Interplay in Working Memory.** GEROME MORA, *Université*

*de Bourgogne*, PIERRE BARROUILLET, *University of Geneva*, & VALÉRIE CAMOS, *Université de Bourgogne and Institut Universitaire de France*—Whereas in Baddeley's working memory model (Baddeley, 1986), the maintenance of verbal information depends on the availability of an articulatory rehearsal mechanism, within the time-based resource-sharing model (Barrouillet et al., 2007), it depends on an attentional refreshing mechanism. The interplay of these two mechanisms was investigated in two experiments, one in adults and one in 7-year-old children. In both experiments, the phonological similarity of the words to remember, the articulatory suppression (AS), and the attentional load of concurrent processing were manipulated within a complex span paradigm. The results replicated the classic effects of phonological similarity, AS, attentional load, and the similarity  $\times$  AS interaction. More interestingly, similarity and AS never interacted with attentional load. Such findings are in agreement with our claim of independence of the two mechanisms of maintenance for verbal information, which could then be separately or jointly involved in maintenance.

(5072)

**Motor Programming Disrupts Verbal Maintenance.** SOPHIE PORTRAT, *University of Geneva*, VALÉRIE CAMOS, *Université de Bourgogne and Institut Universitaire de France*, & PIERRE BARROUILLET, *University of Geneva* (sponsored by Anik De Ribaupierre)—Executive control is related to high-level processes implicated in complex cognitive activities. However, recent studies indicate that premotor regions of the prefrontal cortex (PFC) underlie sensory control as first stage of a hierarchical cascade of control. Our study comprised a computer-paced complex span task usually used to assess working memory. Adults had to maintain to-be-recalled letters while performing a location judgment task. The results show that increasing the demand of programming the motor response in the location task by increasing the complexity of the movement to press keys has a disruptive effect on recall performance. Moreover, this effect is akin to the effect of other attention-demanding processes. These results, which strongly suggest that any task involving executive control can disrupt concurrent maintenance, not only are in line with the architecture of the PFC, but also enlighten the dynamic functioning of working memory within the time-based resource-sharing model (Barrouillet et al., 2007).

(5073)

**The Downside of Attentional Control: When Working Memory Capacity Overshadows Insight.** MARCI S. DECARO, *Miami University*, MAREIKE WIETH, *Albion College*, & SIAN L. BEILLOCK, *University of Chicago*—In problem solving, higher working memory (WM) capacity enables complex problem-relevant information to be held online while seemingly irrelevant information is inhibited. However, associatively driven problem solutions that operate largely outside WM might sometimes benefit performance. We show that higher WM leads to more accurate problem solving when solutions depend on explicit step-by-step reasoning processes (incremental problems). However, when problem solving requires abandoning initial solution strategies and, instead, adopting associatively driven approaches (insight problems), higher WM capacity actually hinders performance. Moreover, asking participants to talk out loud during insight problem solving—bringing problem steps into explicit attentional focus—drops lower WM performance down to that of higher WM. Although the ability to focus attention helps incremental problem solving, it can lead higher WM to overshadow associative approaches needed for some types of creative problem solving. Lower WM can be led to look like higher WM, but counterintuitively, this may not benefit performance.

(5074)

**Semantic Effects on Serial Ordering in Verbal Working Memory: Evidence From a Novel Dual-Task Paradigm.** DANIEL J. ACHESON, MARYELLEN C. MACDONALD, & BRADLEY R. POSTLE, *University of Wisconsin, Madison* (sponsored by Bradley R. Postle)—Phonological representation has long been considered the sole linguistic level over which information is maintained in verbal working memory (WM); however, mounting evidence suggests that semantic representations also affect performance. This study used a novel dual-task paradigm to explore whether semantic representations influence serial ordering in

verbal WM. Participants engaged in two picture judgment tasks while simultaneously performing delayed serial recall on material varying in semantic content: concrete, abstract, and nonword lists. Picture judgments varied in the extent to which they required accessing visual semantic information (i.e., semantic categorization vs. line orientation judgments). The results showed that, relative to line orientation judgments, engaging in semantic categorization judgments increased item ordering errors for concrete lists and phoneme intrusion errors for abstract lists but did not affect error proportions for nonword lists. These results support accounts of WM in which maintenance is achieved via repeated interaction across multiple levels of linguistic representation.

(5075)

**Improving Fluid Intelligence by Training Working Memory—Single *n*-Back Is As Effective As Dual *n*-back.** SUSANNE M. JÄGGI, *University of Michigan*, BARBARA STUDER, *University of Bern*, MARTIN BUSCHKUEHL & JOHN JONIDES, *University of Michigan*, YI-FEN SU, *National Taiwan Normal University*, & WALTER J. PERRIG, *University of Bern*—In a previous study, we found that both dual and single *n*-back task performance predicts fluid intelligence (Gf). As we also demonstrated transfer to Gf after training on dual *n*-back, we hypothesized that a single *n*-back intervention should be as effective as training on dual *n*-back. To that end, we trained two groups of Taiwanese students for 4 weeks with either a single or a dual *n*-back intervention. We investigated transfer effects on Gf, comparing the two training groups' performance with that of no-contact controls. Our results showed that both training groups improved more on Gf than did the no-contact controls, thereby replicating our prior results, but also extending them by showing that single *n*-back training is equally effective. This study opens a wider range of application for our training approach, since the single *n*-back paradigm could be used for participant samples for which the dual *n*-back paradigm might be too complex.

(5076)

**Further Defining Affective Working Memory.** WILLIAM C. DEFRAINE & DALE DAGENBACH, *Wake Forest University*—Selective interference methods have been used to provide evidence of an affective working memory rehearsal component. However, this recent research has solely examined working memory for negative affect. It remains to be shown whether affective working memory is a single rehearsal component or is separable into valence-specific subcomponents, as some other findings have suggested. The present study tested the hypothesis that affective working memory is a single, affective-arousal-based component, using selective interference methodology. Positive affective, negative affective, and visuospatial working memory tasks were employed, along with two emotion-regulation interference tasks and one cognitive interference task. The results supported the present hypothesis: Both negative and positive affect maintenance were impaired by concurrent negative and positive emotion-regulation tasks, whereas concurrent cognitive task performance facilitated positive and negative affect maintenance, as compared with affect maintenance without a concurrent task.

(5077)

**fMRI Study of the Refreshing Process in Schizophrenia.** MARIE-LAURE GRILLON, *INSERM U562 and University of Tours*, FREDERIQUE CHARBONNEAU, *Centre Hospitalier Sainte Anne*, GAËL VAROQUAUX & BERTRAND THIRION, *CEA, I2BM, NeuroSpin*, CATHERINE OPPENHEIM, *Centre Hospitalier Sainte Anne*, & CAROLINE HURON, *INSERM U562 and NeuroSpin*—Reflexive regulation of information processing is dramatically impaired in schizophrenia. In the present fMRI study, we aimed to investigate the cerebral bases of reflexively repeating (refreshing) information in comparison with perceptually repeating information in patients with schizophrenia. During scanning, 15 patients with schizophrenia and 15 control subjects were asked to silently read individual words as they appeared on a screen. Some words were followed by a single new word (read baseline condition), others by a just-seen word (perceptual repetition condition), and others by a single dot signaling participants to think of the word that had preceded the dot (refreshing condition). Contrast analyses showed that the network activated by refreshing, in comparison with reading, included greater

bilateral frontal activations in patients than in control subjects. However, connectivity analyses showed that connectivity between frontal and parietal regions was significantly reduced in patients with schizophrenia.

(5078)

**The Relationship Between Music Cognition and General Working Memory.** MATTHEW D. SCHULKIND & HILARY M. HAIMES, *Amherst College*—Theorists have recently questioned the relationship between music cognition and general cognitive function (Schellenberg & Peretz, 2008). Whereas some researchers have reported selective impairment of musical and nonmusical cognitive tasks (Peretz, 2006), other researchers have shown that musical training can improve general IQ (Schellenberg, 2006). The present experiment examined whether musical training would predict working memory performance. The subjects in the experiment—who had varying levels of musical experience—completed three “*n*-back” tasks. The stimuli were aurally presented musical notes, aurally presented digits, or visually presented digits. Performance on the auditory digit task was correlated with both the musical task and the visual task (which were not correlated with one another). Musical experience predicted performance on the *n*-back task, but only for musical stimuli. These data suggest that musical training does not influence general working memory and that musical and nonmusical working memory tasks draw on different cognitive resources.

(5079)

**STM Predicts Incidental and Explicit Word Learning in Children and Adults.** ANNI SIMULA, HELY YLI-KAITALA, & SINI MAURY, *University of Helsinki*, & ELISABET SERVICE, *McMaster University*—Incidental learning of phonological forms through repeated exposure could be a basic mechanism in vocabulary acquisition. The relations between verbal short-term memory (STM) and explicit and incidental vocabulary learning were studied in three experiments. In Experiment 1, adults' and 8-year-old children's pseudoword spans were used to predict explicit learning of word–pseudoword pairs, as well as incidental learning of a pool of pseudowords used in a separate auditory STM task. Incidental and explicit learning were intercorrelated in both groups but only children's span predicted incidental and explicit learning. Experiment 2 controlled for ceiling effects in adults but found again no correlation between STM span and the two learning tasks. In Experiment 3, less wordlike stimuli were used for incidental learning. The pattern shown by children in Experiment 1 was now replicated in adults. The results suggest that efficient phonological representations form the basis for learning new vocabulary, as well as for verbal STM.

(5080)

**Eye Movement Effects on Traumatic Memories: More Support for a Central Executive Hypothesis.** CHRISTOPHER T. BALL & REBECCA KOPPEL, *College of William & Mary* (sponsored by Christopher T. Ball)—Eye movement desensitization and reprocessing is a therapeutic technique that relies on the use of rapid bilateral eye movements to reduce the negative symptoms associated with traumatic experiences. Gunter and Bodner (2008) found that performance on a reading span task predicted the size of the eye movement effect on traumatic memory vividness and emotionality. We attempted to replicate their findings while incorporating five additional working memory and executive function tasks. We found that the reading span task and Sternberg's item order task predicted the size of the eye movement effect but that the other tasks did not (attention switching, go/no-go, Sternberg item identity, random letter generation). We agree with Gunter and Bodner that the visual aspect of the secondary task is not as important for symptom reduction as the demands on central executive resources imposed by the secondary task.

• ACTION AND PERCEPTION •

(5081)

**Subjective Reports of Stimulus, Response, and Decision Times in Speeded Tasks.** JEFF MILLER, *University of Otago*, PAULA VIEWEG, *University of Osnabrück*, & NICOLAS KRUIZE, *Otago Polytechnic*—Subjective reports about temporal order—especially the times of conscious decisions—play an important role in theories of consciousness

(e.g., Dennett & Kinsbourne, 1992; Libet, 1985), yet people's reports of their own decision times have rarely been studied. We describe initial experiments examining such subjective reports within response time (RT) tasks. After each manual RT response, participants reported the time at which they had decided upon the response or—for comparison—the time of stimulus presentation or of the manual response. We compared reported decision times for more versus less difficult stimulus discriminations and for simple versus complex motor responses to see whether participants' subjective experience of making the decision followed perceptual processing but preceded response organization. We also examined the frequency of reports that the decision was made before stimulus onset or after the manual response, either of which would suggest that the reports were subject to considerable error.

(5082)

**Eliminating the PRP Effect Through Ideomotor Compatibility and Instructional Manipulations.** KIMBERLY M. HALVORSON, HANK EBNER, & ELIOT HAZELTINE, *University of Iowa* (sponsored by J. Toby Mordkoff)—In the psychological refractory period (PRP) paradigm, two stimuli are separated by a variable stimulus onset asynchrony (SOA). Subjects make a separate response to each stimulus. Responses are slowest to the second stimulus at the shortest SOAs, called the PRP effect (Pashler, 2004). This effect has been eliminated when ideomotor-compatible stimuli were used (Greenwald, 2003), although not always (Lien et al., 2002). In a series of PRP experiments, we included mixed blocks in which only one stimulus was presented at a time, but each trial could be either task. In all experiments, RTs were shortest for single-task blocks, but there was no significant difference between the dual-task blocks and the mixed blocks. For both ideomotor-compatible stimuli that did not overlap on any dimensions and traditional stimuli that were presented simultaneously, there was no PRP effect. This suggests that the PRP effect is contingent upon task structure rather than response limitations.

(5083)

**A Developmental Trend of the Effects of Auditory Cues and Task Complexity on Interlimb Coordination and Perception–Action Coupling.** RONG-JU CHERNG, HSIANG-FEI HUNG, & JENNYU CHEN, *National Cheng Kung University* (sponsored by Jenn-Yeu Chen)—Five age groups of subjects (5–6, 7–8, 9–10, and 11–12 years old and young adults) performed a task of marching or clapping alone and marching together with clapping in three auditory cue conditions (no cue, cue with preferred clap frequency, and cue with preferred step frequency) in which a developmental trend for the effects of auditory cues and task complexity on interlimb coordination and perception–action coupling was examined. The coefficients of variances (CVs) of action frequency and step–clap phasing value within trials were used to examine the performance of interlimb coordination. The mean and CV of perception–action phasing value were adopted as the indicators of perception–action coupling ability. The results showed that the interlimb coordination improved with the increase in age. The auditory cue had a detrimental effect on interlimb coordination for all subjects. Task complexity reduced the accuracy but not the stability of perception–action coupling, and the effects were similar across age groups.

(5084)

**Implied Friction Induces Economy of Action Effects in Spatial Displacement.** CHARLES COEY & J. SCOTT JORDAN, *Illinois State University* (sponsored by J. Scott Jordan)—Moving stimuli are perceived to vanish beyond their actual vanishing point (Hubbard, 1995). Such forward displacement (FD) is larger for observers who have experience controlling the stimulus (Jordan & Hunsinger, 2008). Could FD be altered by implied costs of controlling the stimulus (economy of action [EOA] effects; Witt & Proffitt, in press)? In Phase I, participants controlled a stimulus, via computer buttonpresses, under low- or high-implied friction (i.e., the stimulus appeared to move alone or across a surface, respectively), and indicated where the stimulus vanished (for 20 trials). In Phase II, they observed stimulus movements controlled by the experimenter (for 20 trials) and indicated vanishing points. FD increased across phases, except when the implied costs of moving the stimulus decreased (i.e., high-to-

low-friction participants). Apparently, FD is sensitive to EOA factors, even though the actual costs of moving the stimulus (i.e., required buttonpresses) are the same in all implied-friction conditions.

(5085)

**The Source-Monitoring Paradigm and Sense of Agency Over Speech.** ERIKO SUGIMORI, *University of Tokyo*—This study investigated the effects of imagining speaking aloud, sensorimotor feedback, and auditory feedback on respondents' reports of having spoken aloud and examined the relationship between responses to "spoken aloud" in the reality-monitoring task and the sense of agency over speech. After speaking aloud, lip-synching, or imagining speaking, participants were asked whether each word had actually been spoken. The number of endorsements of "spoken aloud" was higher for words spoken aloud than for those lip-synched and higher for words lip-synched than for those imagined as having been spoken aloud. When participants were prevented by white noise from receiving auditory feedback, the discriminability of words spoken aloud decreased, and when auditory feedback was altered, reports of having spoken aloud decreased even though participants had actually done so. These results are explained in terms of the source-monitoring framework.

(5086)

**Analyzing Sequential Dependencies in a Social Simon Task.** ROMAN LIEPELT & DORIT WENKE, *Max Planck Institute for Human Cognitive and Brain Sciences*, RICO FISCHER, *Dresden University of Technology*, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Previous research has shown that joint-action effects in a social Simon task provide a good index for action co-representation. The present study tested whether such effects involve mechanisms of action co-representation and/or feature binding. We distributed a spatial compatibility task among two persons. Each participant took care of only one of two responses. This task was performed alone (individual go/no-go), together with another person (joint go/no-go), and in a typical standard Simon task. Replicating previous findings (Sebanz et al., 2003), we found no spatial compatibility effect in the individual go/no-go condition, but a spatial compatibility effect in the joint go/no-go task setting. We, however, found comparable sequential Simon effects in both the joint go/no-go and the individual go/no-go conditions. Our findings are in line with the assumption that joint-action effects in a social Simon task involve low-level feature-binding processes.

#### • MULTISENSORY INTEGRATION •

(5087)

**Audio-Visual Integration: Testing the Role of the Superior Colliculus.** ELENA MAKOVAC & WALTER GERBINO, *University of Trieste* (sponsored by Walter Gerbino)—Multisensory enhancement occurs when a visual V-stimulus integrated with an acoustical A-stimulus elicits a response stronger than the response to the V-stimulus alone. Multisensory integration is mediated by several brain structures, including the superior colliculus (SC), which is selectively activated by effective AV stimuli presented in close spatiotemporal proximity (Stein & Meredith 1993). Leo et al. (2008) exploited the fact that S-cones send very few afferents to SC and found that cross-modal effects occur with red (SC-effective) but not purple (SC-ineffective) stimuli. In Experiment 1, we confirmed their results, and in Experiment 2, we obtained converging evidence using a tritanopic technique (Cavanagh et al., 1987). AV stimuli were presented in same versus different positions. As predicted, multisensory enhancement was stronger for red versus blue stimuli in the AV-same condition, whether no difference was obtained in the AV-different condition.

(5088)

**Modality-Independent Coding of 3-D Layout: fMRI Evidence for PPA Involvement of Haptic and Visual Scenes.** NICHOLAS A. GIUDICE, *University of Maine*, MAGDALENA WUTTE, *Ludwig Maximilian's University Munich*, ROBERTA L. KLATZKY, *Carnegie Mellon University*, JACK M. LOOMIS, *University of California, Santa Barbara*, & THOMAS WOLBERS, *University of Edinburgh*—The parahippocampal place area (PPA) has been established as a brain area crucial



for extracting the visuospatial structure of 3-D scenes. However, previous research has been carried out only with visual stimuli. We propose that the PPA is recruited for spatial computation of 3-D geometric configuration, independently of encoding modality. To test this prediction, we used fMRI and compared PPA involvement for scenes apprehended from touch or vision. In Experiment 1, sighted participants showed similar PPA activation for visual and tactile exploration of LEGO scenes but not objects. These effects were not related to visual recoding, given that we observed the same pattern of results in blind participants during haptic conditions in Experiment 2. Taken together, our findings strongly suggest that the PPA is an amodal (or supramodal) spatial processing region, which indicates that the human brain may represent space in a more abstract fashion than was previously thought.

(5089)

**Spatial Limit of the Visual Capture of the Felt Hand Location in a Mirror.** TAKAKO YOSHIDA, *University of Tokyo*, YUKI MIYAZAKI, *Tokyo Metropolitan University*, & TENJI WAKE, *Kanagawa University*—On the basis of the mirror-box techniques of Ramachandran and colleagues, when normal healthy participants view their left arm in a mirror positioned along the midsagittal plane, the impression of viewing their right hand visually captures the felt right-hand location, and participants rarely notice their unseen real right-hand location, which is far from the virtual hand. To investigate the relationship between this illusion and peripersonal space, we evaluated the spatial limit of the illusion along the sagittal plane. Participants put their left hand on the mirror at a fixed position. In each trial, they put their right hand at a random position and reported whether they felt that their right hand was located in a mirror-inversed position relative to their left hand or not. The illusion disappeared when they twisted their hand to the limit, suggesting that the strong muscle tensions and signals from joints can overcome visual capture and recalibrate the visual–proprioceptive conflict.

(5090)

**Regulatory Factors of Japanese Synesthetes in Synesthetic Perception.** KAZUHIKO YOKOSAWA & MICHIO ASANO, *University of Tokyo*—Grapheme–color synesthesia is the most common form of synesthesia. Although it is characterized as an idiosyncratic trait (i.e., color–grapheme associations are not identical across synesthetes), certain regularities in synesthetic perception have been reported. This study aimed to determine regulatory factors operative in Japanese grapheme–color synesthesia. Using Kanji characters, which have their own meaning, three possible factors were examined: meaning, sound (reading), and visual components. Participants were 2 Japanese synesthetes. From a palette of 138 colors, participants selected 1 color corresponding to each of 96 Kanji characters (comprising eight groups, each consisting of 12 characters). Two experimental sessions, separated by an 8-month interval, assessed participants' consistency of color choices. The results indicated no regularities between color choice and Kanji sounds or visual forms. By contrast, meaning was a strong determinant of synesthetic color choice for Kanji characters, suggesting that higher order processing (i.e., semantics) is involved in grapheme–color synesthesia.

(5091)

**The Poison Hypothesis and Motion Sickness.** FREDERICK BONATO & ANDREA BUBKA, *Saint Peter's College*—Motion sickness symptoms (dizziness, headache, nausea, vomiting, etc.) can result for individuals who move passively or perceive self-motion, relative to the Earth, even though no such motion may be occurring (vection). Perhaps related, about 70% of astronauts experience space sickness during initial days in zero gravity. Sensory conflict is the most commonly cited cause of motion sickness. However, more recently, other theories have gained attention that propose causal factors such as retinal slip, postural instability, nystagmus eye movements, and subjective–vertical mismatch. Treisman (1977) suggested that sensory conflict mimics sensory inputs that occur when some types of poison are ingested—hence, the hypothesis that motion sickness is due to an evolutionary neural mechanism aimed at ridding the body of poison. Here, we present a polygenic theory of motion sickness that asserts that factors that lead to poisoning-like symptoms (in addition to sensory conflict) can collectively lead to symptoms.

• VISION •

(5092)

**Mislocalizing the Onset Position of Moving Stimuli: The Froehlich Effect in 3-D Space.** INES ANN HEBER, *RWTH Aachen*, JOHANNA HAUKE, *University Hospital RWTH Aachen*, MARC WOLTER & TORSTEN KUHLEN, *RWTH Aachen*, BRUNO FIMM, *University Hospital RWTH Aachen*, & JOCHEN MÜSSELER, *RWTH Aachen* (sponsored by Gisa Aschersleben)—The onset position of a moving stimulus is usually mislocalized in direction of the movement. This phenomenon, also called the “Froehlich effect,” has been widely studied in 2-D space; however, little is known about its occurrence in 3-D space. We conducted a study of the Froehlich effect in 3-D space by presenting foveofugal and foveopetal moving stimuli in virtual peri- (40 cm) and extrapersonal (200 cm) space. The Froehlich effect occurred in both peri- and extrapersonal space, but we also observed an interaction of depth and direction of movement. The findings are discussed in the light of the “attentional capture” assumption and the “bow-wave” assumption, which seek to explain spatial mislocalizations.

(5093)

**The Stimulus Specificity of Motion Perceptual Learning Depends on the Difficulty During Posttest Rather Than Training.** ALEXANDER A. PETROV, *Ohio State University*—Psychophysical performance improves with practice, but the improvement is often specific to the trained stimuli. This stimulus specificity is often modulated by task difficulty (Ahissar & Hochstein, 1997; Liu, 1999). These results were first established using experimental designs that confounded the difficulty during training and subsequent generalization tests. To remove this confound, we measured  $d'$  on both easy and difficult tests (within subjects) before and after training on either an easy or a difficult motion-direction discrimination task (between subjects). The stimuli were moving filtered-noise textures. After 4 days of practice,  $d'$  improved significantly, and the improvement was partially specific to the trained motion direction (Experiment 1,  $N = 20$ ) and retinal position (Experiment 2,  $N = 24$ ). Importantly, the posttest profile in the easy-training group was identical to that in the difficult-training group in both experiments. This challenges the influential claim that training difficulty determines the locus of perceptual learning (Ahissar & Hochstein, 1997).

(5094)

**Motion Aftereffect Duration Is Not Changed by Perceptual Learning: Evidence Against the Representation-Modification Hypothesis.** NICHOLAS M. VAN HORN & ALEXANDER A. PETROV, *Ohio State University* (sponsored by Vladimir M. Sloutsky)—The representation-modification hypothesis of perceptual learning attributes the practice-induced improvements in sensitivity and/or discriminability to changes in the early visual areas. Motion aftereffects (MAEs, “waterfall illusion”) arise from and, thus, track changes in these representations. In our first experiment, static MAE durations were measured for 10 subjects before and after 4 days of training on a motion-direction discrimination task. As expected, the  $d'$  improved significantly, and the learning effect was partially (~50%) specific to the trained direction. Posttest MAE durations did not differ significantly between the trained direction, its opposite, and two orthogonal controls. A second experiment ( $N = 12$ ) replicated these results using both static and dynamic test stimuli. As in the first experiment, dynamic MAE durations were independent of the trained direction. All observers showed this independence with high statistical power. These data appear inconsistent with representation modification and provide indirect support for the alternative hypothesis—selective reweighting.

(5095)

**Asymmetrical Transfer of Perceptual Learning Between Luminance- and Contrast-Defined Motion: Evidence for Shared and Distinct Processing.** TAYLOR R. HAYES & ALEXANDER A. PETROV, *Ohio State University* (sponsored by Mark A. Pitt)—It remains a contentious issue whether luminance-defined motion (LDM) and contrast-defined motion (CDM) are processed by one shared pathway or two distinct pathways. Patterns of transfer of perceptual learning are diagnostic of the amount of processing overlap. Twenty participants practiced a

motion-direction discrimination task. Experimental schedule: pretest both LDM and CDM on Day 1, train either LDM or CDM (between subjects, Days 2–4), posttest both LDM and CDM on Day 6. In both groups,  $d'$  improved. The CDM-trained group performed as well as the LDM-trained group on the LDM posttest, indicating full transfer from CDM to LDM. However, the LDM-trained group performed only 35% as well as the CDM-trained group on the CDM posttest, indicating partial transfer from LDM to CDM. A second experiment ( $N = 24$ ) replicated this asymmetrical transfer pattern. The asymmetry is inconsistent with one-pathway models and suggests a hybrid architecture combining both shared and distinct processing components.

(5096)

**Corrective Saccades and Viewpoint Information.** CHRISTOPHER COX & PABLO GOMEZ, *DePaul University*—Information stored in visual short-term memory (VSTM) has been shown to play an important role in controlling eye movements. If needed, information about an intended target is utilized immediately following a saccade to make corrective saccades. In this research, we explore the nature of the representation generated in VSTM and how it affects the decision stage in the production of corrective saccades. We present two experiments in which we manipulated the discriminability of the targets and distractors, along with their viewpoints. Palmer, Rosch, and Chase (1981) coined the term *canonical* to describe perspectives in which identification performance is best, and in our research we found that participants were more likely to make corrective saccades to objects shown in a canonical viewpoint. In addition, we found that the latency of the corrective saccade was unaffected by the similarity of the target and distractors.

• MUSIC PERCEPTION/COGNITION •

(5097)

**Exploring an Artificial Music Grammar.** ERICA R. KNOWLES & MARIANNE E. LLOYD, *Seton Hall University* (sponsored by Marianne E. Lloyd)—Recent neuroimaging and behavioral research has suggested a possible overlap in syntax-processing mechanisms between music and language (Patel, 2008). Music and language may also share common mechanisms for the learning of syntactical knowledge through statistical probabilities (Saffran, 1999). The present study used an artificial music grammar (Loui & Wessel, 2006) in order to test the ability of nonmusician participants to learn a new music grammar, as well as to observe a possible interaction between music and language syntax processing. Although participants were able to learn the artificial music grammar, a language task was not affected by errors in the new music grammar, as has been found with Western music-syntax errors (Slevc, Rosenberg, & Patel, 2009). Participants may need more exposure to the new music grammar in order to gain a more complete representation of the regularities within the grammar.

(5098)

**Effects of Liking, Similarity, and Familiarity on Memory for Music.** STEPHANIE M. STALINSKI & E. GLENN SCHELLENBERG, *University of Toronto, Mississauga*—We examined effects of liking, similarity, and familiarity on recognition memory for music. In the first phase, participants heard 24 musical excerpts and rated how much they liked each excerpt, how similar each excerpt was to the music they usually listened to, and how familiar they were with that type of music. In the second phase, participants heard 48 excerpts (24 old, 24 new) and judged whether they recognized each excerpt from the first phase. Ratings of liking, similarity, and familiarity were correlated and similarly related to memory. Recognition was better for excerpts that were more liked, more similar, and more familiar, as compared with excerpts that were disliked, dissimilar, and unfamiliar, or responded to neutrally. Nonetheless, effects of similarity and familiarity on recognition were mediated by liking. In other words, musical familiarity and similarity are predictive of increases in liking, which, in turn, are predictive of enhanced memory for music.

(5099)

**The Function of Timbre Similarity in Traditional Timbre Effects in Melody Recognition.** STEPHEN WEE HUN LIM & WINSTON D.

GOH, *National University of Singapore*—The effects of timbre similarity in recognition memory for melodies played by multiple instruments were investigated in a single experiment, by comparing recognition performance when studied melodies were repeated in same, similar, or distinct timbres at test. Melodies that remained in the same timbre from study to test were recognized better than melodies that were presented in a distinct timbre at test. But when a timbre that was different from, but similar to, the original timbre played the melodies at test, performance was comparable to that when the same timbre played them. An interpretation based on exemplar models of memory and categorization offers a good account of our data. When a similar timbre was used for the memory probe, it was effective in inducing a close match between the overlapping timbre attributes of the memory trace and probe, enhancing recognition performance.

(5100)

**Within- and Cross-Modality Category Priming of Songs.** SARAH K. JOHNSON, *Moravian College*, & ANDREA R. HALPERN, *Bucknell University* (sponsored by Andrea R. Halpern)—Memory for music may be the most ubiquitous type of semantic memory apart from language, yet the semantic-memory properties of music have rarely been studied. We explored these properties using a priming paradigm. In Experiment 1, we compared priming for closely associated songs (e.g., “The Star Spangled Banner” and “God Bless America”) versus distantly associated songs (e.g., “Deck the Hall” and “God Bless America”), with associations derived from a previous sorting task and resulting cluster analysis. Analogous to linguistic associative-priming effects, we found faster responses on a tune-verification task (is it a real song?) for close versus far primes. However, in Experiment 2, no cross-modal priming of songs was found using written category names as primes (e.g., *patriotic*). Thus, in terms of tune–tune relationships, the semantic network characteristics for music appear similar to those for language, but mediation of relationships through category nodes may be weaker in music.

(5101)

**Neural and Behavioral Evidence of Working Memory Differences in Musicians and Nonmusicians.** DONNA COCH & ELYSE GEORGE, *Dartmouth College*—Previous research has suggested that music training improves working memory. However, it is unclear which domain(s) of working memory might be affected: executive control, auditory (phonological loop), or visual (visuospatial sketchpad). We investigated neural and behavioral aspects of working memory in college-aged musicians and nonmusicians, using event-related potentials (ERPs) and a standardized working memory measure (Test of Memory and Learning). ERPs were recorded in standard auditory and visual oddball paradigms (response to infrequent deviants embedded in lists of standards). Behaviorally, musicians outperformed nonmusicians on standardized subtests of visual, auditory, and executive memory. Electrophysiologically, musicians demonstrated faster updating of working memory (shorter latency P300s) in both the auditory and visual domains and increased sensitivity to the standard/deviant difference (larger amplitude P300) in the auditory condition. These findings demonstrate that long-term music training is related to improvements in working memory, in auditory and visual domains, in both behavioral and ERP measures.

(5102)

**Prosodic Cues Affecting Memory in Music As a Function of Expertise.** JAMES D. MARCH & AIMÉE M. SURPRENANT, *Memorial University of Newfoundland*, & ZEHRA F. PEYNIRCIOĞLU, *The American University* (sponsored by Aimée M. Surprenant)—Prosodic features of speech (such as stress, rhythm, and intonation) carry meaning and can be integrated into a memory representation (Speer, Crowder, & Thomas, 1993). Similar acoustic features help distinguish musical compositions. The present study addressed the role of musical training in remembering prosody, using simple tunes. Participants were presented with a series of musical sequences. At test, they listened to a new set of sequences containing melodically and prosodically old items, new melodies, and old items that were changed in their accent pattern but that had a previously presented melodic pattern. The results showed that although musicians and nonmusicians did not differ in either recognizing items played

with an old accent pattern or rejecting totally new compositions, musicians more often rejected prosodically changed items as “old” than did nonmusicians. The present research further delineates how expertise in music changes perception and memory for musical compositions.

• COGNITIVE SKILL ACQUISITION •

(5103)

**The Effect of Button Switch and Dual-Task Conditions on Automatic Categorization Performance.** SÉBASTIEN HÉLIE, JENNIFER G. WALDSCHMIDT, KYLE LIBAN, MELISSA MORRISON, ALECIA M. MOSER, & F. GREGORY ASHBY, *University of California, Santa Barbara*—Thirty-two participants were trained for over 10,000 trials in a simple categorization task with different underlying category structures. The results showed that after the first few sessions, there were no significant behavioral differences between participants who learned rule-based versus information-integration categories. Subsequent manipulations showed that switching the locations of the response keys after automaticity had developed caused a similar highly significant interference, regardless of category structure. In addition, a simultaneous dual task that engaged executive functions did not interfere with either rule-based or information-integration categorization. It has been shown elsewhere that rule-based categorization performance does not suffer from button switch interference (Ashby, Ell, & Waldron, 2003) but suffers from dual-task interference (Waldron & Ashby, 2001) before the development of automaticity. Overall, the results are consistent with a theory assuming separate processing pathways for initial rule-based and information-integration category learning, but a common processing pathway after the development of automaticity.

(5104)

**Experience With a Complex Skill Moderates the Benefits of Spaced Practice on Performance.** PATRICIA A. DEWINSTANLEY, HAROLD SUNDT, EMILY ROBINSON, CAITLIN CARLTON, & TYLER KINZY, *Oberlin College*—We examined the benefits of spaced versus massed practice when learning a new complex skill. Participants in both experiments learned to play the drums, using the video game Rock Band 2 on Xbox 360. In the first experiment, participants learned to play a song and then immediately practiced the same song (massed practice) or learned a second song and then practiced the first song (spaced practice). Participants with no previous experience performed better when they were in the spaced-practice condition, as compared with the massed-practice condition. Participants who had played the video game drums before the experimental session performed equivalently in the spaced- and massed-practice conditions. Participants in the second experiment were tested over multiple days. The results of the two studies suggest that learning a complex skill can benefit from spaced practice, but massed practice is best when attempting to turn a sequence into a procedure.

(5105)

**Separating Perceptual and Conceptual Representations in Memory: Investigations Using the Novel Card Game SET.** MOLLY M. POTTRUFF, DAVID I. SHORE, & KARIN R. HUMPHREYS, *McMaster University*—The game SET requires participants to identify 3 target cards in a 12-card array on the basis of whether their featural relationships conform to a conceptual grouping rule. Using a repetition manipulation, we investigated the nature of the underlying mental representation in this game. Participants were asked to discriminate between correct and incorrect 3-card sets while their reaction time and explicit recognition memory were measured. In Experiment 1, repeated trials were perceptually and conceptually identical, whereas in Experiment 2, global perceptual repetition was disrupted while maintaining conceptual repetition. In both experiments, participants were faster on the repeated trials, an improvement in performance that was not positively correlated with their explicit recognition. The results from these experiments show that conceptual learning can occur independently of perceptual repetition, suggesting that information in this game may be represented on the basis of both the perceptual features of the cards and their conceptual relationships to each other.

(5106)

**Prioritizing Subcomponents of the Space Fortress Game Enhances Learning and Engenders Transfer.** CHANDRAMALLIKA BASAK, *University of Illinois, Urbana-Champaign*, WALTER R. BOOT, *Florida State University*, & MARK B. NEIDER, MONICA FABIANI, GABRIELE GRATTON, & ARTHUR F. KRAMER, *University of Illinois, Urbana-Champaign* (sponsored by Arthur F. Kramer)—From perceptual learning to problem solving, transfer of training is found to be narrow. The aim of the present study was to explore the best training strategies to enhance learning and engender broad transfer of complex psychomotor and cognitive skills. Participants were trained for 30 h in a revised Space Fortress designed to focus on various cognitive constructs. The experimental groups ( $n = 20$ ) were provided with variable priority (VP) training, where participants were trained to prioritize several subcomponents of tasks in the context of the whole task, and the control group ( $n = 20$ ) played the game with fixed priority (FP) training. Individual differences in initial game performance affected learning; for initial low performers, the VP group reached a higher asymptote than did the FP group. Evidence of transfer was greater for VP than for FP, particularly for near transfer tasks, such as tracking and short-term memory.

(5107)

**Pre-Post Improvement on the Observed Tasks of Daily Living—Revised: A Rarely Seen Occurrence.** HELGA NOICE & TONY NOICE, *Elmhurst College*—Cognitive improvements found in older adult training studies such as ACTIVE (Ball et al., 2002) have generally not transferred to other cognitive abilities or to activities of daily living. However, over the past few years, theatrically based interventions (e.g., Noice & Noice, 2009) have consistently produced gains on cognitive measures that were not targeted by the training. The present study produced significant gains on the Observed Tasks of Daily Living instrument (OTDL-R; Diehl et al., 2005), a rare finding. This instrument requires hands-on execution of 28 tasks/subtasks such as filling out medical-office forms. The ACTIVE study found no improvement on this instrument, although Willis et al. (2006) found a small delayed gain in self-reported everyday activities (not on the OTDL-R), but only for one of the three trained groups. Thus, the present study presents evidence that a short-term, novel, multimodal intervention may enhance seniors' performance of activities necessary for independent living.

• METAMEMORY/METACOGNITION •

(5108)

**Comparing Methods and Cognitive Demand in Prospective Time Estimation.** ELSA EIRIKSDOTTIR & RICHARD CATRAMBONE, *Georgia Institute of Technology*—Conflicting evidence exists regarding the role of attention and short-term memory (STM) in time perception, and different estimation methods make comparison difficult. This study compared two methods while varying cognitive demand to determine the role of methodology. Participants completed two sessions where they searched for one or four targets (to vary STM demand) in a visual search task (to produce attentional demand). In one session, they verbally estimated block duration in seconds, and in the other session, they reproduced a given duration while concurrently doing the search task. The two methods yielded different results: Verbal estimation was disrupted by cognitive demand on the longest duration (10 sec), whereas reproduction was disrupted by cognitive demand on the shortest duration (2 sec). This indicates that the estimation method directly affects whether cognitive resources are disruptive, and determining the nature of time perception using only a single method might not provide the full picture.

(5109)

**Eye Movements and Subjective Recognition Confidence Measures of Relational Memory.** ELIZABETH F. CHUA, DEBORAH E. HAN-NULA, & CHARAN RANGANATH, *University of California, Davis*—Eye movements can be used as a measure of relational memory, but the relationship between eye movement measures and subjective experience is unclear. To address this question, we monitored eye movements during a face-scene associative recognition task. Test trials consisted of a scene preview, followed by three faces superimposed on the scene. Participants



were asked to indicate which of three faces had been studied with that scene previously and then indicated their confidence using a 5-point scale. The results showed that, for accurate trials, participants disproportionately fixated on the associated face, and viewing time increased with higher confidence levels. In contrast, on inaccurate trials, there was no relationship between viewing of the incorrectly identified face and recognition confidence. These results indicate that, for accurate associative recognition judgments, confidence and eye movement measures may be driven by similar factors, whereas subjective confidence on inaccurate trials appears to be based on other factors.

(5110)

**Metamemory Predictions at Encoding Are Insensitive to Implicit Interference Effects at Retrieval.** DEBORAH K. EAKIN, *Mississippi State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—Words differ in terms of the number of semantic associates they have, a characteristic known as set size. Memory is worse for large-set-size cues and targets, but only when the target is studied alone and later prompted with a related cue (extralist). When the pairs are studied together (intralist), recall is the same regardless of set size; set-size effects are eliminated. Theoretically, set-size effects are due to the relative amount of implicit interference from semantic associates competing for retrieval, given the cue. Metamemory predictions at retrieval (e.g., delayed judgments of learning [JOLs], feelings of knowing) accurately reflect these implicit interference effects. We contrasted cue-set-size effects on metamemory between predictions at retrieval and predictions made during encoding (i.e., immediate JOLs). As expected, metamemory predictions made at retrieval tracked implicit interference effects on memory. However, immediate JOLs did not vary with set size and were not accurate at predicting the implicit interference effects obtained in memory.

(5111)

**Bilingual Visual Word Recognition in a Sentence Context.** WOUTER DUYCK, EVA VAN ASSCHE, ROBERT HARTSUIKER, DENIS DRIEGHE, & KEVIN DIEPENDAELE, *Ghent University*—Recent research on bilingualism has shown that lexical access in isolated visual word recognition by bilinguals is not selective with respect to language. In this series of experiments, we investigated whether nonselective lexical access also occurs when bilinguals are reading sentences, which constitutes a strong unilingual linguistic context. In the first study, we investigated second-language (L2) sentence reading by Dutch–English bilinguals in an eyetracking paradigm. Results revealed that bilinguals were faster to recognize cognate words (i.e. translation equivalents that are similar in form; e.g., *banaan*–*banana*), even when these words were presented in sentences. In the second study, we investigated language selectivity of lexical access in the same population of bilinguals reading sentences in the native language (L1). Again, a cognate effect was obtained in eyetracking times: Bilinguals showed shorter fixation durations for L1 words that have form-similar L2 translations. This cognate effect became stronger as the degree of orthographic overlap between translation equivalents increased (i.e., a larger cognate effect for *banaan* than for *donder* [*thunder*]). In the third eyetracking study, we investigated Dutch–English bilinguals reading L2 sentences that semantically constrained toward the same cognate target words (e.g., *Salsa has become a popular dance* [Dutch: *dans*] *in Belgium*). Again, fixation times showed a cognate effect. Together, these results suggest that the linguistic and semantic contexts provided by sentences do not nullify cross-lingual lexical interactions during early visual word recognition by bilinguals, even if those bilinguals are reading in their native language. As such, these findings support bilingual models of visual word recognition in which lexical access is not language selective and in which cross-lingual interactions are only weakly affected by top-down factors. These results are interpreted within the BIA+ (bilingual interactive activation) model of Dijkstra and colleagues (Dijkstra & Van Heuven, 2002).

(5112)

**Metacognitive Control and Spaced Practice: Clarifying What People Do and Why.** MICHAEL S. COHEN, *UCLA*, & THOMAS C. TOPPINO, *Villanova University*—Previous studies of people's metacognitive

control of distribution of practice have been confounded by perceptual difficulty, recency (i.e., choosing spacing always led to restudying shortly before the test), or both. In Experiment 1, we compared the effect of item difficulty on the tendency to choose spaced practice for learning materials that either were or were not expected to cause perceptual problems. In Experiment 2, we minimized the confound between spacing and recency and varied the initial-presentation duration of items within a range that was sufficient to ensure perception of the items while still affecting functional study time. In all conditions for which perceptual difficulties were avoided, people exhibited a tendency to space items more as item difficulty increased. The effect was strong even when the potential effect of recency was minimized. The results are interpreted as supporting a discrepancy-reduction-based account in which people appreciate the potential benefits of spaced practice.

(5113)

**It's Important, I'll Remember It: Evidence for Value-Biased Judgments of Learning.** NICHOLAS C. SODERSTROM & DAVID P. McCABE, *Colorado State University* (sponsored by David P. McCabe)—The present study examined how value and fluency interact to influence metacognitive judgments. Participants studied related and unrelated word pairs, each accompanied by point values between 1 and 6, denoting how important the pairs were to remember. These values were presented either “before” or “after” each pair in a between-subjects design. Item-by-item judgments of learning (JOLs) were elicited in which participants predicted on a 0%–100% scale the likelihood that each pair would be remembered later. In both conditions, participants predicted better memory for related pairs than for unrelated pairs, indicating that fluency was used as a metacognitive cue. Additionally, JOLs increased monotonically with value, even in the “after” condition in which value had no impact on recall. These results support a cue-weighting process in which JOLs are based on multiple cues, which may or may not be predictive of future recall, and support an agenda-based monitoring framework.

(5114)

**Effects of Text-Based Interest on Metacognition and Learning.** ALTHEA N. BAUERNSCHMIDT & JEFFREY D. KARPICKE, *Purdue University* (sponsored by David B. Pisoni)—Interest generated by a text is presumed to play an important role in comprehension and memory (Krapp, Hidi, & Renninger, 1992). However, prior research has shown that text-based interest sometimes produces no effect on future recall (McDaniel et al., 2000). We examined the effects of interest on recall and metacognitive judgments. Students read stories and rated how interesting they found each one. The students also made judgments of learning (JOLs); they predicted how well they would recall ideas from the stories either 5 min or 1 week after learning. We then tested final recall either 5 min or 1 week later. Text-based interest was significantly correlated with JOLs, but neither was a strong predictor of future recall. Thus, interest level may inflate one's overconfidence in one's learning. Text-based interest is a salient cue that students use to inform their JOLs, but it may not be diagnostic of future memory performance.

(5115)

**Variability in the Correlates of Metacomprehension Judgments: The Effects of Task Type and Individual Differences.** YASUHIRO OZURU, *University of Alaska, Anchorage*, CHRISTOPHER A. KURBY, *Washington University*, & DANIELLE S. McNAMARA, *University of Memphis*—This study investigated the role of task type and individual differences in comprehension monitoring. Participants read an extended psychology text one sentence at a time and, after each sentence, made either a judgment of difficulty (JOD) or a prediction of performance (POP) for a future test. The magnitudes of the JODs and POPs were analyzed regarding their relations with two predictor variables: reading time for each sentence and Flesch reading ease scores. The results showed that these predictor variables—in particular, reading time—were more closely correlated with JODs than with POPs. Furthermore, the metacognitive accuracy of JODs and POPs, measured by gamma, was correlated with different individual difference measures. The accuracy of JODs was mainly predicted by measures of sensitivity to retrieval fluency, whereas the accuracy of POPs was mainly predicted by reading

ability. The results are discussed with respect to the role of task-specific processing and individual differences in metacomprehension.

• HUMAN LEARNING AND INSTRUCTION •

(5116)

**Is Subsequent Learning Hurt by Prior Erroneous Guessing?**

SEAN H. KANG & HAL PASHLER, *University of California, San Diego*, DOUG ROHRER, *University of South Florida*, & SHANA K. CARPENTER, *Iowa State University*—Taking a test has been shown to produce enhanced retention of the retrieved information. On tests, however, students may encounter items for which they are unsure of the answers, and they often end up guessing. Do wrong guesses get stamped in, impairing subsequent learning of the correct answer? In previous experiments where immediate corrective feedback was provided, we were surprised to find no harmful effects of forced guessing, even with the learning of information that seemingly depends upon the familiarity of possible candidate responses (e.g., spelling of hard-to-spell words, pronunciation of French words). We present new experiments exploring conditions where feedback is delayed and when the study material contains more elaborate conceptual structure. In addition, we assess subjects' metacognitive judgment of the impact of guessing. Practical and theoretical implications are discussed.

(5117)

**Preparing to Teach Improves the Processing and Retention of Information.**

JOHN F. NESTOJKO, *UCLA*, DUNG C. BUI, *Washington University*, NATE KORNEILL, *Williams College*, & ELIZABETH L. BJORK, *UCLA*—As many teachers know, one learns by teaching. In the present research, we investigated the effects of preparing to teach without actually teaching. Participants studied a passage (the role of film in history) under instructions either to (1) prepare for a test or (2) prepare to teach the passage to another student who would take a test. Instead, however, all participants were given a free recall test followed by a short-answer test. Free recall performance showed a clear advantage of preparing to teach over preparing for a test, as did short-answer performance for important details. More detailed analyses of free recall results revealed that participants preparing to teach produced more structured and coherent output than did those preparing for a test. These results suggest an explanation of the benefits of preparing to teach: People focus on important information and mentally organize that information in a coherent, meaningful way.

(5118)

**How Achievement Goals and Instructional Activities Interact to Promote or Hinder Transfer of Knowledge.**

DANIEL M. BELENKY & TIMOTHY J. NOKES, *University of Pittsburgh*—We investigated the interaction between instructional activities and students' academic motivations on their ability to learn and transfer statistics knowledge. Motivation was classified in terms of students' achievement orientation, which contrasted mastery goals (wanting to understand new concepts) with performance goals (wanting to demonstrate ability). Participants were randomly assigned to one of four conditions that manipulated learning activities (direct instruction or invention) and motivation (performance or mastery instructions). In addition, students' achievement goals were assessed with a validated questionnaire (Elliot & McGregor, 2001) at the beginning and end of the experiment. Transfer was assessed with problems that extended target knowledge to a new concept. Entering the study high in mastery motivation predicted strong learning gains, except among those students who invented with performance-oriented instructions. These results suggest that a performance orientation induced by instructions may have a negative impact in invention-based activities.

(5119)

**Conceptual Analysis Facilitates Learning and Transfer in Both Laboratory and Classroom Settings.**

TIMOTHY J. NOKES, *University of Pittsburgh*, BRIAN H. ROSS & JOSE P. MESTRE, *University of Illinois, Urbana-Champaign*, ELIZABETH STROHM, *University of Pittsburgh*, & DAVID T. BROOKES & ADAM FEIL, *University of Illinois, Urbana-Champaign*—Do learning principles discovered in the

psychology laboratory improve learning when instantiated in classroom instruction? We tested whether an instructional intervention based on principles of self-explanation and analogical comparison improved academic learning, as compared with more traditional problem-solving instruction. We tested the intervention in a laboratory experiment with college students reviewing introductory physics, as well as with high school students learning the material for the first time. The results showed that students given instruction based on cognitive principles showed improved performance, as compared with students given more traditional instruction on conceptual learning and transfer tests in both the laboratory and classroom environments. These results provide evidence that learning principles discovered in the laboratory can generalize to more complex systems such as classrooms and have a practically significant effect on learning and transfer.

(5120)

**Using Cognitive Science to Improve Middle School Science Learning.**

ALICIA CHANG, ELIZABETH STROHM, TIMOTHY J. NOKES, & CHRISTIAN D. SCHUNN, *University of Pittsburgh* (sponsored by Christian D. Schunn)—How can we use cognitive science to improve middle school science learning? A major problem for cognitive science and education is to determine how to adapt, apply, and instantiate cognitive science learning principles into instruction and pedagogy to improve student learning. We redesigned two major middle school science curricula (one text based and one inquiry based) with learning principles from cognitive science, including analogical reasoning vis-à-vis contrasting cases, diagrammatic reasoning, and targeting misconceptions. We tested this redesigned curricula against the traditional nonmodified instruction. We predicted improvements in content knowledge and scientific reasoning for students given the revised curricula. We report data from experiments with teachers implementing the revised curricula in experimental classes, as compared with their traditional instruction in the control classes.

• LETTER/WORD PROCESSING •

(5121)

**Detection of Letter and Letter Sequence Targets While Processing Prose.**

ALICE F. HEALY, *University of Colorado, Boulder*, & THOMAS F. CUNNINGHAM, *St. Lawrence University*—College students searched for either the target letter "h" or the target letter sequence "the" across two versions of a prose passage in which every instance of the letter "h" occurred in the word "the." The passage versions differed only in that a given sentence was in the active or passive voice, so that a given noun phrase containing the word "the" occurred as a subject in one passage version and as an object in the other passage version. Target condition (letter, letter sequence) and noun phrase (subject, object) were both manipulated as within-subjects variables. A much greater proportion of detection errors occurred for letter targets than for letter sequence targets. Also, with letter targets but not with letter sequence targets, more detection errors occurred for object noun phrases than for subject noun phrases. These findings suggest that both unitization and processing time contribute to detection errors in reading text.

(5122)

**Mipselling the Middle of Words: The Serial Position Effect and Orthographic Texture.**

ANGELA C. JONES & JOCELYN R. FOLK, *Kent State University*—A serial position effect (SPE) in which word-initial and -final letters are typically spelled with higher accuracy than medial letters has been found in the error patterns of beginning (Mendenhall, 1930; Treiman et al., 1993), skilled (Wing & Baddeley, 1980), and neurologically injured spellers (Caramazza et al., 1987). This effect has been attributed to competition among letters during output. However, no alternate hypothesis has been explored. In the present study, we test the hypothesis that the SPE is due not to competition during output, but instead to orthographic texture, or variations in the activation strength of individual letters in words. The results are particularly damaging to competition accounts of the SPE because accuracy in word-medial positions was as high as or higher than accuracy in word-initial and -final positions when a measure of orthographic texture was manipulated. Instead, results support the hypothesis that the SPE is due to orthographic texture.

(5123)

**Get a Grip and Go for Broca.** ANTHONY S. BARNHART & STEPHEN D. GOLDINGER, *Arizona State University*, & CHARLES A. PERFETTI, *University of Pittsburgh*—Recent experiments employing EMG and fMRI have shown that right-hand muscles increase activation during lexical access; these effects are augmented when reading handwritten words. An embodied explanation is that handwritten words are perceived through a motor simulation of the strokes used in their generation (in a fashion similar to the motor theory of speech perception). In the present study, we assessed motor activity during lexical access by measuring deviations in grip force during the processing and articulation of low- and high-frequency printed and cursive words. Few studies have examined motor activity during lexical access, and no studies have examined the motor consequences of lexical variables such as word frequency. We observed increases in maximum grip force and squeeze duration for the right hand during the processing of low-frequency, cursive words. Inducing fatigue in the hand muscle groups slowed word naming times, with fatigue in the right hand demonstrating the largest effects.

(5124)

**ERP Masked Priming in Two Different Japanese Scripts.** KANA OKANO, *Tufts University*, JONATHAN GRAINGER, *CNRS and University of Provence*, & GINA R. KUPERBERG & PHILLIP J. HOLCOMB, *Tufts University* (sponsored by Phillip J. Holcomb)—Research using roman script languages has shown a series of effects consistent with a fast interactive model of visual word processing. However, the generality of these findings to nonroman script languages are unclear. The present study examined the time-course of processing in two different Japanese scripts (Hiragana and Katakana), using an event-related potential (ERP) masked priming paradigm. In separate blocks, Japanese speakers read Hiragana and Katakana target words preceded by the same or an unrelated masked prime word that could be in the same script as the target or a different script. Similar to previous ERP masked priming studies, Japanese speakers showed within- and cross-script repetition priming on the N250 and N400 components for Hiragana targets, but no such effects were observed for Katakana targets. These results suggest that Hiragana words are processed similarly to roman script words but that Katakana words are likely processed via a different mechanism.

(5125)

**Lexical Status of Chinese Phonetics Affect Character Naming.** SAU-CHIN CHEN, *Tzu Chi University* (sponsored by In-Mao Liu)—The lexical status of phonetics distinguishes the phonetic types of Chinese characters (homophonous, heterophonous, and nonphonetic) and decides the phonetic-to-sound mapping between the correct pronunciation and the phonetic pronunciation. In the comparisons of these three phonetic types, this study examines how the mapping relations contribute to Chinese character naming. To control the impact of neighborhood characteristics, all of the stimulus characters have only one pronunciation among neighboring characters. The latency data showed the similar effects caused by the heterophonous characters and the nonphonetic characters. Meanwhile, the most regularity errors occurred in the low-frequency exception characters with a small summed frequency of friends. These results suggest that the magnitudes of regularity and consistency effects associate the phonetic pronunciation, which would be strengthened by the accumulated experience of neighboring characters, and the lexical status of phonetics influences the retrieval of the correct pronunciation.

(5126)

**Processing Differences Between Subgroups of College Students With Dyslexia.** STACY BIRCH, *College at Brockport, SUNY*—Individuals with developmental dyslexia have been classified into subgroups similar to those with acquired dyslexia. Phonological and surface subtypes of dyslexia are based on dissociations between component reading skills. For instance, an individual with particular difficulty in orthographic processing could be classified as a surface dyslexic. The present study investigated the prevalence of these subtypes in college students with developmental dyslexia, along with the extent to which the subgroups dissociated on component skills. Students with and without dyslexia completed standardized language and nonlanguage tasks, along with a

series of verbal and visual processing tasks. Most (78%) students with dyslexia were in a subgroup, with the majority being in the phonological group. The subgroups with dyslexia differed significantly from controls on most language and visual tasks but dissociated from one another only on rapid naming and on oral reading rate. Implications of these results for subtyping in developmental dyslexia are discussed.

(5127)

**Poor Readers in College and Their Phonological Abilities.** LEONARD KATZ & STEPHEN D. KATZ, *University of Connecticut and Haskins Laboratories*—In spite of having the intelligence and instructional experience that would ordinarily enable them to read well, some college students develop into poor readers. We study such students in depth; each one receives 8 h of testing, primarily of their phonological abilities (both production and perception). A number of related variables (IQ, ADHD, math ability, language-learning ability, etc.) are also studied. This poster presents results at the halfway point of a 5-year study.

(5128)

**Extracting Phonological Information From Systematic Alphabetic Form.** GREG B. SIMPSON & UN-SO PARK-DIENER, *University of Kansas*, APRIL FUGETT, *Marshall University*, & REBECCA TREIMAN, *Washington University*—Byrne (1984, 1989) found that participants were unable to use the visual form of artificial letters to discern their sounds. We examined Korean letters, with related sounds represented by similar letters. Experiment 1 tested whether participants could learn the distinction between vowels and consonants. In a paired-associates task, subjects learned the pronunciations paired with correct Korean letters, or re-paired to render the print-sound relationship arbitrary. Those in the correct condition mastered the association in fewer trials and with fewer errors than did participants in the re-paired condition. Experiment 2 examined similarity within the consonant and vowel categories. Subjects learned the pronunciation of vowels when they were paired with correct letters, but not that of consonants. In Experiment 3, more consonants were used, and the correct condition was learned faster with fewer errors. These results demonstrate that, in this nonartificial writing system, participants were able to take advantage of the systematic relationship between letter shape and pronunciation.

# • PSYCHOLINGUISTICS •

(5129)

**Impact of Grammatical Voice and Animacy on Verb Processing.** MARTIN PACZYNSKI, *Tufts University*, & GINA R. KUPERBERG, *Tufts University and Massachusetts General Hospital* (sponsored by Robert G. Cook)—Using event-related potentials (ERPs), we examined neural activation differences to verbs in either the active or the passive voice. Participants read simple sentences, with either animate (*gardener*) or inanimate (*water*) subjects. Grammatical voice was manipulated via auxiliary verbs (e.g., . . . *had soaked* [active]/ . . . *was soaked* [passive]). To prevent these auxiliaries from predicting voice, filler sentences used alternative grammatical constructions (. . . *was soaking* [active]/ . . . *had been soaked* [passive]). Verbs in the passive (vs. active) voice evoked a right-lateralized negativity between 200 and 250 msec, followed by a sustained left-lateralized positivity peaking at around 700 msec. Additionally, verbs preceded by inanimate (vs. animate) subjects evoked a late, widely distributed positivity peaking at approximately 700 msec that was not modulated by grammatical voice. Our data suggest that comprehending passive verbs entails early and late neurocognitive costs and that animacy exerts effects on verb processing that are independent of the syntactic assignment of thematic roles.

(5130)

**Temporal Concepts and Predicted Duration Estimates.** MARILYN G. BOLTZ, *Haverford College*, & YEN NA YUM, *Tufts University*—The planning fallacy is a bias in which people underestimate the predicted duration of a given task. The present research investigated whether this bias is influenced by certain conceptualizations of time. In Experiment 1, participants were presented with one of three types of primes (video, linguistic, both) that reflected either an ego or a time motion perspective



(i.e., time as a stationary backdrop through which one moves vs. time moving toward a stationary observer). Afterward, all participants predicted the time required to sort and shelve a stack of journals before actually completing the task. The results showed that across all priming conditions, subjects in the ego (vs. time) motion condition underestimated to a greater extent. Experiment 2 replicated this effect and also found that underestimations are reduced when the task's perceived ending point is near versus far. Lastly, both studies revealed a set of individual differences that influence the magnitude of the planning fallacy.

(5131)

**Body-Based Insults Are Harder to Ignore: Embodiment Effects in the Stroop Task.** PAUL D. SIKALUK, *University of Northern British Columbia*, PENNY M. PEXMAN, *University of Calgary*, & MICHELE WELLSBY, HOLLY-ANNE R. DALRYMPLE, JODIE JACOB, & 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., *bonehead*), nonembodied insults (e.g., *idiot*), and noninsults (e.g., *natal*) in a Stroop task. The results of a multiple regression analysis showed that embodiment ratings accounted for a significant amount of color naming latency variance, even when several control variables were included in the analysis. The effect was inhibitory such that color naming was slower for the embodied insults. To determine whether the effects of embodiment would generalize to non-insults in the Stroop task, we conducted a second experiment in which words rated as either high or low on body-object interaction (BOI) were used. In this case, there was no effect of BOI on color naming latency. We propose that embodied information is an important component of conceptual knowledge for insults.

(5132)

**An ERP Study of Cerebral Asymmetries for Processing Literal and Figurative Meanings.** NATALIE A. KACINIK, *Brooklyn College, City University of New York*, & JOHNCHRISTOPHER A. ARAGON & TAMARA Y. SWAAB, *University of California, Davis*—Our prior studies have repeatedly failed to show hemispheric and N400 differences for the integration of literal and figurative meanings into ambiguous contexts (Kacirik & Chiarello, 2007; Kacirik et al., in preparation), despite claims of preferential right-hemisphere involvement in comprehending subordinate figurative meanings (e.g., Anaki et al., 1998; Brownell, 2000; Jung-Beeman, 2005). This hypothesis was further investigated by comparing event-related potentials elicited by lateralized sentence-final words related to the literal or the figurative sense of polysemous words in ambiguous contexts (e.g., *The girl did not approach the slimy FROG/CLERK*). No significant differences between the integration of literal and figurative meanings were found in either visual field with respect to both N400 and late positive effects. However, literal endings in the left visual field/right hemisphere showed a frontal imageability effect, supporting prior indications that differences in underlying brain activity are mainly due to imageability, rather than to the literalness or figurativeness per se.

(5133)

**Parafoveal Preprocessing of Word N + 2 Is Not Enhanced by Short Words n+1.** BERNHARD ANGELE & KEITH RAYNER, *University of California, San Diego* (sponsored by Keith Rayner)—Recently, attempts at testing the predictions of computational models of eye movements in reading have focused on demonstrating the presence or absence of parafoveal preprocessing of the second word to the right of fixation ( $n+2$ ). Specifically, it has been suggested that parafoveal processing of word  $n+2$  requires the first word to the right of fixation ( $n+1$ ) to be very short (Angele, Slattery, Yang, Kliegl, & Rayner, 2008). We manipulated  $n+1$  and  $n+2$  previews, using the boundary paradigm (Rayner, 1975). Before readers crossed the boundary, words  $n+1$  and  $n+2$  had either both incorrect or both correct preview. In a third condition, only word  $n+1$ , which was either “the” or a high-frequency three-letter word, had incorrect preview. Despite the shorter  $n+1$ , we did not find evidence for parafoveal-on-foveal or preview benefit effects on  $n+2$ . Additionally, we partially replicated Drieghe, Pollatsek, Staub, and Rayner’s (2008) findings concerning Radach’s (1996) word grouping hypothesis.

(5134)

**When Meaning Permeates Form: Effects of Iconicity for Phonological Decisions in British Sign Language.** ROBIN L. THOMPSON, DAVID P. VINSON, & GABRIELLA VIGLIOCCO, *University College London* (sponsored by Gabriella Vigliocco)—Signed languages exploit the visual/gestural modality to create iconic expression across a wide range of conceptual structures, using the phonetic resources of the language to build up an analogue of a mental image. Previously, we demonstrated a processing advantage in a picture/sign matching task when iconic properties of signs were made salient in corresponding pictures (Thompson et al., 2009). The present study investigates the extent of iconicity effects with a phonological decision task in which the meaning of the sign is irrelevant (does the sign have straight or bent fingers). The results show that iconicity is a significant predictor of response latencies: More iconic signs lead to slower responses. We conclude that meaning is activated automatically for iconic properties of a sign, creating interference when making form-based decisions. The present study extends previous work by demonstrating that iconicity effects permeate the entire language system, arising automatically even when access to meaning is not needed.

(5135)

**Lingering Garden-Path Effects on the Reading of Subsequent Text.** TIM SLATTERY, *University of California, San Diego*, & KIEL CHRISTIANSON, *University of Illinois, Urbana-Champaign*—An eye movement study explored the possibility that a temporarily ambiguous (“garden path”) sentence might affect the reading of subsequent sentences. Such downstream effects are not predicted to occur according to traditional accounts of sentence parsing and/or reanalysis, be they serial or parallel. The results revealed clear effects of garden-path structure on the reading of the syntactically ambiguous sentence. Additionally, these effects were more pronounced when the embedded noun phrase was a plausible patient for the main verb (Pickering & Traxler, 1998). Moreover, reading of critical text in a subsequent sentence was influenced by the interaction of the ambiguity and noun phrase plausibility in the first sentence. These results are consistent with “good enough” sentence processing (Ferreira, Bailey, & Ferraro, 2002), in which the processor might move on to subsequent text before exhaustive processing of an ambiguous sentence is complete.

(5136)

**Receptive Vocabulary Knowledge in Individuals With Autism As Assessed by Eye Movements, Pupillary Dilation, and Event-Related Potentials.** KERRY LEDOUX, ERIN J. PICKETT, LAURA V. VAN DROOF, ESTEBAN BUZ, NIA M. BILLINGS, & BARRY GORDON, *Johns Hopkins University* (sponsored by Barry Gordon)—We tested the hypothesis that relatively implicit measures of cognitive processing (eye movements, pupillary dilation monitoring, and the N400 component of event-related potentials) would prove sensitive to receptive vocabulary knowledge in nonverbal individuals, even in the absence of more traditional behavioral responses. We first demonstrate the use of these measures in three populations in whom behavioral responses were expected to be reliable: normal adults, normally developing children, and high-functioning individuals with autism. In all three groups, the implicit measures differentiated known from unknown words: Eye movements were faster to a named picture for known words; pupillary dilation from baseline was greater in the unknown condition; and an N400 congruency effect was observed for known (but not unknown) words. These measures similarly differentiated known from unknown words in low-functioning individuals with autism. These results suggest that these measures may be used as valid measures of comprehension, even in nonverbal, nonresponding individuals.

(5137)

**Learning Language Statistics When World Statistics Are Equal.** MICHAEL S. AMATO, JON A. WILLITS, RACHEL S. SUSSMAN, & MARYELLEN C. MACDONALD, *University of Wisconsin, Madison* (sponsored by Maryellen C. MacDonald)—Verb knowledge encompasses both statistics of the world (e.g., what events a verb typically refers to) and the language (e.g., what words typically co-occur in a sentence). A two-part experiment investigated the effect of language statistics, holding

events constant. Participants first learned about novel verbs by watching them acted out in videos and by reading and hearing the verbs embedded in English sentences. All videos showed a human using an instrument to act on an inanimate object. The accompanying sentences mentioned the instrument 100% of the time for some verbs and 20% for others. In the second phase, self-paced reading times showed that participants differentially expected instrument arguments on the basis of the unequal language statistics, even though instruments had been equally prevalent in the video training. This suggests an important role for word co-occurrence patterns during comprehension, in addition to the accepted role of world knowledge about the events to which verbs refer.

(5138)

**Acquiring Morphological Endings: The Role of the Stem.** MARJOLEIN M. MERKX & KATHLEEN RASTLE, *Royal Holloway, University of London*, & MATTHEW DAVIS, *MRC Cognition and Brain Sciences Unit* (sponsored by Kathleen Rastle)—Some theories of morphological processing suggest that the acquisition of affix knowledge depends on familiarity with the stems with which affixes occur. We tested these theories using an artificial affix learning paradigm in which participants were taught one set of novel affixes in combination with word stems (e.g., *buildnule*) and a second set with nonword stems (e.g., *slanktege*). Tests of recognition memory performed 2 days after learning showed that participants had good explicit knowledge of the novel words. Furthermore, participants segmented ambiguous letter strings according to learned affix units, suggesting that they treated both sets of novel affixes as independent orthographic units in offline tasks. In online tasks, however, a difference arose between the two affix sets. Only affixes trained in combination with real word stems affected latencies in reading aloud and shadowing. The results show that sublexical information alone can provide sufficient information to support affix acquisition for offline tasks.

• LANGUAGE PRODUCTION/Writing •

(5139)

**Searching for Inhibition: The Effects of Delayed Retrieval on Resolving Tip-of-the-Tongue States.** MAX J. THOMAS & LISE ABRAMS, *University of Florida* (sponsored by Lise Abrams)—This experiment investigated whether delaying retrieval decreases resolution of tip-of-the-tongue (TOT) states, or temporary word retrieval failures. Participants read general knowledge questions corresponding to a “target” word to induce TOT states and responded that they knew the target, did not know it, or were having a TOT. Following TOTs, the next question contained either a “prime word,” with the same first syllable as the target, or an unrelated word. The original question was then presented again immediately or five or six questions later. The results showed that more TOTs were resolved following questions containing prime words, as compared with unrelated words, but only when TOT resolution was attempted immediately. After multiple intervening questions, primes did not increase target retrieval. These findings support the hypothesis that phonologically related words impede TOT resolution in naturalistic studies, but not laboratory studies, because of the greater amount of time between TOT incidence and resolution.

(5140)

**Language As Prediction.** MICHAEL RAMSCAR, DANIEL YARLETT, & MELODY DYE, *Stanford University*—What is going on in the mind of someone who is speaking, or listening to someone speak? We propose that when people communicate, they engage in a process of mutual prediction, exploiting a system of conventionalized cultural and experiential cues. This idea is grounded in the notion that cognition and learning are themselves fundamentally predictive—that the purpose of a cognitive system is to successfully predict events in the environment, whereas the purpose of learning is to minimize surprise in achieving this. Conceiving of language—a central aspect of human cognition—from within this kind of predictive framework not only makes sense, it allows us to resolve many linguistic “puzzles.” Drawing on evidence from computational linguistics, eyetracking experiments, childhood language acquisition studies, and corpus analyses, we advance the idea that grammar and understanding are predictive and probabilistic and that languages, far from being innately specified, are learnable.

(5141)

**Verb Production Hinders Concurrent Speech Planning More Than Does Noun Production.** DANIEL KLEINMAN & VICTOR S. FERREIRA, *University of California, San Diego*—When speakers produce words in rapid succession, what properties of a given word affect concurrent planning of upcoming words? In four experiments, speakers named sequences of object (noun) and action (verb) pictures in which both the current and upcoming pictures were visible. Relative to noun pictures, naming verb pictures slowed the naming of subsequent pictures (Experiments 1–3)—a verb hangover effect. No such effect was observed when pictures weren’t simultaneously visible (Experiments 1 and 2) or when speakers categorized the current picture’s form class instead of naming it (Experiment 3). Post hoc analyses of the results of Experiments 1–3 revealed intransitive verbs to be the culprit: In every experiment, naming low-transitive verb pictures slowed subsequent naming more than did high-transitive verb or noun pictures; in Experiment 4, a controlled manipulation of transitivity confirmed this. Thus, producing an intransitive verb hinders the production of a concurrently planned word.

(5142)

**The Furniture Beside the Fireplace Are on Fire! The Singularity of Mass Nouns Revisited.** ERICA L. MIDDLETON, *Moss Rehabilitation Research Institute* (sponsored by Kathryn Bock)—Mass nouns (i.e., invariant singulars, such as *air*, *milk*, *kerosene*, and *furniture*) typically (although not always) refer to substances, whereas count nouns (e.g., nouns that alternate as singulars and plurals, such as *leaf/leaves*, *rainbow/rainbows*, *bottle/bottles*) generally refer to enumerable objects. A long-standing debate centers on whether the grammatical differences between count and mass nouns are rooted in meaning differences or intrinsic syntactic features. The present work evaluates the syntactic feature account against the meaning account by assessing how mass nouns impact verb number in grammatical agreement. Participants repeated and completed sentence fragments that contained mass heads or local nouns (e.g., *The furniture beside the fireplace*; *The fireplace beside the furniture*) and the number of the agreeing verb was assessed. The results suggest that the grammar of mass nouns is not regulated by intrinsic syntactic features but that it may be motivated by—and originate in—noun and noun phrase semantics.

(5143)

**The Representation of Morphology in Language Production: A Large Picture-Naming Study With Compound Words.** NIELS JANSSEN, *University of La Laguna*, & PETRA E. PAJTAS & ALFONSO CARAMAZZA, *Harvard University*—A common assumption in current models of language production is that the morphemes of complex words play a role in lexical access. This assumption is confirmed by studies that show the impact of various morphological measures on the production of compound words in the cued-association task (e.g., Bien, Levett, & Baayen, 2005). Here, we studied the impact of these measures on the production of a large set of compounds ( $N = 186$ ), using the ecologically more valid picture-naming task. Participants ( $N = 28$ ) were native English speakers. All morphological measures were derived from the Celex lexical database and included the compounds’ surface frequency, constituent frequency, positional frequency, complement frequency, entropy, derivational entropy, and family size. Mixed-effect analyses revealed only surface frequency as a reliable predictor of naming latencies. The results provide evidence against a role for morphology in lexical access, at least in the context of the picture-naming task.

(5144)

**Age-Related Differences in the Syllable Frequency Effect: Evidence From Tip-of-the-Tongue States.** MEAGAN T. FARRELL & LISE ABRAMS, *University of Florida*—Syllable frequency, the rate of a syllable’s use within a language, influences speech production in some languages but has yielded inconsistent results in English. To assess the contribution of syllable frequency to age-related changes in speech production, this study examined whether first-syllable frequency influenced incidence and resolution of tip-of-the tongue (TOT) states in young, young-old, and old-old adults. Data from three published TOT studies were compiled, and the TOT target words’ first syllable was categorized

as high or low syllable frequency. Young-old and old-old adults, but not young adults, produced more TOTs for words beginning with low-frequency first syllables, relative to high-frequency first syllables. Furthermore, primes containing the target's first syllable increased TOT resolution, relative to unrelated words, but only for targets with low-frequency first syllables. The results demonstrate a syllable frequency effect in English and suggest a unique role for syllabic-level processes in explaining age-related declines in phonological retrieval.

(5145)

**Electrophysiological Correlates of Frequency and Repetition Effects in Overt Picture Naming.** KRISTOF STRIJKERS, *University of Barcelona*, PHILLIP J. HOLCOMB, *Tufts University*, & ALBERT COSTA, *Pompeu Fabra University* (sponsored by Albert Costa)—In a previous study, it was found that lexical frequency elicited an early positive going ERP effect (P2) in picture naming, with high-frequency words resulting in a more positive amplitude, as compared with low-frequency words (Strijkers, Costa, & Thierry, in revision). This strikingly early result did not, however, disambiguate a possible moderating influence of repetition. Here, we explored that possibility directly. Twenty participants performed the picture-naming task, while recording the EEG with the overt naming response. The results reveal P2 modulations for the lexical frequency effect similar to those previously encountered. Interestingly, repetition also showed P2 modulations (as well as N300 and N400), but with an inverse direction in terms of response speed: Repeated items showed the most positive amplitude. The data support the notion that lexical frequency affects the speech production process early and seems to be independent of long lag repetition.

(5146)

**Syllable Frequency Effects in Language Production and Language Comprehension Tasks.** JOANA CHOLIN, CRISTINA BAUS, & MANUEL CARREIRAS, *University of La Laguna*—High syllable frequency has been found to evoke facilitation in spoken production tasks (i.e., picture-naming and syllable production tasks). In contrast, in comprehension tasks such as lexical decision, high-frequency syllables are found to inhibit word recognition. Until now, the syllable frequency effect in the lexical decision task has been reported only with visually presented targets. To exclude that the opposing effects in production and comprehension are (1) due to different material sets or (2) due to the visual presentation of stimuli in previous lexical decision tasks, we conducted a picture-naming experiment and an auditory lexical decision experiment, using the same frequency-manipulated Spanish materials. The results showed a facilitatory effect of high-frequency first syllables in picture naming. Longer lexical decision times were observed for auditorily presented words with high-frequency first syllables.

(5147)

**Number of Features and Concreteness in Speech Production.** ANSGAR HANTSCH & MANUEL CARREIRAS, *University of La Laguna*—In a variety of cognitive tasks (e.g., lexical decision, word naming, recall, etc.), concrete nouns are found to be processed faster and more accurately than abstract nouns. The underlying mechanism of the so-called concreteness effect is still under debate. One aspect closely related to concreteness is the number of features (NoF) associated with a given concept. We conducted a picture-naming experiment to examine the role of NoF with respect to the concreteness effect in picture naming. Four sets of pictures were selected that varied (1) in NoF (high vs. low) and (2) in concreteness (high vs. low). The four item sets were matched with respect to a number of variables (e.g., frequency, imageability, word length, familiarity). A series of control studies employing different experimental tasks (i.e., lexical decision, object decision) was conducted. The results indicate that NoF contributes significantly to concreteness effects in picture naming.

(5148)

**Word Form Encoding in Chinese Begins With the Syllable: Further Evidence From Picture Naming With Masked Prime.** JENN-YEU CHEN & TRAIN-MIN CHEN, *National Cheng Kung University*, & PADRAIG G. O'SEAGHDHA, *Lehigh University*—The roles of the syllable versus the segment in Mandarin Chinese speech production were

investigated using word-naming and picture-naming tasks with masked character primes. In the related condition, the single-character prime shared the onset segment or the segmental syllable with the first character of the two-character target word or picture name. In the unrelated condition, the prime and the target shared no onset segment or beginning syllable. For both word naming and picture naming, positive syllable priming and negative onset priming were observed. These results suggest that the segment is activated but not selected and that the syllable is the first-selected sublexical unit during word form encoding in Chinese word production.

(5149)

**The Distractor Frequency Effect in the Stroop and Picture–Word Interference Paradigms.** JINGYI GENG & TATIANA T. SCHNUR, *Rice University*, & NIELS JANSSEN, *University of La Laguna*—The color-naming (Stroop) and picture–word interference (PWI) paradigms play a pivotal role in theorizing about cognitive processes in general and language production in particular. Despite their assumed similarities, there exist discrepancies. In this study, we compared the effect of distractor word frequency between color-naming and PWI tasks (in PWI, picture naming is slower for low-frequency distractors than for high-frequency distractors; Miozzo & Caramazza, 2003). In four experiments, we confirm an absence of the effect in the color-naming task and the presence of the effect in the PWI task, using a within-subjects and within-materials design. However, we also showed that in the color-naming task, this effect appears when the experiment includes the classic Stroop condition (congruent and incongruent color words). These results challenge extant hypotheses regarding processing in each task and undermine the notion that the two tasks are strictly comparable.

(5150)

**A Tale of Two Factors: Grammatical Class Ambiguity and Word Frequency Effects on TOT Resolution.** SABRA D. PELHAM & LISE ABRAMS, *University of Florida*, & KATHERINE K. WHITE, *Rhodes College*—Previous research has shown that phonologically related words (primes) facilitate tip-of-the-tongue (TOT) resolution when they are a different part of speech from the TOT target. The present study examined the effect of a prime's grammatical ambiguity (the number of possible parts of speech) on TOT resolution. Participants saw general knowledge questions whose answer corresponded to a target word. When having TOTs, participants heard three words, one of which was the phonologically related prime or an unrelated word, and repeated them aloud. Primes were either grammatically unambiguous (only one part of speech) or ambiguous (two or more parts of speech). The question was presented again, and resolution of TOTs was recorded. The results showed that both unambiguous and ambiguous primes increased TOT resolution, relative to unrelated words, with greater priming for unambiguous primes. We conclude that having multiple parts of speech in conjunction with higher word frequencies diffuses the activation necessary for target retrieval.

# • PICTURE PROCESSING •

(5151)

**Recognizing Facial Emotions With Familiar and Unfamiliar Faces.** CHRISTOPHER J. KOCH & AMANDA SMITHBERGER, *George Fox University*—The present study was conducted to determine whether familiarity with an individual influences the facial features examined while recognizing emotions. Pictures of a known person were shown as intact, with the eyes removed, or with the mouth removed. Unfamiliar faces were shown in a similar manner. Although there were no response time differences, there was a significant effect of familiarity [ $F(1,15) = 34.86, p < .001, \eta^2 = .70$ ] and face condition [ $F(2,20) = 10.00, p < .001, \eta^2 = .40$ ] for accuracy rate. Subjects were more accurate when identifying the emotions of familiar faces, whereas removing the eyes resulted in reduced accuracy. There was no familiarity  $\times$  face condition interaction. Therefore, the eyes are important for recognizing the emotion in a facial expression regardless of whether or not we are familiar with an individual, but in general, we are more accurate identifying emotions of those we know.



(5152)

**Priming Effects With Ambiguous Figures.** PAULA GOOLKASIAN & COURTNEY WOODBERRY, *University of North Carolina, Charlotte*—We varied the format and semantic content of primes to determine whether they would influence the interpretation of ambiguous figures. The primes were objects or object names that were related in some way to one of the alternative organizations of the ambiguous figures. An orienting question was used to focus attention on the semantic relationship between the prime and the figure. Recognition responses to biased versions of the figures and to new figures were measured. Primes that were loosely and indirectly associated with one of the two alternative versions of an ambiguous figure were found to be effective at biasing the interpretation of an ambiguous figure in the direction of the primed alternative, but only if attention was focused on the semantic relationship between the two stimuli. Attention to the physical characteristics of the stimuli during encoding eliminated the prime's influence.

(5153)

**Animal Recognition and Eye Movements: The Contribution of Outline Contour and Local Feature Information.** TOBY J. LLOYD-JONES, *Swansea University*, JUERGEN GEHRKE, *University of Leicester*, & JASON LAUDER, *University of Exeter*—We assessed the importance of outline contour and individual features in mediating the recognition of animals by examining response times and eye movements in an animal-object decision task (i.e., deciding whether or not an object was an animal that may be encountered in real life). There were shorter latencies for animals than for nonanimals, and performance was similar for shaded line drawings and silhouettes, suggesting that important information for recognition lies in the outline contour. The most salient information in the outline contour was around the head, followed by the lower torso and leg regions. We also observed effects of object orientation and argue that the usefulness of the head and lower torso/leg regions is consistent with a role for the object axis in recognition.

(5154)

**An Examination of Holistic Versus Analytical Retrieval Strategies in Eyewitness Identification Tests.** HEATHER D. FLOWE & ROBYN E. HOLLIDAY, *University of Leicester* (sponsored by Robyn E. Holliday)—Previous research has found that eyewitness identification accuracy varies in relation to testing procedure. The present study examined the extent to which participants engaged in holistic versus analytical processing in eyewitness identification tests, using eye tracking. Participants studied faces and were tested with a lineup (the “suspect” was imbedded among a set of distractor faces) or a showup (the “suspect” face was presented alone without distractors). Additionally, the lineup test faces were presented either simultaneously (test faces presented in an array) or sequentially (test faces presented one at a time). In simultaneous lineups and showups, a greater proportion of time was spent analyzing internal features of the test faces, as compared with sequential lineups. The results suggest that face memory retrieval is more holistic in simultaneous lineup and showup tests, whereas retrieval is more analytical in sequential lineups.

(5155)

**Need for Cognition and Appreciation for Abstract Paintings.** DANIELLE REED & XU XU, *Pennsylvania State University*—Appreciation for abstract art has emerged as an interesting new topic. Some studies have investigated the emotive elements involved in the appreciative process of abstract artworks. The present study examined whether the complexity of an abstract painting and the level of an individual's need for cognition might affect one's emotive responses to the painting. Participants indicated their emotive responses to both simple abstract paintings and complex abstract paintings. (The level of complexity was determined by a norming study.) They then completed the Need for Cognition Scale. The results showed that, in general, complex paintings elicited more intense positive and negative emotive responses than did simple paintings. In addition, individuals with higher need for cognition indicated fewer negative emotions (including loneliness, melancholy, anxiety, desperation, sadness) than did those with lower need for cognition. The findings suggest that cognitive elements play important roles in the appreciation of abstract art.

(5156)

**The Happy Face Superiority Effect With Sequential Judgments.** DEAN G. PURCELL, *Oakland University*, ALAN L. STEWART, *Stevens Institute of Technology*, & JESSICA SHIER, *Oakland University*—Sequences of prime and target faces displaying either angry or happy expressions were presented at a stimulus onset asynchrony of 305 msec. In conventional affective priming tasks, observers report only the affect of the prime. Our observers determined whether the two faces displayed the same emotion. Previously, we found priming both with highly expressive faces and with schematic faces, but not with less expressive faces. Less expressive faces produced a happy face superiority (HS), where happy primes produced fast responding regardless of the second face's affect. The present experiments extended the range of conditions under which the HS can be found, even with extreme expressions. In one experiment, extreme expression faces were used as primes and targets; however, half of the targets were rotated 90° left or right. In two other experiments, extreme primes were matched with nonextreme targets, and vice versa.

# • PERCEPTUAL ORGANIZATION •

(5157)

**Configural Asymmetries Depend on Orientation: Left-Right Targets Are Distinct From Other Orientations.** MOUNA ATTARHA & THOMAS G. GHIRARDELLI, *Goucher College*—Search asymmetries are when observers are significantly faster to find a particular target among distractors than when the identity of the target and distractors are reversed. Monnier, Attarha, Edler, and Birks (in press, *Visual Cognition*) found a configural asymmetry (CA; Junge, 2008) for bicolor disks such that observers were significantly faster to find a target when the border separating the two halves was oriented at 0° (e.g., a green-top-red-bottom among red-top-green-bottoms) than when the border was oriented at 90°. To determine whether this asymmetry forms a continuous function of orientation, participants performed a visual search across a wide range of border orientations (e.g., 45°, 60°, 135°, and 150°). We replicated the earlier effect and showed that the other orientations were comparable to top-bottom and were distinct from left-right. CAs are robust and stable and are not explained by traditional accounts of visual search.

(5158)

**Feature Assignment in Perception of Auditory Figure.** MELISSA K. GREGG & ARTHUR G. SAMUEL, *Stony Brook University*, & TANYA KRALJIC, *University of Pennsylvania*—The auditory system is quite flexible in combining auditory features into auditory objects: A feature can contribute to the perception of an auditory object, even when the two are presented at different spatial locations (e.g., Rand, 1974). However, a feature sometimes will not group with an object sharing the same spatial location if an object in the background can “attract” the feature (Shinn-Cunningham et al., 2007). We explored this discrepancy by examining the characteristics of (1) auditory objects in the figure and (2) auditory features that affect the likelihood of feature and object binding. We found that an object in figure is more likely to group with a feature when that feature is needed to create an identifiable figure object. However, this likelihood decreases when spatial cues allow the feature to contribute to the identity of an object in ground. Implications for how auditory scenes are perceived will be discussed.

(5159)

**Hearing Shapes: Cross-Modal Matching of U.S. States Presented in Music Space.** ERIC C. ODGAARD, *University of South Florida, St. Petersburg*—Sheet music is a visual analogue to music space, with the primary dimensions of pitch (vertical axis) and time (horizontal axis). This study shows that participants can use the converse relationship to recognize two-dimensional shapes. That is, when the border contours of U.S. states are drawn in music space, participants can match the sounds of these shapes to the correct visual target more than 70% of the time in an AB-X design. Performance was better than chance whether participants were matching sounds to visual targets or shapes to sound targets, and whether visual stimuli were presented as trace outlines of the states or as the dot patterns of the musical notation for the stimuli. Although self-reported music experience and familiarity with the states

were correlated with better performance, even untrained and unpracticed participants performed better than chance on average. The implications for cross-modal theory are discussed.

## (5160)

**Effect of Partial Information of Novel Figures on Mere Exposure Effect.** HISATO IMAI & YUKIKO ISHII, *Tokyo Woman's Christian University*—We examined whether partial information of novel figures would induce a mere exposure effect. Stimulus figures were  $4 \times 4$  dot-matrices with eight lines and  $3 \times 3$  dot-matrices with five lines. The latter  $3 \times 3$  figures were embedded as a part of the former  $4 \times 4$  figures. Ninety-four undergraduates were exposed to the  $3 \times 3$  and the  $4 \times 4$  figures on the classroom screen for 1 sec, each for four times. Then they were presented an exposed and an unexposed pair of the  $3 \times 3$  or the  $4 \times 4$  figure. Half of the participants chose more preferable figures, and the other chose less preferable ones. A mere exposure effect was found in all conditions; specifically, participants who made more preferable judgments chose exposed figures significantly more often than chance, and those who made less preferable judgments chose exposed figures significantly less often than chance. These results indicate that exposure to partial information, as well as to the whole information, enhances preference of the figures, and vice versa.

## (5161)

**Different Places for Identical Faces: Perceptual Space “Shrinks” for Other Races.** MEGAN H. PAPESH, STEPHEN D. GOLDINGER, & PETER R. KILLEEN, *Arizona State University*—We examined predictions derived from Valentine's (1991) multidimensional space (MDS) framework for own- and other-race face processing. Two sets of 20 computerized faces were generated from a single prototype. Each face was then saved as Black and White, changing only skin tone, so each structurally unique face was represented in both race categories. Participants made speeded “same–different” judgments to all possible combinations of faces, from which we generated a group psychological space, with “different” RTs as the measure of similarity. Consistent with the MDS framework, all faces were pseudonormally distributed around the (unseen) prototype. The distribution of the faces by race was also consistent with Valentine's (1991) predictions: White faces were well distributed throughout the space and, despite their physical identity to the White faces, Black faces were clustered tightly within the space. Other-race faces were more densely clustered in psychological space, which could underlie well-known recognition deficits.

## (5162)

**A Preference For Smiles Over Angry Expressions Among Four-Month-Old Infants.** SHIH-TSENG TINA HUANG, HAN-SHU CHANG & GARY CHON-WEN SHYI, *National Chung Cheng University* (sponsored by Gary Chon-Wen Shyi)—In Experiment 1, two groups of infants were familiarized to female smiles and angry faces at fixed intervals; they showed no preference between a novel female's smile and angry faces. In Experiment 2, when habituated to a small set of people, other than showing a dishabituation on a smiling face when habituated to angry faces, the infants showed preferences for a smile over an angry expression of the same female even when they were habituated to smiling faces. In Experiment 3, with a larger set of expressions from different people, we found the infants habituated to female smiling faces kept their preference for a smiling expression in a preference test, but not for a familiar angry expression. The results of the three experiments suggested that 4-month-old infants' preference for a smile over an angry face may be due to their typical experience with smiling faces early in development.

## (5163)

**Retrieval Competition for Object Properties.** IRENE REPPA & JO SAUNDERS, *Swansea University*—Successful retrieval from long-term memory relies on forgetting of items associated with the target memory, leading to retrieval-induced forgetting (RIF). The present study examined whether shape and surface properties are equally strong competitors in memory for objects. Shape and color typicality was manipulated within participants, and retrieval cue at final test (same vs. different from

study) was manipulated between participants. Participants studied different objects from each of eight object categories (Experiments 1 and 3) or the same object in different colors (Experiments 2 and 4). An old/new recognition discrimination was carried out on a subset of the studied objects during the practice phase and on all of the studied objects in the final test phase. RIF was observed for both shape and surface properties and was larger for nontypical than for typical object properties. The findings are discussed in the context of theories of object recognition and inhibitory accounts for RIF.

## • SPEECH PERCEPTION •

## (5164)

**Mouse-Tracking Analysis of Context Effects in Speech Perception.** LAWRENCE BRANCAZIO, *Southern Connecticut State University and Haskins Laboratories* (sponsored by Kenneth R. Pugh)—In the mouse-tracking paradigm (Spivey et al., 2005), participants respond to stimuli by moving the cursor to response boxes on a computer monitor. This study examined context effects in speech using mouse tracking; novel analyses extracted initiation of movement toward each response. Experiment 1 examined coarticulatory effects: Stimuli were cross-spliced “sky,” “spy,” and “sty,” where /s/ contained coarticulatory information matching or mismatching the stop consonant. Movements toward the correct response were initiated earlier for matched than for mismatched stimuli; mismatched stimuli had more movements toward the incorrect response (typically, approximately 200 msec postspeech). Experiment 2 examined lexical effects on B–P judgments, using “beace”–“peace”–“beef”–“peef” continua. Initiations of movements toward B or P varied with stimulus ambiguity and lexical status. For ambiguous stimuli, responses forming words (B with ambiguous “b/peef”) had more initial movements toward the nonselected target (P), providing an online window onto the lexical effect.

## (5165)

**What Underlies the Perception of Rhythmic Differences in Speech?** LAURENCE WHITE, SVEN L. MATTYS, & LUKAS WIGET, *University of Bristol* (sponsored by Sven L. Mattys)—Perception of cross-linguistic speech rhythm differences has been related to variation in durational contrast between stressed and unstressed syllables, but differences in speech rate and stress distribution (e.g., the number of unstressed syllables between stresses) may also contribute. We resynthesized utterances into monotone sequences of *sasasa* syllables, preserving only the durational values of the original vowels and consonants. In an ABX categorization task, Experiment 1 showed that English and Spanish *sasasa* utterances could be distinguished. In Experiment 2, we normalized English versus Spanish rate differences: Discrimination was reduced but reliable. Experiment 3 eliminated stress distribution differences, using the same sentences uttered in two English accents differing in durational stress contrast; discrimination was further reduced but still reliable. However, in Experiment 4, which compared two English accents with similar durational stress contrast, discrimination was at chance. Thus, even though rate and stress distribution facilitate rhythmic discrimination, durational stress contrast appears sufficient.

## (5166)

**Lexical Competition in Spoken Word Identification: Effects of Age and Noise.** BOAZ M. BEN-DAVID, *University of Toronto and Toronto Rehabilitation Institute*, CRAIG G. CHAMBERS & MEREDYTH DANEMAN, *University of Toronto, Mississauga*, M. KATHLEEN PICHORA-FULLER, *University of Toronto, Mississauga*, and *Toronto Rehabilitation Institute*, & EYAL M. REINGOLD & BRUCE A. SCHNEIDER, *University of Toronto, Mississauga* (sponsored by Craig G. Chambers)—Twenty-four older and 24 younger adults followed spoken instructions (“Look at the clown”) while viewing objects on a monitor (clown, cloud, ring, wheel). Gaze position was monitored using an eyetracking system. We measured the point in time at which listeners correctly fixated the target and the extent to which listeners momentarily fixated a “competitor” object whose name shared speech sounds with the target (cloud). These measures reflect transitory sources of confusion that can affect comprehension. Speech was presented in quiet or in speech spectrum noise. Different amounts of noise were used to

equate the two age groups for overall accuracy. Eye movements revealed extremely similar patterns for both groups, with greater consideration of the competitor when sentences were presented in noise. The results indicate that, when differences in sensory level are controlled for, the cognitive mechanisms underlying real-time lexical processes appear to be largely robust to effects of aging.

(5167)

**Do Multiple Shadows of the Same Model's Speech Sound Similar to Each Other?** KAUYUMARI SANCHEZ, RACHEL M. MILLER, LAWRENCE D. ROSENBLUM, & NEAL DYKMANS, *University of California, Riverside* (sponsored by Lawrence D. Rosenblum)—Talkers subtly imitate the speech of the individuals to whom they are speaking. This speech alignment occurs in live conversations, as well as in experimental settings where subjects are asked to shadow (quickly say out loud) heard words recorded from a model. The present study examined whether multiple shadows of the same model sound more similar to each other than they do to shadows of a different model. Eight female subjects shadowed words spoken by one of two female models. Similarity judgments of the shadowed utterances were made by naive raters performing a matching task. These raters found that words spoken by shadows of the same model sounded more like each other than did words spoken by shadows of the other model. This could suggest that the properties of the models' speech to which shadows aligned were similar across subjects. This possibility was explored in follow-up acoustical analyses of the shadows' utterances.

(5168)

**Second-Language Articulation Training by Ear and Eye.** LAURA M. MORETT, DOMINIC W. MASSARO, & MRUNAL GAWADE, *University of California, Santa Cruz* (sponsored by Dominic W. Massaro)—Do dynamic visible speech displays facilitate pronunciation acquisition in a novel second language? We compared the learning of two Spanish phonemes absent in English, /r/ and /rr/, via audiovisual presentation of the internal articulators of an embodied conversational agent, Baldero, versus auditory speech alone. Participants learned how to pronounce 20 pairs of Spanish words that differed only in the critical phoneme, both by imitating the correct articulation of words and by pronouncing words displayed as text. Presentation and feedback consisted of auditory speech alone for one group of participants and an animated side view of the tongue, teeth, and palate of Baldero with speech for another group of participants. The results indicate whether audiovisual speech presentation can facilitate the acquisition of a novel phonetic contrast and whether the similarity of the phonemes of the target language to the phonemes of the learner's native language affects the results.

(5169)

**Speaking Rate Modulates the Perception of Durational Cues to Lexical Stress.** EVA REINISCH & ALEXANDRA JESSE, *Max Planck Institute for Psycholinguistics*, & JAMES M. MCQUEEN, *Max Planck Institute for Psycholinguistics and Radboud University Nijmegen* (sponsored by James M. McQueen)—Duration as a cue to phoneme identity is not perceived in an absolute fashion but, rather, relative to speaking rate. In four categorization experiments, we investigated whether speaking rate affects the perception of duration as a cue to lexical stress. Dutch listeners had to decide from which of two words that differed in lexical stress placement (e.g., Alibi–aLInea, “alibi”–“paragraph”; capitals indicate stress) an initial two-syllable fragment had been taken. In Dutch, duration is the primary cue to lexical stress. Duration continua on the fragment's first or second vowel were created. Fragments followed a fast or a slow carrier sentence. Speaking rate affected the perception of stress by influencing the perceived duration of the first syllable. This was true for word pairs with first- versus second-syllable stress contrasts and for those with first- versus third-syllable contrasts. Second syllable information was used less. Lexical stress is perceived relative to speaking rate.

(5170)

**Do Variant Word Forms Compete for Recognition?** MICAHA GEER & PAUL A. LUCE, *University at Buffalo*—Words in casual speech exhibit considerable variation in articulation. In particular, alveolar stop

consonants (/t/ and /d/) in certain phonetic environments may be produced as taps, glottal stops, or careful /t/s and /d/s, or they may be deleted altogether. Thus, words containing non-word-initial alveolar stops may be represented in memory as multiple specific variants. We investigated whether these multiple representations of variant forms might compete for recognition by comparing processing time for monosyllabic words that end in either alveolar or nonalveolar (bilabial or velar) stops. Alveolar-ending words were responded to more slowly than carefully matched non-alveolar-ending words in both a lexical decision and a same–different matching task. This result did not hold for similarly composed nonwords. The results suggest that variant word forms compete at a stage beyond sublexical processing. Implications for characterizing competition in spoken word recognition are discussed.

(5171)

**Perceptual Representations of Phonotactically Illegal Syllables.** MARA E. BREEN, LISA D. SANDERS, & JOHN KINGSTON, *University of Massachusetts, Amherst* (sponsored by Lisa D. Sanders)—Behavioral evidence demonstrates that listeners categorize phonotactically illegal syllables as phonemically similar legal ones (e.g., English listeners report hearing /dla/ as /gla/). Dehaene-Lambertz et al. (2000) failed to elicit a mismatch negativity from deviant, illegal syllables. They argued that phonotactics constrain early perceptual processing. Using a priming paradigm, we compared event-related potentials elicited by targets (/gla/) preceded by (1) different tokens of identical primes (/gla/), (2) phonetically distinct primes (/kla/), and (3) phonotactically illegal primes (/dla/). Mean amplitude 200–350 msec after targets preceded by both control and illegal primes was more positive than that for the same targets preceded by identity primes. Later waveforms (350–600 msec) for targets preceded by identity and illegal primes did not differ, which corresponded to behavioral responses. These data support a model of speech perception in which phoneme clusters are faithfully represented at early stages of perception but later are categorized according to language-specific constraints.

(5172)

**The Effects of Talker Familiarity on the Processing Dynamics of Spoken Word Recognition.** SABRINA K. SIDARAS, LYNNE C. NYGAARD, & JESSICA E. D. ALEXANDER, *Emory University* (sponsored by Lynne C. Nygaard)—We examined the effects of talker-specific perceptual learning on the efficiency of lexical access to assess the point at which effects of talker familiarity emerge during spoken word recognition. Listeners learned to identify six talkers' voices (three male, three female) over 3 days of training. At test, listeners completed either an easy lexical decision task in which nonwords were dissimilar from words or a difficult lexical decision task in which nonwords and words were similar. Items at test were produced by six familiar and six unfamiliar talkers and were blocked by familiarity. The results indicated that effects of talker familiarity were found when the lexical decision task was easy, but not when it was difficult. In addition, talker familiarity interacted with lexical characteristics. These findings suggest that effects of talker familiarity emerge early in spoken word processing but disappear over time as listeners begin to access relatively more abstract representations.

(5173)

**Examining Talker Effects In Bilingual Listeners' Perception Of Spoken Words.** MAURA WILSON & CONOR T. MCLENNAN, *Cleveland State University*, & JULIO GONZÁLEZ, *Universitat Jaume I*—Previous studies demonstrate that listeners are faster to recognize words recently spoken by the same talker, relative to a different talker. However, such talker effects may be more robust when processing is relatively slow. The purpose of the present study was to examine talker effects in bilingual listeners as a function of whether the listeners were hearing words in their first (L1) or second (L2) language. More specifically, in the present study, conducted in Spanish, we examined whether talker changes would affect bilinguals differently, depending on whether Spanish was their L1 (Spanish–English bilinguals) or their L2 (English–Spanish bilinguals). Given that bilinguals typically process their L2 more slowly than their L1, the results were expected to reveal greater talker effects in English–Spanish than in Spanish–English bilinguals. The present study should



provide a greater understanding of the role that talker variability plays in bilingual listeners' online perception of spoken words.

(5174)

**An Electrophysiological Study of Temporal Order and Learning in Speech Perception.** SHIN-YI FANG & JAMES S. MAGNUSON, *University of Connecticut and Haskins Laboratories* (sponsored by James S. Magnuson)—In spoken word recognition, distinguishing patterns with different temporal order (e.g., BOOST and BOOTS) is critical, but the basis is not fully understood. We set out to study temporal order perception, using a passive auditory oddball paradigm, measuring electrophysiological responses to temporal and phonological changes. We compared a standard sequence (/apta/) with deviants where internal segments were manipulated: reversed order (/atpa/), same onset (/apka/), same offset (/akta/), or unrelated (/afla/). Difference waveforms (deviant – standard) showed negativity 200–300 msec after the deviance point with distribution similar to the MMN, except for same onset. All conditions showed an N400-like posterior negativity 400–500 msec postdeviation. However, the component magnitudes changed over time. In the second half of the experiment, MMN-like responses were weaker or absent, but N400-like responses became stronger. This suggests that all items began to be lexicalized with repeated exposure. We discuss implications for theories of speech perception and ERP methods.

(5175)

**Lexical and Sublexical Contributions to Talker Familiarity Effects in Spoken Word Recognition.** ALEXANDRA JESSE, *Max Planck Institute for Psycholinguistics*, JAMES M. McQUEEN, *Max Planck Institute for Psycholinguistics and Radboud University Nijmegen*, & MIKE PAGE, *University of Hertfordshire*—Words are recognized better when repeated by the same talker than when repeated by a different talker (McLennan & Luce, 2005). We examined the relative contribution of lexical and sublexical information to this talker-specific repetition effect. In a between-subjects design, auditory lexical decisions were faster to words repeated by the same speaker, but also to new words that consisted of phonemes previously heard in different words spoken by the same speaker. The repetition advantage was larger for word than for phoneme repetitions, suggesting that both lexical and sublexical speaker-specific information contributed. The phoneme repetition effect, however, was found only for one of the two speakers tested. That is, the relative involvement of lexical and sublexical talker-specific information varied across speakers. The results from additional within-subjects manipulations will be discussed. These findings clarify whether sublexical information contributes to talker familiarity effects or whether these effects reflect storage of lexical episodes alone.

(5176)

**The Roles of Tonal and Segmental Information in Mandarin Spoken Word Recognition: An Eyetracking Study.** JEFFREY G. MALINS & MARC F. JOANISSE, *University of Western Ontario* (sponsored by Marc F. Joanisse)—We examined spoken word recognition in Mandarin, using eyetracking. Of interest was the time course of resolving tonal versus phonemic information. Subjects heard an auditory word and were required to select its corresponding picture from an array that included the target item (e.g., chuang2 “bed”), one of four phonological competitor types (cohort, chuan2 “ship”; rhyme, huang2 “yellow”; segmental,

chuang1 “window”; tonal, niu2 “cow”), and two phonologically unrelated distractors. Growth curve analysis was used to characterize the trajectory of change in gaze to target following word presentation. We found very similar model fits for the segmental and cohort conditions, characterized by slower eye movements to correct targets, as compared with baseline, suggesting that tonal and segmental information are accessed concurrently and play comparable roles in constraining activation. These findings are discussed with respect to current models of spoken word recognition that have not previously accounted for the role of tone.

(5177)

**The \*eel Was on the Table: Revisiting the Role of Following Context in Spoken Word Recognition.** CHRISTINE M. SZOSTAK & MARK A. PITT, *Ohio State University*—Although it is known that recognition of a spoken word can be delayed until after word offset, surprisingly little is known about how following context affects word processing. We explore this issue by revisiting the well-known finding of Warren and Warren (1970), in which a lexical ambiguity could be resolved only by the disambiguating word at the end of the sentence, as in the title of this abstract. Across a series of phonemic restoration experiments, we varied the proximity of the disambiguating word (in terms of both duration and number of syllables) and whether the disambiguating word occurred at all. The results showed that phoneme decision making can be biased by disambiguating words occurring as much as 2 sec later, and that the number of intervening syllables has a stronger influence than does absolute duration.

(5178)

**Effects of Adult Aging and Hearing Acuity on Memory for Surface Structure and Meaning in Spoken Passages.** JONATHAN BENICHOV, PATRICIA A. TUN, & ARTHUR WINGFIELD, *Brandeis University*—It is well-known that listeners show better memory for the meaning of an utterance than for its specific wording. Our question was whether this contrast between meaning and surface structure would hold to the same degree for older adults with age-related hearing loss. Younger adults and older adults with good and with poor hearing acuity listened to spoken passages and then judged whether a probe sentence was either identical to or different from one heard in the passage. The modified probe sentences had either similar wording but a different meaning or similar meaning but a different wording. Passages were presented at two sound levels for a measurement of accuracy and response latencies of judgments. Findings are discussed in terms of an effortfulness hypothesis: that perceptual effort consequent to poor hearing, or challenging sound levels, will have downstream effects that especially impact memory for surface structure.

(5179)

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

(5180)

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