

Attention I

Grand Ballroom Centre, Friday Morning, 8:00–9:40

Chaired by Eliot Hazeltine, University of Iowa

8:00–8:15 (1)

How Does a Working Memory Load Affect Flanker Interference? ELIOT HAZELTINE, CAGLAR AKCAY, & STEVEN J. LUCK, *University of Iowa*—The relationship between response inhibition and working memory has informed theories of executive control by indicating that maintaining information in working memory may engage cognitive processes that are also recruited by response selection operations. We had participants perform a three-choice version of the Eriksen flanker task alone or while performing a concurrent working memory task. Contrary to some recent findings, flanker interference was not larger when participants performed a concurrent working memory task. This pattern was observed when participants counted backward by three (and reaction times were elevated, as compared with single-task blocks) and when participants simply maintained six digits in working memory (and reaction times were similar to those in single-task blocks). However, sequential effects were clearly altered by the working memory task. We discuss the theoretical implication of these findings and how they can be reconciled with demonstrations that working memory tasks increase interference from irrelevant stimuli.

8:20–8:35 (2)

Conflict Monitoring Is Not Enough to Explain Sequential Effects in the Flankers Task. ANA TORRALBO & JUAN BOTELLA, *Autónoma University of Madrid* (read by Juan Botella)—The analysis of sequential effects in a choice reaction time task demonstrates that the processes involved in a given trial interact with those activated in the previous trial. Specifically, the flanker compatibility effect (FCE) is modulated by the compatibility level of the previous trial. This result has been considered as support for the conflict monitoring hypothesis. Our results show that intertrial modulation is linked to target repetition, indicating that some factors beside the conflict level are involved. We explored the modulating effects of such variables as response–stimulus interval and expectations. Although such factors have an effect on first-order sequential effects, they appear not to influence modulation of the FCE as a function of the compatibility of the previous trial and target repetition. Our main conclusion is that the conflict monitoring hypothesis is insufficient to explain the sequential effects observed in the flankers task.

8:40–8:55 (3)

A Color Congruency Flanker Task Effect in Cortical Color Blindness. GEOFF G. COLE, CHARLES HEYWOOD, & ROBERT KENTRIDGE, *University of Durham*—The degree of interference caused by distractors in a letter identification task is dependent on color congruency of target and flankers (Baylis & Driver, 1992). When flankers and target are the same color, reaction time to determine the identity of the target is elevated, relative to when they are different colors. However, if attention is necessary for awareness, color experience cannot provide a basis for preattentive segmentation. The color congruency effect is likely, therefore, to be due to earlier color-processing mechanisms. We tested this by carrying out the color congruency flanker experiment on a cerebral achromatopsic patient. Despite the patient's having had no color experience, a color congruency effect was observed. Furthermore, this occurred only when chromatic contrast of the stimuli was available; when such contrast was not available, the effect was abolished. These results suggest that chromatic contrast provides a greater role in visual segmentation than does color as a surface property.

9:00–9:15 (4)

Attentional Control and the Relatedness Proportion Effect in Semantic Priming. KEITH A. HUTCHISON, *Montana State University*—

In two experiments, participants completed both an attentional control battery (Ospan, antisaccade, and Stroop tasks) and a modified semantic priming task. The priming task measured relatedness proportion effects (RPEs) within subjects, using the color of the prime to indicate the probability that the to-be-named target would be related. In Experiment 2, participants were also told the relatedness proportion prior to each colored prime. Two SOAs traditionally thought to tap automatic (267 msec) versus controlled (1,240 msec) processing were used. Across experiments, exploratory factor analysis on the battery revealed a general attentional control factor (AC). In Experiment 1, the RPE was significant under long-SOA conditions and increased linearly across low, medium, and high AC. In Experiment 2, the RPE again increased with AC and occurred for both short and long SOAs. The relation between AC and semantic priming under high and low relatedness proportion conditions is discussed.

9:20–9:35 (5)

Focusing Auditory Attention From Broadband to Single Tones: Faster at Lower Frequencies. ADAM REEVES, BERTRAM SCHARF, JOHN SUCIU, & ZHENLAN JIN, *Northeastern University*—By indicating the signal frequency to listen for, an auditory cue lowers masked threshold approximately 3 dB (Gilliom & Mills, 1976). We determined how quickly a listener can take advantage of the cue. Measurements were made on six trained listeners against 50-dB continuous broadband noise. Signals were 40-msec tone bursts presented 1 dB above threshold. On each trial, a cue set 6 dB higher than the signal and at the same frequency preceded the signal whose frequency was chosen randomly (570–3400 Hz). Sensitivity was measured by a yes–no procedure, with cues on all trials, signals on half. The interval from cue to signal required for the cue to be effective is under 30 msec at frequencies around 500 Hz and increases to over 100 msec at around 3000 Hz, suggesting an initial bias for listening at lower frequencies or faster processing at lower frequencies.

Inhibition in Memory

Grand Ballroom East, Friday Morning, 8:00–10:00

Chaired by Martin A. Conway, University of Leeds

8:00–8:15 (6)

Episodic Inhibition. MARTIN A. CONWAY, *University of Leeds*, & MIHALY RACSMANY, *Hungarian Academy of Science*—Six experiments examined the proposal that an item of long-term knowledge can be simultaneously inhibited and activated. In two directed-forgetting experiments, items to be forgotten were found to be inhibited in list-cued recall but activated in lexical decision tasks. In three retrieval practice experiments, unpracticed items from practiced categories (rp-items) were found to be inhibited in category-cued recall but were primed in lexical decision. If, however, the primes and targets in lexical decision were taken directly from the study list, inhibition was observed. Finally, it was found that when items highly associated to a study list were processed in between study and test no inhibition in recall was present. These and a broad range of other findings can be explained by the concept of *episodic inhibition* which proposes that episodic memories retain copies of patterns of activation/inhibition originally generated during encoding in conceptual/lexical knowledge structures.

8:20–8:35 (7)

Part-List Cuing Can Be Transient and Lasting: The Role of Encoding. KARL-HEINZ BÄUML & ALP ASLAN, *Regensburg University*—The presentation of a subset of learned items as retrieval cues can have detrimental effects on recall of the remaining items. According to strategy disruption, such part-list cuing disrupts subjects' retrieval plan and thus causes transient forgetting of noncue items. According to retrieval inhibition, part-list cuing leads to covert retrieval of cue items, which causes lasting inhibition of noncue items. For two types

of encoding conditions, we examined, in three experiments, whether part-list cuing is a transient or lasting phenomenon. Across the experiments, the detrimental effect of part-list cues was consistently found to be transient with associative encoding and lasting with nonassociative encoding. These results indicate that the persistence of part-list cuing depends on encoding, thus challenging both strategy disruption and retrieval inhibition as general accounts of part-list cuing. A two-mechanism account is provided, according to which the two mechanisms mediate the effect in different encoding conditions.

8:40–8:55 (8)

The Influence of Preexisting Associations on Integration Effects in Directed Forgetting. LILI SAHAKYAN, *University of North Carolina, Greensboro*, & LEILANI B. GOODMON, *University of South Florida*—The directed-forgetting effect refers to impaired recall of previously studied information as a result of instructing people to forget. Previous research showed that integration resulting from strong primary associations between to-be-forgotten (TBF) and to-be-remembered (TBR) lists reduces the directed-forgetting effect (Conway, Harries, Noyes, Racsmany, & Frankish, 2000). The present studies investigated the effects of the direction and strength of preexisting semantic associations (as measured by free association norms) on directed forgetting. In a series of studies, the TBF and TBR lists were completely unrelated (*rose–business*), linked only in one direction (*stem* activates *rose*, but *rose* does not activate *stem*), or linked in both directions (*rose–petals*). Results revealed no forgetting in the bidirectional condition only. To determine whether greater net strength of the associations or the presence of links in both directions were responsible for these findings, subsequent studies crossed strength with the direction of association.

9:00–9:15 (9)

Protecting Against Inhibition: The Influence of Episodic and Semantic Integration on Retrieval-Induced Forgetting. LEILANI B. GOODMON, *University of South Florida*, & MICHAEL C. ANDERSON, *University of Oregon* (read by Michael C. Anderson)—When people form episodic connections between memories that share a cue, the tendency for those memories to compete is reduced. This episodic integration has been shown to protect memories from retrieval-induced forgetting (RIF), a phenomenon in which retrieval of some associates of a cue suppresses other competitors. Here, we report three experiments examining whether semantic integration (i.e., preexisting associations), also protects against RIF, even when no episodic integration is attempted. In the interset condition, strong a priori associations existed between the retrieval practiced and nonpracticed sets. In the intraset condition, there were strong associations within the practiced set and nonpracticed set. Results show a striking dependency of inhibition on the pattern of associations: The intraset condition revealed substantial inhibition, but the interset condition revealed none. These findings show that integration—whether episodic or semantic—forms a fundamental boundary condition on RIF that is likely to explain variability in this phenomenon.

9:20–9:35 (10)

In Search of Inhibition in Retroactive “Inhibition.” DENNIS J. DELPRATO & KAREN STANLEY, *Eastern Michigan University*—Although retroactive interference (RI) once was routinely referred to as *retroactive inhibition*, convincing evidence of inhibition in the classic RI preparation may have never been reported. This research, in which experimental subjects studied two successive lists of 20 different unrelated words, was designed to rule out several noninhibitory sources of RI decrements. And one of the two RI experimental conditions (study only), like the RI control condition, should not have activated inhibitory processes, because subjects did not overtly recall second-list words prior to the test of first-list retention. The other (study–test) was expected to activate inhibitory control processes, due to overt retrieval of words during second-list study. Over two experi-

ments, RI was evident, but only when the second list was studied for more than a single cycle, provided that the words were also recalled in conjunction with study episodes. These findings seem to suggest that inhibition does participate in RI.

9:40–9:55 (11)

Repression Revisited. MICHAEL S. HUMPHREYS & ANGELA M. MAGUIRE, *University of Queensland*, & DOUGLAS L. NELSON, *University of South Florida*—It has been suggested that the think/no-think paradigm in which participants are encouraged to suppress responses (Anderson & Green, 2001) may provide a model for the Freudian concept of repression. We have been able to replicate the basic results through mere exposure, without having subjects practice suppressing a response. We argue that our results, as well as the Anderson and Green results, are better explained by associative chaining, where interference occurs when a nontarget member of the chain is associated with context.

Causal Learning and Reasoning

Grand Ballroom West, Friday Morning, 8:00–10:00

Chaired by Brett K. Hayes, *University of New South Wales*

8:00–8:15 (12)

The Development of Causal Induction. BRETT K. HAYES & SUSAN P. THOMPSON, *University of New South Wales*—Most process models of category-based induction assume that the strength of an inductive argument is a positive function of the similarity between the features of premise and conclusion instances. This paper examines the development of an alternate basis for induction: shared causal relations in premises and conclusions. Three experiments compared the use of feature similarity and causal relations in the inductive reasoning of 5- and 8-year-olds and adults, using artificial category stimuli. Although the prevalence of induction based on causal relations increased with age, 5-year-olds showed a reliable preference for causal over similarity-based induction. For all ages, inductive inferences based on causal antecedent features were stronger than those based on causal consequent features. Similar results were found across two conceptual domains (animals and artifacts). The implications for models of inductive reasoning and inductive development are considered.

8:20–8:35 (13)

Mechanisms of Induction Across Points of Development. VLADIMIR M. SLOUTSKY, *Ohio State University*—The ability to generalize from known to novel appears early in development. To examine mechanisms of inductive generalization, Sloutsky and Fisher (2004) studied recognition memory for items, using the induction-then-recognition (ITR) paradigm. Adults induced on the basis of category information, whereas 5-year-olds induced on the basis of similarity. The reported research further examines the mechanisms underlying induction across points of development. We presented young children and adults with the ITR task, while recording their eye movements. Overall results indicate that (1) all participants accurately performed the induction task, (2) children had multiple fixations on the studied items and accurately discriminated studied items and new members of studied categories, and (3) adults had few fixations on the studied items and poorly discriminated studied items and new members of studied categories. These findings indicate that children’s induction is based on processing of item-specific information, whereas adults’ induction is based on processing of category information.

8:40–8:55 (14)

Children’s Reasoning Under Uncertainty: The Influence of Conditional and Unconditional Contingencies. EMMA L. JOHNSTONE, MICHELLE R. ELLEFSON, & NICK CHATER, *University of Warwick* (read by Michelle R. Ellefson)—In previous studies, causal contingencies have been suggested to play an important role in causality judg-

ments. However, little is known about how children might use causal contingencies to inform their judgments of causality, especially under uncertainty. In the present study, children's performance was remarkably similar to the performance of adults in previous studies. However, we found that young children (4- to 7-year-olds) are sensitive to both conditional and unconditional causal contingencies. Although performance within this age range is remarkably similar, we found that 4-year-olds were more sensitive to unconditional causal contingencies and were more distracted by uncertainty than were 7-year-olds. Children's sensitivity to statistical properties is a robust finding across a number of cognitive domains and might reflect an application of a fundamental cognitive mechanism that directs cognition more generally, rather than only causal knowledge acquisition.

9:00–9:15 (15)

The Role of Causal Knowledge in Clinical Reasoning With Mental Disorders. WOO-KYOUNG AHN, CAROLINE PROCTOR, & JESSECAE K. MARSH, *Yale University*—Clinicians believe that mental disorders are less likely to have essences than are medical disorders (Ahn, Flanagan, Marsh, & Sanislow, 2005) and weigh the relative importance of symptoms more by statistical knowledge than by their causal theories (Ahn, Levin, & Marsh, 2005). Yet Proctor and Ahn (2005) show that causal knowledge still influences inferences of unknown symptoms. Clinicians learned two mental disorder symptoms (X and Y) about each person. Clinicians who learned that X causes Y judged that a symptom associated with X, but not with Y, was more likely to be present, whereas those who learned that Y causes X in the same person judged that a symptom associated with Y, but not with X, was more likely to be present. This study shows that cause features have greater inductive potency than effect features and that how clinicians interpret causal relations of patients' symptoms affects their inferences about unknown symptoms.

9:20–9:35 (16)

Statistical Contingency Has a Different Impact on Preparation Judgments Than on Causal Judgments. JAN DE HOUWER & STEFAAN VANDORPE, *Ghent University*, & TOM BECKERS, *University of Leuven*—Previous studies on causal learning showed that judgments about the causal effect of a cue on an outcome depend on the statistical contingency between the presence of the cue and that of the outcome. We demonstrate that statistical contingency has a different impact on preparation judgments (i.e., judgments about the usefulness of responses that allow one to prepare for the outcome). Our results suggest that preparation judgments primarily reflect information about the outcome in prior situations that are identical to the test situation. In addition, we show that variations in the nature of the outcome on cue-absent trials can have an impact on causal judgments. The latter findings support the hypothesis that information about cue-absent trials has an impact on causal judgments because this information can reveal hidden causes that might have been responsible for the outcome on cue-present trials.

9:40–9:55 (17)

Configural Learning in Social Reasoning and Consummatory Reasoning. JESSE W. WHITLOW, JR., *Rutgers University, Camden*—The idea that people rely on configural cues to make judgments about causal relations was studied in a social reasoning task (deciding whether one member of a group likes, dislikes, or has neutral feelings for a person judged by the group) and a consummatory reasoning task (deciding whether foods presented as part of a meal cause allergic reactions, enhanced well-being, or no effect when the meal has been consumed). Positive and negative patterning discriminations were combined with positive and negative outcomes for each task. The relative ease of positive and negative patterning discriminations depended on both the type of outcome and the type of reasoning task. Social reasoning tasks may use a different set of explanatory models than do consummatory reasoning tasks.

Discourse Processing

Dominion Ballroom, Friday Morning, 8:00–10:00

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

8:00–8:15 (18)

Anticipation and Prior Knowledge: Are They the Key to Strategic Reading? GARY E. RANEY, *University of Illinois, Chicago*, MARY ANDERSON, *College of DuPage*, & TIMOTHY K. MIURA, SHARON R. OBEIDALLAH, & FRANCES DANIEL, *University of Illinois, Chicago*—Many schools promote the use of active reading strategies (adjusting reading processes on the basis of what the reader knows and how well the text is understood). We explored whether activating prior knowledge, using a pretest, promotes active reading. Readers answered six true–false questions before reading a text. Sentence reading times were sorted into three groups on the basis of subjects' pretest responses: matched prior knowledge, did not match prior knowledge, or no prior knowledge (answered "don't know"). For expository texts, sentences containing information that matched prior knowledge were read more quickly than sentences that did not match prior knowledge or provided new information. For an engaging, narrative-like passage, results were almost opposite. Across passages, differences in reading times between conditions varied on the basis of reading ability. Activating prior knowledge supports the use of active reading strategies, but strategies change on the basis of reading ability and the type of text read. This might reflect metacognitive functioning.

8:20–8:35 (19)

Causation as the Cement of Mental Representation. JENNIFER WILEY, *University of Illinois, Chicago*, & TOM TRABASSO, *University of Chicago*—Previous research has demonstrated the importance of causal structure in text processing and comprehension. The causal status of narrative text has been shown to reliably predict coherence judgments, reading times, importance ratings, recall protocols, and inference verification performance. We extend these results with studies on a diverse set of effects: goal-accessibility and reunion effects in discourse processing, and availability and hindsight biases in decision making. Across studies, we demonstrate parsimony and strength of a causality-based theory of representation for explaining a wide range of phenomena.

8:40–8:55 (20)

Character Attributes and the Representation of Fictional Information. ANDREW M. BOLCE & RICHARD J. GERRIG, *SUNY, Stony Brook* (read by Richard J. Gerrig)—In the course of experiencing fictional worlds, readers frequently encounter information that could be relevant to their nonfictional lives. Marsh, Meade, and Roediger (2003) provided a series of experiments that demonstrated the extent to which information from fictional texts becomes integrated with readers' real-world knowledge. The goal of our project was to demonstrate how the attributes of the characters who offered fictional facts affected readers' propensity to learn those facts from fiction. In Marsh et al.'s studies, story characters offered information that was either correct (e.g., "This here, this is a sextant and it's the main tool used at sea to navigate via the stars"), incorrect (e.g., "compass" replaced "sextant"), or neutral (e.g., "This here, this is the main tool"). Our experiments placed this type of information into the mouths of either positive or negative characters. The characters' attributes affected readers' patterns of responses on subsequent general knowledge questions.

9:00–9:15 (21)

Limits on Updating Discourse Representations. DAVID N. RAPP & PANAYIOTA KENDEOU, *University of Minnesota*—Successful reading necessitates not only encoding information into memory, but also updating those representations to accurately reflect what is described in the text. The degree to which readers spontaneously update

such representations, though, remains questionable. Work on the continued influence effect, conceptual change, and resonance models of memory suggests that, under most circumstances, memory is resistant to spontaneous updating. Thus, determining conditions that facilitate updating is necessary for theories of comprehension. In this study, we examined updating processes for a narrative dimension usually considered important for text comprehension—story protagonists. Participants read stories describing character behaviors associated with particular traits; this was followed by confirming evidence or statements refuting the validity of trait inferences. Later in the stories, characters behaved in either trait-consistent or trait-inconsistent ways. Judgments and reading latencies revealed that readers failed to completely update their models despite refutation statements. Extended explanation was necessary to invoke successful updating.

9:20–9:35 (22)

The Use of Other Side Information: Explaining the My Side Bias in Argumentation. CHRISTOPHER R. WOLFE, *Miami University*, & M. ANNE BRITT, *Northern Illinois University*—Skillful writers address the other side of an argument, whereas less skillful writers exhibit “my side” biases. The first of four experiments analyzed 34 “authentic arguments.” Nearly all rebutted or dismissed other side arguments to outline the parameters of debate. Experiment 2 used opposing claims and reasons to test the hypothesis that agreement is primarily associated with claims and quality is primarily associated with supporting reasons. These predictions were supported. We hypothesized in Experiment 3 that argumentation schemata are deficient in two ways: overemphasizing factual support and ignoring opposition. Thus, we introduced two interventions: “know the opposition” and “more than just the facts” before participants wrote essays. The “opposition” intervention led to more previously presented other side information. The “facts” manipulation led to more novel other side information. The final experiment tested the consequences of concession, rebuttal, and dismissal on perceived persuasiveness, quality, and author credibility. Argumentation schemata are discussed.

9:40–9:55 (23)

When Eyegaze Speaks Louder Than Words: The Advantages of Shared Gaze for Coordinating a Collaborative Search Task. SUSAN E. BRENNAN, *SUNY, Stony Brook*, CHRISTOPHER A. DICKINSON, *University of Delaware*, & XIN CHEN, MARK B. NEIDER, & GREGORY J. ZELINSKY, *SUNY, Stony Brook*—Eyegaze is a potent means of communication. We had remotely located pairs collaborate on a perceptually difficult task: searching for a target (Q) among similar objects (Os) on a shared display. Either partner could press a target present/absent key. Each pair communicated via one condition: speech alone, shared gaze alone (the cursor from each partner’s headmounted eyetracker was superimposed on the other’s display), both shared gaze and speech, or neither (no communication). As was expected, four eyes were better than two, and communication improved efficiency. With shared gaze, speech, or both, partners divided the labor (e.g., one searched the left and the other, the right). Surprisingly, the fastest and most efficient condition was shared gaze alone, especially when targets were absent; in this time-critical task, speaking actually incurred costs. Visual evidence about where a partner is looking is an efficient resource for coordinating collaborative spatial tasks, with implications for mediated communication.

Auditory–Visual Integration

Civic Ballroom, Friday Morning, 8:00–9:40

Chaired by Jean Vroomen, *Tilburg University*

8:00–8:15 (24)

The Spatial Constraint in Intersensory Pairing: No Role in Temporal Ventriloquism. JEAN VROOMEN & MIRIAM KEETELS, *Tilburg University*—A sound presented in close temporal proximity to a flash can alter the perceived temporal occurrence of that flash

(= temporal ventriloquism). Here, we explored whether temporal ventriloquism is harmed by spatial discordance between the sound and the flash. Participants judged, in a visual temporal order judgment (TOJ) task, which of two lights appeared first, while they heard task-irrelevant sounds before the first and after the second light. Temporal ventriloquism manifested itself in that performance was most accurate (lowest just noticeable difference) when the sound–light interval was ~100 msec. Surprisingly, temporal ventriloquism was unaffected by whether sounds came from the same or different positions as the lights, whether the sounds were static or moved laterally, or whether the sounds and lights came from the same or opposite side of the median. These results challenge the common view that spatial correspondence is an important requirement for intersensory interactions in general.

8:20–8:35 (25)

Two-Dimensional Localization With Spatially and Temporally Congruent Visual–Auditory Stimuli. MARTINE GODFROY & ROBERT B. WELCH, *NASA Ames Research Center* (sponsored by Robert B. Welch)—An experiment evaluated the predicted enhancement of perceptual localization with spatially and temporally congruent visual–auditory stimuli in a two-dimensional, reference-free environment. On the basis of the “information reliability hypothesis,” it was expected that relative weighting of visual and auditory modalities in the perceptual response would vary according to the main directional component (i.e., azimuth vs. elevation) of the stimuli. Ten participants were instructed to position a visual cursor toward randomly presented visual, auditory, and visual–auditory targets. Analyses of the responses in terms of their precision, orientation, centering, and variability confirmed optimal integration, as well as the predicted weighting of the two senses in relation to the directional component. For example, in the vertical dimension, in which auditory targets are relatively poorly localized, the influence of vision was greater than in the horizontal dimension. This experiment was repeated using virtual 3-D sound sources, together with a comparison of structured versus unstructured visual fields.

8:40–8:55 (26)

Visual Recalibration and Selective Adaptation in Auditory–Visual Speech Perception. PAUL BERTELSON, *Université Libre de Bruxelles*, & JEAN VROOMEN, SABINE VAN LINDEN, & BÉATRICE DE GELDER, *Tilburg University*—Exposure to incongruent auditory–visual speech can produce both recalibration and selective adaptation of speech identification. In an earlier study, exposure to an ambiguous auditory token (intermediate between /aba/ and /ada/) dubbed onto the video of a face articulating either /aba/ or /ada/, recalibrated the perceived identity of auditory targets in the direction of the visual component, while exposure to congruent nonambiguous /aba/ or /ada/ pairs created selective adaptation—that is, a shift of perceived identity in the opposite direction. Here, we examined the build-up course of the aftereffects produced by the same two types of bimodal adapters, over a 1–256 range of presentations. The aftereffects of non-ambiguous congruent adapters increased linearly across that range, whereas those of ambiguous incongruent adapters followed a curvilinear course, going up and then down with increasing exposure. This late decline might reflect selective adaptation to the recalibrated ambiguous sound.

9:00–9:15 (27)

Asynchrony Tolerance in the Perceptual Organization of Speech. ROBERT E. REMEZ, DARIA F. FERRO, STEPHANIE C. WISSIG, & CLAIRE A. LANDAU, *Barnard College*—Studies of multimodal presentation of speech reveal that perceivers tolerate temporal discrepancy in integrating audible and visible properties. Perceivers combined seen and heard samples of speech to resolve syllables, words, and sentences at asynchronies as great as 180 msec. Although explanations have appealed to general flexibility in perceptual organization, a unimodal test is required to know whether asynchrony tolerance in

audiovisual speech perception differs critically from auditorily apprehended speech. Using sine wave synthesis to force perceivers to resolve phonetic properties dynamically, we tested two conditions of unimodal asynchrony tolerance. Listeners transcribed sentences at each degree of asynchrony of the tone analogue of the first or second formant, relative to the remaining tones of the sentence, ranging from 250-msec lead to 250-msec lag. The results revealed time-critical perceptual organization of unimodal heard speech. The implications for amodal principles of the perceptual organization and analysis of speech are discussed.

9:20–9:35 (28)

Dissociating Uni- From Multimodal Perception in Infants Using Optical Imaging. HEATHER BORTFELD & ERIC WRUCK, *Texas A&M University*, & DAVID BOAS, *Harvard Medical School*—Near-infrared spectroscopy is an optical imaging technique that measures relative changes in total hemoglobin concentration and oxygenation as an indicator of neural activation. Recent research suggests that optical imaging is a viable procedure for assessing the relation between perception and brain function in human infants. We examined the extent to which increased neural activation, as measured using optical imaging, could be observed in a neural area known to be involved in speech processing, the superior temporal cortex, during exposure to fluent speech. Infants 6–9 months of age were presented with a visual event paired with fluent speech (visual + audio) and a visual event without additional auditory stimuli (visual only). We observed a dissociation of neural activity during the visual + audio event and the visual-only event. Results have important implications for research in language development, developmental neuroscience, and infant perception.

Face Processing

Conference Rooms B&C, Friday Morning, 8:00–10:00

Chaired by Christian Dobel
Westfälische Wilhelms-Universität Münster

8:00–8:15 (29)

Learning of Faces and Objects in Prosopagnosia. CHRISTIAN DOBEL & JENS BÖLTE, *Westfälische Wilhelms-Universität Münster*—We investigated a group of congenital prosopagnosics with a neuropsychological testing battery. Their performance was characterized by an impairment in recognizing individual faces. Other aspects of face processing were affected to a lesser degree. In a subsequent eyetracking experiment, we studied the ability of these subjects to learn novel faces, objects with faces, and objects presented in an upright and an inverted manner. Controls mostly attended central regions of stimuli. This was done more so for faces than for objects and more strongly expressed in upright than in inverted stimuli. Prosopagnosics performed as accurately as controls, but latencies were strongly delayed. In contrast to controls, they devoted more attention to outer parts of the stimuli. These studies confirm the assumption that prosopagnosics use a more feature-based approach to recognize visual stimuli and that configural processing might be the locus of their impairment.

8:20–8:35 (30)

On the Other Hand: The Concurrence Effect and Self-Recognition. CLARK G. OHNESORGE, *Carleton College*, & NICK PALMER, JUSTIN KALEMKIARIAN, & ANNE SWENSON, *Gustavus Adolphus College* (read by Clark G. Ohnesorge)—Several recent studies of hemispheric specialization for facial self-recognition in which either visual field or response hand was manipulated have returned contrasting results. In three studies of self-recognition, we simultaneously manipulated visual field and response hand and found evidence for a concurrence effect—that is, an interaction of visual field and response hand indicating better performance when the “viewing” hemisphere also controls the hand used for response. The absence of main effects for either visual field or response hand are evidence against strong

claims for hemispheric specialization in self-recognition. We investigated the generality of the concurrence effect in three further studies and found that it also occurs for identification of unfamiliar faces but disappears when a task is chosen (distinguishing circles from ellipses) that more strongly favors the right hemisphere. The several task- and stimulus-related performance asymmetries we observed are discussed in terms of communication and cooperation between the hemispheres.

8:40–8:55 (31)

Environmental Context Effects in Episodic Recognition of Novel Faces. KERRY A. CHALMERS, *University of Newcastle, Australia*—Effects of context on recognition were investigated in three experiments. During study, novel faces were presented in one of two contexts created by varying screen position and background color. At test, old (studied) and new (nonstudied) faces were presented in the same context as studied faces or in a different context that was either a context seen at study (Experiments 1 and 3) or a new context (Experiment 2). Participants judged whether faces were “old” (studied) or “new” (Experiments 1 and 2) or whether they had been studied in the “same” or “different” context or were “new” faces (Experiment 3). Match between study and test contexts had no effect on correct recognition of faces, even when study context was correctly identified at test. False recognition was higher when the test context was old than when it was new. Implications for global matching models and dual-process accounts of memory are considered.

9:00–9:15 (32)

Processing the Trees and the Forest During Initial Stages of Face Perception: Electrophysiological Evidence. SHLOMO BENTIN & YULIA GOLLAND, *Hebrew University of Jerusalem*, ANASTASIA FLAVERIS, *University of California, Berkeley*, LYNN C. ROBERTSON, *Veterans Affairs Medical Center, Martinez, and University of California, Berkeley*, & MORRIS MOSCOVITCH, *University of Toronto*—Although global configuration is a hallmark of face processing, most contemporary models of face perception posit a dual-code view, according to which face recognition relies on the extraction of featural codes, involving local analysis of individual face components, as well as on the extraction of configural codes, involving the components themselves and computation of the spatial relations among them. We explored the time course of processing configural and local component information during face processing by recording the N170, an ERP component that manifests early perception of physiognomic information. The physiognomic value of local and global information was manipulated by substituting objects or faces for eyes in the global configuration of the schematic face or placing the same stimuli in random positions inside the global face. The results suggest that the global face configuration imposes (local) analysis of information in the “eyes” position, which determines the overall physiognomic value of the global stimulus.

9:20–9:35 (33)

Facial Conjunctions May Block Recollection: ERP Evidence. KALYAN SHASTRI, JAMES C. BARTLETT, & HERVÉ ABDI, *University of Texas, Dallas* (read by James C. Bartlett)—Although conjunctions of previously viewed faces are sometimes falsely judged as “old,” they often are correctly rejected as “new.” This could be due to (1) successful recollection of configural information or (2) low familiarity and/or failure of recollection. To distinguish these ideas, we compared ERPs in a recognition test for hits to old faces and correct rejections of (1) conjunction faces, (2) entirely new faces, and (3) repetitions of new faces. Focusing on differences in ERP positivity, 400 to 800 msec poststimulus, over midline and left parietal sites (CP3, CPZ, P3, and PZ), we replicated the “parietal old/new effect” of greater positivity for old faces than for new faces, a difference frequently attributed to recollection. A comparison of repeated new faces and conjunctions showed this same effect, and, critically, the ERP functions for repeated new faces closely matched that for old faces, whereas the functions for conjunctions closely matched that for new faces.

9:40–9:55 (34)

Different Strategies Used for Recognizing Different-Race Faces. MICHAEL B. LEWIS, *Cardiff University* (sponsored by Dylan Marc Jones)—Other-race faces are harder to recognize than own-race faces, but increased contact with people of the other race can reduce this own-race bias. Two explanations for these effects are considered. First, people employ the same strategy for processing own-race and other-race faces, but this strategy is tuned to own-race faces. Second, different strategies are employed for own-race and other-race faces, and the strategy for own-race faces is superior. An experiment measured recognition performance for the internal features of faces that had been learned with external features that made the face look like either an own-race face or an other-race face. Accuracy was greater when the face had been learned as an own-race face, suggesting that different encoding strategies are employed for different-race faces. One implication of this research is that race affects the perception of an individual even before the face has been fully encoded.

SYMPOSIUM: Applying Cognition to Education
Grand Ballroom Centre, Friday Morning, 10:00–11:50

Chaired by Mark A. McDaniel, *Washington University*

10:00–10:05 (35)

Symposium I: Applying Cognition to Education Intro. MARK A. MCDANIEL, *Washington University*, & AYANNA K. THOMAS, *Colby College*—E. L. Thorndike envisioned a future in which educational practices in teaching would be guided by a psychological theory of learning. Unfortunately, research in cognitive psychology has had little influence on education, an area to which cognition psychology should be well positioned to contribute. However, influential cognitive psychologists are beginning to foreground educational concerns in their research, with this work appearing in our flagship journals (e.g., *JEP:LMC*, January 2005). The proposed symposium will provide a forum to present and stimulate this developing trend in the field. Researchers who have been on the cutting edge of cognitive psychology research will present new research that orients basic cognitive psychology research to educational issues. Research highlighted in this symposium will include how conditions of learning and testing can affect successful performance, whether feedback can improve memory, the consequences of producing incorrect answers, and whether meta-awareness of conditions of study and test affect monitoring and control.

10:05–10:20 (36)

Learning How to Learn: Experiencing the Outcome of Differential Encoding Strategies Enhances Subsequent Encoding. PATRICIA A. DEWINSTANLEY, *Oberlin College*, & ELIZABETH L. BJORK, *UCLA*—We investigated whether participants, given the opportunity to experience the differential memorial consequences of different encoding strategies—such as generating versus reading—would then change how they processed future to-be-learned material. Participants were able to profit from such an experience, but only if that experience was of a particular kind—namely, one that offered them the opportunity to experience the different consequences of alternative encoding strategies within a single test. Our findings suggest educational innovations that might lead students to adopt more effective processing strategies. They are also consistent with metacognitive research indicating that learners can be insensitive to the effectiveness of certain learning-enhancing factors (e.g., Koriat & Bjork, in press) and are typically unable to judge the efficacy of a given processing strategy during its execution and do not switch from a less to a more effective strategy without an opportunity to experience their relative effectiveness (e.g., Dunlosky & Hertzog, 2000).

10:20–10:35 (37)

Zoning Out During Reading: An Underappreciated Source of Comprehension Failure. JONATHAN W. SCHOOLER, JONATHAN

SMALLWOOD, & MERRILL McSPADDEN, *University of British Columbia*, & DAVID HALPERN & ERIK D. REICHLER, *University of Pittsburgh*—Considerable research has demonstrated that reading difficulties can stem from comprehension-monitoring failures. However, this research has largely overlooked the fact that people frequently fail to notice not only that they are having trouble understanding the text, but also that they are not even attending to what they are reading. This talk will introduce two paradigms that examine comprehension failures resulting from “zoning out” during reading. These include (1) a self-report + experience sampling procedure that frequently “catches” participants zoning out during reading before they catch themselves and (2) a gibberish detection paradigm that demonstrates that when zoning out, participants regularly fail to notice that they are reading gibberish. Collectively, these studies indicate that zoning out is an important source of comprehension failure that is due, in part, to lapses in meta-awareness of the current contents of thought.

10:35–10:50 (38)

Working Memory, Math Performance, and Math Anxiety. MARK H. ASHCRAFT & JEREMY KRAUSE, *University of Nevada, Las Vegas*, & KELLY RIDLEY, *Cleveland State University*—The literature is very clear on the global consequences of mathematics anxiety. People who are highly math anxious avoid math: They avoid elective coursework in math, both in high school and college, they avoid college majors that emphasize math, and they avoid career paths that involve math. We go beyond these psychometric relationships to examine the cognitive consequences of math anxiety. We show how performance on a standardized math achievement test varies as a function of math anxiety and how math performance depends on available working memory capacity, which varies inversely with math anxiety. High math anxiety corresponds closely to a dual-task setting; preoccupation with one’s math fears and anxieties functions exactly like a resource-demanding secondary task. We speculate on possible developmental and educational factors that contribute to the development of math anxiety.

10:50–11:05 (39)

Region of Proximal Learning. JANET METCALFE, *Columbia University*—In contrast to the view that people should study, first and longest, the items judged most difficult, we propose that people attempt to study within their own region of proximal learning. A model is proposed for how they do so. The model emphasizes two components: choice and perseverance. If people’s judgments of learning (JOLs) are sufficiently high that they believe they know the items already, they choose to not study. If they do choose to study, though, the order is from that which they believe is almost known to the more difficult (high JOL to low JOL). The decision of when to stop studying is determined by judgments of the rate of learning (jROLs). When learning is perceived to be proceeding quickly, they continue studying. When their subjective assessment indicates that learning is at a standstill, they stop. Research findings bearing on the region of proximal learning model will be reviewed.

11:05–11:20 (40)

The Negative Cascade of Incongruent Task–Test Processing in Memory and Metamemory. AYANNA K. THOMAS, *Colby College*, & MARK A. MCDANIEL, *Washington University*—The present study was conducted to examine the effects of the encoding–retrieval process interaction on metamemory for text. Previous research suggests that metamemory for text can improve when specific processing variables are manipulated. We expand on this idea by testing whether a match (or mismatch) between processes instantiated by study tasks and those instantiated by retrieval demands affect monitoring and subsequent implemented control strategies. In two experiments, participants were presented with expository texts and engaged in letter deletion, sentence sorting, or reading. After processing the passages, participants provided section-by-section judgments of learning (JOLs). Participants were then given either a detailed or a

conceptual-oriented cued recall test. When processes of study and test were congruent, cued recall performance and metamemory predictions were more accurate than when study and test were incongruent. These findings suggest that a transfer-appropriate processing framework could extend to metamemory for text.

11:20–11:35 (41)

Retrieval and Memory: Test-Enhanced Learning. MARK A. McDANIEL & SEAN KANG, *Washington University*, JANIS ANDERSON, *Harvard University*, KATHLEEN B. McDERMOTT & HENRY L. ROEDIGER III, *Washington University*—We investigated the effect of testing on later performance and whether effects are modulated by the format of the initial test. In a laboratory experiment, after reading short journal articles, participants received a multiple-choice or short-answer test (both with feedback) or the target items for additional study. Regardless of the format of the final test (multiple choice or short answer), an initial short-answer test provided the greatest enhancement on the final test. A parallel experiment conducted in the classroom found converging results. College students in a psychology course given initial short-answer tests (with feedback) on course content had the best performance on the unit exams (testing several weeks of content), relative to taking an initial multiple-choice test (with feedback) or reading statements that corresponded to tested facts. These findings on memory have implications for the type of quizzes that educators may employ to enhance learning.

11:35–11:50 (42)

Negative Consequences of Testing. ELIZABETH J. MARSH, *Duke University*, HENRY L. ROEDIGER III, *Washington University*, ROBERT A. BJORK & ELIZABETH LIGON BJORK, *UCLA*—Although tests are typically treated as assessment tools in educational settings, it is also well known that they can improve memory through retrieval practice (the testing effect). However, multiple-choice tests typically expose students to more incorrect answers than correct ones. The prediction from other suggestibility paradigms (such as Loftus's misinformation procedure) is that the lures have the potential to interfere with later retrieval of the correct answer. When we examined the consequences of taking multiple-choice tests on later general knowledge tests, large positive testing effects were always obtained: Prior testing aided final cued recall performance. But prior testing also led to the production of multiple-choice and true–false lures as answers on later tests. Effects are not explainable by simple activation accounts; negative consequences were reduced (but still significant) when questions involved applying knowledge (as opposed to retrieving facts) or when cued recall questions were reworded from the original questions.

Aging and Memory

Grand Ballroom East, Friday Morning, 10:20–12:00

Chaired by Marilyn Hartman
University of North Carolina, Chapel Hill

10:20–10:35 (43)

Temporal Integration: Measuring Age Differences in Working Memory Capacity and Consolidation. MARILYN HARTMAN & NICOLE D. PUKAY-MARTIN, *University of North Carolina, Chapel Hill*, JENNIFER McCABE, *Marietta College*, & JAMES R. BROCKMOLE, *Michigan State University*—The temporal integration paradigm (Di Lollo, 1980) can be used to examine the nature of age differences in working memory (WM). This task requires the integration of information from two successive visual arrays; prior research has shown that Array 1 information is available briefly in a perceptual store and is retained after that only if it can be consolidated into WM (Brockmole et al., 2002). Comparison of younger and older adults' performance, using a range of interarray intervals, showed slower WM consolidation for older adults and smaller asymptotic WM capacity. Despite age-related reductions in sensory/perceptual ability and in the

ability to integrate a percept with a WM image, there was no evidence of a causal link to deficits in working memory. These findings are discussed in relationship to theories of age differences in WM.

10:40–10:55 (44)

Aging Dissociates Recollection-Based Monitoring Processes. DAVID A. GALLO, *University of Chicago*, SIVAN COTEL, *Wesleyan University*, CHRISTOPHER MOORE, *Princeton University*, & DANIEL L. SCHACTER, *Harvard University*—We used the criterial recollection task to investigate two types of false recognition suppression in younger and older adults. After studying a list of red words and pictures, subjects were given two tests (using black words as cues). On the red word test, they decided (yes/no) if the item was studied as a red word, and vice versa on the picture test. In younger adults, false recognition was lower on the picture test than on the red word test, demonstrating a distinctiveness heuristic (i.e., “I don't recall a picture, so I probably didn't study one”). False recognition was further reduced when study formats were mutually exclusive, as compared with a control condition, demonstrating a recall-to-reject strategy (i.e., “I recall a picture, so this item couldn't have been studied as a red word”). Critically, aging spared the distinctiveness heuristic but impaired recall to reject, providing the first experimental dissociation of these two monitoring processes.

11:00–11:15 (45)

Memories of September 11 and a Personal Control Event: Effects of Age and Time of Initial Testing. LIA KVAVILASHVILI, SIMONE J. T. SCHLAGMAN, KERRY FOLEY, JENNIFER MIRANI, & DIANA E. KORNBRÖT, *University of Hertfordshire*—A question about the special status of flashbulb memory has remained controversial, with some studies showing a good test–retest consistency and others substantial distortion and forgetting. Study 1 investigated the consistency of flashbulb memories of September 11 as a function of age (young, old), delay between the event and an initial test (1–2 days, 10–11 days), and the number of initial tests (one, two). An identical design was used in Study 2 to investigate the consistency of control memories about hearing some unimportant personal news. The consistency of flashbulb memories with the test–retest delay of 23–24 months was significantly higher than for memories of the control event with a delay of only 11–12 months. The number of initial tests, the delay between the event and the initial test, as well as the age group, did not have any effects on the consistency of flashbulb and control memories.

11:20–11:35 (46)

Source Memory in Young and Old Adults for Schema-Congruent Utterances. SAMI GULGOZ & MIRI BESKEN, *Koç University*—Memory for source was investigated in young and older adults as a function of schemas of sources, activation time of schemas, and similarity between sources. Forty young and 40 older adults were presented 48 statements that were schema congruent, schema incongruent, or neutral from two sources. The sources were paired as doctor–nurse for half the participants and as doctor–cashier for the other half. The profession was revealed either before or after item presentation. In the test phase, participants were asked to discriminate 36 old and 18 new items, as uttered by one of the sources or as new. The analyses of hits, misattributions, misses, false alarms, and the conditional source identification measure revealed that schema similarity facilitated source identification, particularly for older participants who were given the profession information prior to the presentation of the items. The results also indicated an additive effect of age, rather than a qualitative change in source memory performance.

11:40–11:55 (47)

I Misremember It Well: Why Older Adults Are Unreliable Eyewitnesses. CHAD S. DODSON & LACY E. KRUEGER, *University of Virginia*—We used the eyewitness suggestibility paradigm to evaluate two explanations for why cognitive aging is associated with increased memory distortions. We found no support for the consensus

view that older adults' reduced source memory causes their false memories. That is, we observed that even when older and younger adults showed equivalent source accuracy for all item types, older adults were still more than twice as likely as their younger counterparts to claim that they had witnessed events in a video that were only suggested in a questionnaire. Moreover, older adults were most likely to commit suggestibility errors when they were most confident about the correctness of their response, whereas their younger counterparts committed these errors only when they were uncertain about the accuracy of their response. These results exactly fit the predictions of a vivid false recollection hypothesis about the effects of cognitive aging on episodic memory.

Psycholinguistics
Grand Ballroom West, Friday Morning, 10:20–12:00

Chaired by Sam Glucksberg, Princeton University

10:20–10:35 (48)

Understanding Novel Metaphors: When Comparison Fails. SAM GLUCKSBERG & CATRINEL HAUGHT, *Princeton University*—Bowdle and Gentner recently argued that novel metaphors are invariably understood as comparisons, whereas conventional ones can be understood either as comparisons or as categorizations. We show that whether a metaphor is understood as a comparison or as a categorization depends on the relative aptness of the two forms. Using a novel adjectival modification paradigm, we show that novel metaphors, such as “billboards are advertising warts,” can be understood as categorizations but are anomalous as comparisons. We also show that some metaphors and their corresponding similes have distinctly different interpretations. These findings lead to the conclusion that comparison theories of metaphor are fundamentally flawed.

10:40–10:55 (49)

The Processing of Novel Metaphors by the Two Cerebral Hemispheres. MIRIAM FAUST & NIRA MASHAL, *Bar-Ilan University*, TALMA HENDLER, *Wohl Institute for Advanced Imaging, Sourasky Medical Center, Tel-Aviv*, ABRAHAM GOLDSTEIN & YOSHI ARZOUAN, *Bar-Ilan University*, & MARK JUNG-BEEMAN, *Northwestern University*—Some research indicates that the right cerebral hemisphere (RH) plays a unique role in comprehending the figurative meaning of metaphors, whereas the results of other studies do not support the notion of a selective role for the RH in accessing metaphorical meanings. In the present research, participants were presented with four types of word pairs—literal, conventional metaphoric, novel metaphoric, and unrelated—and were asked to decide whether each expression was meaningful or not. The findings of behavioral and ERPs experiments suggest that the RH contributes significantly to the processing of novel metaphoric expressions. Furthermore, the results of an fMRI experiment show that a unique network, consisting of the right homologue of Wernicke's area, the left and right premotor areas, the right and left insula, and Broca's area, is recruited for the processing of novel metaphors, but not for the processing of conventional metaphors.

11:00–11:15 (50)

Determinants of Speed of Processing Effects on Spoken Idiom Comprehension. CRISTINA CACCIARI & ROBERTO PADOVANI, *University of Modena*—Using a cross-modal lexical decision paradigm, we investigated the extent to which individual speed of processing (SOP) affected spoken language comprehension in language-unimpaired participants when the sentence contained a semantically ambiguous Italian idiom (e.g., “break the ice”) embedded in an idiom-related context. To differentiate among sensorimotor speed components, cognitive speed components, and personality-based components, we investigated the main factors that might account for the differences in idiom activation latencies between fast versus slow participants. The participants enrolled in the cross-modal study were pre-

sented with a battery of tests assessing (1) the SOP in nonlinguistic tasks, (2) the ability to inhibit irrelevant information, (3) the role of verbal working memory components, (4) word recognition, lexical access, and reading abilities, (5) nonverbal intelligence, and (6) personality structure and anxiety level. The speed with which idiomatic meanings were activated was modulated by phonological, semantic, memory-based, and personality components.

11:20–11:35 (51)

Laughter in Bill Clinton's *My Life* (2004) Interviews. DANIEL C. O'CONNELL, *Georgetown University*, & SABINE KOWAL, *Technical University of Berlin*—Two types of laughter of Bill Clinton and his interviewers—as an overlay of words spoken laughingly and as laughter of the ha-ha sort—were investigated in 13 media interviews given after the publication of his memoirs. His laughter was found to be predominantly an overlay of words spoken laughingly, whereas Hillary Clinton's had been found to be largely of the ha-ha type (O'Connell & Kowal, 2004). The presence of interviewers' laughter disallowed neutralism on their part. Ha-ha laughter occurred as interruption or back channeling 30% of the time and, hence, did not necessarily punctuate speech during pauses at the end of phrases and sentences (Provine, 1993). Laughter did not follow upon “banal comments” (Provine, 2004, p. 215) nor reflect either “nonseriousness” (Chafe, 2003a, 2003b) or uncensored spontaneity (Provine, 2004, p. 216). Instead, laughter reflected the perspective of interviewer and/or interviewee and was used as a deliberate, sophisticated, and rhetorical device.

11:40–11:55 (52)

Comprehending Stuttered Speech in Different Referential Contexts. MICHELLE F. LEVINE & MICHAEL F. SCHOBBER, *New School for Social Research* (read by Michael F. Schobber)—How do listeners comprehend stuttered speech? In an experiment, listeners selected one of two squares on a computer screen on the basis of recorded instructions produced by a person who stuttered. The instructions consisted of naturally occurring stutters with repeated initial phonemes (“Pick the g-g-g-green square”), the same stimuli with stutters excised (“Pick the green square”) or replaced by pauses of equal length (“Pick the . . . green square”), and matched fluent instructions by the same speaker. In general, stutters did not hurt and sometimes speeded comprehension of the target word, measured from the word's onset. When the squares' colors started with different phonemes (green vs. black), listeners selected the target more quickly when they heard the stuttered instruction, as compared with any other version. When colors started with the same phonemes (green vs. gray), the benefit decreased. As with some other disfluencies, stutters can actually be informative about speakers' intentions, speeding comprehension without loss of accuracy.

Models of Reasoning

Dominion Ballroom, Friday Morning, 10:20–12:00

Chaired by David J. Bryant, Defence R&D Canada

10:20–10:35 (53)

Heuristic and Bayesian Models for Classification With Uncertain Cues. DAVID J. BRYANT, *Defence R&D Canada*—Fast and frugal heuristics provide potential models for human judgment in a range of tasks. The present research explored whether a fast and frugal heuristic could successfully model participants' decision behavior in a simulated air threat classification task. Participants learned to classify simulated aircraft, using four probabilistic cues, and then classified test sets designed to contrast predictions of several heuristics, including the take-the-best-for-classification (TTB-C) and pros rule, developed specifically for threat classification. When cues were presented textually, most participants appeared to use TTB-C or pros rule, but no participant was observed to respond as predicted by a Bayesian strategy. In contrast, items presented pictorially resulted in a large proportion of participants conforming to predictions of the Bayesian

model. Thus, participants appear to be able to use various heuristic and normative decision procedures, depending on task conditions.

10:40–10:55 (54)

Prediction and Change Detection. MARK STEYVERS & SCOTT D. BROWN, *University of California, Irvine*—We measure the ability of human observers to predict the next datum in a sequence that was generated by a simple statistical process undergoing change at random points in time. Accurate performance in this task requires identification of changepoints and prediction of future observations on the basis of the observations following the last changepoint. We assess individual differences between observers both empirically and using two kinds of models: a Bayesian approach for change detection and a family of cognitively plausible fast and frugal models. Some individuals detect too many changes and, hence, perform suboptimally, due to excess variability. Other individuals do not detect enough changes and perform suboptimally because they fail to notice short-term temporal trends.

11:00–11:15 (55)

Modeling Binary Choice Patterns of Individuals. DOUGLAS H. WEDELL, *University of South Carolina*—Several extant models of binary choice differ in their conceptualization of (1) the comparison process, (2) contextual sensitivity of valuation and weighting, (3) the importance of the covariance structure of alternatives, (4) the role of bias, and (5) the ability to predict choice latencies and effects of time pressure. Two experiments reported here were designed to provide insights into the applicability of these models. Both studies were presented via the Internet, with repeated choices enabling the modeling of choice proportions of individuals. Experiment 1 replicated and extended the gambles experiment of Tversky (1969), designed to produce violations of weak stochastic transitivity (WST). Robust violations of WST were found and were well explained by models that assumed bias toward choosing the higher outcome gamble. Experiment 2 was a simulated shopping study based on a design that sampled a choice space across which models showed markedly different patterns of choice behavior.

11:20–11:35 (56)

Signal Detection Analyses of Deductive and Inductive Reasoning. EVAN HEIT, *University of California, Merced*, & CAREN M. ROTELLO, *University of Massachusetts, Amherst*—Reasoning can be conceived of as a signal detection task in which the goal is to discriminate strong from weak arguments. Hence, analyses more commonly used in other research domains, including estimation of sensitivity and bias and the evaluation of receiver operator characteristic (ROC) curves, can also be applied to reasoning. Two experiments were conducted, following Rips (2001), in which subjects judged a set of 16 arguments in terms of either deductive validity or inductive plausibility. It was found that deductive and inductive judgments differed in many ways. In general, deduction did not simply reflect a stricter criterion for saying “yes,” as compared with induction. There were also differences between deduction and induction in terms of sensitivity and preferred ranking of arguments, as well as the form of the ROC curves. Overall, the results point to a two-process account of reasoning, rather than to a single process underlying both deduction and induction.

11:40–11:55 (57)

An EZ-Diffusion Model for Response Time and Accuracy. ERIC-JAN WAGENMAKERS & HAN VAN DER MAAS, *University of Amsterdam*—The EZ-diffusion model for two-choice response time takes response times and accuracy as input. The model then transforms these data via three simple equations to unique values for the quality of information (i.e., drift rate), response conservativeness (i.e., boundary separation), and nondecision time. This redescription of the observed data in terms of latent variables addresses the speed–accuracy tradeoff and thereby affords an unambiguous quantification of performance differences in

two-choice response time tasks. Performance of the EZ model was studied with Monte Carlo simulations. The advantage of the EZ model over the full diffusion model (e.g., Ratcliff, 1978) is that the EZ model can be applied to data-sparse situations, facilitating the use of individual-subject analysis.

Visual Perception

Civic Ballroom, Friday Morning, 10:00–12:00

Chaired by J. Farley Norman, Western Kentucky University

10:00–10:15 (58)

The Perception of Distances and Spatial Relationships in Natural Outdoor Environments. J. FARLEY NORMAN, CHARLES E. CRABTREE, ANNA M. CLAYTON, & HIDEKO F. NORMAN, *Western Kentucky University*—The ability of observers to perceive distances and spatial relationships in outdoor environments was investigated. In Experiment 1, the observers adjusted triangular configurations to appear equilateral, whereas in Experiment 2, they adjusted the depth of triangles to match their base width. The results of both experiments revealed that there are large individual differences in how observers perceive distances in outdoor settings. The observers’ judgments were greatly affected by the particular task they were asked to perform. The observers who had shown no evidence of perceptual distortions in Experiment 1 (with binocular vision) demonstrated large perceptual distortions in Experiment 2 when the task was changed to match distances in depth to frontal distances perpendicular to the observers’ line of sight. Considered as a whole, the results indicate that there is no single relationship between physical and perceived space that is consistent with observers’ judgments of distances in ordinary outdoor contexts.

10:20–10:35 (59)

Generalization of Perceptual and Cognitive Prism Adaptation. GORDON M. REDDING, *Illinois State University*, & BENJAMIN WALLACE, *Cleveland State University*—Prism exposure produces two kinds of adaptive responses. Recalibration is ordinary strategic remapping of spatially coded movement commands to rapidly reduce performance error produced by prismatic displacement, a kind of cognitive learning. Realignment is the extraordinary process of transforming spatial maps to bring the origins of coordinate systems into correspondence, a kind of perceptual learning. Realignment occurs when spatial discordance signals noncorrespondence between spatial maps. The two kinds of aftereffects were measured for three test positions, one of which was the exposure training position. Recalibration aftereffects generalized nonlinearly, whereas realignment aftereffects generalized linearly. Recalibration and realignment are distinct kinds of adaptive processes, both evoked by prism exposure, and require methods for distinguishing their relative contributions.

10:40–10:55 (60)

Perception of Slopes of Hills Is More Accurate in Near Space. BRUCE BRIDGEMAN & MERRIT HOOVER, *University of California, Santa Cruz*—We have found that slopes of hills are perceptually overestimated in far space (15 m), but not in near space (1 m). A motor measure, however, shows similar and more accurate estimates at both ranges. Slopes were measured with observers standing at the bases of real hills; the perceptual measure required estimating the slope verbally in degrees, whereas for the motor measure, observers matched the slope with the forearm. Perceptual overestimates might be due to near space being handled by different brain structures than far space, or the brain might calculate a combination of the real slope and the work required to reach the far point. This was tested by measuring perceived slope at 1, 2, 4, 8, and 16 m. Perceived slope increased linearly, indicating that work required is the best description of the result. Perception gives us the environment’s layout combined with predictions of the work required to interact with it.

11:00–11:15 (61)

Visual Acuity in Virtual and Real Depth. ANKE HUCKAUF, *Bauhaus University, Weimar*—Acuity, one of the basic visual functions, is known to be higher on the horizontal than on the vertical meridian (Rovamu & Virsu, 1979). We investigated visual acuity in depth and compared it with acuity in horizontal and vertical directions. Letters were presented tachistoscopically at 3°, 6°, and 9° of eccentricity in the left, upper, or backward visual field. Presentation was elicited by an accurate fixation. For depth acuity, a fixation arrow was placed at various distances between the monitor and the observer. Letter recognition was worse in depth than in both other directions, repeatedly and for all observers. However, the presentation of a virtual fixation arrow on an auto-stereoscopic monitor resulted in better performance than did the presentation of a real fixation arrow. This result demonstrates that accommodation can be controlled independently from vergence. However, an independent adjustment of accommodation and vergence does not seem to be under voluntary control.

11:20–11:35 (62)

The Roles of Altitude and Fear in the Perception of Height. JEANINE K. STEFANUCCI & DENNIS R. PROFFITT, *University of Virginia* (read by Dennis R. Proffitt)—People often exhibit normative biases in their perception of the environment. For instance, slant is typically overestimated, and distance is usually underestimated. Surprisingly, the perception of height has rarely been studied. In a series of experiments, participants performed visual matching assessments of apparent distance and size while looking down from a balcony or looking up from the ground. When they were looking down, distances were overestimated by 60%, and the size of targets on the ground was overestimated by 22%. When they were looking up, the same distances were overestimated by 23%, and size estimates for targets viewed from below were accurate. In addition, a nonoptical variable—fear—was positively correlated with participants' overestimation of height. We suggest that the overestimation of height that occurs when one looks down from a high place is due to both the altitude and a fear of falling.

11:40–11:55 (63)

Color/Luminance Dissociations Across “How,” “What,” and “Where” Processing of Normal Participants: A Second Look. ALISSA WINKLER, CHARLES E. WRIGHT, & CHARLES CHUBB, *University of California, Irvine* (read by Charles E. Wright)—In 2003, we reported that equiluminant color and isochromatic luminance defined stimuli that were found to be equisalient in a shape identification (“What”) task did not support equivalent performance in a pointing (“How”) task. Such task-related contrasts (TRCs) are consistent with the suggestion that there exist functionally separate pathways in the architecture of visual processing. Here, we report new experiments that (1) replicate our earlier finding of a TRC for color- and luminance-defined stimuli across the What and How tasks, eliminating methodological concerns, (2) reveal new TRCs between these tasks and an allocentric “Where” task, and (3) find no TRCs between speeded and information-limited variants of the What and Where tasks.

Animal Learning

Conference Rooms B&C, Friday Morning, 10:20–12:00

Chaired by Ralph R. Miller, SUNY, Binghamton

10:20–10:35 (64)

Laws of Learning Appear to Differ for Elemental Cues and Compound Cues. RALPH R. MILLER & GONZALO P. URCELAY, *SUNY, Binghamton*, & KOUJI URUSHIHARA, *Osaka Kyoiku University*—The basic laws of learning for cues trained elementally have been intensively studied for a century. Recently, additional laws of learning have been identified for elements trained as part of compound cues, but researchers have assumed, without proper tests, that the laws governing elements alone also apply to elements within compounds. Experiments with rats will be reviewed demonstrating that interactions

between elements of compound cues not only produce the well documented phenomena of cue competition, but also, under certain circumstances, negate laws that apply to elemental cues alone. Examples of deleterious effects that do not always appear when target training occurs as part of a compound cue include trial massing, CS lengthening, latent inhibition, partial reinforcement, degraded contingency, and US preexposure effects. The addition of any one of these deleterious treatments to a preparation that otherwise yielded overshadowing reduced both the effect of the deleterious treatment and the overshadowing effect. The generality of these findings are discussed.

10:40–10:55 (65)

Out of Sight, Not Out of Mind: Rats Know When an Absent Event Should Have Been Observed and When It Shouldn't Have. AARON P. BLAISDELL, *UCLA*, MICHAEL WALDMANN, *University of Göttingen*, & W. DAVID STAHLMAN, *UCLA*—We previously failed to demonstrate second-order conditioning involving tone→light and light→food pairings in rats. When tested on the second-order tone alone, rats might have expected the light to occur upon termination of the tone. However, the light did not occur on tone-alone test trials, which may have reduced the expectation of food. We tested the hypothesis that occluding the light bulb at test, thereby removing the expectation that the light should be observable, would salvage the expectation of food at test. This hypothesis was confirmed by the demonstration of greater nosepoking to the tone, relative to an unpaired control stimulus, when the light bulb was occluded at test, but no difference in nosepoking when the light bulb was visible. Furthermore, the temporal location of the increased rate of nosepoking suggests that rats integrated a tone–food temporal map based on the tone–light and light–food temporal maps.

11:00–11:15 (66)

Blocking and Pseudoblocking: New Control Experiments With Honeybees. P. A. COUVILLON, RACHEL E. BLASER, & M. E. BITTERMAN, *University of Hawaii, Manoa*—Prompted by doubts about the adequacy of the various control procedures long used in research on blocking, we repeated some earlier experiments with honeybees that had given the appearance of forward, concurrent, and backward blocking. The new experiments differed from the earlier ones only in that the target stimulus was omitted during the training and was encountered for the first time in the test. In the new experiments, just as in the earlier ones, the blocking groups responded less to the target stimulus than did the control groups. The results show that the effects of the different treatments of nontarget stimuli commonly compared in blocking experiments may generalize to the target stimulus and, thus, affect responding to that stimulus independently of experience with it. Implications for research on blocking in honeybees and other animals are considered.

11:20–11:35 (67)

Delta-9-Tetrahydrocannabinol and Cannabinol, but not Ondansetron, Interfere With Conditioned Retching in the *Suncus murinus*: An Animal Model of Anticipatory Nausea and Vomiting. LINDA A. PARKER & MAGDALENA KWIATKOWSKA, *Wilfrid Laurier University*, & RAPHAEL MECHOULAM, *Hebrew University of Jerusalem*—Chemotherapy patients report not only acute nausea and vomiting during the treatment itself, but also anticipatory nausea and vomiting upon reexposure to the cues associated with the treatment. We present a model of anticipatory nausea based on the emetic reactions of the *Suncus murinus* (musk shrew). Following three pairings of a novel distinctive contextual cue with the emetic effects of an injection of lithium chloride, the context acquired the potential to elicit conditioned retching in the absence of the toxin. The expression of this conditioned retching reaction was completely suppressed by pretreatment with each of the principal cannabinoids found in marijuana, Δ^9 -tetrahydrocannabinol or cannabidiol, at a dose that did not suppress general activity. On the other hand, pretreatment with a dose of ondansetron (a 5-HT₃ antagonist), which interferes with acute vomit-

ing in this species, did not suppress the expression of conditioned retching during reexposure to the lithium-paired context. These results support anecdotal claims that marijuana, but not ondansetron, may suppress the expression of anticipatory nausea.

11:40–11:55 (68)

Opioid Receptors and Individual Differences in Consummatory Successive Negative Contrast. SANTIAGO PELLEGRINI, MICHAEL WOOD, ALAN M. DANIEL, & MAURICIO R. PAPINI, *Texas Christian University* (read by Mauricio R. Papini)—Rats exposed to a downshift from 32% to 4% sucrose exhibit consummatory suppression, followed by recovery of normal behavioral levels, relative to 4% unshifted controls (consummatory successive negative contrast, cSNC). Previ-

ous research shows that opioid agonists (morphine, DPDPE) reduce the size of cSNC, whereas opioid antagonists (naloxone, naltrindole) enhance it. The recovery process involves emotional activation and conflict and is characterized by substantial individual differences. After a 32–4 downshift, rats ($N = 40$) were classified as exhibiting either fast recovery (resilience) or slow recovery (vulnerability) and were subsequently tested in an activity situation. The activity test was chosen as an independent measure of opioid sensitivity. Relative to saline controls, the nonspecific receptor antagonist naloxone (2 mg/kg) had a larger suppressing effect on activity in the slow-recovery than in the fast-recovery group. Individual differences in opioid receptors may determine whether rats exhibit resilience or vulnerability to the emotionally activating effects of cSNC.

SYMPOSIUM: The Effect of Emotion on Declarative Memory
Grand Ballroom Centre, Friday Afternoon, 1:30–3:25

Chaired by Morris Moscovitch, University of Toronto

1:30–1:45 (69)

The Effect of Emotion on Declarative Memory. MORRIS MOSCOVITCH, ADAM K. ANDERSON, & DEBORAH TALMI, *University of Toronto*—In this symposium, speakers attempt to integrate the exciting work on the cognitive mechanisms and the neural substrate underlying the effect of emotion on declarative memory. Going beyond the fundamental claim that memory for emotional events is better than memory for neutral events, speakers discuss the phenomenological, cognitive, and neurobiological uniqueness of emotional memories. Cahill discusses the effect of sex differences and hemisphere laterality on the modulatory effects of emotion on memory consolidation. Kensinger discusses the effects of emotional content on the likelihood that individuals will remember particular details associated with an event. LaBar discusses how emotional intensity and valence alter the perceptual and cognitive properties of autobiographical memories. Anderson discusses the role that self-referential and meaning-based encoding processes have in the enhanced retention of emotional memories. Speakers draw on and integrate data from behavioral, neuroimaging, and animal research.

1:45–2:10 (70)

Sex and Hemisphere Influences on Emotional Memory. LARRY CAHILL, *University of California, Irvine*—Extensive evidence from animal and human subject work supports the view that endogenous stress hormones and the amygdala interact to modulate memory storage processes for emotionally arousing events. In recent years, increasing evidence has documented influences of both subject sex and cerebral hemisphere on brain mechanisms of emotional memory. These influences will be the focus of this presentation.

2:10–2:35 (71)

The Effects of Emotion on Memory Specificity. ELIZABETH KENSINGER, *Boston College and Martinos Center for Biomedical Imaging*—Emotion infuses many of life's experiences. Numerous studies have demonstrated that the likelihood of remembering a particular experience can be affected by its emotional content, with emotional experiences more often remembered than neutral ones. In this talk, I will present recent evidence indicating that the emotional content of information also can increase the likelihood that individuals remember particular details associated with an event (e.g., whether an item was imagined or remembered; the specific visual details of a presented item). I also will discuss neuroimaging evidence suggesting that the engagement of limbic regions (particularly the amygdala and orbitofrontal cortex) during encoding and retrieval mediates these effects of emotional content on memory specificity.

2:35–3:00 (72)

The Phenomenological Experience of Emotional Remembering. KEVIN LABAR, *Duke University*—Psychologists tend to define the memory-enhancing effect of emotion as the likelihood that an emotional event will be retrieved, relative to a neutral one. However, emotion influences not just the accessibility of memory traces but also subjective aspects of remembering. Behavioral data will be presented that considers how emotional intensity and valence alter the cognitive properties of autobiographical memories. Neuroimaging studies will be reviewed that identify components of the autobiographical memory network that are sensitive to variations in emotional intensity and the sense of reliving during recall. Finally, the role of the medial temporal lobe in the successful retrieval of remote emotional memories will be discussed, with an emphasis on dissociating structures that mediate recollection versus familiarity. This research characterizes the broad influence of emotional intensity on memory and reveals synergistic actions of the amygdala, hippocampus, and inferior pre-

frontal cortex that underlie the phenomenological experience of emotional remembering.

3:00–3:25 (73)

Psychological and Neural Accounts of Emotional Enhancement of Episodic Memory. ADAM K. ANDERSON, *University of Toronto*—Emotional events are often highly personally relevant and may be associated with self-referential and meaning-based deep processing, resulting in their enhanced retention and phenomenological salience. Neurobiological approaches, however, suggest that such emotional enhancement critically depends upon enhanced memory consolidation mediated by the amygdala—an evolutionarily older neural structure not associated with higher order psychological processes. Neural accounts suggest that the greater psychological salience of emotional memories may simply reduce to the prerequisite of greater amygdala recruitment. Data will be presented in only partial support of this notion, showing that amygdala recruitment is necessary but insufficient to account for enhanced remembrance of emotional events.

Task Switching

Grand Ballroom East, Friday Afternoon, 1:30–3:50

Chaired by Erik M. Altmann, Michigan State University

1:30–1:45 (74)

Switch Cost Confusion: Validity Problems in Task-Switching Research. ERIK M. ALTMANN, *Michigan State University*—A central construct in the study of cognitive control is switch cost, the effect on performance of switching, as opposed to repeating a task between trials. However, a little-discussed fact is that the most common paradigms for measuring switch cost, explicit cuing and alternating runs, measure it differently. Whereas explicit cuing compares trials after a switch cue with trials after a repeat cue, alternating runs compares the first trial of a run (also a switch trial) with the second trial of a run (also a repeat trial), which is a significant confounding, because both the position and the switching variables independently affect performance. Widespread discussion of these two switch cost measures as identical has likely contributed to the heterogeneity of the data on switch cost, and the confounded nature of the alternating-runs version suggests that even dramatic findings from that paradigm add little diagnostic value to theoretical debates over models of cognitive control.

1:50–2:05 (75)

Decomposing Interference and Adaptation Costs in Task Switching. DANIEL GOPHER, VERED YEHENE, & OLGA CHUNTONAV, *Technion—Israel Institute of Technology*—Experiments were conducted to evaluate the relative contribution, to the costs of task switching, of adaptation and reconfiguration efforts, as compared with interference and inhibition factors. Theoretical accounts for performance costs in task switching vary in their emphasis on the influence of the two types of costs. We combined task switching with the task flankers paradigm, in an attempt to distinguish between these determinants of switching costs. Flankers on the sides of the imperative stimulus at each trial are distractors that need to be actively blocked. Results show that in task switching, flankers in one task become effective distractors in another task only when tasks are practiced in alternation, but not in uniform blocks. In task-switching blocks, their effects are comparable to flankers of the same task, both in repetition and in switching trials. The results are discussed in the framework of executive control models and the costs of task switching.

2:10–2:25 (76)

Across-Trial Stimulus Similarity Affects Response Speed, But Not the Task-Switching Cost. ANDRÉ VANDIERENDONCK, BAPTIST LIEFOOGHE, & FREDERICK VERBRUGGEN, *Ghent University*—The possible influence of stimulus-to-task associations on the cost of switching between two tasks was investigated in a cued task-switching design. This was studied by means of across-trial distance priming of

small numbers. In three experiments, participants performed magnitude and parity judgments of digits while across-trial distance between the digits systematically varied. The first experiment involved only parity judgments and showed that latencies of response repetitions increased with across-trial distance, whereas latencies of response alternations decreased with distance. The second and third experiments confirmed this pattern of results in switching from magnitude to parity with informative and uninformative cues, respectively. The relevance of the findings to current views on task switching is discussed.

2:30–2:45 (77)

Conflict and Control: Conflict-Triggered Goal Shielding and Distractor Inhibition in Task Set Switching. THOMAS GOSCHKE, *Dresden University of Technology*—Organisms pursuing goal-directed behavior in a changing environment face two fundamental challenges: to maintain and shield goals from distraction, on the one hand, and to flexibly switch between goals and monitor the environment for potentially significant stimuli, on the other. Here, I show that response conflicts automatically trigger an enhanced shielding of the currently active goal by inhibiting distracting information. In a cued task-switching paradigm in which participants responded to either the shape or the color of stimuli, conflicts induced by response-incompatible stimuli produced increased switch costs and incompatibility effects on the subsequent trial, indicating enhanced persisting inhibition of distracting stimulus dimensions. In addition, response conflicts impaired detection of prospective memory cues signaling the requirement to switch to a different task. Results extend current theories of conflict monitoring and cognitive control in showing that response conflicts enhance distractor inhibition on the current trial of a task and impair background monitoring for potentially significant stimuli.

2:50–3:05 (78)

On the Origins of the Task-Mixing Cost in the Cuing Task-Switching Paradigm. ORIT RUBIN & NACHSHON MEIRAN, *Ben-Gurion University of the Negev* (read by Nachshon Meiran)—Poorer performance in task switching, relative to single-task conditions, is called *mixing cost* (MC). In three experiments exploring the origins of MC, participants either switched between cued *shape* and *color* tasks or performed them as single tasks. Experiment 1 failed to support the hypothesis that MC reflects controlled mode of processing, by showing that a flanker interference effect was not affected by task mixing. Experiment 2 supported the hypothesis that mixed-task trials require the resolution of task ambiguity by showing that MC existed only with ambiguous stimuli that afforded both tasks and not with unambiguous stimuli affording only one task. Experiment 3 failed to support the hypothesis that holding multiple task sets in working memory (WM) generates mixing cost, by showing that systematic manipulation of the number of S–R rules in WM did not affect MC. The results emphasize the role of competition management between task sets during task control.

3:10–3:25 (79)

Repetition Benefit in Task Switching. MYEONG-HO SOHN, *George Washington University*, JOHN R. ANDERSON, *Carnegie Mellon University*, & BRUCE C. PETERSON, *George Washington University*—Performing a new task is slower than performing a repeated task, and this difference has been attributed to the benefit of task repetition, as well as to the cost of engaging a new task. The present study examined whether task repetition benefits from carryover of the previous task or priming of an upcoming task. Participants performed two tasks (T1 and T2) on every trial, and the two tasks were either identical (task repetition) or different (task switch). T2 was preceded by an uninformative task cue, which was consistent with T2 (positive cue), inconsistent (negative cue), or neutral (neutral cue). In general, T2 latency was shorter in task repetition than in task switch. However, the benefit of task repetition was observed only with positive or neutral cues but not with negative cues. These results suggest that task repetition may benefit from carryover of the recently performed task.

3:30–3:45 (80)

Is There Volition in the Voluntary Switching Paradigm? ULRICH MAYR & THEODORE A. BELL, *University of Oregon*—The voluntary task-switching paradigm (Arrington & Logan, 2004) requires “random” selection between tasks and promises a window into executive task selection independently of exogenous influences present in standard task-switching situations (Arrington & Logan, 2004). We show here that the degree to which subjects perseverate the last trial’s task captures unique individual-differences variance, but also that the switch rate is under strong stimulus-driven control: “Voluntary” switches are much more frequent when the stimulus changes than when it stays the same. Most important, we show that individuals who selectively slow down on no-switch trials exhibit less perseveration and stimulus-driven effects (and thus more “voluntary” selection). We suggest that selective slowing indicates a strategy of treating trials as discrete events—possibly through inhibition of the preceding task. These results not only demonstrate massive “nonvoluntary” influences on voluntary selection, but also show how these influences can be counteracted through strategic adaptations.

Attention II

Grand Ballroom West, Friday Afternoon, 1:30–3:10

Chaired by Shaun P. Vecera, *University of Iowa*

1:30–1:45 (81)

The Spatial Distribution of Object-Based Attention. SHAUN P. VECERA, ASHLEIGH M. RICHARD, & ANDREW HOLLINGWORTH, *University of Iowa*—The hallmark of object-based attention is that perceptual judgments are more efficient when a target appears in an attended object than when it appears in an unattended object. However, the manner in which attention is oriented to objects and distributed within objects is poorly understood. We investigated a core issue in object-based selection: the spatial distribution of attention within an object. We manipulated the within-object distance between a cue and a target. Spatial distance effects within objects would support grouped-array theories of object-based attention (Vecera, 1994). In accord with grouped-array theories, targets were detected more quickly near the attended end of an object than further from this attended end. Similar results were found in a masked discrimination task, which eliminated the possibility of shifts of spatial attention. Our results suggest that object-based effects arise because of the spatial profile of attention across an object, not because of shifts of attention between objects.

1:50–2:05 (82)

Spatial Attention to a Partially Occluded Object. DESTINEE L. CHAMBERS, KYLE R. CAVE, & SIMON J. BUECHNER, *University of Massachusetts, Amherst*, & SHANNON BAILEY, *University of Rochester* (read by Kyle R. Cave)—Much of the evidence for object-based attention comes from studies with overlapping objects, and understanding how one object can be selected when it is partly occluded is key to understanding visual attention. We used spatial probes to measure the allocation of attention to different parts of a target object and distractor object when one occluded a portion of the other. The results show that the region in which part of the target object is occluded by a distractor receives less attention than do the visible parts of the target. This result conflicts with findings from Haimson and Behrmann (2001) indicating that attention was equally allocated to unoccluded and occluded parts of the target. Comparing these results shows that under some conditions, spatial attention can be strategically allocated to only the visible parts of a target, while occluded parts are inhibited.

2:10–2:25 (83)

Stimulus-Driven Attentional Capture by Objecthood. RUTH KIMCHI, YAFFA YESHURUN, & ALIZA COHEN-SAVRANSKY, *University of Haifa*—Exogenous cues (e.g., peripheral flickers or abrupt

onset of a new object) attract attention automatically. We examined whether the organization of some elements in the display into an object, with no abrupt onset or any other unique transient, can also attract attention automatically. Participants were presented with a display of nine elements, one of which was the target, and had to identify the target's color. On some of the trials, a subset of the elements grouped into an object. The object was irrelevant to the task and unpredictable of the target. The results show that performance on trials with an object present in the display was faster than performance on trials with no object for targets in the object area (a benefit) but was slower for targets in a nonobject area (a cost). These findings suggest that a perceptual object can capture attention in a stimulus-driven manner by its mere objecthood.

2:30–2:45 (84)

Capturing Driver Attention. CRISTY HO, *University of Oxford*, HONG Z. TAN, *Purdue University*, & CHARLES SPENCE, *University of Oxford* (read by Charles Spence)—We report a series of experiments designed to assess the relative effectiveness of spatial auditory, vibrotactile, and visual warning signals in alerting drivers to potential emergency driving events seen through the windshield or rearview mirror in a simulated driving task. Our results show that while directional congruency between a warning signal and a target traffic event may be sufficient to facilitate performance, due to response priming, attentional facilitation typically requires the collocation of the cue and the target within the same functional region of space. Our results are discussed in terms of the distinction between the brain's processing of stimuli presented in peripersonal and extrapersonal space. We will also highlight research comparing spatial versus verbal warning signals and comparing the effectiveness of unimodal versus multisensory warning signals.

2:50–3:05 (85)

Separating Multisensory Integration From Unspecific Warning Effects in Saccadic Reaction Time. ADELE DIEDERICH, *International University Bremen*, & HANS COLONIUS, *Universität Oldenburg*—Saccadic reaction time (SRT) to visual targets tends to be faster when auditory or tactile stimuli occur in close temporal or spatial proximity, even when subjects are instructed to ignore the nontarget. The time-window-of-integration (TWIN) model for multisensory integration (Colonius & Diederich, 2004, *J. Cog. Neurosci.*) distinguishes an early afferent stage of parallel peripheral processing from a second stage comprising neural integration of the input and preparation of an oculomotor response. TWIN is extended here to allow separation of a—spatially unspecific—warning effect from true multisensory integration. TWIN is supported by SRT data from a study using 23 different stimulus onset asynchronies over a range of 700 msec, with visual stimuli and auditory or tactile nontargets presented ipsi- or contralateral to the target.

Reasoning With or About Others

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

Chaired by Robert L. Goldstone, *Indiana University*

1:30–1:45 (86)

The Propagation of Innovations in a Social Network. ROBERT L. GOLDSTONE, WINTER MASON, & ANDY JONES, *Indiana University*—Social organisms can explore solutions to problems on their own or can exploit innovative solutions discovered by their peers. Our participants guessed numbers between 0 and 100 and were shown the points earned by their guesses, based upon a hidden scoring function that either was single peaked or had three peaks (two local maxima and one global maximum). Over 15 rounds, participants received feedback not only on their own guesses, but also on their neighbors' guesses. Neighbors were determined by one of four network topologies: locally connected lattice, random, fully connected, and small world (e.g., a lattice plus a few long-range connections). For the

single- and three-peaked functions, the fully connected and small-world networks, respectively, converged most quickly on the global maximum. These results suggest that complete information is not always beneficial for a group and that problem spaces requiring substantial exploration may benefit from networks with mostly locally connected individuals.

1:50–2:05 (87)

Making Decisions With Your Spouse. KATHLEEN M. GALOTTI, *Carleton College*—Parents of kindergarten students participated in a longitudinal study, tracking them up to three times over the course of a year as they made a decision for educational placement (from among seven to eight available options) for their child for the following year. Ninety-six couples have participated to date. This presentation will examine the effects of having a similar or dissimilar decision-making style with one's spouse or significant other on both performance measures and affective reactions to the process. We will also examine whether having values, goals, or criteria in common makes the process easier or harder.

2:10–2:25 (88)

Making Decisions for Others: Accuracy and Competence. GRETCHEEN B. CHAPMAN, *Rutgers University, Piscataway*, & LAURA KRESSEL, *New York University*—Surrogate decisions made on behalf of a beneficiary should ideally match the decisions the beneficiary would make him- or herself. We examined two factors that affect accuracy of surrogate decisions: (1) the beneficiary's competence in providing instructions to the surrogate about his or her preferences and (2) the surrogate's competence in applying those instructions. In Experiment 1, 56 undergraduates playing the role of beneficiary completed a living will that provided instructions for medical care and responded to a series of medical scenarios. Living wills from select participants of varied competence were given to 75 undergraduate "surrogates" in Experiment 2. Surrogates read the living wills and then predicted the beneficiaries' responses to the medical scenarios. Accuracy of prediction was statistically related to both beneficiary competence in expressing instructions in the living will (as scored in Experiment 1) and surrogate competence in using information in a living will (as scored in Experiment 2).

2:30–2:45 (89)

What Do You Want? Event Indexing When Inferring Goals. JOSEPH P. MAGLIANO, JOHN J. SKOWRONSKI, & MARY A. BRITT, *Northwestern Illinois University*, CHRISTOPHER D. GÜSS, *North Florida University*, & CHRIS FORSYTHE, *Sandia National Laboratories*—This study investigated the processes by which one infers the goal of a stranger. Adopting a mental model view of social inferences, it was assumed that understanders monitor situational cues present during social interactions and that goal inferences are guided by the informativeness of these cues—that is, their diagnosticity and typicality. In Experiment 1, a procedure for identifying cues was developed. Experiments 2 and 3 assessed the relative importance of cue categories (space, time, characteristics of oneself, characteristics of the stranger, and stranger's behavior) and measures of cue informativeness (diagnosticity and typicality) for goal judgments. The results indicate that both measures of informativeness have a significant impact on goal judgments but that their combined impact was far greater than their unique impact. Furthermore, some cues, such as stranger characteristics and stranger behavior, affect judgments more than would be expected from measurements of their typicality and diagnosticity.

2:50–3:05 (90)

Understanding Intention From Minimal Displays of Human Activity. FRANK E. POLLICK & PHILIP MCALEER, *University of Glasgow*—Social intention and meaning can be attributed to displays of moving geometric shapes, yet the visual and cognitive processes that underlie this perception of animacy are still open to debate. Typically, animacy displays are created by talented animators or synthesized

with the aid of mathematical formulations. We present a subtractive method where video recordings of human actions are progressively reduced into displays that show only the motion of simple geometric shapes. It is the focus of our study to extract the mechanisms, both visual and cognitive, at the root of this perception. We will present empirical data showing that subjects can differentiate the intentions of dyads in various animacy displays. Results shall be discussed in terms of the relationship and kinematics of one agent to another in the displays.

3:10–3:25 (91)

A Preference-Scaling Analysis of the Link Between Eating Disorders and Self-Perception. TERESA A. TREAT, *Yale University*, RICHARD J. VIKEN, *Indiana University*, SHIRLEY S. WANG, *Yale University*, RICHARD M. MCFALL, *Indiana University*, & MARIANN R. WEIERICH, *Yale University*—Preference-scaling methods were used to examine (1) women's utilization of body size, facial affect, and attractiveness, as well as their preferred values along these dimensions, when defining their real self, their ideal self, and their perception of men's ideal, and (2) the links between these processing characteristics, gender, and eating disorder symptoms. Three hundred college women viewed all possible pairs of 24 photos of undergraduate women three times, rapidly selected one woman in response to particular questions (e.g., "Which woman is more like you?"; "Which woman do you think men would find more attractive?"), and then completed assessments of eating disorder symptoms. Fifty-three college males completed a preference task in which they indicated which woman was more attractive on each trial. As was expected, dimensional utilization and preferred values varied with rating condition, gender, and eating disorder symptoms. These findings highlight the utility of preference-scaling models for the evaluation of individual differences in socially relevant information processing.

Sentence Processing

Civic Ballroom, Friday Afternoon, 1:30–4:10

Chaired by David N. Caplan, *Massachusetts General Hospital*

1:30–1:45 (92)

Task Effects on BOLD Signal Correlates of Syntactic Processing. DAVID N. CAPLAN, *Massachusetts General Hospital*, EVAN CHEN, *University of Pennsylvania*, & GLORIA S. WATERS, *Boston University*—Behavioral and BOLD signal measures were obtained while 16 participants performed two tasks when presented with sentences with more complex subject–object relative clauses and less complex object–subject relative clauses. In Task 1 (plausibility judgment), participants read sentences and made speeded judgments regarding the plausibility of each sentence. In Task 2 (nonword detection), participants read sentences and made speeded judgments regarding whether the sentence contained a nonword. The behavioral and neurovascular results indicate that the comprehension of a sentence is affected by the ease of thematic role assignment and the syntactic structure of a sentence and that the effects of these factors are increased when subjects make conscious decisions about sentence meaning. The results also bear on the neural location of operations involved in assigning the syntactic structure of sentences and the interaction of these processes with thematic role assignment.

1:50–2:05 (93)

External/Internal Status Explains Neither the Frequency of Occurrence Nor the Difficulty of Comprehending Reduced Relative Clauses. MARY L. HARE, *Bowling Green State University*, MICHAEL K. TANENHAUS, *University of Rochester*, & KEN McRAE, *University of Western Ontario*—McKoon and Ratcliff (*Psychological Review*, 2003) argue that reduced relatives (RRs), such as "The horse raced past the barn fell," are incomprehensible because the meaning of the RR construction requires a verb with an event template that includes an external cause (EC). Thus, RRs with internal cause (IC) verbs such as *race* are "prohibited." Their corpus analyses showed that RRs are common with EC but rare with IC verbs. Alternatively, RRs may be

rare with IC verbs because few of these occur in the passive. Those that do, however, should make acceptable RRs, with ease of comprehension related to difficulty of ambiguity resolution, rather than to the IC/EC distinction. In two experiments, we show that English speakers willingly produce RRs with IC verbs and judge their acceptability on the basis of factors known to influence ambiguity resolution. Moreover, a regression model demonstrates that frequency of the passive, not IC/EC status, predicts RR frequency in parsed corpora.

2:10–2:25 (94)

Syntactic Priming in Comprehension. MATTHEW J. TRAXLER, *University of California, Davis*, MARTIN J. PICKERING, *University of Edinburgh*, & KRISTEN TOOLEY, *University of California, Davis*—A series of eye-tracking experiments investigated syntactic priming in comprehension. Prior experiments indicated that sentences containing reduced relative clauses are processed more easily when they follow sentences with the same syntactic structure and the same past participle. In addition, syntactic priming effects occur when local structural relations are preserved but aspects of global structure are changed. In Experiment 1, the past participle in the prime and the target sentences were identical or were synonyms. Priming was observed only for the repeated past participle. In Experiment 2, reduced relative primes were contrasted with pluperfect primes, and only the former type facilitated target sentence processing. We conclude that the source of priming is the repeated past participle, together with its implicit argument structure.

2:30–2:45 (95)

The Order of Modifiers in Noun Phrases. EDWARD J. WISNIEWSKI, *University of North Carolina, Greensboro*, GERT STORMS, *University of Leuven*, & PHIL MAGUIRE, *University College Dublin*—Language researchers suggest that the adjectives of a noun phrase are ordered by their intrinsicity with respect to the head noun, such that more intrinsic adjectives are placed closer to the head noun. On this account, a speaker would refer to a church that is large and gray as a "large gray church" because grayness is more intrinsic to a church than is size. Contextual factors are also important in adjective order. We examine the generality of these views, for both adjectives and noun modifiers, and suggest that other factors play an important role in how modifiers are ordered in a noun phrase.

2:50–3:05 (96)

Online Effects of NP Types on Sentence Complexity. YOONHYOUNG LEE, MARCUS JOHNSON, PETER C. GORDON, & RANDALL HENDRICK, *University of North Carolina, Chapel Hill* (read by Peter C. Gordon)—The effect of different types of noun phrases (NPs) on the ease of understanding complex sentences has been a topic of considerable recent interest because these effects offer a way of understanding the nature of the interaction between language and memory. Research on this topic, using offline methods or online methods with relatively low temporal resolution, has shown that sentence complexity effects are maximized when the critical NPs in the sentence are similar, a result that points to the operation of an interference mechanism such as that common in many nonlinguistic types of human memory. The present research uses eye tracking to study how the similarity of NPs affects the online processing of complex sentences in English and in Korean. The results from both languages provide evidence that similarity-based interference occurs as an early online process and may continue to occur in later stages of sentence comprehension.

3:10–3:25 (97)

Verb Repetition in Distractor Items Affects Structural Priming in Comprehension. GAIL MAUNER & SUNFA KIM, *SUNY, Buffalo*—Readers often garden path on sentences whose main verb is biased toward a direct object (DO) complement but resolves as a sentential complement (SC). Experiment 1 demonstrates that garden pathing is reduced in disambiguating regions when an SC target sentence whose main verb is biased toward a DO completion is preceded by an SC

prime with the same main verb, as compared with when it is preceded by a DO prime with the same verb. However, Experiment 2 shows that garden pathing is not reduced when presentation lists include distractor sentence pairs that also repeat verbs but vary in syntactic structure or verb sense from first to second sentence. Thus, while Experiment 1 extends structural priming in comprehension to the reduction of the DO/SC ambiguity, results of Experiment 2 suggest that structural priming in comprehension is mediated, in part, by learning that verb repetition may signal structural repetition.

3:30–3:45 (98)

Motor Resonance in the Comprehension of Action Sentences. ROLF A. ZWAAN & LARRY J. TAYLOR, *Florida State University*—There is evidence that observing actions and understanding sentences about actions activate corresponding motor processes in the observer/comprehender. In five experiments, we examine this phenomenon of motor resonance further. Specifically, we address two novel questions. The first question is whether visual motion associated with an action produces motor resonance in sentence comprehension. The second question concerns the modulation of motor resonance during sentence comprehension. Experiment 1 shows that a rotating visual stimulus affects manual rotation. Experiment 2 shows that comprehending a sentence about manual rotation (e.g., “He turned down the volume”) affects sensibility judgments made by actual manual rotation. Experiment 3 shows that a rotating visual stimulus affects the comprehension of manual rotation sentences. Experiments 4 and 5 show that motor resonance is a rather immediate and localized phenomenon, exclusively occurring during the main verb of the sentence that specifies the rotation direction.

3:50–4:05 (99)

ERP and Joint Time–Frequency Responses to Grammatical and Semantic Violations in Dutch–English Bilinguals. DOUGLAS J. DAVIDSON & PETER INDEFREY, *F. C. Donders Centre for Cognitive Neuroimaging*—Previous research on multilingual sentence processing has shown that event-related potential (ERP) responses to grammatical or semantic violations in sentences presented in a second language are delayed or more variable than first-language responses. We examined responses to grammatical and semantic violations in Dutch speakers who were proficient in English, to investigate whether joint time–frequency analyses can provide additional insight into the nature of second-language sentence processing. The analyses indicated that grammatical violations led to a power reduction with a relatively broad distribution at approximately 10–15 Hz following the violation, relative to the controls, and a corresponding increase in power at approximately 3–5 Hz. Analyses of the ERP results indicated an N400 effect for semantic violation critical words, relative to controls, as well as a P600 effect for the grammatical violations. The event-related changes in power suggest that grammatical violations incur a greater attentional load in bilinguals.

Counting, Timing, and Time Perception Conference Rooms B&C, Friday Afternoon, 1:30–3:10

Chaired by Richard A. Carlson, *Pennsylvania State University*

1:30–1:45 (100)

Counting on Emotion. RICHARD A. CARLSON & RACHEL E. SMITH, *Pennsylvania State University*—Emotion is thought to play roles in the control of cognitive processes at scales ranging from the guidance or biasing of attention to the selection of decision-making strategies. We considered hypotheses about the role of emotion in control and error monitoring of a routine cognitive task, event counting. Participants in several experiments counted sequences of briefly presented schematic faces that could be happy, neutral, or sad. Counting was generally more accurate with faces than with other stimuli. More interesting, the emotionality of the faces being counted influenced the patterns of error types (undercounts vs. overcounts) and the success

with which participants monitored their performance for errors. These effects depended on other factors known to influence event counting and are unlikely to be due to shifts in general mood. The results point to a role for emotionality in the online intentional control of fluent performance.

1:50–2:05 (101)

Adults’ Age-Related Differences in Approximate Quantification. DELPHINE GANDINI & PATRICK LEMAIRE, *CNRS and Université de Provence* (read by Patrick Lemaire)—Young and older adults had to find the approximate number of dots for collections of between 11 to 98 dots within 6 sec. On the basis of previous works, participants could choose between two strategies in a choice condition: visual scanning strategy (i.e., participants scanned the collection of dots and gave an approximate numerosity without counting dots) or anchoring strategy (i.e., participants first enumerated a few dots and then visually estimated the remaining dots). Participants were also forced to use each strategy on all trials in no-choice conditions. Data showed age-related changes in strategy use (percent use of each strategy) and strategy adaptivity (i.e., choosing the best strategy on each item), in strategy performance (latency and accuracy) and in eye-movement data (number and duration of fixations). Implications of these findings for the further understanding of approximate quantification skills and the effects of age on these skills will be discussed.

2:10–2:25 (102)

Interval Length and Event-Counting Errors. DANIEL N. CASSENTI & RICHARD A. CARLSON, *Pennsylvania State University*—The speed–accuracy tradeoff specifies that as speed of processing increases, the chance of error increases. Experiment 1 demonstrated that as presentation speed of to-be-counted events decreases, the chance of a counting error increases, suggesting a revision of the speed–accuracy tradeoff. Experiment 2 distinguished between two causes of this effect: forgetting or overuse of a strategy of rehearsal to prevent forgetting. The results implicate the overuse of rehearsal and suggest that the speed–accuracy tradeoff is a special case of a more general speed–accuracy relation. Results are discussed in relation to the nature of goals, cognitive control, and error detection.

2:30–2:45 (103)

Auditory Kappa: Effects of Pitch on Perceived Time. NOAH MACKENZIE & MARI R. JONES, *Ohio State University* (read by Mari R. Jones)—The kappa effect refers to a phenomenon whereby spatial relationships among stimuli affect judgments of temporal relationships among those stimuli. Events widely separated in space will be perceived as being further apart in time than events spaced closer together. One explanation for this appeals to the apparent motionlike properties of the stimuli. Three experiments on auditory kappa were conducted. In Experiment 1, a listener judged whether the second tone in a sequence of three (a kappa cell) was closer in time to the first or the third tone. Listeners were most accurate when the pitch of the second tone was closest to the first or third tone. Experiments 2 and 3 added serial context immediately preceding the kappa cell. It was found that a serial context preserving the motionlike properties of the kappa cell preserved the kappa effect, whereas a context that did not preserve these properties abolished it.

2:50–3:05 (104)

A 20-Year Longitudinal Study of Musical Tone Discrimination and Identification. SHELDON G. LEVY, *Wayne State University*—Ear-training experiments have been reported for more than a century. However, past research has investigated the phenomenon over relatively short periods of time. This report is based on 20 years of identification/discrimination of randomly generated tones. Intervals without practice ranged from 1 day to 5 years. Tones were generated within a two-octave range (approximately normal distribution around G above middle C) with 60–80 tones per minute, depending upon the speed of response and the accuracy of identification. The maximum allowable

time within a trial before another tone was generated was 1 sec. Two additional subjects replicated the early stages of learning. The data provide a baseline for the learning and relearning of musical tone identification/discrimination. It appears that despite the aging process (the subject got older), the ability to reach maximum levels of accuracy did not decrease.

Visual Short-Term Memory
Grand Ballroom Centre, Friday Afternoon, 3:50–5:30

Chaired by Pierre Jolicœur, Université de Montréal

3:50–4:05 (105)

Tracking the Involvement of Visual Short-Term Memory Using Human Electrophysiology. PIERRE JOLICŒUR, BENOIT BRISSON, NICOLAS ROBITAILLE, ÉMILIE LEBLANC, ROSALIE PERRON, & DAVID PRIME, *Université de Montréal*—Elegant work by Vogel and Machizawa (2004) suggests that maintaining information selected for storage in visual short-term memory (VSTM) causes a sustained posterior contralateral negativity (SPCN) in event-related potentials, reflecting neural activity associated with memory retention. We observed similar SPCNs in ERPs from several experiments designed to measure the N2pc (another interesting ERP strongly correlated with visual spatial selective attention). In this paper, we review several spatial selective attention experiments in which we observed both N2pc and SPCN ERPs. We also present new experiments designed to dissociate the N2pc from the SPCN and to use the SPCN as an ongoing measure of VSTM involvement in visual cognition.

4:10–4:25 (106)

Dissociable Neural Mechanisms Supporting Visual Short-Term Memory for Objects. YAODA XU & MARVIN M. CHUN, *Yale University*—There is growing debate contesting whether visual short-term memory (VSTM) capacity is variable or limited to a fixed number of objects. Using fMRI, we show that while activations in the superior intraparietal sulcus (IPS) and the lateral occipital complex (LOC) track the number of objects held in VSTM as object feature complexity vary, those in the inferior IPS increase with set size and plateau at set size 4 regardless of object feature complexity. Moreover, while inferior IPS representations are spatial in nature, those of the superior IPS and the LOC are not. These results suggest a two-stage model of VSTM whereby a fixed number of objects are first selected via their locations by the inferior IPS, and then a variable number of objects, depending on visual complexity, are subsequently retained in VSTM by the superior IPS and the LOC. VSTM capacity is, therefore, determined both by a fixed number of objects and by object complexity.

4:30–4:45 (107)

Working Memory Capacity and Control of Visual Search. BRADLEY J. POOLE & MICHAEL J. KANE, *University of North Carolina, Greensboro* (read by Michael J. Kane)—The executive attention theory of working memory (WM) capacity proposes that WM span tasks predict individual differences in fluid cognitive abilities because span reflects a domain-general attention control ability (Engle & Kane, 2004). Supportive evidence comes from findings that individual differences in WM capacity predict performance on tasks requiring conscious control of habitual responses and visual attention. However, we have previously reported that WM capacity is not related to prototypical visual search performance, even in tasks eliciting substantial RT slopes. Because attention deployment in typical search tasks is not volitional (Wolfe et al., 2000), here, we designed two visual search tasks to increase demands on executive control—one requiring the volitional movement of attention around a search display and one requiring the restriction of search to discontinuous locations amid distractors. Results indicate that WM capacity predicts the ability to discontinuously focus visual attention, especially when focus must be reconfigured across successive trials.

4:50–5:05 (108)

Errors in Visuospatial Working Memory. CESARE CORNOLDI & ROSSANA DE BENI, *University of Padua*, & NICOLA MAMMARELLA, *University of Chieti*—It is common knowledge that elderly people have difficulty in performing working memory tasks, including visuospatial working memory (VSWM) ones. Unfortunately, the generality and the characteristics of this difficulty have not yet been deeply examined. A series of experiments investigated the active component of VSWM in young and elderly people. Participants were shown sequences of matrices on which three positions were pointed at; their task was to process all the positions and then to indicate only the final positions of each sequence. Results showed that the success in active VSWM tasks depends—at least partially—on difficulties in discriminating between items having a different status and, in particular, in avoiding intrusions (i.e., avoiding the recall of information already activated).

5:10–5:25 (109)

Similarity and Interference in Visual Working Memory. STEVEN J. LUCK, PO-HAN LIN, & ANDREW HOLLINGWORTH, *University of Iowa*—Similarity leads to interference between representations in long-term memory and in verbal working memory. Does it also lead to interference between representations in visual working memory? To answer this question, we conducted a color change detection experiment in which the items in a given sample display were either similar to or different from each other in hue. Accuracy was not impaired when the colors were similar to each other; instead, accuracy was improved. Superior accuracy was also observed for similar items when the to-be-remembered items were presented sequentially, even when the first item in the sequence was tested. The increased accuracy for similar items does not, therefore, reflect a more accurate initial encoding but, instead, reflects differences in the maintenance or comparison processes. Thus, similarity between concurrent representations in visual working memory influences performance, but the effect is the opposite of the interference effects observed with other forms of memory.

Prospective Memory

Grand Ballroom East, Friday Afternoon, 4:10–5:30

Chaired by Bob Uttil, University of Tamagawa

4:10–4:25 (110)

Quo Vadis, Prospective Memory? BOB UTTL, *University of Tamagawa*—Prospective memory proper (ProMP) brings back to awareness previously formed plans at the right place and time; ProMP is distinct from other subdomains of prospective memory (ProM), such as vigilance/monitoring. A quantitative review of over 200 age contrasts from published studies revealed that although both ProMP and vigilance show substantial age declines, the declines in ProMP are larger than those in vigilance/monitoring and in retrospective memory. Strikingly, the size of observed age declines on ProM tasks is directly related to the degree to which researchers are able to avoid ceiling effects ($r^2 > .40$, $p < .0001$). Furthermore, studies that bias task demands to benefit older versus younger adults show smaller age effects. In sum, age declines have been underestimated, due to methodological shortcomings, including ceiling-limited scores, age confounds, and inappropriate effect size measures. Finally, a failure to distinguish the multiple subdomains of ProM contributes to literary confusion and theoretical quagmire.

4:30–4:45 (111)

Age Invariance in Prospective Memory: Focal Cues and Resource Allocation. MARK A. MCDANIEL, *Washington University*, & GILLES O. EINSTEIN, *Furman University*—In two experiments, we varied how focal the prospective memory cue was to the ongoing task. We found no age differences in prospective memory. Importantly, for focal cues,

neither young nor old demonstrated costs to the ongoing task either in accuracy (Experiment 1) or in speed of responding to the ongoing task (Experiment 2). In contrast, for nonfocal cues, older adults maintained levels of prospective memory performance comparable to that of young adults, but at a cost to ongoing task performance (reduced accuracy and longer response times). These data provide strong support for the idea that when the prospective memory cue is focal to the ongoing task, prospective memory retrieval is typically spontaneous and, accordingly, is not likely to produce age-related decline. Second, older adults' resource allocation policies with nonfocal target events clearly can support prospective memory at levels comparable to those of younger adults, albeit at a price to ongoing activity.

4:50–5:05 (112)

Effects of Aging and Working Memory Load on Prospective Memory. ROBERT WEST & RITVIJ BOWRY, *University of Notre Dame*—ERPs were used to examine the effects of aging on the neural correlates of prospective memory. In the task, we varied working memory load and prospective memory load in a 2×2 factorial design. Individuals judged whether letters had repeated one or two items back in the list. For half of the blocks, they also made prospective responses when letters were presented in a specific color. The ERP data revealed several interesting findings: (1) *n*-back load influenced the amplitude of the N300 in younger adults, but not in older adults, (2) prospective memory was associated with the recruitment of different neural generators in younger and older adults, and (3) the prospective interference effect was associated with the recruitment of different neural generators in younger and older adults. These findings support the idea that there are age-related differences in the recruitment of preparatory attention that facilitates the realization of intentions.

5:10–5:25 (113)

“Haste Makes Waste”: A Momentum Theory of Prospective Memory Test Performance. PETER GRAF, *University of British Columbia*—Prospective memory (ProM) is the ability to make plans and to recollect them later upon the occurrence of the appropriate retrieval cues. In the context of everyday life, we may fail to follow through with a plan, such as posting a letter, because we are immersed in a heated conversation at the time of walking past the mailbox. The present research explored the hypothesis that ProM test performance is determined by the momentum of the activity—the ongoing conversation—in which the retrieval cues are encountered, with high momentum activities defined as those that are more difficult to interrupt. We manipulated task momentum in a number of different ways—for example, by giving subjects speed versus accuracy instructions for an old/new recognition test. The results showed higher ProM test performance for cues presented in lower momentum ongoing tasks.

Cuing Visual Attention

Grand Ballroom West, Friday Afternoon, 3:30–5:30

Chaired by Soledad Ballesteros
Universidad Nacional de Educación a Distancia, Madrid

3:30–3:45 (114)

Effects of Word Fragmentation, Cortical Magnification, and Visual Eccentricity on Stroop Effect. SOLEDAD BALLESTEROS & JOSÉ M. REALES, *Universidad Nacional de Educación a Distancia, Madrid*, & DIONISIO MANGA, *Universidad de León*—Directing attention to a spatial location improves responses to stimuli presented at that location. However, selective attention is not totally successful. In a series of experiments using the Stroop paradigm, we examined the effect of stimulus fragmentation on item type (congruent, incongruent, neutral, emotional, negative, semantic, orthographic), experimental design (blocked, random), and stimulus eccentricity on interference and facilitation. In this study, congruent, incongruent, neutral, and semantically related words at four levels of fragmentation were presented appropriately enlarged by a magnification factor at two eccen-

tricitities to the left or to the right of fixation. Results showed that as in previous studies, both item type and fragmentation level were significant. However, neither stimulus size nor its interaction with other factors was significant. Results suggest that when the stimuli are enlarged by a magnification factor to match eccentricity, Stroop effects at a foveal location are similar to those presented at the periphery.

3:50–4:05 (115)

Visual Attention and the Semantics of Space: Beyond Central and Peripheral Cues. BRADLEY S. GIBSON, *University of Notre Dame*, & ALAN F. KINGSTONE, *University of British Columbia*—The distinction between central and peripheral cues has played an important role in understanding the functional nature of visual attention for the past 30 years. In the present talk, we propose a new taxonomy that is based on linguistic categories of spatial relations. Within this framework, spatial cues are categorized as either “projective” or “deictic.” Using an empirical diagnostic developed by Logan (1995), we demonstrate that word cues such as *above*, *below*, *left*, and *right* express projective spatial relations, whereas arrow cues, eye gaze cues, and abrupt onset cues express deictic spatial relations. Thus, the projective versus deictic distinction is shown to crosscut the more traditional central versus peripheral distinction. The theoretical utility of this new distinction is discussed in the context of recent evidence suggesting that a variety of central cues can elicit reflexive orienting.

4:10–4:25 (116)

The Attentional White Bear Phenomenon: The Mandatory Allocation of Attention to Expected Distractor Locations. YEHOSHUA TSAL & TAL MAKOVSKI, *Tel Aviv University*—We report additional data supporting the “attentional white bear” hypothesis. We devised a prestimulus probe method to assess the allocation of attention as a function of subjects' top-down expectancies concerning distractor and target locations. Participants performed the flanker task, and distractor locations remained fixed. On some trials, instead of the flanker display, two simultaneous dots appeared. The dot in the expected target location was perceived to occur before the dot in the expected distractor location. More interesting, the dot in the expected distractor location was perceived to occur before the dot in the expected empty location, indicating that attention is allocated to expected distractor locations prior to stimulus onset. We propose that a process-all mechanism guides attention to expected locations of all stimuli, regardless of task demands, and that this constitutes a major cause for failures of selective attention.

4:30–4:45 (117)

Endogenous Cuing and Saccade Curvature. JAN THEEUWES & STEFAN VAN DER STIGCHEL, *Vrije Universiteit Amsterdam*—In a standard Posner paradigm, participants were endogenously cued to attend to a peripheral location in visual space without making eye movements. Participants responded more quickly to target letters presented at cued locations than to those at uncued locations. On some trials, instead of a manual response, participants had to move their eyes to a location in space. The extent to which the eyes curved away from cued and uncued locations was related to the dynamics of attention allocation. Not only did the eyes curve away from validly cued locations, but also when the cue was invalid and attention had to be shifted to the uncued location, the eyes curved away, but now from the uncued location. We show that covert endogenous shifts of attention always result in activity in the oculomotor system, even in tasks in which participants covertly direct attention to a location in space.

4:50–5:05 (118)

Alternative Accounts of the Effect of Prior Probability on Response Time. JOHN PALMER & MARIA K. MCKINLEY, *University of Washington*, & MICHAEL N. SHADLEN, *HHMI and University of Washington*—Perceptual decisions are based on a combination of sensory evidence and prior knowledge. We address how sensory evidence is combined with prior knowledge of the probability of stimulus alter-

natives. Observers viewed a patch of dynamic random dots in which a fraction of the dots moved coherently to the left or right. The task was to indicate the net direction of motion by an eye movement to a peripheral target. Sensory evidence was manipulated by varying the motion coherence, and prior knowledge was manipulated by varying the probability of a particular direction of motion. We found that the effect of prior probability is similar to the effect of motion coherence. By traditional sequential-sampling models, prior probability is assumed to affect the decision criterion, and not the sampling process. Our results are inconsistent with these models but can be explained by prior probability's modulating the input into the decision process.

5:10–5:25 (119)

How Does Naming the Task Help Task Set Reconfiguration? STEPHEN MONSELL & GUY A. MIZON, *University of Exeter*—In the task-cuing paradigm, the cost of switching tasks and its reduction as cue–stimulus interval increases can (despite some recent skepticism) provide separate indices of anticipatory task set reconfiguration and “residual” interference from the previous task that is not eliminable by preparation. If, as some have claimed, covert verbal self-instruction is a critical component of task set preparation, a verbal cue matching that instruction could result in more rapid anticipatory reconfiguration, reduce the residual cost, or both. The task switched between classifying the color or shape of objects and classifying the age and gender of faces. We compared the effect of a spoken cue naming the dimension to be classified with the effect of a matched cue arbitrarily related to the dimension. We also examined the effect of hearing the cue in the subject's own voice versus another's voice.

Spatial Cognition

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

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

3:50–4:05 (120)

How Real Is Virtual Reality? XIAOANG IRENE WAN, RANXIAO FRANCES WANG, & JAMES A. CROWELL, *University of Illinois, Urbana-Champaign* (read by Ranxiao Frances Wang)—Virtual reality provides vivid sensory experience, but it is fictitious at a conceptual level. Two experiments examined whether the perceptual system treats virtual reality as “real” or “fictitious” environments in a spatial updating task. Participants viewed objects in both a real room and a virtual kitchen. Then they turned to face targets, either in the room or in the kitchen, while blindfolded and pointed to the targets before and after turning. Participants updated both environments equally well regardless of instruction conditions, suggesting that they automatically updated their relation to the virtual kitchen as the real room. In contrast, when the real environment was described verbally but not perceived, participants automatically updated their relation to the virtual kitchen, but not to the real room, suggesting that the virtual environment is more “real” than a verbally described real environment. These results suggest that automatic spatial updating is determined by participants' perceptual experience, not conceptual knowledge.

4:10–4:25 (121)

Human Spatial Representation: Egocentric Updating and Cognitive Maps. DAVID WALLER & ERIC HODGSON, *Miami University*—Two competing theories describe how humans mentally represent spatial information about their environment. By one account, we represent our environment transiently and egocentrically; by another, environments are represented by means of enduring cognitive maps. Recently, Wang and Spelke (2000) have shown that knowledge of the directional relationships among objects in one's environment decreases as a result of disorientation. They interpreted this finding as evidence for transient egocentric representations. In several experiments, we replicate Wang and Spelke's results but show that they are limited to recently learned, immediate environments. We then provide

direct evidence for two systems of spatial representation by means of a double dissociation involving egocentric pointing (which is impaired by disorientation) and judgments of relative direction (which are improved by disorientation). This two-systems account encourages additional research examining the conditions under which people are more or less likely to represent their environment egocentrically versus with a cognitive map.

4:30–4:45 (122)

Are Interobject Spatial Relations Coded Allocentrically in Novel Environments? M. JEANNE SHOLL, *Boston College*—There is extensive behavioral and neurophysiological evidence consistent with allocentric coding of interobject relations. However, Wang and Spelke's (2000) finding that knowledge of object location is easily disrupted by disorientation is difficult to reconcile with this body of evidence, leading to their claim that interobject relations are coded egocentrically, but not allocentrically. A series of experiments is reported that failed to replicate a disruptive effect of disorientation on represented object locations, and possible reasons for this failure to replicate are explored.

4:50–5:05 (123)

Cognitive Modeling of an Analytic Strategy for Cardinal Direction Judgments. LEO GUGERTY, WILLIAM RODES, & JOHNNEL BROOKS, *Clemson University*—Cardinal direction judgments are a type of spatial judgment that requires coordinating information in egocentric and egocentric spatial reference frames. Researchers have suggested that people coordinate reference frames when making cardinal direction judgments by using a mental rotation strategy (Gunzelmann, Anderson, & Douglass, 2004) or an analytic strategy that minimizes mental rotation (Gugerty & Brooks, 2004). Here, we present evidence for the analytic strategy. We trained 7 participants on the analytic strategy, had them make 200 practice cardinal direction judgments using this strategy, and then measured their response times on 150 further judgments using the strategy. Response time data from the final 150 trials were used to validate an ACT-R model we developed of the analytic strategy. The response times generated by this model fit well with how human response times varied with viewer heading and with the location of objects in the 3-D scene.

5:10–5:25 (124)

Gender Differences in Object Location Memory: A Meta-Analysis. DANIEL VOYER, *University of New Brunswick*, ALBERT POSTMA, *Utrecht University*, BRANDY BRAKE, *University of New Brunswick*, & JULIANNE IMPERATO-MCGINLEY, *Weill Medical College of Cornell University*—The goal of the present study was to quantify the magnitude of gender differences in object location memory tasks. Fifty effect sizes (d) drawn from 23 studies were included in a meta-analysis using a hierarchical approach. Effect sizes were partitioned by age of the sample, specific test used (object identity memory, conventional object location memory, variations of the conventional task), and scoring method to achieve homogeneity. Significant gender differences in favor of females were obtained in all clusters, except in participants under the age of 13 years and with measures of distance. In addition, year of birth was negatively related to magnitude of gender differences. Implications of these results for future work and for theoretical interpretations are discussed.

Touch and Perception

Civic Ballroom, Friday Afternoon, 4:30–5:30

Chaired by Frank H. Durgin, *Swarthmore College*

4:30–4:45 (125)

Rubber Hands Feel the Touch of Light. FRANK H. DURGIN, NATALIE B. DUNPHY, LAUREL E. EVANS, SUSAN J. KLOSTERMANN, & KRISTINA D. SIMMONS, *Swarthmore College*—We have found that when the light of a laser pointer is drawn across a rubber

hand (placed in proximity to an unseen matching real hand), most observers report that they feel tactile and/or thermal sensations from the “touch” of the light on the rubber hand. The phenomenon occurs despite conscious awareness that the hand is not one’s own and that lights do not produce tactile sensations. Three experiments examine the effects of the appearance and orientation of the false hand and the method of occluding the real hand (a mirror is best) on cross-sensory “incorporation.” The results emphasize the dissociation between conscious cognitive understanding and the unconscious perceptual reality of the body schema, for which intensity of light seems to be sufficient to produce neural activity that is experienced as touch.

4:50–5:05 (126)

Viewpoint and Orientation Influence Picture Recognition in the Blind. MORTON A. HELLER, *Eastern Illinois University*, JOHN M. KENNEDY, *University of Toronto, Scarborough*, & MELISSA R. MCCARTHY, ASHLEY CLARK, NICOLE KAFFEL, & TARA RIDDLE, *Eastern Illinois University*—Subjects felt solid geometrical forms and matched raised-line pictures to the objects. Performance was best in Experiment 1 for top views (83.3% correct), with shorter response latencies than for side views, front views, or 3-D views with foreshortening. In Experiment 2 with blind participants, matching accuracy was not significantly affected by prior visual experience. Speed advantages were found for top views, with 3-D views also yielding better matching accuracy than did side views. There were no performance advantages for pictures of objects with a constant cross-section in the vertical axis. The objects were rotated to oblique orientations in Experiment 3. Early blind participants performed worse than the other subjects given object rotation. Visual experience with pictures of objects at many angles could facilitate identification at oblique orientations. Alternative theoretical implications of the results are discussed.

5:10–5:25 (127)

Adaptation to Textured Surfaces: A Comparison of Direct and Indirect Touch. MARK HOLLINS & FLORIAN M. LORENZ, *University of North Carolina, Chapel Hill*—Participants examined and gave magnitude estimates of the roughness of textured surfaces (arrays of truncated pyramids, with spatial periods ranging from 124 to 1,416 microns). Test trials followed adaptation to (1) a surface with a spatial period of 416 microns or (2) a smooth, featureless surface. Some participants used direct touch to examine both the adapting and the test surfaces, whereas others touched all surfaces indirectly, through a stylus. With indirect touch, there was a significant interaction of test surface and adapting condition: Texture adaptation lowered the roughness of fine surfaces more than that of coarse ones. This result is consistent with vibrotactile mediation of roughness perception during indirect touch. Texture adaptation had no significant effect under conditions of direct touch. We discuss the implications of these findings for theories of roughness coding.

Information and Belief

Conference Rooms B&C, Friday Afternoon, 3:30–5:30

Chaired by David V. Budescu
University of Illinois, Urbana-Champaign

3:30–3:45 (128)

To Bayes or Not To Bayes? A Comparison of Models of Information Aggregation. DAVID V. BUDESCU & HSIU-TING YU, *University of Illinois, Urbana-Champaign*—We model the aggregation process used by individual decision makers (DMs) who obtain probabilistic information from multiple, possibly nonindependent sources. We distinguish between three qualitatively different approaches: choosing a single “best” advisor, “compromising” by averaging the advisors’ opinions, and combining the forecasts according to Bayes’s rule. The DMs in our studies had access to forecasts provided by $J = 2$ or 3 advisors who judged multiple cases. Our data are unusually rich in many respects,

since the studies involve natural sampling of cues with various levels of and types of dependence and various patterns of information overlap. This provides an excellent opportunity to compare the quality of these models. Overall, the DMs’ judgments are closest to the averaging model, but clearly, they do not use one model exclusively. In particular, their aggregates are more in line with Bayes when the advisors are (1) highly consistent with each other and (2) provide extreme forecasts.

3:50–4:05 (129)

The Perception of Correlation From Scatterplots. MICHAEL E. DOHERTY, RICHARD B. ANDERSON, ANDREA M. ANGOTT, & DALE S. KLOPPER, *Bowling Green State University*—Research on the perception of correlation from scatterplots suggests that people’s estimates of the Pearson r tend to be lower than the calculated value and that the estimated r is a positively accelerated function of the calculated value. This suggests that scatterplots representing high correlations should be more discriminable than those representing low correlations, given equal differences in calculated r . Experiment 1 used the classical psychometric method of rank order across 21 values of r . Subjective rank orders correlated with objective rank orders, but confusability was greater for low than for high correlations. Experiment 2 used a *yes/no* task and showed that d' was higher for pairs of scatterplots representing high correlations, rather than for pairs representing low correlations. Subjects in both experiments were also asked to make an absolute judgment of correlation. For those judgments, high correlations tended to be underestimated, but low correlations tended to be overestimated.

4:10–4:25 (130)

Temporal and Probability Discounting of Money, Alcohol, and Food Rewards. JOEL MYERSON, LEONARD GREEN, SARA J. ESTLE, DANIEL D. HOLT, & TESSA MAZZOCCO, *Washington University*—Using hypothetical delayed rewards, previous research has shown that drug abusers discount their drug of abuse more steeply than money. This could reflect specific characteristics of drugs or drug abusers or, as Odum and Rainaud (2003) suggested, a general property of consumable rewards. To test their suggestion, we compared temporal and probability discounting of a nonconsumable reward (money) and three consumable rewards (candy, soda, beer). With delayed outcomes, money was discounted less steeply than the consumable rewards, which were discounted at similar rates. With probabilistic outcomes, there was no effect of reward type on discounting rate. Larger probabilistic amounts were discounted more steeply than smaller amounts, regardless of the type of reward. Larger delayed monetary amounts were discounted less steeply than smaller monetary amounts, but no such magnitude effect was observed with the consumable rewards, potentially explaining the absence of magnitude effects in studies of temporal discounting by nonhuman animals.

4:30–4:45 (131)

Further Tests of an Information Leakage Account of Attribute Framing Effects. CRAIG R. MCKENZIE, *University of California, San Diego*—When Levin and Gaeth (1988) described ground beef as “75% lean,” rather than as “25% fat,” participants rated it as superior on various dimensions. Evidence is presented that supports an “information leakage” account of this well-known framing effect: Speakers were more likely to describe ground beef as being “75% lean” (rather than “25% fat”) when it was believed to be relatively lean than when it was believed to be relative fatty. Furthermore, listeners presented with the “75% lean” frame were more likely to infer that the beef was relatively lean. A speaker’s choice of frame leaks relevant information about whether the speaker believes that the beef is lean or fatty, and listeners “absorb” this information. Also of interest is that listeners were sensitive to the source of the frame: The absorption effect almost disappeared when the frames were presented in the context of an advertisement (rather than a conversation).

4:50–5:05 (132)

Belief Trumps Logical Structure. RUSSELL REVLIN, *University of California, Santa Barbara*, AARON J. RICE, *University of Pennsylvania School of Medicine*, & DUSTIN P. CALVILLO, *University of California, Santa Barbara*—In a counterfactual reasoning study, university students were asked to certify the consistency among a set of three statements: One was a generality about which they had a prior belief; the other two were pertinent facts. They then had to accept a fourth statement, “for the sake of argument,” that introduced inconsistencies into the set. To restore consistency, subjects rejected two statements in light of the assumption. Prior research proposes that (1) students restore consistency by imagining a possible world based on the lawlike characteristics of the generality and (2) the logical structure of the statements, and not their believability, controls the counterfactual strategy employed. In contrast, by using a wider range of beliefs among the statements, the present study shows that the effect of logical structure is illusory: The logical forms alter the post hoc believability of the statements, so that the decisions are based primarily on belief.

5:10–5:25 (133)

Belief Bias and Working Memory: Implications for Impulsivity. ALLISON MATTHEWS, PAUL WHITNEY, & JOHN M. HINSON, *Washington State University* (read by Paul Whitney)—We previously demonstrated that working memory (WM) loads increase impulsive decision making in a simulated gambling task. The present study extends these results to the relationship between individual differences in WM and temporal reasoning. Participants judged whether a conclusion followed logically from a set of premises. For example, the conclusion “Elvis starred in *Jailhouse Rock* during the rock-n-roll era” is not a logically valid conclusion from the following premises: The rock-n-roll era was before the punk music era, grunge music was popular before the punk music era, *The Silence of the Lambs* was released during the punk music era. There is a general tendency to accept an invalid conclusion as valid when the conclusion itself is believable. Our data demonstrate that people with lower WM spans are especially susceptible to belief-based errors. The results support a general model of impulsivity that treats prior beliefs as a potent response.

Word Production**Essex Room, Saturday Morning, 8:00–9:40***Chaired by Jens Bólte, Westfälische Wilhelms-Universität, Münster***8:00–8:15 (134)**

Categorical Inhibition and Associative Facilitation in Language Production. JENS BÓLTE, ANNETT JORSCHICK, & PIENIE ZWITSERLOOD, *Westfälische Wilhelms-Universität, Münster*—Associative effects are rarely investigated in word production research, which focuses on categorical and phonological effects. We investigated different types of associative relation (part–whole, location, and feature) in a picture–word interference experiment, which also included distractors that were categorically related to the pictures. The particular associations used were not due to collocations, as was shown in a lexical database analysis. The impact of associative and categorical distractors was assessed relative to a baseline with unrelated distractors. Associatively related distractors facilitated picture naming irrespective of the type of relation; categorically related distractors, however, produced inhibition. We explain the different direction and time course of effects in terms of the ways in which associative and semantic distractors are linked with the picture’s concept and lexical entry.

8:20–8:35 (135)

Are Age-of-Acquisition Effects in Object Naming Simply Due to Differences in Object Recognition? PATRICK BONIN, ALAIN MÉOT & MARYLÈNE CHALARD, *Université Blaise Pascal*, & CHRISTOPHER BARRY, *University of Essex*—Levelt (2002) argued that effects of word frequency and age of acquisition (AoA) reported in recent picture-naming studies might be due to confounded effects operating at the level of object recognition, rather than being relevant to theories of lexical retrieval. In order to investigate this issue, AoA effects were examined in an object recognition memory task (Experiments 1 and 2) and in a word–picture verification task (Experiment 3) and were compared with those found for naming the same pictures. Contrary to Levelt’s concerns, the results of the three experiments show that the AoA effect in picture naming has a lexical origin and does not simply result from a possible confound of object identification times.

8:40–8:55 (136)

Capacity Demands in Word Production. ANTJE S. MEYER & AMY FLAVELL, *University of Birmingham*—The received view in the speech production literature is that only conceptual planning, but not lexical retrieval processes, require processing capacity. However, using a dual-task paradigm (naming of pictures accompanied by related or unrelated distractor words + tone discrimination), Ferreira and Pashler (2002, *JEP:LMC*) showed that the retrieval of lexical–semantic units required processing capacity, whereas the retrieval of the corresponding phonological segments appeared to be an automatic process: Picture-naming and tone discrimination latencies were longer after semantically related than after unrelated distractors, but phonological relatedness affected only the picture-naming, but not the tone discrimination, latencies. In Experiment 1, we replicated these results. However, in Experiment 2, we used distractor pictures instead of words and found phonological effects for the tone discrimination, as well as the picture-naming, latencies. The methodological and theoretical implications of these findings will be discussed.

9:00–9:15 (137)

The Fate of Nonproduced Picture Names. NIELS O. SCHILLER, *Maastricht University*, NINA GROTEN, *University of Bonn*, & INGRID K. CHRISTOFFELS, *Maastricht University*—A series of picture–word interference experiments is presented that investigate whether or not pictures are phonologically encoded even though their names are not pronounced. In an associate naming task, Dutch participants saw pictures (e.g., of a cow; “koe” in Dutch) and were asked to name an associate (e.g., “melk,” milk). Distractor words were semantically related (e.g., “ezel,” donkey), phonologically related (e.g., “koek,”

cookie), or unrelated to the picture name (e.g., “appel,” apple). Results showed shorter response latencies in both the semantic and the phonological conditions. These results can be accounted for by interactive and serial models (via cohort activation—i.e., “koek” activates “koe”) of language production. In a second experiment, end-related phonological distractors (e.g., “taboe,” taboo) were used, and again phonological facilitation was obtained. This result makes an account in terms of cohort activation more unlikely and favors an interactive activation account.

9:20–9:35 (138)

Picture Naming: The Role of Target Learning. PATRIZIA TABOSSI, *Università di Trieste*, & SIMONA COLLINA, *Università degli Studi Suor Orsola Benincasa*—In the classic Stroop effect, naming the ink color of a written word (e.g., red) takes longer if the word refers to the same, rather than to a different, color (e.g., red vs. green). Similar effects obtain when the color of the Stroop stimulus is replaced by a picture. However, unlike the classic Stroop research, picture–word interference studies are typically preceded by a learning phase, during which participants learn the names of the pictures that they will have to produce during the experiment. The effects of this procedure on task performance are explored in a series of experiments. The implications of the results for current models of word production are discussed.

Memory Processes I**Grand Ballroom East, Saturday Morning, 8:00–9:40***Chaired by Michael J. Kahana, University of Pennsylvania***8:00–8:15 (139)**

Associative Processes in Episodic Memory. MICHAEL J. KAHANA, *University of Pennsylvania*—Although traditionally studied using paired associates, interitem associations can also help describe data on free recall and serial recall tasks. I present new data on the role of temporally defined associations in item recognition and in the pattern of errors (false memories) committed in free and cued recall tasks. I show how the interplay of temporal and semantic associations gives rise to subjective organization over the course of learning. Finally, I discuss these findings within the framework of a new version of the temporal context model (TCM).

8:20–8:35 (140)

The Mirror Effect and the Spacing Effect. BENNET MURDOCK, *University of Toronto*—The mirror and spacing effects are two rather surprising effects found in simple item-recognition–memory studies. They illustrate a “leapfrog” effect where a weaker or older item jumps over a stronger or more recent item after a single presentation. I recently proposed a simple model based on a linear combination of excitatory, inhibitory, and context factors that was able to fit the data reasonably well with the same parameter values for both effects. I report the results of several experiments dealing with the spacing effect for low- and high-frequency words that were roughly consistent with the predictions of the model.

8:40–8:55 (141)

Are Frequency Effects Due to Frequency? ANGELA B. NELSON & RICHARD M. SHIFFRIN, *Indiana University* (read by Richard M. Shiffrin)—Word frequency effects are pervasive in explicit and implicit memory: In different tasks, higher frequency sometimes produces better performance and sometimes worse. However, words that differ in frequency differ in essentially every other word characteristic that can be measured (length, spelling, concreteness, and so on), making it hard to assess the role of past experience per se. We trained observers to search for Chinese characters in a visual search task, for 12 sessions. Different characters were given different degrees of training. We demonstrated differential learning by a differential reduction in slope and intercept. In one transfer task, we tested episodic recognition, showing an advantage for low-frequency characters and a mir-

ror effect. In a second transfer task, we tested the equivalent of *lexical decision*, showing an advantage for high-frequency characters. We discuss the relation to prior research and implications for the role of experience per se.

9:00–9:15 (142)

Memory Improvement Following Spaced Retrieval Practice: Effects of Familiarity, Delay, and Self-Pacing. PETER E. MORRIS, CATHERINE O. FRITZ, PETER J. HAMPSON, & CAROLINE WADE, *Lancaster University*—The effects of spaced retrieval practice were investigated in two experiments. First, participants studied unfamiliar psychological terms in the context of simple, factual statements, with instructions to remember the appropriate term for each. Although practice more than doubled performance on a cued recall test after 30 min, following 2 weeks most of the practice-based benefit had been lost. The second experiment showed that this uncharacteristic dwindling of the effect may have been due to the unfamiliar nature of the to-be-learned materials. Participants studied more and less familiar Latin equivalents for English words and were tested for the Latin with cued recall after 1 h and again after 5 weeks. Spaced practice led to improved recall, and the benefits were better maintained for familiar than for unfamiliar words. In both experiments, self-pacing by the participants was no better than experimenter-paced presentations.

9:20–9:35 (143)

Fritz Reuther: Recognizing Another Neglected Pioneer. WAYNE DONALDSON, *University of New Brunswick*—In 1905, Fritz Reuther completed and published his doctoral dissertation “Beiträge zur Gedächtnisforschung” [Contributions to Memory Research]. He introduced the method of identical series for studying recognition memory of complex material. Five studies were reported, examining the effect of number of presentations, exposure duration, series length, interval between presentations, and retention interval on recognition memory. Except for a brief mention in Boring’s 1953 *Psychological Bulletin* article, “A History of Introspection,” his name and research are generally absent from both the memory literature and history of psychology texts. This paper provides a brief introduction to the methodology and findings of these first studies in recognition memory.

Visual Search

Grand Ballroom West, Saturday Morning, 8:00–9:40

Chaired by Jeremy M. Wolfe

Brigham & Women’s Hospital and Harvard Medical School

8:00–8:15 (144)

Visual Search Has No Foresight: An Event-Related Signal Detection Approach to Speeded Visual Search Tasks. JEREMY M. WOLFE, *Brigham & Women’s Hospital and Harvard Medical School*, STEPHEN J. FLUSBERG, *Brigham & Women’s Hospital*, & DAVID E. FENCSEK & TODD S. HOROWITZ, *Brigham & Women’s Hospital and Harvard Medical School*—Does information about target presence accumulate gradually during an extended visual search task (e.g., search for T among Ls, yielding RTs of nearly 1 sec), or are targets identified swiftly, but only once they are selected by attention? A novel method allowed us to measure signal strength at different times prior to the end of search. Mouse clicks produced 100-msec glimpses of the search array. Click positions along a scale served as confidence ratings. A final mouse click, localizing the target, ended the trial. Ratings were used to generate ROCs for each frame, relative to the frame on which the target was found. In other visual tasks, this method revealed slow accumulation of information. In T-versus-L search, just two frames prior to the finding of the target, d' was near zero even though observers had searched for many frames. There was no evidence for gradual accumulation of information in this search task.

8:20–8:35 (145)

Unique Change Captures Attention. ADRIAN VON MÜHLENEN,

Ludwig-Maximilians-Universität München, & JAMES T. ENNS, *University of British Columbia*—Some events break through and attract our attention even when we are engaged in a task for which these events are irrelevant. Previous research on this kind of attentional capture focused mainly on spatial factors. It showed that a new object is more salient in capturing attention than an abrupt change in object features. Here, we point to a temporal factor, over and above the importance of new objects. In three experiments, we show that feature changes capture attention as effectively as new objects, provided that they occur during a period of temporal calm, where no other display changes occur. The results show that this unique change hypothesis applies to changes in color and in motion and even to the sudden appearance of new objects. These findings highlight the importance of considering both space and time in studies of attentional capture.

8:40–8:55 (146)

The BOLAR Theory of Eye Movements During Visual Search. GREGORY J. ZELINSKY, *SUNY, Stony Brook*—A computational model is introduced to describe the pattern of eye movements made during visual search. Image-processing techniques are used to represent search scenes in terms of simple visual feature detector responses (colors, orientations, scales). Visual routines then act on these representations to produce a sequence of simulated eye movements. The model’s “eye” consists of a biologically plausible artificial retina. The model was validated by comparing its behavior with the eye movement behavior of human observers as they searched for targets in the identical scenes input to the model. These scenes ranged in complexity from simple OQ displays to fully realistic scenes depicting wooded landscapes. In all cases, the model and the human data agreed closely in terms of the number of fixations made during search and the eye movement scanpath distance. The model’s behavior under standard search manipulations (e.g., set size, search asymmetries, and changes in target-distractor similarity) is discussed.

9:00–9:15 (147)

Distractor Location, But Not Identity, Is Remembered During Visual Search. MATTHEW S. PETERSON & MELISSA R. BECK, *George Mason University*, WALTER R. BOOT, *Beckman Institute*, MIROSLAVA VOMELA, *George Mason University*, & ARTHUR F. KRAMER, *Beckman Institute*—During visual search, knowledge about previously examined distractors is used to guide attention toward unexamined items. In the experiments reported here, we investigate whether any identity information is explicitly remembered about rejected distractors. We used three different search tasks: a conventional search task, an oculomotor-contingent task, and a categorical search that required deep processing to identify items. In all experiments, on roughly one third of the trials, search was terminated, an examined location was circled (a place holder marked that location), and observers were quizzed about the item that had been at that location (two-alternative forced choice). Although observers clearly remembered examined items—they avoided revisiting the last four items in the oculomotor-contingent experiments—performance in the 2AFC recognition tasks was extremely poor. This suggests that people do remember the locations of rejected distractors but that their explicit memory for distractors does not include their identity.

9:20–9:35 (148)

Resolution of the Serial/Parallel Issue in Visual Attention. DAVID L. GILDEN & THOMAS L. THORNTON, *University of Texas, Austin*—One of the central issues in visual search concerns the parallel or serial use of attentional resources. Although early developments in visual search methods seemed to promise a quick resolution to this issue, Townsend’s comments regarding the existence of capacity-limited parallel processes made it clear that distinguishing serial from parallel processes was not going to be easy. In fact, this problem has resisted further definition, and there seems to be a growing sentiment in the research community that perhaps this distinction was never real in the first place. This is not true; it is just that the distinction is dif-

difficult to make empirically. We show how a multiple-target search methodology that is analyzed using sequential sampling models can effectively discriminate between capacity-limited parallel search and truly serial search. We find that there are, at most, two stimulus classes that require serial inspection of targets and distractors.

STM and Language Processing
Dominion Ballroom, Saturday Morning, 8:00–10:00

Chaired by *Elisabet M. Service*
University of Helsinki and Dalhousie University

8:00–8:15 (149)

Phonological Short-Term Memory Span and the Quality of Phonological Traces. ELISABET M. SERVICE, *University of Helsinki and Dalhousie University*, & SINE MAURY & EMILIA L. LUOTONIEMI, *University of Helsinki*—A correlation between vocabulary learning and STM performance (e.g., digit span, nonword repetition) has been explained by assuming that phonological WM modulates what gets transferred to LTM. Our results suggest a different explanation. Two groups with relatively good versus poor nonword span were tested. In Experiment 1, lists of three CVCVCV nonwords constructed from a pool of 12 stimuli were presented to participants for immediate serial recall. In a surprise test after the STM task, participants were given free recall, cued recall, and recognition tests for the nonwords in the stimulus pool. The good group remembered more in all tests. In Experiment 2, experience of correct output was controlled by presenting span + 1 lists. Despite equal STM, the good group again outperformed the poor group in memory for the stimulus pool items. We suggest that the good group forms stronger phonological representations, available for both STM and LTM tasks.

8:20–8:35 (150)

When Does Silence Speak Louder Than Words? Using Recall Dynamics and Recall Quality to Investigate Working Memory. JOHN N. TOWSE, *Lancaster University*, NELSON COWAN, *University of Missouri, Columbia*, & NEIL J. HORTON, *Lancaster University*—Working memory span tasks combine nontrivial processing requirements with explicit memory demands. They are extensively used as indices of working memory capacity and are linked with a wide range of important higher level cognitive skills. Drawing upon evidence that includes silent pauses in sequence recall, we report four studies that assess the interdependence between processing and memory in reading span. Each experiment compares two types of reading span, in which memoranda are either integrated with or independent from sentence processing. Absolute levels of recall vary substantially between these conditions, and the chronometry of recall strongly suggests that reconstructive processes contribute to commonly employed forms of reading span. We assess reading span, using both spoken recall and an item and order reconstruction paradigm involving nonspoken responses. We also examine the contribution of a generation effect (Slamecka & Graf, 1978) to reading span performance. The data provide fresh theoretical perspectives on working memory.

8:40–8:55 (151)

Articulation Without Suppression: Dissociable Processing Streams for Phonology and Articulation. TIMOTHY C. RICKARD, *University of California, San Diego*—Subjects were instructed to synchronize vocal repetition of “ta” with subvocal recitation of the alphabet to a specified letter. Another group was instructed to interleave these tasks. For the synchronize group, subvocal recitation accuracy was high at all rates (1,000–400 msec per letter), whereas for the interleave group, accuracy was lower and decreased markedly with increasing rate. Several factors eliminate the possibility that subjects recited the letters visually, instead of phonologically. These results are consistent with the subjective experience that subvocalization is possible while reading under articulatory suppression and with related results from the speech

production literature. Previous findings to the contrary, using the phonological similarity task, may reflect task difficulty and (or) failure of subjects to adopt a synchronize strategy. Data from an ongoing experiment, as well as implications for working memory theory and for use of articulatory suppression as a research tool, are discussed.

9:00–9:15 (152)

Artificially Induced Valence of Distractors Increases the Irrelevant Speech Effect. AXEL BUCHNER & BETTINA MEHL, *Heinrich Heine University, Düsseldorf*, KLAUS ROTHERMUND, *Friedrich Schiller University, Jena*, & DIRK WENTURA, *Saarland University*—In a game context, nonwords were artificially associated with negative valence, or they were neutral or irrelevant. Subsequently, participants memorized target words in silence or while ignoring the irrelevant, neutral, or negatively valent distractor nonwords. The presence of distractor nonwords impaired recall performance, but negative distractor nonwords caused more disruption than did neutral and irrelevant distractors, which did not differ in how much disruption they caused. These findings conceptually replicate earlier results showing disruption due to valence with natural language words, and they extend these earlier results in demonstrating that auditory features that may possibly be confounded with valence in natural language words cannot be the cause of the observed disruption. Explanations of the irrelevant speech effect within working memory models that specify an explicit role of attention in the maintenance of information for immediate serial recall can explain this pattern of results, whereas structural models of working memory cannot.

9:20–9:35 (153)

Integrating Verbal Information in Working Memory With Language Knowledge. GRAHAM J. HITCH, ALAN D. BADDELEY, & RICHARD J. ALLEN, *University of York* (sponsored by Philip Thomas Quinlan)—We investigated the hypothesis that an episodic buffer (Baddeley, 2000) is necessary for integrating verbal information held in working memory with knowledge about sequential redundancy in language. We did this by comparing the effects of various concurrent tasks on immediate serial recall of *constrained sentences* and scrambled word lists. The concurrent tasks were designed to interfere with phonological storage, visuospatial storage, or executive components of working memory. Results suggest that the beneficial effect of sequential redundancy is largely automatic when a sentence is spoken but involves executive processes when presentation is visual and access to the phonological store is blocked. The first finding is consistent with a direct link between the phonological store and language knowledge that does not require access to an episodic buffer. The second finding suggests that episodic buffer storage is required when the direct link is not available.

9:40–9:55 (154)

Neuroimaging Evidence for a Single Lexical–Semantic Buffer Involved in Language Comprehension and Production. RANDI C. MARTIN & PHILIP BURTON, *Rice University*, & A. CRIS HAMILTON, *University of Pennsylvania*—Patients with semantic short-term memory deficits have difficulty comprehending sentences in which several word meanings must be held prior to integration (Martin & He, 2004) and with producing phrases containing multiple content words (Martin & Freedman, 2001). These results suggest that the same lexical–semantic buffer is used in comprehension and production. As these patients’ lesions include the left inferior frontal gyrus (LIFG), the present fMRI study sought evidence from neurally intact subjects for LIFG involvement in semantic retention. Our experiments contrasted neural activation for delayed versus immediate word meaning integration during sentence anomaly detection (Experiment 1) and for the production of adjective–noun phrases versus copular sentences (Experiment 2). Results provide converging evidence for the involvement of the same lexical–semantic buffer in comprehension and production and for a LIFG localization for this buffer.

Visual Cognition**Civic Ballroom, Saturday Morning, 8:00–10:20***Chaired by James R. Brockmole, Michigan State University***8:00–8:15 (155)**

Contextual Cuing in Real-World Scenes. JAMES R. BROCKMOLE & JOHN M. HENDERSON, *University of Edinburgh*—We investigated whether contextual cuing in real-world scenes is driven by memory for local objects and features or whether a scene's gist guides attention to targets. During learning, twice the number of repetitions were required to observe maximal learning benefits for inverted scenes (making them harder to interpret), as compared with upright scenes, indicating a role for semantic memory in cuing. Following learning, scenes were mirror reversed, spatially translating features and targets while preserving gist. Observers first moved their eyes toward the target's previous position in the display. This localization error caused an increase in search time, since additional fixations were required to locate the target. The disruption was not absolute; when initial search failed, the eyes quickly moved toward the target's new position. This suggests that the scene's gist initially guides attention to the target and that localized feature information is used if the gist association fails.

8:20–8:35 (156)

Varieties of Emergent Features in Visual Perceptual Organization. JAMES R. POMERANTZ & MARY C. PORTILLO, *Rice University*—At the heart of Gestalt effects in perception are nonlinearities, where the whole is perceived differently from the sum of its parts or, put differently, where elements are perceived and discriminated differently in different contexts. We study such Gestalt organization by searching for configural superiority effects (CSEs), which are instances where stimuli are discriminated from each other more quickly and accurately in the presence of context elements even when those elements by themselves provide no information relevant to the discrimination. In most instances, adding such context hinders performance: Discriminating A from B is easier than discriminating AC from BC (where C is the context). We demonstrate a dozen or so cases where context actually helps (sometimes greatly), and we try to extract general principles to explain CSEs in terms of emergent features arising when elements group.

8:40–8:55 (157)

Fixation Position Changes During Fixations in Reading. ALBRECHT W. INHOFF, & ULRICH WEGER, *SUNY, Binghamton*, SETH GREENBERG, *Union College*, & RALPH R. RADACH, *Florida State University*—Readers move the eyes to apply high acuity vision to different text segments and they keep the eyes relatively stationary (fixated) after that so that linguistic detail can be obtained. The study examined whether small position changes that occur during fixations are a consequence of oculomotor reflexes and/or ongoing processing demands. Two tasks were used: silent reading and reading plus detection of a target letter. The left eye was more stable than the right eye in both tasks. A strong directional bias was present in the reading task, with larger and more frequent position changes toward the right than toward the left. This bias was eliminated when letter detection was added to the task. An ongoing "pull-mechanism" appears to shift the eyes toward to-be-identified words during fixations in reading. However, when readers are forced to consider linguistic detail such as a target letter, the pull-mechanism is apparently suppressed.

9:00–9:15 (158)

Forgetting Pictures: Visual Versus Conceptual Information. MARY C. POTTER & LAURA F. FOX, *Massachusetts Institute of Technology*—Rapidly presented pictures are quickly, but not immediately, forgotten (Potter, Staub, & O'Connor, 2004). We assessed memory for concep-

tual gist and memory for visual and spatial information in experiments using title or picture recognition tests. In addition, subjects made a forced choice between two versions of a picture that differed in visual/spatial features, such as color, left–right orientation, or presence/absence of details. Although gist memory declined over testing, visual/spatial memory (poorer to begin with) did not, suggesting that if gist is remembered, so is any visual/spatial information encoded with the gist. Hence, the conceptual gist of a picture is extracted early and determines what is remembered. We also compare gist and visual/spatial information in longer term memory for pictures.

9:20–9:35 (159)

Tunnel Vision During Visual Scanning: Do Smaller Views Yield Smaller Representations? HELENE INTRAUB & KAREN K. DANIELS, *University of Delaware*—Regions of real 3-D scenes delimited by "windows" are remembered as having included more of the world than was actually shown (boundary extension [BE]; Intraub, 2004). Does the scope of each exploratory fixation constrain BE? In Experiment 1, viewers ($N = 60$) studied scene regions with multiple objects for 30 sec each. Vision was binocular (normal) or monocular through tunnel vision goggles with large (3 cm) or small (0.6 cm) apertures. Binocular vision encompassed the entire region and surrounding space; tunnel viewing required effortful head movements to examine the regions. At test, viewers reconstructed the windows to recreate the delimited areas. In all conditions, viewers remembered seeing about one third more area; dramatic differences in visual scope did not influence spatial extrapolation. Experiment 2 ($N = 40$) replicated the results and demonstrated that viewers were experiencing true BE—not simply creating "conventionally sized" regions. Layout extrapolation was constrained by the targeted view—not the scope of the input.

9:40–9:55 (160)

The Role of Visual Short-Term Memory in Gaze Control. ANDREW HOLLINGWORTH, ASHLEIGH M. RICHARD, & STEVEN J. LUCK, *University of Iowa*—It is well established that object representations are maintained in visual short-term memory (VSTM) across saccades, but the functional role of VSTM in gaze control is not well understood. Saccades are often inaccurate, and when the eyes miss a saccade target, multiple objects will lie near fixation, especially in cluttered, real-world scenes. We tested the hypothesis that VSTM stores target information across the saccade to identify the target among other local objects, supporting an efficient corrective saccade to the target. A new paradigm was developed to simulate saccade error. During a saccade, a stimulus array was shifted so that the eyes landed between the saccade target object and a distractor. Accurate gaze correction to the target required transsaccadic memory for the target's visual form. VSTM-based gaze correction in this paradigm was accurate, fast, and automatic, demonstrating that VSTM plays an important role in the direction of gaze to goal-relevant objects.

10:00–10:15 (161)

Fixational Eye Movements at the Periphery. JUDITH AVRAHAMI & OREN FLEKSER, *Hebrew University of Jerusalem*—Although the fact that the eye is moving constantly has been known for a long time, the role of fixational eye movements (FEMs) is still in dispute. Whatever their role, it is structurally clear that, since the eye is a ball, the size of these movements diminishes for locations closer to the poles. Here, we propose a new perspective on the role of FEM, from which we derive a prediction for a three-way interaction of a stimulus' orientation, location, and spatial frequency. Measuring time to disappearance for gratings located in the periphery we find that, as predicted, gratings located to the left and right of fixation fade faster when horizontal than when vertical in low spatial frequencies and faster when vertical than when horizontal in high spatial frequencies. The opposite is true for gratings located above and below fixation.

Reading**Conference Rooms B&C, Saturday Morning, 8:00–9:20***Chaired by Simon P. Liversedge, University of Durham***8:00–8:15 (162)**

Reading Transposed Text: The Importance of Word Initial Letters. SARAH J. WHITE, *University of Durham*, REBECCA L. JOHNSON & KEITH RAYNER, *University of Massachusetts, Amherst*, & SIMON P. LIVERSEDGE, *University of Durham* (read by Simon P. Liversedge)—An eye-tracking experiment is presented in which participants read text including transposed adjacent letters. Participants read single sentences within which all words five or more letters long contained transposed letters. Transpositions were either external (e.g., xexternal) or internal (e.g., iternal) and at either the beginning (e.g., xternal) or the end (e.g., internla) of words. We also included a word frequency manipulation. For all eye movement measures, external transpositions were more disruptive than internal transpositions. For several measures, there was also an interaction such that transpositions at word beginnings were more disruptive than transpositions at word endings for external, but not for internal, letters. There was also a robust frequency effect regardless of the type of transposition. Our results suggest that word initial letters are very important for word recognition during normal reading, where words are preprocessed prior to fixation.

8:20–8:35 (163)

Orthographic Familiarity and Word Frequency: Implications for Eye Movement Control During Reading. SARAH J. WHITE, *University of Durham*—The variables of word frequency and orthographic familiarity were independently manipulated in an eye movement reading study. The critical words were frequent and orthographically familiar (e.g., *town*), infrequent and orthographically familiar (e.g., *cove*), or infrequent and orthographically unfamiliar (e.g., *quay*). For each item, critical words from each of the three conditions were embedded in the same sentential frame up to and including the word after the critical word. For orthographically familiar words, reading times were longer on infrequent than on frequent words, and frequent words were more likely to be skipped than infrequent words. Lexical characteristics of words directly influenced saccade programming. Orthographic familiarity had effects on early reading time measures, whereas word frequency also influenced later measures of processing. In addition, there were parafoveal-on-foveal effects of orthographic familiarity, but critically, not of word frequency. These results are discussed in relation to models of eye movement control during reading.

8:40–8:55 (164)

Distributed Processing During Eye Fixations in Reading: Data and Model. REINHOLD KLIEGL & RALF ENGBERT, *University of Potsdam*—Fixation durations in reading are jointly influenced by visual acuity constraints and processing difficulty. Frequency, predictability, and length of fixated words are established contributors to fixation durations in reading. Here, we show that frequency, predictability, and length of neighboring words, as well as incoming and outgoing saccade amplitudes and fixation position in the current word, also influence the duration. Sentence-reading data are reported from 222 readers (159,888 fixations). Novel results are simultaneous effects of last and next word frequency and predictability, as well as replications of four disputed parafoveal-on-foveal effects. Our computational model of saccade generation, SWIFT, reproduces the observed immediacy, lag, and successor effects. Novel lag effects are reproduced, assuming (1) lexical processing tied to limits of the perceptual span and (2) delayed inhibition of saccade programs due to foveal-processing difficulty. Novel successor effects are due to spatial selection effects in the perceptual span.

9:00–9:15 (165)

A Cross-Linguistic Analysis of Visual Word Form Effects in Normal Reading. RALPH R. RADACH, *Florida State University*, CHRISTIAN VORSTIUS, *Florida Center for Reading Research*, & ARTHUR M.

JACOBS, *Free University of Berlin* (sponsored by K. Anders Ericsson)—Despite growing interest in the role of visual word form information (e.g., word shape) in letter and word processing, its role in continuous reading is not well understood. Noun capitalization in written German offers a unique possibility of manipulating visual word form features in a way that is not confounded with other orthographic and lexical word properties. In one experiment, participants read sentences containing seven-letter target nouns with capital or noncapital initial letters. Saccade-contingent display changes were used to present nouns parafoveally in irregular noncapitalized format. Results show significant preview benefits of capitalization, confirming the role of word form information in early stages of word processing. A second experiment involved extended training of reading in capitalized and noncapitalized formats with native speakers of German versus English. Results allow us to separate influences of general word form familiarity from specific effects of capitalization on word recognition and sentence-level processing.

Word Processing**Grand Ballroom Centre, Saturday Morning, 10:00–12:00***Chaired by Ken McRae, University of Western Ontario***10:00–10:15 (166)**

Distinguishing Features Play a Privileged Role in Word Meaning Computation. KEN MCRAE & CHRIS McNORGAN, *University of Western Ontario*, & GEORGE S. CREE, *University of Toronto, Scarborough*—Distinguishing features (features that occur in very few concepts) play an important role in theories of categorization and category-specific semantic deficits. We present evidence that distinguishing features play a privileged role in the computation of word meaning. In Experiment 1, a feature verification paradigm, participants responded more quickly to distinguishing features than to shared features when those features preceded a concept name, suggesting that distinguishing features activate relevant concepts more quickly than do shared features. In Experiment 2, participants were faster to verify distinguishing features than shared features when they followed the concept name, suggesting that distinguishing features are activated more quickly than shared features from a concept name. The effects were robust for both living and nonliving thing concepts across multiple SOAs. We use a connectionist attractor model of semantic memory to explain why distinguishing features have this privileged status and use the model to simulate the findings from the two experiments.

10:20–10:35 (167)

Transfer of Meaning Selection. DAVID S. GORFEIN, LESLEY S. BLACK, & EMILY A. EDWARDS, *University of Texas, Arlington*—A point of theoretical contention in the lexical ambiguity literature is the nature of the process that selects appropriate-to-the-context meaning for ambiguous words. The present study examines the effect of initially selecting a secondary meaning for both normatively balanced and unbalanced homographs when the homograph reoccurs in a new task. The study was designed to test the breadth of the effects of such meaning selection. Specifically, homographs originally primed by pictures related to their secondary meanings in a picture location task are repeated in a variety of transfer tasks ranging from language tasks, such as sentence sensibility judgment, to episodic memory tasks, such as free recall. Theoretical models that require suppression/inhibition processes are contrasted with models that do not require inhibition processes. Implications of word encoding are discussed for memory tasks.

10:40–10:55 (168)

Experience Provides Sound Advice: Individual Differences in Experience Explain Differential Cue Use in Language Comprehension. THOMAS A. FARMER & MORTEN H. CHRISTIANSEN, *Cornell University*, & KAREN A. KEMTES, *University of Nevada, Las Vegas* (read by Morten H. Christiansen)—In Study 1, we demonstrate that phonological typicality—the degree to which the sound properties of an individual word are typical of other words in its lexical category—can

influence the processing of syntactic ambiguities arising from the presence of N/V homonyms. Homonyms high in noun typicality created a garden path effect on verb-resolved sentences, and vice versa for homonyms high in verb typicality. In Study 2, we demonstrate that individual differences in reading experience, as measured by reading span and vocabulary, account for differences in the degree to which individuals utilize phonological typicality to avoid garden path effects. Individuals high in reading experience seem to be much less reliant upon the phonological cue than do the low-experience individuals. In Study 3, we demonstrate that those extremely high in reading experience—namely, older adults (>65)—are markedly insensitive to the phonological typicality cue, as compared with their younger counterparts.

11:00–11:15 (169)

Automatic Semantic Activation of Embedded Words in Spoken Supersets. JEFFREY S. BOWERS, COLIN J. DAVIS, SVEN L. MATTYS, MARKUS F. DAMIAN, & DEREK HANLEY, *University of Bristol*—We report a series of studies that assess the extent to which words embedded in longer spoken words are activated to the level of meaning (e.g., is *arm* activated in *charm*?). The studies rely on the picture–word interference effect, which refers to the finding that picture naming is slowed by the simultaneous presentation of a semantically related distractor word; for example, naming a picture of a *leg* is delayed by the spoken distractor *arm*. The key question is whether naming is also slowed when semantically unrelated distractors contain embedded words semantically related to the picture. For example, is naming a picture of a *shirt* slowed by the distractor *that*? We observed interference for words that include initial (e.g., *tramp*) and final (e.g., *scar*) subsets, suggesting that both subsets are activated to the level of meaning.

11:20–11:35 (170)

Investigating the Time Course of Spoken Word Recognition: Evidence From Event-Related Potentials. AMY S. DESROCHES, RANDY LYNN NEWMAN, & MARC F. JOANISSE, *University of Western Ontario* (read by Marc F. Joanisse)—Event-related potentials (ERPs) were used to investigate the time course of spoken word recognition. Neurologically healthy right-handed English speakers were tested during a visual–auditory mismatch paradigm. Scalp potentials were recorded from 64 channels as participants were presented with a target picture followed by an auditory word that was a match (CONE–*cone*), a rhyme mismatch (CONE–*bone*), a cohort mismatch (CONE–*comb*), or an unrelated mismatch (CONE–*fox*) to the target picture. The conditions of greatest interest, rhyme and cohort, elicited two different ERP components. The phonological mismatch negativity (PMN), a component associated with phonological processing, was elicited at approximately 250 msec poststimulus onset in the rhyme condition. In the cohort condition, an N400, a component commonly associated with semantic processing, peaked around 450 msec. The findings provide evidence that phonologically similar items compete for recognition as speech perception unfolds; however, different competition effects are reflected in distinct neural markers (PMN and N400).

11:40–11:55 (171)

Sleep and the Acquisition of Novel Spoken Words. GARETH GASKELL & NICOLAS DUMAY, *University of York*—When a new word is learned, its representation must be integrated with existing knowledge in the learner’s mental lexicon. For spoken word recognition, this “lexicalization” process is characterized by the ability to inhibit recognition of existing words. We examined the involvement of sleep in lexicalization by teaching people novel words at different times of day. Words learned at 8 p.m. induced inhibitory effects only after a 12-h interval including sleep, with this effect remaining after 24 h. Conversely, words learned at 8 a.m. showed no inhibitory effects after 12 h of wakefulness, but these emerged after 24 h, once sleep had occurred. Although the simple acquisition of a spoken form is swift, the integration of this knowledge in long-term memory is slower and

is associated with sleep. We relate these results to models of learning in which sleep provides an opportunity for hippocampal information to be fed into long-term neocortical store.

Substrates of Episodic Memory

Grand Ballroom East, Saturday Morning, 10:00–12:00

Chaired by Lynne M. Reder, *Carnegie Mellon University*

10:00–10:15 (172)

Recollection Depends on Unitization, But Uncommon Stimuli Can Be Recognized by Familiarity Alone. LYNNE M. REDER & JOYCE OATES, *Carnegie Mellon University*, JOSEPH J. QUINLAN, *Presbyterian Hospital, University of Pittsburgh Medical Center*, EDWARD THORNTON, *Carnegie Mellon University*, & ABIGAIL KAUFER & JEN SAUER, *University of Pittsburgh Medical Center*—Midazolam is a drug that creates temporary anterograde amnesia. In a within-subject, double-blind experiment, participants viewed a set of abstract pictures, faces, scenes, and high- and low-frequency words under the influence of saline in one session and under the influence of midazolam on a different day. Recognition memory was tested for the five stimulus types at the end of both sessions. Memory was reliably poorer in the midazolam condition than in the saline condition, but this amnesic effect was smaller for pictorial stimuli than for words and was almost nonexistent for abstract pictures. It is argued that unfamiliar stimulus types cannot be associated with an experimental context but that they are also less vulnerable to false alarms. We present converging evidence to bolster our claims for the role of familiarity on unitization and episodic binding.

10:20–10:35 (173)

Dose Effects of Triazolam on Brain Activity During Episodic Memory Encoding. MIRIAM Z. MINTZER, HIROTO KUWABARA, MOHAB ALEXANDER, JAMES R. BRASIC, ROLAND R. GRIF-FITHS, WEIGUO YE, & DEAN F. WONG, *Johns Hopkins University School of Medicine*—It is well documented that acute administration of the benzodiazepine hypnotic triazolam impairs episodic memory encoding. We assessed the pattern of brain activity associated with triazolam-induced encoding impairment by parametrically manipulating the level of impairment via administration of three doses of triazolam (0.1, 0.2, and 0.4 mg/70 kg) to 12 healthy volunteers in a four-session, placebo-controlled, double-blind, crossover design. Following oral drug administration, regional cerebral blood flow was measured using positron emission tomography with [15 O]H $_2$ O during performance of semantic categorization (encoding) and orthographic categorization (control) tasks. Whereas results in the placebo condition replicated those of nondrug encoding studies, triazolam significantly decreased activation dose dependently during encoding in several regions, including the prefrontal cortex, medial temporal areas, and the anterior cingulate. Regions where activation during encoding was correlated with subsequent memory performance were also identified. Results enhance the understanding of the neuroanatomical substrates of drug-induced amnesia and episodic memory encoding.

10:40–10:55 (174)

An ROC Analysis of the Role of the Hippocampus in Recollection. PETER WAIS & JOHN T. WIXTED, *University of California, San Diego*, & LARRY R. SQUIRE, *Veterans Affairs Medical Center, San Diego* (read by John T. Wixted)—Fortin, Wright, and Eichenbaum (2004, *Nature*) conducted an odor recognition memory experiment with rats, in which they examined the effects of retention interval and bilateral hippocampal lesions on the shape of the receiver-operating characteristic (ROC). The results were taken to support a high-threshold dual-process theory of recognition memory, according to which the hippocampus selectively subserves the recollection process, whereas the adjacent parahippocampal structures subserve the familiarity process. We performed an experiment that was modeled on Fortin et al.’s experiment with humans, some of whom had bilateral

hippocampal lesions. Undergraduate subjects received recognition memory tests 1 h, 1 day, 1 week, 2 weeks, or 8 weeks following study, and the hippocampal patients received easy and hard recognition tests 3 min after study. Our ROC results argue against the idea that the hippocampus selectively subserves recollection and, more generally, against the high-threshold dual-process model of recognition memory.

11:00–11:15 (175)

Genetic Influences on Memory Function in Healthy Individuals. LARS-GÖRAN NILSSON, *Stockholm University*—On the basis of a prospective cohort study on memory, health, and aging, it is proposed that genetic markers affect memory function in a way that is of interest for memory theory. Two markers related to the immune system (Complement C3 and Haptoglobin) affect episodic memory, but not semantic memory. With demented and potentially demented people and people with cardiovascular disease, ApolipoproteinE (APOE) affects episodic memory—in particular, recall—and executive function. There is also a predictable decrease in episodic memory as a function of the dose of the malign $\epsilon 4$ allele of this gene. The COMT gene, related to the dopamine system, also affects episodic memory and executive function, but not other memory systems. The results obtained are discussed in terms of gene–gene and gene–environment interactions.

11:20–11:35 (176)

Bilateral Eye Movements Impair the Encoding and Enhance the Retrieval of Episodic Memories. STEPHEN D. CHRISTMAN & MICHAEL BUTLER, *University of Toledo*—Engaging in bilateral saccadic eye movements (EMs) immediately prior to retrieval has been shown to enhance the retrieval of episodic, but not semantic, memories (Christman, Garvey, Propper, & Phaneuf, 2003; Christman, Propper, & Dion, 2004). The present study extended this paradigm by investigating the effect of EMs at encoding, as well as at retrieval. EMs prior to encoding led to a significant impairment in episodic recall ($p = .004$), relative to no-EM controls. In contrast, in the absence of EMs at encoding, EMs at retrieval led to marginally better episodic recall ($p = .12$). EM manipulations had no effects on tests of implicit and semantic memory. Thus, bilateral saccadic EMs impair versus enhance the encoding versus retrieval of episodic memories, respectively. Results are interpreted in terms of EM-induced increases in cholinergic activity (resulting in episodic memories being integrated into semantic networks) versus interhemispheric interaction (resulting in enhanced access to right-hemisphere–based retrieval mechanisms).

11:40–11:55 (177)

A Basic Systems Approach to Episodic Memory. DAVID C. RUBIN, *Duke University*—A model of episodic memory is proposed that assumes that memories are constructed from information in the basic systems of the mind and brain, including vision, audition, olfaction, other senses, spatial imagery, language, emotion, narrative, and motor output. Each of these systems has its own functions, neural substrates, processes, structures, and kinds of schemata, which have been extensively studied individually, but not as interacting components of episodic memory. Neuropsychological, neuroimaging, and behavioral findings that arise from applying the model to autobiographical memory are presented and used to argue that a model such as the one proposed is the only way to understand episodic memory for multimodal stimuli routinely encountered outside the laboratory. The model is contrasted to existing behavioral and neural models of memory.

Working Memory

Grand Ballroom West, Saturday Morning, 10:00–12:00

Chaired by Andrew R. A. Conway, *Princeton University*

10:00–10:15 (178)

An fMRI Analysis of Functional Localization and Integration in Working Memory Networks: An Individual-Differences Approach. ANDREW R. A. CONWAY, *Princeton University*, JEREMY R. GRAY,

Yale University, AGATHA LENARTOWICZ, *Princeton University*, TODD S. BRAVER & GREG C. BURGESS, *Washington University*, DEIDRE L. KOLARICK, NOAH A. SHAMOSH, & A. SCHAEFER, *Yale University*, & RANDALL W. ENGLE, *Georgia Institute of Technology*—To identify sources of variability in working memory (WM), fMRI was used to examine brain activity during a three-back task. Subjects ($n = 47$) performed blocks of three-back that had either words or faces as stimuli. WM performance was recorded during the scan; fluid intelligence was assessed separately. Functional connectivity analyses were conducted using spatiotemporal partial least-squares (st-PLS; McIntosh, Chau, & Protzner, 2004). Task-related activation was also examined by fitting general linear models (GLMs) on a voxel-by-voxel basis. We derived estimates of both individual and group-mean effects, using block-design analyses (for st-PLS, task-related latent variables and individual loadings; for GLM, random-effects t or Z maps and individual percentage of signal change by voxel). For both methods, group maps were similar in the regions implicated (loading on a task-related latent variable, or activating from resting fixation), including the anterior cingulate and the bilateral parietal and lateral prefrontal cortices. Moreover, both st-PLS and GLM activity parameters predicted fluid intelligence.

10:20–10:35 (179)

The Relationship Between Inhibition and Working Memory: A Latent-Variable Approach. DAVID Z. HAMBRICK & ELIZABETH A. HELDER, *Michigan State University*, LYNN HASHER, *University of Toronto and Rotman Research Institute*, & ROSE T. ZACKS, *Michigan State University* (read by Lynn Hasher)—Inhibition is currently a major focus of research in cognitive psychology and has been implicated in individual and developmental differences in a variety of tasks. We present evidence concerning the distinction between two aspects of inhibition proposed to regulate the contents of working memory (Hasher, Zacks, & May, 1999). Access is the ability to selectively process information relevant to the task at hand, whereas deletion is the ability to discard information that is no longer relevant. Two hundred thirty-six participants, ranging in age from 18 to 87 years, performed tasks designed to assess these functions, along with working memory tasks. There was evidence for distinct access and deletion factors, and together, these factors accounted for a large proportion of age-related variance in working memory. These results support the view of inhibition as a multidimensional construct and further support the role of inhibition in cognitive aging. Theoretical and methodological implications are discussed.

10:40–10:55 (180)

Do Working Memory Spans Depend Only on Time? VALÉRIE CAMOS & PIERRE BARROUILLET, *Université de Bourgogne*—Our model, the time-based resource-sharing model, is a new model that accounts for working memory spans in adults and, more generally, for working memory functioning. It assumes that memory traces decay as soon as attention is switched away. Thus, the proportion of time during which the processing component of any working memory span task captures attention determines its cognitive load and, thus, the spans. An open question is whether the spans are only a mere function of time or depend also on the nature of the processing component that captures attention. In a series of experiments, we investigated this question by comparing the effect on spans of different activities (selection of response, retrieval from memory) while time was held constant.

11:00–11:15 (181)

“False” Working Memories: Memory Distortion in a Mere Four Seconds. ALEXANDRA S. ATKINS & PATRICIA A. REUTER-LORENZ, *University of Michigan* (read by Patricia A. Reuter-Lorenz)—False memories are well-established, long-term memory phenomena: Semantically related lures are confidently and erroneously remembered as studied items. We have discovered this effect in working memory as well. In an item recognition task that required four semantically related words to be remembered over a 3- to 4-sec retention interval, se-

matically related lure probes were consistently mistaken as members of the memory set. Related lures took longer to correctly reject than did unrelated negative probes, suggesting interference due to the semantic relatedness of the lure. The false working memory effect on accuracy increased when a distractor task performed during the retention interval interfered with subvocal rehearsal. Our results demonstrate the existence of “false” working memories and suggest that the working memory system is highly susceptible to rapid distortion, presumably due to the effects of spreading semantic activation.

11:20–11:35 (182)

Proactive Interference Slows Retrieval in Recognition Memory by Eliminating Fast Assessments of Familiarity. BRIAN McELREE & ILKE ÖZTEKIN, *New York University*—The response signal speed–accuracy tradeoff procedure was used to investigate how proactive interference (PI) affects retrieval from working memory. Participants were presented with six-item study lists, followed by a recognition probe. A classic release from PI procedure was used: All items in a list were from the same category (e.g., *fruits*), and the category was changed (e.g., *tools*) after three consecutive trials with the same category. Analysis of the retrieval functions demonstrated that PI decreased asymptotic accuracy and, crucially, also decreased the growth of accuracy over retrieval time, indicating that PI slowed retrieval speed. Analysis of false alarms to recent negatives (lures drawn from the previous study list) and distant negatives (lures not studied for 168+ trials) demonstrated that PI slows retrieval by selectively eliminating fast assessments based on familiarity. There was no evidence indicating that PI affects recollection.

11:40–11:55 (183)

Working Memory and Mathematical Computation: Does Problem Representation Shift With Increasing Expertise? SHAKTHI D. KUMAR, *Michigan State University*, SIAN L. BEILock, *University of Chicago*, & THOMAS H. CARR, *Vanderbilt University* (read by Thomas H. Carr)—The representation of mental arithmetic in working memory has been shown to vary as a function of a number of factors (e.g., presentation orientation, duration, modality). We investigated whether math skill level also affects working memory representation, using a selective interference paradigm. Participants solved complex mental arithmetic problems under three conditions: single-task baseline, dual-task performance with a verbal concurrent task requiring overt repetition of heard words, and dual-task performance with a visuospatial concurrent task requiring joystick movement in the directions indicated by visually presented arrows. Baseline math performance predicted patterns of selective interference. At lower levels of math skill, the relative amount of verbal dual-task interference was greater than visuospatial dual-task interference. At higher skill levels, this pattern was reversed. These results demonstrate that problem representation varies not only as a function of the constraints imposed by the problems themselves, but also as a function of constraints imposed by the performers solving the problems.

Metacognition

Dominion Ballroom, Saturday Morning, 10:20–12:00

Chaired by Christopher Hertzog, *Georgia Institute of Technology*

10:20–10:35 (184)

Metacognition and the Updating of Strategy Knowledge From Task Experience. CHRISTOPHER HERTZOG, AILIS BURPEE, & JODI PRICE, *Georgia Institute of Technology*, & JOHN DUNLOSKEY, *Kent State University*—We studied learning about the differential effectiveness of two strategies (rote repetition and interactive imagery) for mediating paired-associate learning, using metacognitive judgments and questionnaire ratings to measure strategy knowledge acquisition for two recall trials. Do people learn that interactive imagery produces superior recall? Task goal (control, goal intention, or goal implementation) instructions and recall presentation type (random vs. blocked)

were manipulated to see whether explicitly instructing participants to learn about the strategies or providing strategy-homogeneous blocks of PA recall would result in improved absolute accuracy of participants’ monitoring. The joint manipulation of goal intention instructions and blocked testing resulted in the best absolute accuracy for participants’ global predictions. Blocked testing improved the absolute accuracy of performance monitoring (global postdictions). Participants’ judgments of learning were unaffected and showed limited knowledge updating. Ratings of strategy effectiveness before and after task experience yielded substantial knowledge updating effects not fully reflected in metacognitive judgments.

10:40–10:55 (185)

The Strategic Regulation of Memory Reporting: Monitoring and Control of Informativeness. MORRIS GOLDSMITH, ASHER KORIAT, RAKEFET ACKERMAN, & AINAT PANSKY, *University of Haifa*—Rememberers do not report all items of information that come to mind. Rather, they use metacognitive monitoring and control processes to decide whether to report the item (report option) and, if so, at what level of precision–coarseness (grain size). Previous work on control of grain size (Goldsmith et al., 2002, 2005) supported a “satisficing” model, in which people trade informativeness for accuracy, coarsening their answers until subjective probability–correct passes a preset accuracy criterion. What happens, however, when satisfying the accuracy criterion requires a ridiculously coarse, uninformative answer? New results suggest that an “informativeness criterion” must also be satisfied: When the quality of memory is insufficient to simultaneously satisfy both criteria, the accuracy criterion may be violated, or, given report option, a “don’t-know” response may be preferred. The results point to a unified model of report option and grain regulation that includes monitoring and control of informativeness in accordance with social-pragmatic norms.

11:00–11:15 (186)

Metacognitive Processes Underlying the Inflation of Conditional Predictions. ASHER KORIAT, *University of Haifa*, KLAUS FIEDLER, *University of Heidelberg*, & ROBERT A. BJORK, *UCLA*—Several experiments will be reported that indicate that conditional predictions—the assessed probability that a certain specified outcome will occur, given a certain specific condition—tend to be markedly inflated. The results suggest that prediction inflation derives, in part, from a backward activation process in which the specified outcome highlights aspects of the condition that support the likelihood of occurrence of that outcome. One consequence is that alternative outcomes do not compete as fully as they should. Another is that the inflation of conditional predictions is resistant to manipulations that induce participants to consider alternatives to the target outcome. The results illustrate the contributions of a posteriori associations to metacognitive biases—especially foresight bias (Koriat & Bjork, 2005)—which act to induce overconfidence in monitoring one’s knowledge during study.

11:20–11:35 (187)

Separating Bias and Sensitivity in Judgments of Associative Memory. WILLIAM S. MAKI, *Texas Tech University*—Human subjects overestimate the associative strength binding a pair of words. We have found that a linear function relates numerical estimates (JAM) to associative strength obtained from free association norms (FSG); roughly, $JAM = 50 + 0.4 FSG$. This JAM function is characterized by a high intercept (overestimation bias) and a shallow slope (diminished sensitivity to associative differences). In Experiment 1, subjects were trained with error-correcting feedback on many pairs of words. No effects on the slope were found, but lower intercepts were shown by those groups who received training and feedback instructions. In Experiment 2, subjects simultaneously rated four associates of each cue word, but ratings were constrained to add to 100%. Despite the (forced) reduction in bias, the slope remained shallow. The invariance of the slope is the basis for concluding that low sensitivity is not merely a ceiling effect caused by the bias.

11:40–11:55 (188)

Metacomprehension for Multiple-Choice, Essay, and Recall Tests. RUTH H. MAKI, CYNTHIA J. DEMPSEY, AMY J. PIETAN, MICHAEL T. MIESNER, & JOSHUA ARDUENGO, *Texas Tech University*—Students' abilities to predict multiple-choice test performance after reading text is often poor. In order to predict performance on multiple-choice tests, students must predict what specific topics will be tested and the difficulty of incorrect alternatives. This uncertainty is removed for posttest judgments. We manipulated the uncertainty of the test by using three types of tests: multiple choice, essay, and recall. We scored essay and recall answers with latent semantic analysis. Overall, correlations between judgments and performance were higher for multiple-choice than for essay tests, with recall falling in the middle. This was true for prediction and posttest confidence judgments and for students of high, medium, and low verbal abilities. Metacomprehension for essay tests was particularly poor, even after students had written the answers. Because predictions for multiple-choice tests tended to be the best, uncertainty about questions and expected answers cannot explain poor performance predictions.

Comparative Cognition

Civic Ballroom, Saturday Morning, 10:40–12:00

Chaired by David A. Washburn, Georgia State University

10:40–10:55 (189)

Constraint Competition in the Control of Attention. DAVID A. WASHBURN, *Georgia State University*—In a series of experiments modeled after the Kane and Engle (2003) studies on the control of attention in Stroop task performance by humans, rhesus monkeys were tested to examine how experiential constraints (habits) and executive constraints (intentions) vie for the control of behavior. The monkeys performed a numerical Stroop task under varying proportions of congruous or incongruous trials. Overall, the monkeys performed similarly to the low-memory-span humans of the Kane and Engle (2003) study: Errors increased on infrequent incongruous trials, response times were longer for incongruous than for baseline or congruous trials, and the monkeys switched between processing sets with difficulty. Even in these conditions, however, it appeared that the monkeys had not forgotten the rules of the task; rather, it seems that these manipulations of task cues were effective in biasing the competition that exists between automatic and controlled determinants of attention.

11:00–11:15 (190)

Familiarity Processing in Primates and Avians: Proactive Interference. ANTHONY A. WRIGHT, *University of Texas Health Science Center, Houston*, JEFFREY S. KATZ, *Auburn University*, TAMO NAKAMURA & JACQUELYNE J. RIVERA, *University of Texas Health Science Center, Houston*, & BRADLEY R. STURZ & KENT D. BODILY, *Auburn University*—Rhesus monkeys and pigeons learned a *same/different* concept with a large set of pictures. After the *same/different* concept had been learned, proactive interference was measured and manipulated to test the degree to which performance and transfer depended on familiarity and feature processing.

11:20–11:35 (191)

Operant Conditioning and Hoarding in Dwarf Hamsters (*Phodopus campbelli*). KRISTA A. WERTZ & JEROME FRIEMAN, *Kansas State University* (read by Jerome Frieman)—Hamsters are prolific hoarders. They store large amounts of food in their cheek pouches and also create large caches of food in or around their nests. Because they hoard food, they rarely experience severe deprivation and do not respond well to it. They can be trained to leverpress without being deprived of food. We trained dwarf hamsters (*Phodopus campbelli*) to leverpress for food in a closed economy under various fixed ratio schedules of reinforcement and manipulated whether they could accumulate a hoard in their nest. We observed them leverpressing for food in fairly regular bursts spaced hours apart, primarily during the night. The

lengths of bursts in leverpressing increased when they were unable to amass a hoard. These observations reflect the adaptive strategies in a species that hoards food.

11:40–11:55 (192)

Learning in Antlions, Sit-and-Wait Predators: Hurry Up and Wait. KAREN L. HOLLIS, AMBER M. HAYDEN, & MARGARET L. McDERMOTT, *Mount Holyoke College*—Antlions (Neuroptera: Myrmeleontidae), the larvae of an adult winged insect, capture food by digging funnel-shaped pits in sand and then lying in wait, buried at the vertex, for prey to fall inside. A captured prey is injected with digestive enzymes, and the fluids are extracted via the mandibles. The sedentary nature of antlions' sit-and-wait predatory behavior and, especially, their innate ability to detect prey arrival, do not fit the profile of invertebrates that possess learning capabilities. However, we show that learning can play an important, and heretofore unrecognized, role in this insect's predatory behavior. Once each day for 16 days, individual antlions received either a brief vibrational cue presented immediately before the arrival of food or that same cue presented independently of food arrival. Signaling of food enabled antlions not only to extract food faster, but also to dig more efficient pits and molt sooner than antlions for which food was not signaled.

Speech Perception

Conference Rooms B&C, Saturday Morning, 9:40–12:00

Chaired by Delphine Dahan, University of Pennsylvania

9:40–9:55 (193)

Speaker Specificity in Speech Perception: The Importance of What Is and Is Not in the Signal. DELPHINE DAHAN, *University of Pennsylvania*, & REBECCA A. SCARBOROUGH, *Stanford University*—In some American English dialects, /æ/ before /g/ (but not /k/) raises to [ɛ], reducing phonetic overlap between, for example, “bag” and “back.” Here, participants saw four written words on a screen (e.g., “bag,” “back,” “dog,” “dock”) and heard a spoken word. They indicated which word they had heard. Participants' eye movements to the written words were recorded. Participants in the “æ-raising” group heard “bag”-like words containing [ɛ]; participants in the “control” group heard cross-spliced “bag”-like words containing [æ]. The æ-raising group participants identified “back”-like words (identical between groups) more quickly and more accurately and made fewer fixations to the competitor “bag,” than did control group participants. Thus, exposure to raised realizations of “bag” facilitated identification of “back” because of the reduced fit between the input and the altered representation of the competing hypothesis “bag.” So listeners evaluate speech with respect to what is and what is not in the signal, and this evaluation involves speaker-specific representations.

10:00–10:15 (194)

Lexical Knowledge and Speaker Familiarity Modulate Perception of Assimilated Segments. REBECCA PIORKOWSKI & WILLIAM BADECKER, *Johns Hopkins University* (read by William Badecker)—We present experiments that examine how the perception of assimilated segments is influenced by lexical knowledge: for example, when lexical access to an underlying form (“bean”) is influenced by competition with its assimilated surface form (“beam”) in contexts such as “the dye turned the bean blue.” Using cross-modal priming, we compared the priming effect of words that assimilate to nonwords in phonological licensing contexts (“brown pea”) with the priming effect of words that assimilate to other words in a licensing context (“bean blue”). We also compared the priming effect of mid-frequency words whose assimilated form is more frequent with the priming effect of mid-frequency words whose assimilated form is less frequent. We found that lexical access to the underlying form is influenced by the frequency and lexicality of the surface form, the listener's knowledge of the speaker, and the relative timing of the spoken prime and visual probe.

10:20–10:35 (195)

Rapid Lexical–Semantic Integration in Speech Processing: Evidence From Pause Detection. SVEN L. MATTYS & CHRISTOPHER W. PLEYDELL-PEARCE, *University of Bristol*—In this study, we use pause detection (PD) as a new tool for studying the online integration of lexical and semantic information during speech comprehension. When listeners were asked to detect 200-msec pauses inserted into the last word of a spoken sentence, their detection latencies were influenced by the lexical–semantic information provided by the sentence. Pauses took longer to detect when they were inserted within a word that had multiple potential endings in the context of the sentence than when inserted within words with a unique ending. An event-related potential variant of the PD procedure revealed brain correlates of pauses as early as 101–125 msec following pause onset and patterns of lexical–semantic integration that mirrored those obtained with PD within 160 msec. Thus, both the behavioral and the electrophysiological responses to pauses suggest that lexical and semantic processes are highly interactive and that their integration occurs rapidly during speech comprehension.

10:40–10:55 (196)

Spatiotemporal Properties of Brain Activation Underlying Lexical Influences on Speech Perception. DAVID W. GOW & CHRISTINA CONGLETON, *Massachusetts General Hospital*, & SEppo P. AHLFORS & ERIC HALGREN, *MGH/MIT/HMS Athinoula A. Martinos Center*—Behavioral evidence from a variety of paradigms suggests that there is a two-way relationship between fine-grained phonetic factors and lexical activation. Within-category phonetic variation affects the course of lexical activation, and lexical knowledge affects the interpretation of phonetic ambiguity. We examined this relationship in a study combining MEG and fMRI to provide high spatiotemporal resolution imaging data while participants performed a phonetic categorization task. In each trial, listeners heard a token of “_ampoo” or “_andal” in which the initial segment was /s/, /ʃ/, or a fricative judged to be intermediate between /s/ and /ʃ/. Listeners showed a robust behavioral Ganong effect, interpreting the ambiguous fricative as /s/ in “_ampoo” and /ʃ/ in “_andal.” Physiological data showed a distinctive pattern of activation reflecting the interaction between phonetic and lexical activation. The results are discussed in the context of the general problem of interaction between top-down and bottom-up perceptual processes.

11:00–11:15 (197)

Entering the Lexicon: Form and Function. LAURA LEACH & ARTHUR G. SAMUEL, *SUNY, Stony Brook* (read by Arthur G. Samuel)—Lexical entries contain semantic, syntactic, phonological, and orthographic information. However, they are not static repositories; lexical entries dynamically interact. We are studying the acquisition and development of new lexical entries (e.g., for “figondalis”). Adult participants either incidentally learned new “words” while doing a phoneme monitoring task or were trained to associate each word with a picture

of an unusual object. We then measured both form learning (recognizing words in noise) and functionality (the ability of the word to support perceptual learning of its constituent phonemes). Across 5 days of training and testing, form learning increased steadily and substantially in both training conditions. However, new words were not well integrated into the lexicon when trained via phoneme monitoring; their ability to support perceptual learning was small and did not increase over training. In contrast, learning words as the names of objects rapidly produced lexical entries with both form and function.

11:20–11:35 (198)

Auditory Language Perception Is Unimpaired by Concurrent Saccades and Visuospatial Attention Shifts. WERNER SOMMER, *Humboldt University, Berlin*, OLAF DIMIGEN, *University of Potsdam and Humboldt University, Berlin*, ULRIKE SCHILD, *Humboldt University, Berlin*, & ANNETTE HOHLFELD, *Universidad Complutense de Madrid*—Language perception at the semantic level—as indicated by the N400 component in the event-related brain potential—can be severely delayed in time when other tasks are performed concurrently. This interference could be explained by a central processing bottleneck or by attention shifts elicited by the additional tasks. Here, we assessed whether the additional requirement of performing saccades of 10° to the left and right would aggravate the N400 delay. In a first experiment, delays of N400 were more pronounced when the additional task involved saccades than when it did not. However, when the saccade-induced delay of information input in the additional task was compensated by correcting SOA, the effects of additional tasks with and without saccades on N400 latency were indistinguishable. It is concluded that language perception is unimpaired by exogenously triggered visuospatial attention shifts, lending further support to the bottleneck account of concurrent task effects.

11:40–11:55 (199)

The Time Course of Shifts in Overt Attention Toward Visual Objects During Language-Mediated Visual Search. JAMES M. McQUEEN, *Max Planck Institute for Psycholinguistics*, & FALK HUETTIG, *Ghent University*—A visual world study is reported investigating the time course of how phonological, visual shape, and semantic information accessed from spoken words is used to direct gaze toward objects in a visual environment. During the acoustic unfolding of Dutch words (e.g., “kerk,” church), eye movements were monitored to pictures of phonological, shape, and semantic competitors (e.g., a cherry [“kers”], a house [“huis”], and a grave [“graf”]) and to pictures of objects unrelated on all three dimensions. Time course differences were observed with attentional shifts to phonological competitors preceding shifts to shape competitors, which in turn preceded shifts to semantic competitors. These data suggest that, during language-mediated visual search, attention is directed to the item with the currently highest priority ranking. This ranking is codetermined by the type of lexical information that becomes available as the spoken word unfolds and by the types of featural information that are copresent in the visual display.

SYMPOSIUM: Event Representation
Grand Ballroom Centre, Saturday Afternoon, 1:30–3:40

Chaired by Thomas F. Shipley, Temple University

1:30–1:40 (200)

Event Representation Symposium Introduction. THOMAS F. SHIPLEY, *Temple University*—Humans effortlessly recognize all sorts of events, from simple events like objects colliding and humans walking, to complex events like a double play or getting mad. Humans can also remember and describe these events and generally react appropriately, be it catching an approaching object or comforting a friend. The phenomenal ease of our interactions with events belies the complexity of the underlying processes. Although psychology has historically concentrated on the study of static aspects of the world, that is changing. Events, things that happen over time, are the basis of all experience, and thus understanding how we process events is an important area of research in every psychological domain. This symposium offers an overview of research on event processing. The talks will illustrate the breadth of issues and give a sense of the interconnections across the traditionally separate domains of perception, categorization, memory, and emotion.

1:40–2:00 (201)

Inducing Causal Events From Physical and Social Forces. PHILLIP WOLFF, *Emory University*—Simple collision events give rise to the impression of causation. Most of the research on this effect has focused on the kinematics of these events—that is, on the motions of the objects without regard to the forces that produced those motions. In contrast, the vector model (Wolff & Zettergren, 2002)—based on Talmy's (1988) theory of force dynamics—proposes that the perception of causation in collision events is based upon the underlying dynamics—that is, upon the forces that produce the motions. Whereas a kinematic representation of causal events is largely limited to physical interactions, a force vector representation extends easily to other kinds of causation, including social causation. In support of this, I describe a series of experiments in which intentions and desires are treated like physical forces in the perception of causation involving people. Potential implications for the semantics of causal verbs will be discussed.

2:00–2:20 (202)

Levels of Biological Motion Perception. NIKOLAUS TROJE, *Queen's University*—Biological motion has long been treated as one single phenomenon. Here, we want to suggest a dissociation between a mechanism responsible for a nonspecific, shape-independent detection of biological events, on the one hand, and a mechanism that retrieves shape from motion and recovers the articulation and general structure of a specific body, on the other hand. Evidence for this dissociation is presented in terms of experiments designed to explore the nature of the inversion effect in biological motion. As long as it is presented upright, scrambled biological motion still contains information about the facing direction of a walker. We isolate the invariants responsible for this inversion effect as being representative of the ballistic movement of limbs under conditions of gravity. The consequences of using scrambled motion to mask biological motion in detection experiments and the usage of scrambled motion as a control stimulus in imaging studies are discussed.

2:20–2:40 (203)

Recognizing Gender From Affective Arm Movements: How to Throw Like a Man. FRANK E. POLLICK, *University of Glasgow*, KERRI L. JOHNSON, *New York University*, & LAWRIE S. MCKAY, *University of Glasgow*—Arm kinematics systematically vary when an actor depicts the same action with different affective states (Pollick et al., 2001). Using a motion library of 29 actors (14 male), we examined the recognition of gender from point-light throwing actions when the actors were asked to perform throws in sad, neutral, happy, and angry emotional styles. In accord with the notion of kinematic specification

of dynamics, actions with the greatest velocity, in this case angry throws, produced the highest accuracy in gender recognition. However, interpretation of this result is complicated by a strong bias for angry throws to be reported as male. Two distinct models could explain this bias: (1) there is a social stereotype to categorize angry movements as male and (2) the kinematic elements that signal maleness are more pronounced in angry actions. We investigate these two possibilities and present the outcome.

2:40–3:00 (204)

Event Boundaries in Autobiographical Memory. MARTIN A. CONWAY & HELEN L. WILLIAMS, *University of Leeds*, & ALAN D. BADDELEY, *University of York*—Two experiments explored the boundaries of episodic memories. In the first experiment, participants provided a detailed account of all that occurred from leaving home to arriving at the University. One week later, they repeated this recall. A second group performed a similar free recall for a vacation. Participants then studied their recall narratives, divided them up into memories, and placed the recalled details in forward temporal order. The majority of memories were found to start with an action. Thoughts, feelings, and facts were less frequent as first details, although they were present for some memories. Last details were highly variable, and no single type of detail predominated. Very few memories were retrieved 1 week later, but participants showed relatively good memory for their earlier recall. The findings of these preliminary studies provide some initial insights into the goal-oriented nature and boundaries of everyday autobiographical memories.

3:00–3:20 (205)

When Action Meets Word: Event Parsing, Representation, and Verb Learning. THOMAS F. SHIPLEY & SHANNON PRUDEN, *Temple University*, RACHEL PULVERMAN & ROBERTA M. GOLINKOFF, *University of Delaware*, & KATHY HIRSH-PASEK, *Temple University*—Events are a fundamental unit of human experience. We perceive, remember, and communicate about events. Events are composed of dynamic spatial relations. Among them, path, an object's motion through space, might prove foundational for perception of complex aspects of events, including cause and intention. Segmentation of paths may be accomplished using geometric properties of the path; spatiotemporal path curvature extrema predict perceptual event boundaries. Recognition of local path fragments may then be based on spatiotemporal shape. Whereas our research focuses on how we perceive path, path appears in the world's languages in verbs and prepositions. Language-learning infants appear to attend to path before other elements of events. Here we explore the hypotheses that infants use a default strategy of attending to and using path information to link novel verbs to events. Only later will they show sensitivity to statistical properties of their native language (e.g., that English verbs generally encode manner).

[3:20–3:40 Event Representation Roundtable Discussion]

Mechanisms of Attention

Grand Ballroom East, Saturday Afternoon, 1:30–3:10

Chaired by Steven Yantis, Johns Hopkins University

1:30–1:45 (206)

Distributed Representation of Attentional Priority in Human Cortex. JOHN T. SERENCES & STEVEN YANTIS, *Johns Hopkins University* (read by Steven Yantis)—Selective attention biases competition for cortical representation in favor of behaviorally relevant stimuli (voluntary attentional control) or salient stimuli (stimulus-driven control). We used fMRI to investigate the cortical representation of attentional priority by having observers view two multicolored RSVP letter streams containing occasional digit cues that instructed them to shift attention between the streams during search for a red target letter. Topographically organized regions of extrastriate (V1–V4), parietal

(IPS), and frontal (FEF) visual cortex exhibited sustained responses during epochs of voluntary attention to the contralateral visual field. Furthermore, contralateral target-colored distractors that captured attention evoked heightened responses within these same cortical areas. Thus, these regions constitute an array of attentional priority maps that combine stimulus-driven and goal-directed influences. The degree to which a given region is influenced by salient image features or by top-down goals varies continuously from early to late regions of the visual system.

1:50–2:05 (207)

Native and Supported Mode Processing in Attentional Control Network. WALTER SCHNEIDER, NICOLE HILL, & MICHAEL COLE, *University of Pittsburgh*—In fMRI experiments, we examined attentional control between frontal cortex (DLPFC) and posterior parietal cortex (PPC) to establish what functions are native mode (can be done directly by PPC) and supported mode (requires frontal cortex input). In a visual line search paradigm, attention was allocated to a single or multiple locations either exogenously controlled (single pop up) or endogenously controlled (scan in circular pattern, along diagonal, or single position). Activity in PPC indicated selective attentional processing. Exogenous search produced little DLPFC involvement, whereas endogenous search, diagonal search, and even maintaining attention on a single position required substantial DLPFC involvement. This suggests that PPC attentional processing is quite limited and that most of what we view as voluntary attention is due to external (DLPFC) driving of attentional control in PPC. This is consistent with the CAP2 model (Schneider & Chein, 2003) and suggests that PPC attention control requires extensive frontal input.

2:10–2:25 (208)

Anisotropy of Attention Orienting Across the Visual Field. ALEXA ROGGEVEEN & LAWRENCE M. WARD, *University of British Columbia* (read by Lawrence M. Ward)—Voluntary, covert attention enhances processing of stimuli at attended locations (see Carrasco et al., 2002). Previous behavioral data have revealed that attentional enhancement is anisotropic, with more accuracy and speed improvement in the lower visual field and on the horizontal meridian, and more enhancement as stimulus eccentricity increases (Carrasco et al., 2001). Our cue–target experiment expanded these results by mapping attentional enhancement across the visual field using a different paradigm, measuring both behavior and event-related potentials (ERPs), and specifically examining attentional modulations of early sensory ERPs (Mangun & Hillyard, 1991). Surprisingly, our behavioral results showed a different anisotropic pattern of attentional enhancement than has been previously found. Furthermore, we found a problematic lack of correlation between behavioral and ERP measures of attentional enhancement at various locations in the visual field. These results will be discussed in terms of top-down influences on attention allocation strategies.

2:30–2:45 (209)

Top-Down Control of Visual Attention: A Rational Account. MICHAEL C. MOZER & MICHAEL SHETTEL, *University of Colorado, Boulder*, & SHAUN P. VECERA, *University of Iowa*—Some theories of visual attention are premised on the notion of a saliency map that encodes conspicuous locations in the visual field. Features such as local color contrast and motion drive the saliency map, and top-down attentional control modulates the relative contribution of each feature type. Insight into attentional control comes from studies that explore repetition priming effects in a sequence of visual search trials. We interpret priming in these studies as a manifestation of attentional control adapting to the statistical structure of the environment. We propose a probabilistic model of the environment that is updated after each trial. Under the assumption that attentional control operates so as to make performance more efficient for more likely environmental states, we obtain parsimonious explanations for data from a wide range of experiments. Furthermore, our model provides a ratio-

nal explanation for why the influence of past experience on attentional control is short lived.

2:50–3:05 (210)

Empirical Tests of a Resource Allocation Model of Hick's Law. MARIAN E. BERRYHILL & HOWARD C. HUGHES, *Dartmouth College* (read by Howard C. Hughes)—Hick's law (Hick, 1955) states that reaction times are proportional to the logarithm of the number of response alternatives. Initial accounts of this relationship in terms of information theory were quickly recognized as inadequate, and there is still no comprehensive account of the effects of response uncertainty on response latency. The present paper presents a resource allocation model that attempts to account both for Hick's law and for some previously reported violations. This account is tested using a dual-task procedure. The results do not provide direct support for the resource allocation model, but can be reconciled with a modified version of the basic ideas behind the model.

False Memory

Grand Ballroom West, Saturday Afternoon, 1:30–3:50

Chaired by *Giuliana Mazzoni, University of Plymouth*

1:30–1:45 (211)

Intentional Suppression of True and False Memories. GIULIANA MAZZONI, *University of Plymouth*—In a cued-recall task of pairs of unrelated words, target words can be intentionally suppressed by simply not thinking about them (Anderson & Green, 2000). In other conditions, asking not to think about an item produces the paradoxical effect of enhancing its memory (the “white bear effect”). The suppression (think–no think) procedure was used in a DRM task by asking participants not to think about words presented in the center of the lists (true memories), and about critical nonpresented words (false memories). The procedure was repeated zero, four, or eight times. Results showed that in the no-think condition, recall and recognition of presented words increased, but they decreased for critical nonpresented words. The results reveal one condition in which the same instructions have opposite effects on true and false memories and are discussed in terms of the paradoxical “white bear” effect.

1:50–2:05 (212)

Does the d' Difference for Critical Items and Associates From DRM Lists Depend on Study Intentionality and Within-List Relatedness? CHI-SHING TSE & JAMES H. NEELY, *SUNY, Albany* (read by James H. Neely)—A person's ability to discriminate (as indexed by d') whether an item was or was not studied in a Deese/Roediger–McDermott (DRM) study list containing all related items has been shown to be lower for critical items (CIs; e.g., sleep) than for associates (e.g., blanket). We find that this “CI memory inferiority effect” occurs to the same degree whether the CI or associate is studied in a related DRM list or in a list of totally unrelated words, and whether the CI or associate is studied under intentional learning conditions or in a shallow, incidental letter search task. We discuss the implications these results have for DRM CI versus associate memory differences and for the general issue of how semantic relatedness of study items affects recognition memory.

2:10–2:25 (213)

DRM Lists in Experiments About the “Violent Black Man Stereotype.” BEM P. ALLEN, *Western Illinois University*—Previous research on the Web and in the lab has shown that subjects primed with a “violent man” DRM list (“murderer”) subsequently were more likely to falsely report “African American” in recollection of entries on an ethnic names DRM target list (sans “African American”) in comparison with control–prime conditions (a royalty list and a positive/neutral list referring to black men). In the present Web experiment, subjects performed interpolated activities between exposure to prime lists and the presentation of the target lists. Comparisons were made with the po-

tent “cold” list, a “woman” set of prime and target lists, and a “terrorist” set of lists. There were three opportunities to recall all target lists. Results showed no reliable difference between false reports of “cold” and those of “African American,” but both significantly exceeded false reports related to “woman” and “terrorist,” which did not differ from each other ($ps = .000$ to $.008$).

2:30–2:45 (214)

False Memory for Emotionally Charged Words. PETER B. WALKER, PAUL A. HOUCK, & W. TRAMMELL NEILL, *SUNY, Albany* (read by W. Trammell Neill)—Participants studied lists of words that were phonologically similar to emotionally charged words (e.g., *rape*) or neutral words (e.g., *park*). The critical word was included in some studied lists, which allowed measurement of hit rates as well as false alarms on a subsequent recognition memory test. As previously found by Pesta, Murphy, and Sanders (2001), false alarms were increased for list-related charged words relative to charged words related to unstudied lists. However, hit rates for charged words were also very high, and d' was much higher for charged words than for both neutral critical words and list words that were phonologically similar to charged words. The results suggest limitations on generalizing from the DRM list procedure to putatively false memories for emotional and traumatic events.

2:50–3:05 (215)

The Effect of Strength on Source Memory Judgments of True and False Memories. IRA E. HYMAN & EDWIN ANDERSON, *Western Washington University*—True and false memories are predicted to differ in terms of source memory. We investigated the effect of strength on recognition and source judgments using two different methodologies: Deese/Roediger–McDermott word lists and Bransford and Franks sentences. We varied strength by presenting different numbers of items related to each topic during encoding. Strength affected recognition rates of old and new words and sentences but had little effect on source judgments. Instead, participants made source judgments based on relatedness to the topics of the studied lists. Source memory does not differentiate true and false memories and appears to be constructed.

3:10–3:25 (216)

Recollection Rejection of Constructed False Memories. C. J. BRAINERD, V. F. REYNA, & S. ESTRADA, *Cornell University*—Recollection rejection is a verbatim operation of key forensic interest because it generates principled suppression of false-memory responses by neutralizing the familiarity of new events that preserve the meaning of experience. Mathematical models that partition memory processes for word lists were used to measure recollection rejection of false memories in Bransford–Franks narratives. Parameter estimates showed that recollection rejection suppressed those false memories 50% of the time, even when distractors' surface structure and meaning were almost the same as the targets'. Manipulations that strengthen verbatim memory (e.g., target repetition, target presentation order, repeated testing) improved recollection rejection. Surprisingly high levels of recollection rejection were preserved intact over a 1-week interval in conditions that inoculated verbatim traces against disintegration. Although our findings violate constructivist theories of narrative memory, they are explained by dual-process theories that stress the opposing effects of verbatim and gist traces on false memory.

3:30–3:45 (217)

False Retrieval of Text. MURRAY SINGER, *University of Manitoba*, & GILBERT REMILLARD, *Morehead State University*—Our research evaluated the hypothesis that text inference retrieval receives support from a process of phantom recollection (Brainerd et al., *JEP:LMC*, 2001) plus recollection and familiarity. We used Brainerd et al.'s conjoint recognition procedure: Three groups were respectively instructed to accept test probes if (1) they recognized them, (2) the probe matched the gist of an antecedent message, and (3) the probe was implied, but not stated, in a message. A 3-process phantom recognition

model was compared with two 2-process models: a traditional model and one that blended process dissociation and phantom recognition. For 0- versus 2-day delayed text retrieval, only the 3-process model satisfactorily fit the data, and phantom recollection was invariant with delay. In a shallow-encoding experiment, however, phantom recognition was negligible, and the 2-process models achieved satisfactory fits. These results are consistent with a phantom-recognition process that reflects robust gist-based representations.

Motor Control

Dominion Ballroom, Saturday Afternoon, 1:30–3:50

Chaired by Jonathan Vaughan, Hamilton College

1:30–1:45 (218)

Planning Trajectories in 3-D Space on the Basis of Three Postures. JONATHAN VAUGHAN, *Hamilton College*, MARY KLEIN BRETELER, *Radboud University Nijmegen*, DAVID A. ROSENBAUM, *Pennsylvania State University*, STEVEN JAX, *Moss Rehabilitation Research Institute*, & KIMBERLY LANTZ & ARAM KUDURSHIAN, *Hamilton College*—To move an arm, one must plan both a target posture and the movement trajectory to it. Forearm movements around obstacles in 2-D space have been modeled by superimposing a symmetric reversible movement to a “bounce” posture on the direct movement from start to target posture. Modeling 3-D movements is more challenging because of the noncommutativity of successive rotations about different joint axes. We now extend the obstacle-avoidance algorithm, based on three postures, to trajectories in 3-D. Eight seated subjects touched a handheld tool to a sequence of targets, sometimes circumventing an obstacle. Trajectories (with six postural degrees of freedom) were modeled using the observed start and target postures and one intermediate bounce posture. Circuitous 3-D trajectories were synthesized by superimposing a direct movement to the target (using single-axis joint rotations) and a reversible movement to a bounce posture. The results support the role of postural representations in motor planning.

1:50–2:05 (219)

Looking Into the Future: How We Grasp Objects Reflects Anticipation of Future Positions. DAVID A. ROSENBAUM & RAJAL G. COHEN, *Pennsylvania State University*—The farther into the future one looks, the less sure one can be about the usefulness of one's plans. On the other hand, immediately forthcoming events may be anticipated with great precision. One domain where such near-term anticipation can be studied is motor control, where the way one behaves at some point in time may reflect the nature of the plan for the behavior to follow. We illustrate this approach in a series of studies on object manipulation. Our subjects reached for an object, knowing they would transport it to other locations. How they took hold of the object reflected considerable sensitivity to future states. The results indicate that behavioral methods are important for studying motor planning and that the study of motor planning may reveal much about cognition.

2:10–2:25 (220)

Fitts's Law in Actual and Imagined Action: A Closer Look. SUZANNE M. GRILLI & ANDREW B. SLIFKIN, *Cleveland State University* (read by Andrew B. Slifkin)—A large literature suggests substantial overlap of the processes involved in actual and imagined action. For example, in a Fitts aiming paradigm, actual and imagined movement time (MT) was essentially identical at common levels of the index of difficulty (ID) (see, e.g., Sirigu et al., 1996). Here, we extend that research by examining performance over a broadened range of target amplitudes (A) and widths (W): ID ranged from 1.00 to 5.00 bits, and W ranged from 0.13 to 2.16 cm within each ID level. MT always increased with ID, and within each ID level MT was constant across the larger values of W. Those results confirm Fitts's law. However, MT tended to lengthen with further reductions in W. This

tendency was slight for actual movement but more pronounced for imagined movement. Thus, similar processes appear to operate during actual and imagined action, but accuracy requirements are weighted more heavily in imagination.

2:30–2:45 (221)

Moving Farther but Faster: An Exception to Fitts's Law. JOS J. ADAM & ROBIN MOL, *University of Maastricht*, JAY PRATT, *University of Toronto*, & MARTIN H. FISCHER, *University of Dundee* (read by Jay Pratt)—Fitts's law holds that movement time (MT) increases with higher indexes of difficulty (IDs; resulting from smaller targets and/or longer movement distances) across a wide range of movement tasks. Specifically, Fitts's law states that MT increases as a logarithmic function of ID. Here we report a series of studies that show a violation of this law: When the target appears in a structured, linear display with multiple placeholders indicating the possible target locations, MTs to the most distant target (i.e., the highest ID) do not fit the logarithmic function that describes the less distant targets. Rather, the MT to the most distant target is equal to or less than the MT to the second most distant target. These experiments suggest that Fitts's law may be limited to egocentric visuomotor action, and, moreover, that the visual control of hand movements may use allocentric, in addition to egocentric, spatial information.

2:50–3:05 (222)

Rhythm in Golf. RICHARD J. JAGACINSKI, TAE HOON KIM, & STEVEN A. LAVENDER, *Ohio State University*—Golfers often talk about the *rhythm* of a golf shot without offering a precise definition of this term. The relative timing of the force pattern at the clubhead versus the force pattern against the ground provides a simplified definition of golfing rhythm. One advantage of this definition is that it facilitates comparisons across individuals with markedly different kinematic patterns of limb movement. Both (3 vs. 2) and (3 vs. 3) rhythmic force patterns were commonly exhibited in a study of short golf shots into a target net. Across individuals, shot accuracy was strongly correlated with the timing of the final weight shift relative to the force pattern early in the swing and also with the range of forces at the clubhead prior to impact.

3:10–3:25 (223)

Action Simulation Mediates Synchronization in Piano Duet Playing. BRUNO H. REPP, *Rutgers University, Newark, and Haskins Laboratories*, GÜNTHER KNOBLICH, *Rutgers University, Newark*, & PETER E. KELLER, *University of Management and Finance, Warsaw, Poland*—Ensemble musicians play in synchrony despite expressively motivated irregularities in timing. We hypothesized that synchrony is achieved by each performer internally simulating the concurrent actions of other ensemble members, relying initially on how they would perform in their stead. Hence, musicians should be better at synchronizing with recordings of their own earlier performances than with others' recordings. We required pianists to record one part from each of several piano duets and later to play the complementary part in synchrony with their own or others' recordings. The pianists were also asked to identify their own recordings. The pianists were better at synchronizing with their own than with others' performances, and they were able to recognize their own recordings. Furthermore, synchronization accuracy and recognition were correlated: Pianists who were relatively accurate at synchronizing with their own performances were also good at recognizing them. Thus, action simulation may underlie both synchronization and self-recognition.

3:30–3:45 (224)

Dyspraxia, Autism, and the Cerebellum: A Case Study. MORTON ANN GERNSBACHER, *University of Wisconsin, Madison*, & THOMAS A. ZEFFIRO & JOHN W. VANMETER, *Georgetown University Medical Center*—We provide a case study of a young male (current age 9 years, 7 mos.) who presents with genius-level intellectual skills, severe oral and limb dyspraxia, and autistic traits. The child's oral dys-

praxia is so severe that he struggles to produce vocal sounds and oral movements. His spontaneous utterances are belabored, primarily vocalic, and relatively unintelligible. The child's limb dyspraxia is so severe that despite his genius-level IQ, he is unable to accomplish simple commands such as "touch your nose," his imitation is profoundly impaired, and his manual gesture inventory is extremely limited. These difficulties in executing volitional movements contrast with his excellent coordination in tasks involving balance. Structural brain imaging revealed a striking loss of white matter density in the vermis of the posterior cerebellum and its connections, paralleling post-mortem analyses of "minimally verbal" individuals with autism. Implications for the speech, imitation, and gesture deficits sometimes associated with autism will be discussed.

Problem Solving

Civic Ballroom, Saturday Afternoon, 1:30–3:10

Chaired by Stellan Ohlsson, *University of Illinois, Chicago*

1:30–1:45 (225)

Multiple Difficulties in Insight Problem Solving: The Necklace Problem. TRINA C. KERSHAW, STELLAN OHLSSON, & STACIE HARISSIS, *University of Illinois, Chicago* (read by Stellan Ohlsson)—In previous work, we (Kershaw & Ohlsson, 2004) have suggested that insight problems are difficult because multiple converging difficulties—perceptual, knowledge, and process factors—conspire against the solution. In the present work, we apply this multiple-convergent-factors principle to the necklace problem. Participants solved versions of the necklace problem that were designed to eliminate one or more difficulties. Problem perception was manipulated by having participants build the three-link chains that figure in the problem. Process load was reduced by eliminating the prices assigned to problem steps in the standard presentation. The results show that the elimination of multiple difficulties led to higher solution rates than the elimination of a single difficulty. The results also show that participants in the process condition had higher solution rates and solved more quickly than participants in the perceptual condition. Implications for insight problem solving theories will be discussed.

1:50–2:05 (226)

The Influence of Incentives on Attention During Problem Solving. MAREIKE WIETH, *Albion College*, & BRUCE D. BURNS, *University of Sydney* (read by Bruce D. Burns)—Our previous research has shown increases in problem solving performance and memory due to incentives. Attention is essential in determining what information is processed, encoded, and later retrieved (Broadbent, 1958). It was therefore hypothesized that incentives increased performance because they either expanded or shifted attentional resources. Participants performed in either dual-task (tone monitoring while solving insight and incremental problems) or single-task (problem solving only) conditions. Results showed that incentives increased problem solving performance in the single-task but not in the dual-task condition. These findings indicate that incentives lead to an increase in performance by shifting attentional resources to the rewarded task rather than by increasing the pool of resources available for problem solving. In accord with this finding, where incentives were effective, they appeared to change the quality of processing. This methodology has the potential to provide further insight into how incentives affect cognitive processes.

2:10–2:25 (227)

Mental Comparisons With Complex Structures: Kin-Like Structures, Complex Trees, and Item-Specific Processing. CLAUDE G. CECH, *University of Louisiana, Lafayette*—In work presented previously, I showed that distance and congruity effects occurred with comparisons of relative age of individuals from learned family trees. Of particular significance was the finding that comparisons of nonlinear relatives took longer, consistent with a claim that people were sensi-

tive to the multidimensional structure of the family tree. I explore this finding further in three experiments. The first tests whether these effects occur with complex structures for which a familiar prototype such as a family tree is not available. The second looks at comparisons involving a more complex family tree in which up to four degrees of lineality are possible. The third demonstrates that the results depend on availability of item-specific information.

2:30–2:45 (228)

The Effects of Working Memory Capacity and Cognitive Load on Instructional Design: Subgoals Still a Good Idea. RICHARD CATRAMBONE, *Georgia Institute of Technology*—Learners studied example physics mechanics problems that either did or did not highlight relevant subgoals. They then solved isomorphs and far-transfer problems. During training and transfer, participants provided cognitive load ratings. Transfer performance was superior for participants who studied examples that highlighted subgoals. Cognitive load ratings were lower for the subgoal condition during both the training and problem solving phases. Participants' working memory capacity affected performance in the no-subgoal condition but not in the subgoal condition. This result suggests that examples designed to convey subgoals can place reduced loads on working memory, so that learners can more effectively acquire useful problem solving knowledge even with lower working memory capacity; less effective instructional materials might require learners to have greater working memory capacity in order to learn from them.

2:50–3:05 (229)

Symbolic and Perceptual Comparisons With Remembered Instructions. WILLIAM M. PETRUSIC, *Carleton University*, SAMUEL SHAKI, *College of Judea and Samaria*, & CRAIG LETH-STEENSEN, *Carleton University*—Semantic congruity effects (SCEs) were obtained in each of two experiments, one with symbolic comparisons and the other with comparisons of visual extents. SCEs were reliably larger when the instructions indicating the direction of the comparison were represented by consonant–vowel–consonant (CVC) nonsense syllables that had been associated with the usual instructions in a preliminary learning phase of the experiment. The enhanced SCE with the CVC instructions is not readily explained by any of the non-evidence accrual theories of the SCE (e.g., expectancy, semantic coding, and reference point). On the other hand, the general class of evidence accrual views of SCEs, such as those developed in Leth-Steensen and Marley (2000) and Petrusic (1992), receive considerable empirical support.

Spelling and Print-to-Sound Conference Rooms B&C, Saturday Afternoon, 1:30–3:30

Chaired by Rebecca Treiman, Washington University

1:30–1:45 (230)

Long-Distance Anticipatory Effects in Spelling-to-Sound Translation. REBECCA TREIMAN & BRETT KESSLER, *Washington University*—Phonological decoding of written words is often viewed as a serial process. To test this view, we examined whether college students' productions reflect sensitivity to English spelling patterns that require long-distance nonserial processing. Word-initial *g* is usually velar (hard), but before *e*, *i*, or *y*, it is coronal (soft) if the root word is classical or Romance (e.g., *giant* vs. Germanic *give*). Students were more likely to use the coronal pronunciation for nonwords with classical or Romance spelling patterns (e.g., *gepous*, *gileph*) than for those with native Germanic patterns (e.g., *gepness*, *gileff*). This tendency was found also for rare words, and to some extent for initial *c*. Students who had studied a Romance language produced more coronal pronunciations of initial *g* and *c* than did those who had not. Thus, when decoding word-initial letters, readers consider complicated and largely untaught patterns that extend to the ends of words.

1:50–2:05 (231)

A Challenge to Chaining Theories of Serial Order: An SRN Investigation. ARIEL M. GOLDBERG, ADAM B. BUCHWALD, & BRENDA C. RAPP, *Johns Hopkins University* (read by Brenda C. Rapp)—Serial behavior is the production of a set of items in the proper sequence. For example, spelling is an everyday task requiring serial behavior. Prominent among theories of serial order are chaining theories, which hold that serial order is achieved through interitem associations. We used simple recurrent networks (SRNs), which are generally assumed to instantiate complex chaining, to test the chaining hypothesis of serial order in spelling. The performance of SRNs trained to spell a large corpus of words was compared with that of two dysgraphic individuals suffering from damage to the serial order component of the spelling process. Although SRNs with simulated damage produced length effects matching those of the dysgraphics, very significant differences were found for multiple features, including serial position effects. These findings constitute an important challenge to chaining theories of serial order in spelling and, by extension, to chaining theories of serial order more generally.

2:10–2:25 (232)

Nature of Orthographic Representations: Disrupting the Graphemic Buffer in Unimpaired Spellers. ANGELA C. JONES & JOCELYN R. FOLK, *Kent State University* (read by Jocelyn R. Folk)—We investigated the hypothesis that the orthographic representations involved in spelling are multidimensional; consonant/vowel status, doubling information, and syllabic structure are part of orthographic representations (see, e.g., Caramazza & Miceli, 1990; McCloskey et al., 1994). The evidence for this hypothesis has come exclusively from studies of dysgraphic patients with damage to the graphemic buffer, the processing stage responsible for maintaining the activation of orthographic representations as serial output occurs. In the present study, we sought to examine the nature of orthographic representations in a neurologically intact sample by inducing cognitive load in unimpaired spellers, hindering the operation of the graphemic buffer. We examined the nature of the spelling errors produced under these conditions. We found convergent evidence for the multidimensional nature of orthographic representations. In addition, we found evidence of texture across and within orthographic representations; some words or letters within a word may be more strongly represented than others.

2:30–2:45 (233)

Even Preschool Children Show Orthographic Influences on Phonological Awareness Tasks. ANNE CASTLES, JOANNE WEDGWOOD, & VIRGINIA HOLMES, *University of Melbourne*—It is well established that experienced readers show influences of orthographic knowledge on their performance on tasks ostensibly tapping pure phonological awareness. For example, people tend to report that there are more phonemes in the word *pitch* than the word *rich*, because of the extra letter in the former word. Here we demonstrate that even preschool children are influenced by their emerging orthographic abilities when performing such tasks. Three- and 4-year-old children were required to identify the initial phonemes of words describing pictured objects, and their familiarity with the written form of the letters corresponding to those phonemes was assessed. An item-specific effect of letter knowledge was found: The children performed significantly better on items in the phonemic awareness test if they could identify the corresponding letter than if they could not. These results have important implications for theories of the role of phonological awareness in reading acquisition.

2:50–3:05 (234)

The Effect of Age of Acquisition on Bilingual Word Translation. J. MICHAEL BOWERS & SHELIA M. KENNISON, *Oklahoma State University* (read by Shelia M. Kennison)—An experiment with Spanish–English bilinguals tested the hypothesis that connections between conceptual representations and some first language (L1) words are

stronger than others. We hypothesized that the strength of memory connections would be influenced by the age of acquisition of individual words. L1 words learned early in life were predicted to have stronger connections to conceptual information than do L1 words learned later in life. Evidence for this hypothesis was obtained in an experiment with 36 highly fluent Spanish–English bilinguals for whom Spanish was a first language. Participants carried out a translation task in which they translated L1 words into the second language (L2) and L2 words into the L1 under conditions in which the words were presented in random order or blocked by semantic category (cf. Kroll & Stewart, 1994). The results have implications for models of bilingual word memory.

3:10–3:25 (235)

Ubiquitous Control of Lexical and Nonlexical Pathways in Reading Aloud. MIKE REYNOLDS & DEREK BESNER, *University of Waterloo* (read by Derek Besner)—Subjects were asked to read aloud words and nonwords that appeared one at a time in a predictable sequence. Control was assessed by measuring the effect of predictable switches in the lexicality and regularity of the stimuli. The results of three experiments are consistent with the claim that skilled readers can control the relative contribution from separate lexical and nonlexical routes when reading aloud.

Masked Priming and Word Recognition
Grand Ballroom Centre, Saturday Afternoon, 4:10–5:30

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

4:10–4:25 (236)

Masked Form Priming Effects and the Interactive-Activation Model. STEPHEN J. LUPKER, *University of Western Ontario*, COLIN J. DAVIS, *University of Bristol*, & JASON R. PERRY, *University of Western Ontario*—The ability of various versions of the interactive-activation model to explain masked priming effects was investigated in a series of experiments. Facilitation effects were obtained from a variety of form-related nonword primes: standard nonwords (*azle*–AXLE), partial nonwords (*h#use*–HOUSE) and letter pairs (*##ai#*–TRAIL). Inhibition effects were obtained from form-related word primes (e.g., *able*–AXLE) and from letter primes that, together with the rest of the target word, create a competing word (e.g., *##ia#*–TRAIL). The version of the model that was most successful in simulating these data was one that assumed that (1) letter activations are reset when the target is presented, (2) orthographic similarity modulates lexical inhibition such that lexical units only inhibit other lexical units with which they share letters, and (3) the lexical units activated by a letter string are more extensive than just those corresponding to the conventionally defined substitution neighbors.

4:30–4:45 (237)

Masked Orthographic and Phonological Priming: Evidence From ERPs. JONATHAN GRAINGER, *CNRS & University of Provence*, & KRISTI KIYONAGA & PHILLIP J. HOLCOMB, *Tufts University*—Masked priming combined with the recording of event-related brain potentials (ERPs) was used to plot the time course of orthographic and phonological processing in visual word recognition. Participants monitored target words for animal names, and critical (nonanimal) trials were primed by briefly presented (50-msec) pattern-masked nonwords that varied in terms of their orthographic and phonological overlap with target words. The earliest evidence for an orthographic effect on target word processing appeared at around 150 msec post–target onset, and phonological priming effects were already robust only about 50 msec later. These results fit with the predictions of the bimodal interactive-activation model, proposed over 10 years ago to account for a similar time course pattern in behavioral data.

4:50–5:05 (238)

The Neural Correlates of Long-Term Morphological Priming. JAY G. RUECKL, *University of Connecticut and Haskins Laboratories*,

STEPHEN J. FROST & W. EINAR MENCL, *Haskins Laboratories*, DANIEL J. YAFFEE, *University of Connecticut*, REBECCA SANDAK, *Haskins Laboratories*, & KENNETH R. PUGH, *Haskins Laboratories and Yale School of Medicine*—Event-related functional magnetic resonance imaging (fMRI) was used to identify the neural correlates of morphological priming in visual word identification. Subjects performed a continuous lexical decision task in which prime words preceded their targets at an average lag of about 10 intervening items. The neural response to targets primed by morphologically related words (*marker*–MARK) was contrasted with the responses to words primed by either identity primes (*mark*–MARK) or orthographically similar words (*market*–MARK). Morphological priming was associated with reductions in activation in a number of cortical regions, including in particular the occipitotemporal juncture (OT)—an area sometimes referred to as the “visual word form area.” The results are considered in light of both previous neuroimaging results concerning the neural basis of word identification and previous behavioral results suggesting an early, modality-specific basis for morphological priming.

5:10–5:25 (239)

Visual Word Recognition in Hebrew and English: Are the Differences Qualitative or Quantitative? RAM FROST & HADAS VELAN, *Hebrew University of Jerusalem*—Previous studies have reported marked differences in processing orthographic and morphological information in Hebrew and English. These differences concern effects of morphological priming compared with effects of simple orthographic priming. Are these differences quantitative or qualitative? Do Hebrew and English represent extreme ends of the same distribution, or do they differ qualitatively in their lexical organization? We present a series of experiments that compared performance of Hebrew–English bilinguals. Our empirical investigation explored effects of masked morphological and form priming and the impact of letter transposition on priming as well as on fast reading. Our results lead us to suggest that in contrast to English, the Hebrew orthographic lexicon is organized by morphological principles by which words are clustered in lexical space according to their root morphemes and not according to contiguous letter units. Thus, lexical architecture for visually presented words is primarily determined by morphological rather than by orthographic constraints.

Memory Processes II
Grand Ballroom East, Saturday Afternoon, 3:30–5:30

Chaired by Jeffrey N. Rouder, *University of Missouri, Columbia*

3:30–3:45 (240)

Selective Influence Within the Process Dissociation Model. JEFFREY N. ROUDER, *University of Missouri, Columbia*, JUN LU, *American University*, & PAUL L. SPECKMAN, DONGCHU SUN, & RICHARD D. MOREY, *University of Missouri, Columbia*—Although the process dissociation model (Jacoby, 1991) has been extraordinarily successful in assessing recollection and familiarity, it has a known statistical shortcoming. In conventional analyses, estimates of familiarity may be downward biased, making it difficult to assess selective influence (Curran & Hintzman, 1995). The bias comes about if participants with high recollection also have high familiarity or if items that are more recollectable are also more familiar. To get accurate estimates, it is necessary to model covariation of recollection and familiarity across both participants and items. We do so within a Bayesian hierarchical model with random effects for participants and items. On the basis of this improved analysis of empirical data, we show that (1) recollection and familiarity are uncorrelated across participants; (2) recollection and familiarity correlate highly across items; and (3) study duration selectively influences recollection and not familiarity.

3:50–4:05 (241)

Estimating Controlled and Automatic Processes in Free Recall Using the Process Dissociation Procedure. DAVID P. MCCABE, HENRY L.

ROEDIGER III, & JEFFREY D. KARPICKE, *Washington University* (read by Henry L. Roediger III)—Free recall is often assumed to be a direct index of recollection. However, some research suggests that automatic activation contributes to free recall. In three experiments, we examined the contribution of controlled and automatic processes to recall using the process dissociation procedure. Subjects studied categorized word lists under full- or divided-attention conditions. Later, they were forced to try to recall all of the words they studied, guessing if necessary (i.e., an inclusion condition). They also were required to produce an equal number of new category exemplars (i.e., exclusion). Results indicate that divided-attention reduced the recollection estimate (R), but the automaticity estimate (A) was equivalent for both full- and divided-attention conditions. Follow-up experiments estimating R and A using forced recall with subjective memory reports (remember/know/guess) and traditional free recall instructions led to identical results. These data indicate that, contrary to conventional wisdom, automatic processes makes a substantial contribution to free recall.

4:10–4:25 (242)

On the Status of Unconscious Memory: Merikle and Reingold (1991) Revisited. DAVID R. SHANKS & CHRISTOPHER J. BERRY, *University College London*, & RICHARD N. A. HENSON, *MRC Cognition & Brain Sciences Unit*—Merikle and Reingold (1991) reported priming for words in the absence of recognition memory in matched indirect (implicit) and direct (explicit) memory tests. Their striking result provides powerful and widely cited support for unconscious memory processes in normal subjects. Using the same paradigm, we report a series of experiments failing to replicate this key result. After a study phase, new and previously unattended words were presented against a background mask. Participants decided whether each word was old or new (direct task) or whether the contrast between the word and the background was high or low (indirect task). Unlike Merikle and Reingold, we consistently found that the magnitude of recognition memory was greater than or equal to that of priming. These results question the existence of implicit memory and are, instead, compatible with the view that performance on implicit and explicit memory tasks is mediated by a single conscious process.

4:30–4:45 (243)

Using Remember–Know Estimates Versus Categories to Explore the Wane of Childhood Amnesia. KRISTI S. MULTHAUP, DIANA AIKEN, ALLISON KAVANAGH, & CATHERINE JAHNES, *Davidson College*—To determine the wane of childhood amnesia, recent studies have used a threshold procedure in which participants classify childhood memories as *remember* or *know* memories (e.g., Bruce, Dolan, & Phillips-Grant, 2000; Multhaup, Johnson, & Tetirick, 2005). These studies have yielded a consistent finding of roughly 4.7 years as the transition point from childhood amnesia to the development of autobiographical memories. However, autobiographical memories are so complex, it is likely that a given childhood memory has aspects that are remembered and other aspects that are known. The present research modified prior procedures by allowing participants to estimate the percentages of given childhood memories that were remembered or known, rather than forcing participants to place their memories entirely into either category. The transition point with the modified estimation procedure is roughly 4.7 years of age, replicating the prior findings.

4:50–5:05 (244)

Using Sampling and Recovery to Estimate Context and Item Effects in Memory. DAVID E. HUBER, YOONHEE JANG, & JAMES P. VAN OVERSCHELDE, *University of Maryland, College Park*—Many global memory models assume that memory retrieval consists of two components, with sampling depending on the effectiveness of contextual cuing and the relative strength of encoding and recovery depending on the adequacy of lexical–semantic knowledge for target items. Using data from two different sets of experiments, we applied a simplified version of sampling and recovery to describe data pat-

terns in terms of the respective contributions of context and item. In two recall experiments, we measured the effects of preexposure training on recall of high- and low-frequency words in pure and mixed lists. In other experiments, we tested recall and recognition for the “list before the last,” examining interference as a function of intervening list length and target list length. Similar to signal detection theory, this descriptive memory modeling is applied to individual subject data, with the resultant parameters analyzed using standard inferential statistics.

5:10–5:25 (245)

On Jost’s Law, Individual Differences, and Asymptotes. ANDREW J. HEATHCOTE, *University of Newcastle*, & MICHAEL S. HUMPHREYS, *University of Queensland*—On the basis of an analysis of participant-average retention functions, Wixted (2004) rejected exponential forgetting and supported Jost’s law. His conclusions depend on two assumptions, that eventually forgetting is complete (asymptotically, retention is zero) and that participant averaging does not cause bias. We show that participant averaging did bias his analyses, and that when this bias is avoided by analyzing individual participant retention functions, results support an asymptote greater than zero and exponential forgetting for most participants. We propose a model of forgetting based on retrieval failure that is consistent with exponential forgetting, nonzero asymptotes, and individual differences.

**Attention During Tracking and Motion
Grand Ballroom West, Saturday Afternoon, 4:10–5:30**

*Chaired by Todd S. Horowitz
Brigham & Women’s Hospital and Harvard Medical School*

4:10–4:25 (246)

How Do Distractors Affect Performance on the Multiple-Object Tracking Task? TODD S. HOROWITZ, *Brigham & Women’s Hospital and Harvard Medical School*, & SKYLAR S. PLACE, *Brigham & Women’s Hospital*—Recent evidence from multiple-object tracking (MOT) experiments suggests that distractors must be actively suppressed. Does distractor suppression require the same attentional resource as target tracking? To answer this question, we developed a new MOT task that allows us to vary target and distractor load independently. Observers tracked one, four, or eight target disks moving against a grid of stationary disks. After 2–4 sec, moving disks stopped coincident with the grid, then all disks changed color to mask targets. One stationary disk was probed, requiring a *yes* or *no* response. We tested the effect of the mere presence of distractors by comparing performance with zero distractors and one distractor; there was no effect. Next, observers tracked four targets with zero, one, two, three, or four distractors. The number of distractors had no effect. Segregating targets from distractors does not draw on the resource used to track targets.

4:30–4:45 (247)

The Dynamics of Time-Sharing Control. PAMELA S. TSANG, JEFF T. FLINN, BRYAN V. STORK, & JEFF M. DEVRIES, *Wright State University*—This study examined the cognitive and motor control of time-sharing a continuous tracking task and a discrete spatial processing task. A dynamic task difficulty manipulation and the relative priority manipulation were used to induce resource allocation between the time-shared tasks. Difficulty of the tracking task was manipulated dynamically within a trial. Task difficulty and response modality of the spatial task were manipulated between trials. A microanalysis of the continuous performance time locked to the response of the discrete task was used to examine the structural constraints and strategic control of the time-sharing performance. Forty-two subjects completed approximately 20 h of task performance each.

4:50–5:05 (248)

The Role of Attention in Processing Rotary Motion Across Fixations. ALEXANDER POLLATSEK, IBRAHIM DAHLSTROM-HAKKI, &

TIMOTHY J. SLATTERY, *University of Massachusetts, Amherst*—Participants viewed two rotating lines side by side. Each rotated around its center, but at different angular velocities. Initial fixation was above the two lines, and participants saccaded to another location below the lines. During the saccade, there was a change in the motion of one, both, or neither of the lines. (The change was an “advance” in the rotation sequence followed by rotation at the initial velocity.) There were two instruction conditions: (1) selective attention—detect changes in one of the two lines; (2) divided attention—detect changes in either (or both) lines. Although performance was better in the selective attention condition, the difference was smaller than was predicted if attention can only be directed to one line; in contrast, performance was not very divergent from assuming two independent parallel channels.

5:10–5:25 (249)

Exploring Attentional Control of Attentional Capture Using Illusory Line Motion and Human Performance. YOKO ISHIGAMI, JOHN J. CHRISTIE, & RAYMOND M. KLEIN, *Dalhousie University* (read by Raymond M. Klein)—Uninformative peripheral cues and digit targets were combined with illusory line motion probes in order to explore attentional capture. Cues were presented above, below, to the left, and to the right of fixation. Any marker could brighten, but for a particular participant targets only appeared on the horizontal or vertical axes. Occasionally, a diagonal line was presented connecting two of the 8s. Such lines are seen to be drawn away from a cue when the cue is adjacent to the line. Digit identification and line judgment performance revealed that attention was captured by exogenous cues even when they were presented at task-irrelevant locations. When the line task was removed, the digit task revealed that attention was not captured by cues presented at task-irrelevant locations. An experiment is underway to determine what prevented the establishment of attentional control settings at task-relevant locations: The spatial presentation of the line probes or memory load due to the dual task.

Serial Recall

Dominion Ballroom, Saturday Afternoon, 4:10–5:30

Chaired by Stephan Lewandowsky, *University of Western Australia*

4:10–4:25 (250)

Temporal Isolation Does Not Benefit Short-Term Memory for Serial Order. STEPHAN LEWANDOWSKY, *University of Western Australia*, GORDON D. A. BROWN, *University of Warwick*, & LISA M. NIMMO, *University of Western Australia*—According to the popular temporal distinctiveness notion, items that are temporally isolated from their neighbors during list presentation should be recalled better than temporally crowded items. We report several experiments in which list items were separated by unpredictably varying temporal pauses. Irrespective of whether memory was tested by serial recall, serial reconstruction, or probed recall, temporal isolation did not benefit memory for serial order unless participants used pauses to group a list or the temporal list structure was predictable. Simulations of the SIMPLE model provide convergent evidence that memory for serial order need not involve temporal representations.

4:30–4:45 (251)

The Role of Domain-Specific Background Knowledge on Serial Recall: Theory and Data. MATTHEW M. BOTVINICK, *University of Pennsylvania*—Knowledge concerning domain-specific regularities in sequential structure has long been known to affect recall for serial order. However, little work has been done toward specifying the exact role such knowledge plays. In recent work, we have proposed a theory of serial recall in structured domains, based on Bayesian decision theory and a set of representational assumptions proceeding from recent computational and neurophysiological research. The theory makes specific predictions concerning the relationship between sequence structure and the probability of correct recall and concerning the characteristics of sequencing errors in structured domains. These predic-

tions have been tested and confirmed through subsequent behavioral work, in which participants performed immediate serial recall on sequences generated from an artificial grammar. Our empirical findings, together with earlier observations concerning background knowledge and serial recall, present a challenge to some prominent theories of short-term memory for serial order and provide useful constraints on further theory development.

4:50–5:05 (252)

Phonological and Semantic Interference in Serial Recall: Bringing in the Lexicon. AMIT ALMOR, *University of South Carolina*—Six experiments examined how phonological and semantic relatedness affect serial recall. Replicating previous research, phonological relatedness interfered with recall. Semantic relatedness, however, facilitated the recall of related words, but interfered with the recall of some of the unrelated words in the same lists. Both the facilitation and the interference associated with semantic relatedness were enhanced when the task required lexical semantic processing either because the stimuli were acoustically degraded or because a secondary semantic judgment task was added. The finding that semantic relatedness can at the same time facilitate and interfere with recall may explain the inconsistent semantic overlap effects in the literature, in which the sum effect of facilitation and interference was mistakenly interpreted as a weak or nonexistent effect. Furthermore, the interference associated with semantic relatedness can help explain why in some areas of language processing (e.g., referential processing) semantic relatedness has been shown to slow processing.

5:10–5:25 (253)

Immediate Serial Recall, Nonword Repetition, and Nonword Learning: A Computational Model. PRAHLAD GUPTA, JAMIE TISDALE, & BRANDON ABBS, *University of Iowa*—The relationship between immediate serial list recall (ISR) and nonword repetition (NWR) has been studied intensively in recent years. We present a computational model of performance in ISR and NWR tasks, offering an account of key findings that have suggested a relationship between these abilities. Simulations using the model exhibit (1) serial position effects in both ISR and NWR (as documented recently in Gupta, 2005, and Gupta et al., in press); (2) correlations between performance in these tasks, as has been widely documented in the literature; (3) deficits (following simulated damage to the model) in both ISR and NWR, but not in repeating known words, similar to the neuropsychological syndrome termed a *pure short-term memory deficit*; and (4) gradual learning of nonwords following multiple exposures to them, corresponding to empirical data to be presented. The model thus offers an account of the interplay between short-term memory and long-term learning.

Expertise and Real-Life Decision

Civic Ballroom, Saturday Afternoon, 3:30–5:30

Chaired by Shawn P. Curley, *University of Minnesota*

3:30–3:45 (254)

What Can the Popular Press Teach Us About Software Piracy? SHARIFFAH ZAMOON & SHAWN P. CURLEY, *University of Minnesota* (read by Shawn P. Curley)—Ethical decisions are a special class of decisions that are characterized by a combination of the social nature of the decision and the use of ethical norms and principles for justifying decisions. The rapid development of technology has led to situations (e.g., with software piracy) in which our society has not yet developed consensual norms—software producers decry the billions of losses due to piracy, but those engaged in the activity disavow any ethical difficulties. Articles reporting on software piracy in the highest circulation U.S. newspapers from 1989 to 2004 are used as data on the social construction of the reality of software piracy and attitudes toward it. A content analysis is performed, identifying rationales for and against software piracy. These rationales are also analyzed within

Sykes and Matza's (1957) framework of neutralization techniques—that is, arguments for the temporary removal of norms or for qualification of their application.

3:50–4:05 (255)

Can Expert Decision Making Be Improved? Four Successes and One Failure. JAMES SHANTEAU, *Kansas State University*, BRIAN FRIEL, *Delaware State University*, RICK THOMAS, *Carnegie Mellon University*, & JOHN RAACKE, *Briar Cliff University*—Despite the obvious need to improve expert decision making, most previous approaches (e.g., debiasing or giving outcome feedback) have been unsuccessful. The present paper summarizes results from five studies using a different strategy: Experts used a hands-on approach of self-discovery to learn how to distinguish relevant from irrelevant information in ambiguous situations. Four of these studies succeeded, one failed. In each of the four successes (soil judging, nursing diagnosis, small business innovation, and air traffic control), focusing attention on reducing the impact of irrelevant information led to improved decision quality. However, the approach was unsuccessful when applied to accountants making decisions involving sunk costs. Thus when experts can distinguish relevant from irrelevant information, their decisions can be improved by ignoring irrelevance. But, when experts cannot make this distinction (e.g., for sunk costs), their decisions remain unimproved.

4:10–4:25 (256)

Directionality of Reasoning by Lay People When Solving Health Problems. VIMLA L. PATEL & DAVID R. KAUFMAN, *Columbia University*—The ability to draw appropriate inferences under conditions of uncertainty is one of the distinguishing characteristics of expert performance. We have conducted numerous studies that have characterized differences in reasoning strategies across levels of expertise. In most domains, experts tend to use a forward-directed reasoning strategy in which evidence leads sequentially to a solution, whereas less-expert subjects are more likely to employ backward or hypothesis-driven strategies. In our present study, we investigated sexual decision-making in young adults, who are at high risk of HIV infection. Directionality of reasoning was analyzed in the explanations provided for condom use decisions by subjects who were either consistent or inconsistent in their use. The results show the shifts in directionality of reasoning in lay people to be consistent with degree of uncertainty in dealing with problems, similar to findings for professionals' reasoning.

4:30–4:45 (257)

Dual Processes in Estimating Risks: A Fuzzy-Trace Theory Approach. VALERIE F. REYNA, *Cornell University*—Prior work on fuzzy-trace theory has provided a theoretical analysis of decision framing effects that stresses dual intuitive and analytical processes. Research will be reported on an ironic effect in health decision making that emerges from this analysis. The predicted finding is that, counterintuitively, people will seek screening tests when they are already sick and will avoid the same tests when healthy. Similarly, people estimate the probability of having a cancer gene given that they develop cancer as higher than the probability that they will develop cancer given that they have the gene, reversing the objective probabilities. These findings were investigated by asking subjects to estimate risks of breast cancer and genetic mutations that cause breast cancer, as well as to report their behaviors and intentions regarding cancer screening and genetic testing. Variations in quantitative processing—numeracy—and experimental manipulations of denominator neglect modulated the effects.

4:50–5:05 (258)

Toward a Valid Risk Taking Scale: Evolutionary Domains and Personal Life History. X. T. WANG, *University of South Dakota*, DANIEL KRUGER, *University of Michigan*, & ANDREAS WILKE, *Max Planck Institute for Human Development*—In response to recent calls for domain-specific measures of risk taking, this study emphasized the need of evolutionarily valid domains. A total of 693 participants

responded online to a set of questionnaire items and rated them in terms of perceived riskiness, attractiveness, and the likelihood of engaging in a risk behavior. An exploratory factor analysis identified five domains of risk taking (i.e., within-group competition, between-groups competition, survival and physical risks, mating and mate attraction, and reproductive risks). Most monetary items did not have high factor loadings. We further hypothesized that reduction in the values of life history references would make personal goals more eminent and risks worth taking. We found that the attractiveness and likelihood measures were negatively related to subjective life expectancy, age, and reproductive goals (the maximum desired number of offspring) in specific risk domains. Men were more risk taking than women in all five domains.

5:10–5:25 (259)

Effects of Knowledge and Display Design on Eye Fixations While Interpreting Weather Maps. MATT CANHAM & MARY HEGARTY, *University of California, Santa Barbara* (read by Mary Hegarty)—It has been proposed that experts focus on the most relevant information in a visual display, whereas novices are drawn to the most salient information. It is not well understood how these differences develop or how much knowledge and experience are required for processing differences to appear. Three experiments examined how eye fixations on a weather map and performance in a simple weather forecasting task changed with brief instruction on meteorological principles. After instruction, novices spent more time fixating on task-relevant aspects of a weather map and less time fixating on irrelevant aspects. Their performance on the weather forecasting task also improved, and improvement was greater when they viewed weather maps that made the most relevant information salient. However, objective measures of saliency were poor predictors of novices' eye fixations. The results are interpreted in terms of the relative importance of top-down and bottom-up processes in graphics comprehension.

Disordered Memory

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

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

3:50–4:05 (260)

Synesthesia, Memory, and Comprehension. GABRIEL A. RADVANSKY & BRADLEY S. GIBSON, *University of Notre Dame*—Synesthesia is a condition in which qualia of one sensory modality bleed over into another (e.g., sound produces the sensation of color). Most work on synesthesia has addressed issues of the mechanisms that give rise to this condition, as well as the perceptual and attentional consequences. In this study, we take a different tack by investigating how synesthesia affects higher level processes such as memory and comprehension. Synesthetes and normals were given a series of simple and complex working memory span tests, von Restorff and other color-based memory tests, and sentence memory and story reading tasks. Our findings show that there is some memory benefit for synesthetes for information such as letters and words. However, at the situation model level, there appears to be a processing cost. Thus, the altered perceptual experience associated with synesthesia may result in different emphases for memory and comprehension.

4:10–4:25 (261)

Multinomial Modeling of Source Monitoring Biases in Schizophrenia. TODD S. WOODWARD & JENNIFER C. WHITMAN, *Simon Fraser University*, MAHESH MENON, *Centre for Addiction and Mental Health*, & XIANGEN HU, *University of Memphis*—Hallucinations and delusions in schizophrenia partially reflect inner/outer confusions in cognition. Thus, source monitoring has proven an important paradigm for investigating the cognitive mechanisms underlying psychotic symptoms. In the present study, participants were required to recall the source of items originating from external (computer and experimenter) or internal (the subject) sources. Multinomial modeling was

used to estimate independent externalization and internalization bias parameters by employing a novel statistical/cognitive model. The results provided support for a double dissociation: Hallucinating patients displayed evidence for an externalization but not an internalization bias, whereas delusional patients displayed evidence for an internalization but not an externalization bias. Neither symptom group displayed an increased likelihood of external source confusion.

4:30–4:45 (262)

Dissociation Between Control of Study Time Allocation and JOL in Patients With Schizophrenia. ELISABETH BACON, *INSERM*, MARIE IZAUTE, *CNRS*, & JEAN-MARIE DANION, *INSERM*—The use of semantic tasks has revealed dysfunctional metamemory in schizophrenia. This study investigated whether patients with schizophrenia exhibit metamemory abnormalities during the encoding of episodic information. The frequency of item presentation was here varied. Both memory monitoring and memory control were then assessed using judgments of learning (JOLs) and study time allocation, respectively. Patients' JOLs were lower than those of controls but remained sensitive to item repetition; patients' predictive values on memory accuracy were not different from those measured in controls. However, patients' patterns of response were abnormal when considering the study time allocated for each item in function of presentation frequency. In addition, none of the patients reported using efficient strategies to help memorize target items. These results argue in favor of impaired strategic regulation of episodic memory encoding in schizophrenia.

4:50–5:05 (263)

Memory and the Korsakoff Syndrome: A Problem of Conscious Recollection at Retrieval. GÉRY D'YDEWALLE & ILSE VAN DAMME, *University of Leuven*—At study, participants generated an association or counted the number of letters with enclosed spaces or the number

of vowels in target words. At test, three-letter stems were presented. One group was instructed to use the stems to retrieve the targets; another group was instructed to complete the stems with the first word that came to mind but to use another word if that first word was a target word; and a third group was instructed to complete the stems, and no reference was made to the target words. A levels-of-processing effect appeared in almost all conditions, and when they were allowed to guess, the performance of Korsakoffs matched the performance of controls. However, Korsakoffs were unable to suppress the target words. Korsakoffs were also unable to indicate whether they remembered or simply knew an item, suggesting a lack of conscious recollection at test, despite the availability of the encoded items.

5:10–5:25 (264)

Dual-Task Coordination and Episodic Memory in Alzheimer's and in Depression. ROBERT H. LOGIE, *University of Edinburgh*, REINER KASCHEL & FRANZISKA GOEHRKE-ARNDT, *University of Giessen*, & SERGIO DELLA SALA, *University of Edinburgh*—Our previous studies indicated that individuals with early-stage Alzheimer's disease (AD) show substantial and reliable impairments in dual-task performance (digit recall with tracking) that are not present in healthy aging and are independent of single-task performance and of task demand. Episodic memory impairment is an additional characteristic of AD, but it also occurs in healthy aging and in other disorders of old age, such as chronic depression. This paper presents recent data demonstrating the robust nature of our previous results for AD and healthy aging, but also showing a lack of dual-task impairments in nondemented individuals suffering from chronic depression, despite the presence of episodic memory failures in the latter group. Results are interpreted as suggesting a specific dual-task coordination function within healthy multicomponent working memory that is affected by AD but not by age or depression.

Event Cognition**Grand Ballroom Centre, Sunday Morning, 8:00–10:00***Chaired by Kathy Pezdek, Claremont Graduate University***8:00–8:15 (265)**

Eyewitness Guessing: Does Postevent Guessing During Police Interrogation Suggestively Influence Eyewitness Memory? KATHY PEZDEK, KATHRYN SPERRY, SHIRLEY LAM, & SHANA OWENS, *Claremont Graduate University*—Two experiments confirm that encouraging eyewitnesses to guess when they are unsure of the answer to a question suggestively influences their memory. In Experiment 1, subjects viewed a 5-min video of a crime, followed by 22 questions: (1) 16 answerable questions and (2) 6 unanswerable questions about information not observed in the video. Subjects in the “forced guess” experimental condition were instructed to answer all questions; they were not given a “don’t know” response option. Subjects in the “no guess” control condition answered the same 22 questions, but with a “don’t know” response option. One week later, subjects answered the same 22 questions with the “don’t know” response option provided. Thirty-eight percent of the subjects who were forced to answer unanswerable questions at Time 1, gave the same answer at Time 2, even when the “don’t know” response option was available. Experiment 2 replicated Experiment 1 and further demonstrated that the subjects who guessed answers to unanswerable questions three times at Time 1 were even more likely to provide that same guessed answer at Time 2. Encouraging eyewitnesses to guess answers to questions about which they report having no memory is a forensically inappropriate procedure.

8:20–8:35 (266)

Effects of Age and Response Deadlines on Unconscious Transference in Eyewitness Memory. ALAN W. KERSTEN, JULIE L. EARLES, & ARIAN R. LOMER, *Florida Atlantic University*—This research examined the ability of young and older adults to associate actors with their actions. Participants viewed a series of video clips involving 60 different actors performing 60 different actions. One week later, participants were tested for recognition of static frames from the video clips. Participants were given either a short or a longer period of time to respond. The critical test type involved an actor seen at encoding performing an action that had been performed by a different actor at encoding. Young adults given a short deadline resembled both groups of older adults in their false recognition of these conjunction stimuli, whereas young adults given a longer deadline showed less false recognition of the conjunction stimuli. These results are consistent with the theory that unconscious transference results from the familiarity of an actor and an action in the absence of recollection of the contexts in which they were encountered.

8:40–8:55 (267)

Effects of Aging and Dementia on Event Perception and Event Memory. JEFFREY M. ZACKS & NICOLE K. SPEER, *Washington University*, JEAN M. VETTEL, *Brown University*, & LARRY L. JACOBSON & MARTHA STORANDT, *Washington University*—To stay oriented, to remember the past, and to plan for the future, people segment ongoing activity into discrete events. Two experiments studied how event segmentation and event memory change with healthy aging and very mild dementia of the Alzheimer type. After watching movies of everyday activities and segmenting them into meaningful events, participants were given tests of memory for the events in the movies. Segmentation was impaired in older adults in comparison with younger adults and impaired further in people with dementia. Memory for temporal order and for visual details showed a similar pattern. Within the older participants, poor segmentation was associated with poor memory. Poor knowledge for the typical structure of everyday events also was associated with poor later memory. These measures of event perception and memory were partially dissociable from general cognitive fitness and thus may indicate a unique source of cognitive changes in aging and dementia.

9:00–9:15 (268)

Schema Consistency and the Misinformation Effect. ROBERT F. BELLI & ROBERT J. NEMETH, *University of Nebraska*—Our study explored the combined effects of schematic knowledge, contradictory/additive misinformation, and retention interval on the production of false memories. Shortly following exposure to scenes, subjects were misled with items that were schema consistent (a toaster in a kitchen) or inconsistent (a stapler in a kitchen) and which either did or did not contradict an original item (a tape dispenser in a kitchen). A cued recall test with *remember* and *know* judgments followed either 10 min or 1 week later. A 2 (consistent, inconsistent) \times 2 (contradictory, additive) \times 2 (remember, know) \times 2 (10 min, 1 week) ANOVA revealed only two main effects: Schema-inconsistent misinformation led to significantly more false memories, as did the shorter retention interval. Results are inconsistent with those of Roediger et al. (2001), who found that items with higher schema consistency produce more false memories, and they do not replicate those of Frost (2000), who found that remember responses increased with a longer retention interval for additive misinformation.

9:20–9:35 (269)

Color Change as a Cause of Object Movement: Revisited. MICHAEL E. YOUNG & OLGA NIKONOVA, *Southern Illinois University, Carbondale*—Michotte (1946/1963) concluded that color “has no bearing whatever on the question of qualitative causality” (p. 235). Surprisingly, this claim has received little empirical investigation in the 60 years since its publication. In a series of experiments involving the launching effect, we investigated people’s judgments of delayed causation when the delay was filled with a sequence of discrete or continuous color changes to the launching object. Judgments of causation were significantly stronger when the delay was filled by color changes rather than unfilled, but the relationship between the type of color change and judgments was context dependent.

9:40–9:55 (270)

Asymmetries in Motion Event Representations. LAURA M. LAKUSTA, ALLISON WESSEL, & BARBARA LANDAU, *Johns Hopkins University* (read by Barbara Landau)—In language there is a bias to represent goals (end points) over sources (starting points). The present studies explored the possibility that this bias originates in the nonlinguistic representation of events using a nonlinguistic change detection method. Four-year-olds and adults were shown pairs of motion events in which the second event changed in terms of source, goal, figure, or motion or did not change at all. After viewing the second event, participants judged whether the events were the same or different. In Experiment 1, goal changes were correctly detected more often than source changes, suggesting a nonlinguistic goal bias. However, this bias became weaker when the actor gazed at the source rather than at the goal while motion occurred (Experiment 2) and when the events contained only inanimate objects (Experiment 3), suggesting that intentionality plays a key role in the representation of events and that of goals are important.

Errors in Judgment and Decision Making
Grand Ballroom East, Sunday Morning, 8:00–10:00

*Chaired by George L. Wolford, Dartmouth College***8:00–8:15 (271)**

The Effect of Context on Evaluating Mammograms. GEORGE L. WOLFORD & ANNE P. ROWLAND, *Dartmouth College*—Misread mammograms underlie one of the most common types of malpractice suits. The evaluation of earlier mammograms in such suits takes place in the face of subsequent knowledge about the existence and often the location of a tumor. In a controlled experiment, we examined the effect of such knowledge on the identification of tumors. We found that knowledge about presence and location led to significant increases in identifications of tumors in earlier stages. Our work suggests that

many malpractice suits in mammography are influenced, perhaps wrongly, by this hindsight bias.

8:20–8:35 (272)

“As Soon As the Bat Met the Ball, I Knew It Was Gone”: Accuracy and Hindsight Bias in Predicting Action Outcomes. ROB GRAY, *Arizona State University*, SIAN L. BEILOCK, *University of Chicago*, & THOMAS H. CARR, *Michigan State University*—Hindsight bias (the “knew-it-all-along effect”) provides a measure of strength and resistance to distortion of memory for predicted outcomes. A virtual-reality batting task was used to compare novice and expert baseball players’ ability to predict their swing outcomes, as well as players’ susceptibility to hindsight bias. During each swing, the simulation stopped when bat met ball. Batters marked where on the field they thought the ball would land. Correct feedback was then displayed, after which batters attempted to re-mark the location they had indicated prior to feedback. Expert batters made more accurate initial predictions and showed less hindsight bias in their postfeedback marking. Furthermore, prediction accuracy and hindsight bias were inversely related to number of hits in the previous block of trials. These results suggest that experts pay attention to different real-time performance information than do novices and that experts’ attention changes dynamically as a function of performance success or failure.

8:40–8:55 (273)

Paradoxical Optimism About What Might Have Been. AIDAN FEENEY, IAN M. DAVISON, & VICTORIA M. TILLET, *Durham University*—When things go wrong, people often consider how events might have turned out better. One view is that beliefs that things could easily have been better amplify negative affect. In the first study described here, we found that people expressed more confidence that a preferred alternative outcome could have happened than did a group of observers judging the same outcome. In a second study, we showed that for recent and distant regrets, high self-esteem (HSE) participants were more confident that things could have been as they would have preferred than low self-esteem (LSE) participants. However, LSE participants reported more intense regrets than did HSE participants. Degree of confidence did not predict intensity of regret. Taken together, these results suggest that people hold optimistic beliefs that things could have been better and that rather than amplifying negative affect, such beliefs make people feel better about themselves.

9:00–9:15 (274)

A Statistical–Ecological Account of the Effects of Sample Size on Correlational and Causal Inference. RICHARD B. ANDERSON, MICHAEL E. DOHERTY, & JEFF C. FRIEDRICH, *Bowling Green State University*—Research on the distributional characteristics of correlation coefficients, and of other measures of statistical association, suggests that when the task is to detect the presence of a population correlation, the environment can favor organisms that are limited in their capacity to gather and process information. When the task is to estimate the strength of a population correlation, however, such organisms may be disadvantaged. In a behavioral study of correlation detection, if the decision criterion was extremely liberal, detection was more accurate when based on a small rather than a large sample; if the criterion was moderate or conservative, accuracy was greater for large than for small samples. A second study examined people’s ability to estimate (rather than simply decide on the presence or absence of) population correlations, and yielded preliminary evidence suggesting that small samples may lead to exaggerated estimations of relationship strength.

9:20–9:35 (275)

Comparison-Induced Anchoring Effects. JESSICA M. CHOPLIN & MARK W. TAWNEY, *DePaul University*—We propose a comparison-induced distortion theory (Choplin & Hummel, 2002) account of anchoring effects, wherein biases created by verbal comparisons mediate the effects of anchors on estimation. This model, like previous

models of anchoring effects, usually predicts biases toward anchor values, but unlike previous models, it sometimes predicts biases away from anchor values. Furthermore, unlike previous models, this model predicts that the words used to express comparisons will influence estimation. The predictions of this model were tested in two experiments. In Experiment 1, participants were asked to compare the to-be-estimated value to the anchor, and the words used to express the comparison were manipulated before the participants estimated the value. Experiment 2 featured the same task, but the range of acceptable estimates was constrained in order to test the prediction that anchors will sometimes bias estimation away from anchor values. The results of these two experiments suggest that some anchoring effects are comparison induced.

9:40–9:55 (276)

Understanding and Modeling Human Sequential Decision Making Under Uncertainty Using Bayesian Statistics. BRIAN J. STANKIEWICZ, CHRIS GOODSON, & ANTHONY R. CASSANDRA, *University of Texas, Austin*—The present study investigates human performance in a sequential decision making with uncertainty task in which the observer’s task is to localize a target using reconnaissance and “destroy” the enemy using artillery. Each of these actions comes with a cost, and the outcomes of these actions are probabilistic. Using a partially observable Markov decision process (Bayesian model), we calculated the optimal performance and compared this performance to the humans’ performance. We found that subjects performed at about 60% efficiency in this task. Further studies revealed that one of the primary limitations preventing human subjects from acting optimally was an inability to accurately update the likelihood of the true state of the system given the previous actions and observations. By providing subjects with an external representation that updated the likelihoods, subjects’ efficiency values increased to 80%–90%.

Associative Representations

Grand Ballroom West, Sunday Morning, 8:00–9:40

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

8:00–8:15 (277)

A Turing Test of a Generative Word Association Model. JON WILLITS & CURT BURGESS, *University of California, Riverside* (read by Curt Burgess)—The (free) association strength between words is used as a basis for many theories of semantic memory and as an explanatory construct for countless memory retrieval effects. Word associations represent a set of relationships between words but provide little theoretical insight into exactly how and why certain words are associated and others are not. A model of word association productions is presented that is based on the probability of two words co-occurring within language and the contextual substitutability (or global co-occurrence similarity) of the two words. The model was used to generate word associations for 30 stimuli, and these associations were compared against those produced by human subjects. Experts (cognitive psychologists) and novices (undergraduates) were tested on their ability to distinguish the human and model-generated associations, constituting a Turing test of the model. This understanding of the word generation process provides a theoretical understanding of this long-used technique.

8:20–8:35 (278)

Using Global Co-Occurrence to Predict Word Associations, Features, and Semantic Priming. JON WILLITS & CURT BURGESS, *University of California, Riverside*, & CATHERINE DECKER, *Chaffey College* (read by Catherine Decker)—Featural similarity and word association strength (both via production norms) can be used to model most semantic memory effects. However, they provide little theoretical insight into how representations based on these relationships come about. We suggest that both are emergent by-products of statistical relationships in the learning environment. Two simulations were performed, modeling human-generated feature productions and word as-

sociations using conditional probability and global co-occurrence similarity (from the HAL model). A priming experiment was conducted, attempting to see what relationship (association strength, feature similarity, or global co-occurrence similarity) explained the most variance in RT. Results showed that after accounting for categorical relatedness, only global co-occurrence similarity predicts additional RT variance. The facts that these statistical relationships can predict normative productions and explain RT differences that norms cannot explain supports the argument that a representation based on these statistical relationships forms the most comprehensive and parsimonious theory of semantic representation.

8:40–8:55 (279)

Assessing Summaries With Human Judgments Procedure and Latent Semantic Analysis. JOSÉ A. LEÓN, RICARDO OLMOS, & INMACULADA ESCUDERO, *Universidad Autónoma de Madrid*, & JOSÉ J. CAÑAS & LALO SALMERÓN, *Universidad de Granada*—In this study, we tested a computer-based procedure for assessing very concise summaries (50 words) using latent semantic analysis (LSA) combined with four expert human judgments and two types of text (narrative and expository). LSA was used to estimate semantic similarity using six different methods: four holistic (summary–text, summary–summaries, summary–expert summaries, and pregraded–ungraded summary) and two componential methods (summary–sentence text and summary–main sentence text). A total of 390 Spanish middle grade students (14–16 years old) and six experts read a narrative or expository text and later summarized it. Despite the fact that results supported the viability of developing a computerized assessment tool using human judgments and LSA, human reliability–LSA was higher in the narrative text than in the expository, and LSA correlated more with human content rates than with human coherence rates. Finally, holistic methods were found to be more reliable than the componential methods analyzed in this study.

9:00–9:15 (280)

Semantic Network Structure Appears in a Social Network in Dreams. RICHARD J. SCHWEICKERT, *Purdue University*—In a semantic network for words, each word is represented as a vertex, and two vertices are connected if the corresponding words have similar meaning, indicated by, say, appearing in the same category in Roget's thesaurus. Steyvers and Tenenbaum (2005) found that such networks have three properties of a class of networks called small-world networks. Average distance between two words is small, clustering is high, and the number of connections for each vertex follows a power law. These properties are of interest because they appear in structures such as the World-Wide Web. Finding these properties in semantic networks suggests that human memory has them as well. Evidence from sleep labs indicates that dreams are largely a product of memory. If so, one would expect to see small-world properties appearing in dreams. Analysis is presented of the social network of characters appearing in the dreams of an artist.

9:20–9:35 (281)

A Framework for Analyzing Sequence Learning. JOSEPH TZELGOV & AMOTZ PERLMAN, *Ben Gurion University of the Negev*—We attempt to characterize sequence learning in terms of automatic versus nonautomatic processing and to apply this contrast independently to knowledge acquisition and knowledge retrieval. In several experiments on sequence learning, automaticity of acquisition and automaticity of retrieval of the acquired knowledge were independently assessed. We found that sequence learning order can be acquired under all combinations of knowledge acquisition and knowledge retrieval. In particular, at least in the case of the simple sequences we employed, our finding applies when both the acquisition and the retrieval of knowledge are strictly automatic—that is, when neither of them is part of the task requirement—and are not beneficial to deliberate behavior. The proposed framework has implications for the notion of sequence learning and for the investigation of learning in general.

Attention III

Dominion Ballroom, Sunday Morning, 8:00–10:00

Chaired by Christian N. L. Olivers, Vrije Universiteit Amsterdam

8:00–8:15 (282)

Spreading the Sparing: Against a Limited-Capacity Account of the Attentional Blink. CHRISTIAN N. L. OLIVERS, & STEFAN VAN DER STIGCHEL, *Vrije Universiteit Amsterdam*, & JOHAN HULLEMANN, *Hull University*—The second of two targets embedded in a stream of distractors is often missed when presented in close temporal proximity to the first—a phenomenon known as the attentional blink. It is thought that the first target consumes limited resources that are then denied to the second. Against this limited-capacity account, Di Lollo, Kawahara, Ghorashi, and Enns (2005; *Psychological Research*, 69, 191–200) found that three targets can be accurately detected as long as a distractor does not intervene. Extending this work, we demonstrate that (1) presenting even more targets does reveal capacity limitations, but these limitations are additive with the attentional blink effect; and (2) targets can be spared from the blink at any point in time whenever they are preceded by another target. The results indicate that temporal attention is much more dynamically controlled than has been previously thought.

8:20–8:35 (283)

The AB Is Due to an Exogenous Disruption of Endogenous Control, Not to Resource Depletion. VINCENT DI LOLLO, *Simon Fraser University*—Identification of the second of two targets is impaired if it is presented less than about 500 msec after the first. Theoretical accounts of this second-target deficit, known as attentional blink (AB), have relied on some form of limited attentional resource that is allocated to the leading target at the expense of the trailing target. This resource depletion account is disconfirmed by the outcome of experiments in which three targets were used instead of the conventional two. These experiments indicate that the AB arises not from resource depletion but from a disruption of endogenous control over the current attentional set. The disruption is triggered exogenously when a distractor is presented while the central executive is busy orchestrating the processing of the first target. This leads to impaired identification of any trailing targets presented within about 500 msec—namely, before endogenous control can be reestablished.

8:40–8:55 (284)

Space-Based and Object-Based Visual Attention in Overlapping Tasks. HAGIT MAGEN, *Princeton University*, & ASHER COHEN, *Hebrew University of Jerusalem* (read by Asher Cohen)—When subjects perform two tasks (T1 and T2) in close temporal succession, performance of T2 is typically severely limited. However, much evidence suggests that some aspects of T2 can be performed concurrently with T1. In our previous research with a visual T2, we showed that this performance limitation can be explained to a large extent by assuming a modular architecture of the visual system. In this talk, we examine whether visual attention can operate on T2. A previous paper showed that spatial attention can be used for T2 concurrently with the performance of T1. We present evidence, using the classical Duncan task, that object-based attention can also be used for T2. We describe a model that assumes different roles for space- and object-based attention systems during overlapping tasks and present an additional experiment with the PRP paradigm that confirms the prediction of this model.

9:00–9:15 (285)

Sparing and Blinking in the Simultaneous-Type/Serial-Token Model of the Attentional Blink. BRAD WYBLE, PATRICK CRASTON, & HOWARD BOWMAN, *University of Kent, Canterbury*—A previously published computational model of the attentional blink (Wyble & Bowman, 2004) has given rise to predictions about the time course of the U-shaped T2 performance curve that is characteristic of this phenom-

enon. We posit that the blink curve is a hallmark of limitations in the temporal resolution of the binding of working memory tokens to types. In our model, lag 1 sparing results from a temporal window approximately 150 msec in length during which multiple items can be bound to the same token. Recovery of the blink occurs when a second token becomes available for binding. Here, we describe a reduced model that captures the dynamics of working memory consolidation inherent in our simultaneous-type/serial-token model. This modeling work is accompanied by experimental work that corroborates our account of sparing as a failure of working memory to assign unique tokens to two targets.

9:20–9:35 (286)

Suppression of Attention at Previously Attended Locations: Evidence From Human Electrophysiology. JOHN J. McDONALD, CLAYTON HICKEY, JESSICA J. GREEN, & JENNIFER C. WHITMAN, *Simon Fraser University*—Inhibition of return (IOR) is the term used to refer to the delay in responding to objects that appear at recently stimulated locations. IOR may reflect a difficulty in deploying attention to recently attended locations, but most evidence has pointed to inhibition in response processes. Here, a component of the event-related potential that is known to reflect the deployment of attention—the N2pc—was examined in order to determine whether IOR reflects an inhibition of attentional processes. If IOR does reflect such inhibition, the N2pc should be reduced or delayed for targets appearing at recently attended locations. If IOR is unrelated to attention, then the N2pc should be the same for targets appearing at recently attended and unattended locations. IOR was associated with a reduced N2pc, which shows that people are slow to respond to objects at recently attended locations because subsequent attentional processes at those locations are suppressed.

9:40–9:55 (287)

Correlated Conjunction Effects Under Selective Attention. J. TOBY MORDKOFF & ROSE HALTERMAN, *Pennsylvania State University*—When performing a selective-attention task, subjects are affected by to-be-ignored items that are associated with responses by the instructions (the standard flanker effect) and by to-be-ignored items that are correlated with certain responses (the correlated flanker effect) . . . at least when the items are defined in terms of just shape or just color. We extended this work by examining situations involving shape–color conjunctions and found no standard flanker effect, as would be predicted by many models, but a strong correlated flanker effect. These data will be discussed in terms of a multipath model of visual perception.

Language Production

Civic Ballroom, Sunday Morning, 8:00–10:20

Chaired by Craig P. Speelman, Edith Cowan University

8:00–8:15 (288)

The Science of Cognitive Systems: A New Approach to Fractionation. CRAIG P. SPEELMAN, *Edith Cowan University*, STEPHAN R. P. HALLOY, *New Zealand Institute for Crop & Food Research*, & KIM KIRSNER, *University of Western Australia*—The science of cognitive systems depends on inferential procedures designed to identify system components. Such procedures have been subject to criticism however (e.g., Dunn & Kirsner, 2003). In this paper, we introduce a new procedure that involves mathematical analysis of abundance distributions (Halloy, 1998) or Zipf functions (Zipf, 1945), a close relative. The objective is to determine whether or not a given set of data violates the expected relationship between log frequency and log rank and demands treatment as two sets or systems. We tested this relationship for words and letters in English, and for kanji and radicals in Japanese, using high-word-frequency data. The results were consistent with the hypothesis that whereas kanji and the radicals constitute a single system, words and letters constitute distinct systems. The utility of this technique supports an argument proposed by Speelman and Kirsner (2005) regarding the relationship between cognition and complex systems.

8:20–8:35 (289)

Memory Processes in Spontaneous Speaking: Measurement of Pause and Speech Segment Duration. KIM KIRSNER, *University of Western Australia*, KATHRYN HIRD, *Curtin University of Technology*, & JOHN DUNN & JONATHAN FOSTER, *University of Western Australia*—The assumption that memory and communication occupy distinct cognitive domains has relied in part on the use of static and decontextualized tasks designed specifically to measure one or other type of behavior. In this paper, we use new measurement procedures to study retrieval effects under natural language conditions. The procedures enable separation and characterization of the short-pause, long-pause, and speech duration distributions in spontaneous speaking (Kirsner, Dunn, Hird, Parkin, & Clark, 2002). The experiment involved the contrast between story generation and story recall and the results were as follows: First, retrieval task influenced the means and other fluency parameters under natural language conditions. Second, the critical pause and speech duration distributions conform to the log normal, a pattern that implies interaction among the memory and communication variables. Third, amnesia influences the pause and speech duration distributions. The results further undermine the argument that memory and communication should be treated as distinct domains.

8:40–8:55 (290)

Structural Persistence in Anterograde Amnesia: Evidence for Implicit Learning. VICTOR S. FERREIRA, *University of California, San Diego*, & KATHRYN BOCK, NEAL J. COHEN, & MICHAEL P. WILSON, *University of Illinois, Urbana-Champaign*—Speakers tend to repeat syntactic structures. This structural persistence is tacit, incidental, and long-lived, suggesting that it is a form of implicit learning. However, most attested forms of implicit learning involve information less abstract than syntactic knowledge. We determined whether structural persistence reflects implicit learning by assessing structural persistence in 4 patients with anterograde amnesia and 4 matched controls. Speakers (1) repeated passive or active primes and dative or double-object primes; (2) repeated 0, 1, 6, or 10 neutral sentences; (3) described pictures that elicited passive or active and dative or double-object descriptions; and (4) made recognition judgments for the prime sentences or matched foils. Amnesics had impaired recognition memory for prime sentences in comparison with controls, but both groups showed significant and equivalent structural persistence. This is consistent with structural persistence being a form of implicit learning and implies that implicit learning accrues even to the abstract knowledge underlying syntactic production.

9:00–9:15 (291)

Do Speakers and Listeners Observe the Gricean Maxim of Quantity? PAUL E. ENGELHARDT, *Michigan State University*, KARL G. D. BAILEY, *Andrews University*, & FERNANDA FERREIRA, *Michigan State University* (read by Fernanda Ferreira)—According to the Gricean maxim of quantity, speakers provide as much information as is required for referent identification and no more. Listeners should therefore expect unambiguous but concise descriptions. In three experiments, we examined the extent to which naive participants are sensitive to this principle of communication. The first experiment was a production experiment that demonstrated that listeners overdescribe in almost one-third of their utterances. The second experiment showed that listeners do not judge overdescriptions to be any worse than concise expressions. The third experiment used the visual world paradigm to measure listeners' moment-by-moment interpretations of overdescribed utterances. This last experiment revealed that overdescriptions trigger eye movements that suggest confusion. The results provide support for the use of a simple heuristic such as minimal attachment or argument saturation to create an initial parse. We conclude that, in general, people are only moderately Gricean.

9:20–9:35 (292)

Effects of Phoneme Repetition in the Spoken Production of Short Phrases. MARKUS F. DAMIAN, *University of Bristol*—The effects

of phoneme repetition in the spoken production of short phrases were explored. Participants named colored pictures with an adjective–noun phrase; the central manipulation concerned whether or not segments within the adjective and the noun matched (*green gun, red rug*) or mismatched (*red gun, green rug*). A robust facilitatory effect of phoneme match was found, suggesting that speakers planned the entire phrase before they initiated a response and that repeated selection of the same phoneme conferred a processing benefit. Further experiments demonstrated that the effect of phoneme repetition is phonological, not articulatory, in nature, and that it is largely independent of the position of the matched segment within each word. Implications for theories of phonological encoding and advance planning are discussed.

9:40–9:55 (293)

Speech Errors Reflect Newly Learned Phonotactic Constraints. JILL A. WARKER & GARY S. DELL, *University of Illinois, Urbana-Champaign* (read by Gary S. Dell)—If speakers repeatedly produce a set of syllables in which all occurrences of, say, /f/ are syllable onsets, and all /s/s are codas, their speech errors will rapidly come to reflect these constraints. For example, when /f/s slip, they will slip to other onset positions, not to coda positions. We attribute this effect to the implicit learning of the phonotactic constraints within the experiment. In four experiments, we show that more complex constraints, such as /f/ appearing in an onset only if the vowel is /æ/, can also be acquired and can influence speech errors. These constraints are learned much more slowly, however. We present a model of the data to illustrate our view that the language production system adapts to recent experience while also continuing to reflect the accumulated experience of a lifetime of speaking and listening.

10:00–10:15 (294)

Self-Monitoring of Sign Language: Implications for the Perceptual Loop Hypothesis. KAREN D. EMMOREY, *San Diego State University*—Models of speech production suggest that an inner, prearticulatory loop and an external, auditory loop monitor the ongoing speech flow. Speakers can monitor their speech output by listening to their own voice—a perceptual loop feeds back to the speech comprehension mechanism. Herein lies a critical difference between signed and spoken language. The visual input from one's own signing is quite distinct from the visual input of another's signing. To investigate how signers monitor their production, normally sighted signers and signers with tunnel vision due to Usher's syndrome were studied. Evidence suggests that signers visually monitor the location of their hands in space but may not parse this visual input via the sign comprehension mechanism. In addition, prearticulatory monitoring and perceptual monitoring of another's signing operate at different representational levels (phonological vs. phonetic). I argue that self-monitoring via a perceptual loop may be less critical for signed than for spoken language.

Movement and Perception

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

Chaired by Michael K. McBeath, *Arizona State University*

8:00–8:15 (295)

Pursuers Maintain Linear Optical Trajectory When Navigating to Intercept Robots Moving Along Complex Pathways. MICHAEL K. McBEATH, WEI WANG, THOMAS G. SUGAR, IGOR DOLGOV, & ZHENG WANG, *Arizona State University*—This study explores the lateral navigational strategy used to intercept moving robots that approach along complex pathways. Participants ran across a gymnasium equipped with an eight-camera, high-resolution motion capture system and tried to catch a robot that varied in speed and direction. Participant behavior was compared with predictions of three lateral control models, each based on maintenance of a particular optical angle relative to the target: (1) constant alignment angle (CAA), (2) constant bearing angle (CBA), and (3) linear optical trajectory (LOT). The results were most consistent with maintenance of a LOT and least con-

sistent with CBA. The findings support the idea that pursuers use the same simple optical control mechanism to navigate toward complexly moving targets that they use when intercepting simple ballistic ones. Maintenance of a linear optical trajectory appears to be a robust, general-purpose strategy for navigating to interception of targets headed off to the side.

8:20–8:35 (296)

Event Path Perception: Recognition of Transposed Spatiotemporal Curves. THOMAS F. SHIPLEY, *Temple University*—An event can be recognized as similar to another (although, logically, events are seen only once). How can we understand this achievement? Aspects of event perception may allow direct analogies to the better-understood domain of object perception. If object recognition models are to serve as the basis for models of event recognition, events should be recognized following spatial transpositions, just as objects are recognized following translation, rotation, or size change. Object paths (the trajectories of objects through space) are recognized despite transpositions. In this experiment, paths shown at one scale (e.g., a human walking along a complex path in an open field) were accurately matched to paths with different objects and different scales (e.g., a hand tracing a path in the air). This is consistent with a model of event perception in which paths of moving objects are decomposed at curvature extrema with recognition based on the spatiotemporal shape of the fragments.

8:40–8:55 (297)

Representational Momentum and Motion Capture. TIMOTHY L. HUBBARD, *Texas Christian University*—In representational momentum, memory for the final location of a moving target is displaced in the direction of target motion. In motion capture, a stationary stimulus is perceived to move in the same direction as a nearby moving target. In the experiments reported here, a stationary stimulus was briefly presented near the end or middle of a moving target's trajectory. Memory for the location of a stationary stimulus presented near the end of the moving target's trajectory was displaced in the direction of target motion, and this displacement was larger with faster target velocities and when the stationary stimulus was closer to the target. Memory for the location of a stationary stimulus presented near the middle of the moving target's trajectory was not displaced. Representational momentum of a moving target can influence memory for a nearby stationary stimulus. Implications for theories of representational momentum and of motion capture are considered.

9:00–9:15 (298)

Scene Movement Versus Observer Movement. CORY FINLAY, MICHAEL MOTES, & MARIA KOZHEVNIKOV, *Rutgers University, Newark* (read by Maria Kozhevnikov)—This research examined the hypothesis that observer movement automatically updates representations of scenes. In our initial study, observers memorized a spatial array of ten objects from a single perspective. Then, either the scene was rotated or participants moved around the scene (from 0° to 360°), and participants judged whether the interobject spatial relations in the array had changed. Regardless of whether the scene was rotated or observers moved, greater angular disparity between judged and encoded views produced slower RTs, suggesting that memory for the scene was not automatically updated following observer movement. Furthermore, varying set size (4, 6, 8, or 10 objects) and delay interval between encoding and movement (0, 6, or 12 sec) produced decreased accuracy and increased RT, with larger angular disparity between encoded and judged views, regardless of set size and delay interval. These data raise important questions regarding conditions under which spatial updating does not occur.

9:20–9:35 (299)

It's All About Me (Well Mostly): Identifying People From Their Actions. SAPNA PRASAD, FANI LOULA, MAGDALENA GALAZYN, & MAGGIE SHIFFRAR, *Rutgers University, Newark* (read by

Maggie Shiffrar)—Why do people demonstrate impressive visual sensitivity to human action? Visual expertise theories suggest that this sensitivity reflects a lifetime of experience watching other people move. Motor experience theories suggest the visual analysis of human movement selectively benefits from motor system contributions. To test these theories, naive observers performed a series of identity discrimination tasks. Observers viewed point-light displays of actions performed by themselves (with which they have the most motor experience), their friends (most visual experience), or matched strangers (baseline condition). On each trial, participants viewed two actions and reported whether the actions were performed by the same actor or two different actors. Across studies, participants demonstrated the greatest visual sensitivity to their own movements. Friends' actions were discriminated at above-chance levels. Performance was viewpoint and action dependent. These results suggest that both motor experience and visual experience define visual sensitivity to human movement.

Emotion and Memory

Grand Ballroom Centre, Sunday Morning, 10:20–12:00

Chaired by Janet Metcalfe, Columbia University

10:20–10:35 (300)

Memory Under Stress: The Case of First-Time Parachute Jumping. JANET METCALFE & BRIDGID FINN, *Columbia University*—The memorial effects of traumatic levels of stress are difficult to assess because of ethical considerations. However, the stress levels during first-time parachute jumping approach those of trauma. A series of memory tests were, therefore, administered to first-time jumpers. The results of these tests will be discussed in terms of the hot/cool framework of memory and emotion.

10:40–10:55 (301)

“Remembering” Emotional Words Is Based on Response Bias Not Recollection. SONYA DOUGAL, *New York University*, & CAREN M. ROTELLO, *University of Massachusetts, Amherst* (read by Caren M. Rotello)—Recent studies have demonstrated that emotion modulates recognition memory by increasing the proportion of *remember* judgments to emotional stimuli (Kensinger & Corkin, 2003; Ochsner, 2000). This finding has led to the claim that recognition memory for emotional stimuli depends largely on a recollective process. We present ROC data from two experiments that challenge this conclusion. In both experiments, subjects studied and received a recognition test for neutral and emotional words. At test, subjects gave confidence ratings that each item had been studied. In Experiment 2, we also collected remember/know judgments. Three models were fit to individual subjects' data: a one-dimensional familiarity-based model (Donaldson, 1996), the dual-process model (Yonelinas, 1994), and STREAK (Rotello et al., 2004). In accord with the literature, we find that emotion increases subjective reports of “remembering.” However, the effect is due to response bias differences rather than sensitivity change or use of a high-threshold recollection process.

11:00–11:15 (302)

The Effect of Mood on Implicit Motor Sequence Learning. JANET E. PALMER, GERALD L. CLORE, & DANIEL T. WILLINGHAM, *University of Virginia* (read by Daniel T. Willingham)—We used music to induce a happy or sad mood and observed the effect on implicit sequence learning using the serial response time task. During training, a sad mood led to overall faster performance, but a happy mood led to more robust implicit sequence learning. After training, participants listened to music designed to bring them back to a baseline mood and then completed a probe of their learning. Once the effect of mood was reversed, the difference in learning disappeared, which indicated that mood affected the expression of implicit learning, but not learning itself. The results are interpreted as supporting the mood-as-information hypothesis.

11:20–11:35 (303)

Emotion-Linked von Restorff and Interference Effects in Immediate Memory: Arousal Versus Priority-Binding Mechanisms. DONALD G. MACKEY & CHRISTOPHER H. HADLEY, *UCLA*—Binding theory (MacKay et al., 2004) predicts three emotion-linked effects in immediate recall of taboo versus neutral words: (1) a von Restorff effect for taboo words presented slowly (2,000 msec/word) in mixed taboo-neutral lists—that is, better recall of taboo words and their immediately adjacent neutral words relative to position- and familiarity-matched neutral words in unmixed lists; (2) equivalent recall of taboo and neutral words in unmixed lists presented at fast or slow rates; (3) encoding interference that impairs recall of neutral words in comparison with taboo words in rapidly presented (200 msec/word) mixed lists—because emotion triggers binding mechanisms for encoding context of occurrence, taboo words impair the encoding of prior and subsequent neutral words in rapidly presented mixed lists as a result of emotion-linked capture of the mechanisms for binding list context. Our data supported all three predictions, suggesting that time-limited binding processes, rather than arousal or rehearsal processes triggered by taboo words, underlie our von Restorff effect.

11:40–11:55 (304)

Working Memory and Emotion: Ruminations on a Theory of Depression. ALAN D. BADDELEY, *University of York*—A number of theories of emotion implicate working memory as a link between physiologically based emotions and psychologically experienced feelings. The Baddeley and Hitch multicomponent model of working memory can account for the effects of fear and anxiety in terms of the distracting effects of worry. Depression presents a greater problem. A possible solution is proposed in terms of a hedonic detector system based on physiological, possibly visceral information that then feeds into a comparator when choices are required. The detector depends on a neutral point which may be influenced genetically, environmentally, or pharmacologically. Depression is assumed to reflect on inappropriate setting of this neutral point. Working memory is required for storage within the comparator and for the direction and control of the detection system. Methods of testing the model empirically will be discussed.

Category Learning

Grand Ballroom East, Sunday Morning, 10:20–12:00

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

10:20–10:35 (305)

Challenging the Role of Implicit Processes in Probabilistic Category Learning. BEN R. NEWELL, *University of New South Wales*, & DAVID A. LAGNADO & DAVID R. SHANKS, *University College London*—Considerable interest in the hypothesis that different cognitive tasks recruit qualitatively distinct processing systems has led to the proposal of separate explicit (declarative) and implicit (procedural) systems. A popular probabilistic category learning task known as the “weather prediction task” is said to be ideally suited to examine this distinction because its two versions—“observation” and “feedback”—are claimed to recruit the declarative and procedural systems, respectively. In two experiments, we found results that were inconsistent with this interpretation. In Experiment 1, a concurrent memory task had a greater detrimental effect on the putatively implicitly mediated (feedback) version than on the explicit (observation) version. In Experiment 2, participants displayed comparable and accurate insight into the task and their judgment processes in both the feedback and observation versions. These findings have important implications for the study of probabilistic category learning in both normal and patient populations.

10:40–10:55 (306)

Regulatory Focus and Flexibility in Classification. ARTHUR B. MARKMAN, GRANT C. BALDWIN, & W. TODD MADDOX, *University of Texas, Austin*—We explored the influence of regulatory fit on category learning. Regulatory focus theory suggests that people

may have a promotion focus (a sensitivity to potential gains in the environment) or a prevention focus (a sensitivity to potential losses). Regulatory fit suggests that people perform best when their regulatory focus matches the payoffs in the environment. We generated a category structure in which a unidimensional rule led to good but sub-criterial performance. The learning criterion could be achieved, however, using a complex conjunctive rule. People were best able to find the conjunctive rule when there was a regulatory fit. If there were rewards on every trial, people with a promotion focus learned better than people with a prevention focus. If there were punishments on every trial, people with a prevention focus learned better than people with a promotion focus. These findings suggest that regulatory fit leads to flexible cognitive processing.

11:00–11:15 (307)

Varying Abstraction in Categorization. GERT STORMS & WOLF VANPAEMEL, *University of Leuven*—A model is proposed that elegantly unifies the traditional exemplar and prototype models. These two models are extreme cases of the proposed varying abstraction model. This unifying model further makes room for many new intermediate pseudoexemplar models. Analysis of empirical data, using both artificial stimuli and natural concepts, showed evidence in favor of intermediate pseudoexemplar models as compared with the classical prototype and exemplar models. A further advantage of the varying abstraction model is that because of its pseudoexemplar models, it allows for sensitive modeling. For example, the model is highly useful for investigating in full detail recent findings that category representation may change during the learning process. The model can also capture possible varying categorization strategies depending on the complexity of the categories under study.

11:20–11:35 (308)

Does Response Scaling Cause the Generalized Context Model to Mimic a Prototype Model? DANIEL J. NAVARRO, *University of Adelaide*, & JAY I. MYUNG & MARK A. PITT, *Ohio State University* (read by Jay I. Myung)—Exemplar and prototype accounts of categorization phenomena differ primarily in terms of the manner in which category information is represented. However, the models also make auxiliary assumptions that are instantiated as model parameters. Smith and Minda (1998) argue that the response scaling parameter in the exemplar-based generalized context model (GCM) makes the model unnecessarily complex and allows it to mimic prototype representations. We estimate the complexity of GCM with and without the parameter, as well as that of a prototype model. We then go on to assess the extent to which the models mimic each other's behavior. The parameter does increase the complexity of the model, but this complexity only allows partial mimicry. Furthermore, if we adopt minimum description length as the measure of model performance, the models become highly discriminable.

11:40–11:55 (309)

Effects of Noun Modification on Plausibility of Attribute Information. JAMES A. HAMPTON, *City University, London*, & MARTIN JONSSON, *Lund University*—Inspired by a recent paper by Connolly et al., we investigated whether attributes judged to be generally true of a noun class will also be considered true of an orthogonal subset of that class. For example, given that ravens are black, how likely is it that young jungle ravens are black? Experiment 1 replicated their result. Modification, particularly with atypical modifiers, reduced the judged truth of typical attributes. Experiment 2 required forced choice decisions of likelihood between modified and unmodified subject nouns and asked for additional justifications. Experiment 3 showed that the reduction in judged likelihood was correlated with the mutability of the predicate for the subject noun. Finally, we demonstrate a new version of the conjunction fallacy. People judged a universally quantified statement (*All ravens are black*) to be more likely to be true than the same statement with a modified subject noun (*All jungle ravens are black*).

Visual Word Recognition

Grand Ballroom West, Sunday Morning, 10:00–12:00

Chaired by Wayne S. Murray, *University of Dundee*

10:00–10:15 (310)

The Form of the Word Frequency Effect. WAYNE S. MURRAY, *University of Dundee*, & KENNETH I. FORSTER, *University of Arizona*—Murray and Forster (2004) made strong claims about the precise form of the effect of word frequency on recognition time. It was argued that the underlying function directly reflects the relationship between access time and the rank order of words in a frequency-ordered search or verification set. Across three experiments, a rank function produced an account that was numerically superior to the more “traditional” description of this function as logarithmic, but no clear statistical superiority was demonstrated. In this paper, we consider word recognition data derived from a number of sources and show that although a log function provides a reasonable approximation across the mid-frequency range, it is clearly inadequate at the frequency extremes, whereas rank produces a good fit throughout the entire frequency range. We discuss both the practical and theoretical consequences of this finding.

10:20–10:35 (311)

1984: Reconsidering the Absence of Frequency Attenuation Effect With Masked Repetition. SACHIKO KINOSHITA, *Macquarie Centre for Cognitive Science*—The frequency attenuation effect refers to the finding that the magnitude of frequency effect in the lexical decision task is reduced for repeated words. Forster and Davis (1984) reported that the frequency attenuation effect is not found with masked repetition but that instead effects of frequency and masked repetition are additive. This pattern has been replicated many times (although see Masson & Bodner, 2003, for contradictory data), and has been taken as a benchmark finding for accounts of masked repetition priming. I report contrary data showing that a frequency attenuation effect is found with some low-frequency words and that this is not due to methodological artifacts, such as greater power or stronger manipulation of frequency. Implications of the results for the nature of lexical representation and the lexical decision task will be discussed.

10:40–10:55 (312)

Visual Word Recognition: Is a Hybrid Connectionist Framework Needed? JENNIFER A. STOLZ, NASEEM AL-AIDROOS, & DEREK BESNER, *University of Waterloo*—Interactive activation is currently the dominant conceptual framework for language processing. That said, such a framework encounters difficulty in explaining the combination of several empirical observations in the context of the lexical decision task (an interaction between the effects of stimulus quality and semantic priming when the relatedness proportion is .5, additive effects of these same two factors when the relatedness proportion is .25, and additive effects of stimulus quality and word frequency). We report a series of simulations from a hybrid model that combines interactive activation across later stages with an earlier stage that is thresholded. This model produces all of the phenomena noted above, as well as many others.

11:00–11:15 (313)

Early Semantic Effects in Visual Word Recognition. KENNETH I. FORSTER, *University of Arizona*—Several phenomena have now emerged suggesting that in semantic categorization experiments, the semantic properties of the category fundamentally alter very early processes in visual word recognition. For example, masked semantic priming with a short-duration prime occurs reliably in semantic categorization but not in lexical decision. Similarly, masked cross-language translation priming from the second language to the first is obtained only in semantic categorization. One possibility is that these effects might be explained as congruence effects. However, there is at least one effect that cannot involve congruence—namely, the greater sen-

sitivity of priming to form overlap in semantic categorization. For instance, *vapary* is an effective prime for CANARY in an animal categorization task but not in lexical decision.

11:20–11:35 (314)

The Fate of the Loser in the Competition of Real and Illusory Words. MICHAEL NIEDEGGEN & MARTIN HEIL, *Heinrich Heine University*, & CATHERINE L. HARRIS, *Boston University* (read by Catherine L. Harris)—“Winner-take-all” networks are an important theoretical construct in diverse fields. An implication of winner-take-all networks is that a word which wins the competition for selection receives maximal activation and will be consciously perceived, even when selection was incorrect (i.e., when the winner out-competes the stimulus present in the input). In the current study, competition was induced between a physically presented (“real”) word and a self-constructed (“illusory”) word (Harris & Morris, 2001; Morris & Harris, 1999). Semantic activation was probed by recording event-related brain potentials (ERPs). Only words reported by participants triggered a spread of activation in the semantic network. Nonreported words failed to prime downstream targets. Both effects were independent of whether the potential primes were “real” or “illusory.” Findings indicate that the neural “winner-take-all” network governing visual attention extends to the processing of lexical units.

11:40–11:55 (315)

Effects of T1 Word and Orthographic Neighbor Frequency on the Attentional Blink. JENNIFER S. BURT, SAMANTHA HOWARD, & EMMALINE FALCONER, *University of Queensland*—In rapid serial visual presentation (RSVP), identification of a target (T2) is poorer when another target (T1) has been presented several items earlier. This attentional blink (AB) increases in severity as the difficulty of identifying T1 increases. In the present experiments, T1 and T2 were words, distractors were pronounceable nonwords, and the frequency and orthographic-neighbor frequency of T1 were varied. In Experiments 1 and 2, the AB was more severe for a low-frequency T1 than for a high-frequency T1. In Experiment 2, when T1 was a high-frequency word, there was a predicted inhibitory effect of high-frequency neighbors on the identification of T1 and T2. Effects of neighbor frequency for a low-frequency T1 were less consistent, with a predicted facilitatory effect observed for T2 identification only at lag 2, and not for T1 identification. The AB paradigm is sensitive to lexical variables but different effects may occur for word identification and word memory.

Animal Cognition

Dominion Ballroom, Sunday Morning, 10:20–12:00

Chaired by William A. Roberts, University of Western Ontario

10:20–10:35 (316)

Studies of Bystander Apathy in Dogs. KRISTA MACPHERSON & WILLIAM A. ROBERTS, *University of Western Ontario* (read by William A. Roberts)—The question of whether dogs recognize an emergency and understand the need to seek help from a bystander was tested in two experiments. Dogs’ owners feigned an emergency in which either the owner had a heart attack or was pinned under a fallen book case and calling for help. Dogs’ behavior was taped and scored to find out if they would go to an available bystander for aid. In no case did a dog solicit help from a bystander. It was concluded that dogs did not understand the nature of the emergency or the need to obtain help.

10:40–10:55 (317)

Remembrance of Places You Passed: Social Spatial Memories in Rats. ROBERT F. FARLEY & MICHAEL F. BROWN, *Villanova University* (read by Michael F. Brown)—Pairs of rats were tested in an eight-arm radial maze. In one experiment, the two rats made choices from among the eight maze arms. In a second experiment, the subject rat first observed the other rat visit four maze arms and was then al-

lowed to choose from among the eight maze arms. In both experiments, there was a tendency to avoid choosing maze arms that had been previously visited by the other rat. This indicates that the spatial location of choices by a foraging partner, like those of choices made earlier by the subject, are coded in spatial working memory.

11:00–11:15 (318)

Rats Can Form a Simple Cognitive Map. REBECCA A. SINGER & THOMAS R. ZENTALL, *University of Kentucky* (read by Thomas R. Zentall)—Evidence for the formation of a cognitive map requires that a familiar goal be reached by a novel path in the absence of available goal-directing landmarks. Rats were trained on a three-arm maze with distinctive arms to find food in two of the arms (the middle arm and one side arm). They were then tested with both side arms blocked and novel paths available between the center and side goal boxes. On the first test trial, rats chose the novel path that led to the side goal box in which they had found food in training significantly above chance (75% of the time). In a second experiment, when the distinctive cues were removed from the arms, no consistent preference was found (49% choice). Thus, it does not appear that the rats were using a vector and distance algorithm (path integration or dead reckoning) to find the goal.

11:20–11:35 (319)

Rats’ Working Memory for Objects Based on Configuration and Location Stability. VARAKINI PARAMESWARAN & JEROME COHEN, *University of Windsor* (read by Jerome Cohen)—Four rats received three baited objects in the study segment of a trial and then a fourth baited “missing” object with the other three nonbaited objects in the test segment of the trial. Rats were more accurate in finding the missing object when it differed from the other three objects than when it was similar to them (*same*) and when the objects remained in the same spatial location in the square foraging arena between segments. Increasing the intersegment delay from 1 min to 10 min reduced accuracy to chance only when the spatial location of the objects was also changed (Experiment 1). Varying the configuration of the different objects between segments disrupted test segment search accuracy more than did merely rotating their configurations (Experiment 2). The theoretical implications of these findings are discussed on the basis of path integration and landmark stability (Biegler; 2000, Biegler & Morris, 1996).

11:40–11:55 (320)

What–Where–When Memory in Pigeons. SHANNON I. SKOV-RACKETTE, NOAM MILLER, & SARA J. SHETTLEWORTH, *University of Toronto* (read by Sara J. Shettleworth)—An animal that encodes the identity, location, and time of an event should respond correctly to any of the questions “What was it?” “Where was it?” and “When was it?” when it cannot anticipate which question will be asked. We describe a novel approach to testing animal “episodic-like” memory based on this assumption. Pigeons were trained in separate, interleaved sessions to match the identity of a 3-sec sample on a touchscreen, to match its location, and to report on the length of the retention interval (2 or 6 sec). When these *what*, *where*, and *when* trials were then mixed randomly within sessions, birds were correct on more than 80% of trials. In order to test whether the three features were bound together in memory or encoded independently, we gave birds two different tests in succession after each sample. Binding of *what* and *where* was tested in a different way in a second experiment.

Priming in Memory Tasks

Civic Ballroom, Sunday Morning, 10:40–12:00

*Chaired by Eva Dreikurs Ferguson
Southern Illinois University, Edwardsville*

10:40–10:55 (321)

Priming, Social Category Content, and Word Repetition Effects.

EVA DREIKURS FERGUSON, *Southern Illinois University, Edwardsville*, & JANET M. GIBSON, *Grinnell College*—The effects of word repetition and social category semantic content in priming paragraphs were explored for word recall. Data from a small liberal arts private college versus results from a large public university were compared. In one study, words to be recalled were either never presented in the priming paragraph (usual semantic priming condition) or were presented once or twice, in anticipation that regardless of how immediately the words followed the priming paragraph, repetition itself would significantly improve recall. This was not found. Rather, social category semantic content and word repetition had complex effects. Word repetition effects on recall were dependent on word block order (how soon the words followed the priming paragraphs). In several studies, autocratic and democratic content affected word recall differently than did other social categories. Affective valence and strength of cognitive identity were explored to explain the semantic social category effects. Implications of the findings are discussed.

11:00–11:15 (322)

Multiple Priming Effects in Episodic Recognition. STEPHEN DOPKINS & JESSE SARGENT, *George Washington University*—In episodic recognition, a positive judgment to a word is impeded following the processing of a superficially similar word, suggesting interference in the recollective component of the recognition process. A negative judgment to a word is impeded following the processing of a semantically similar word, suggesting a positive criterion shift in the familiarity component of the recognition process. These phenomena may be helpful in distinguishing the dual-process conceptions of Norman and O'Reilly and of Brainerd and colleagues. In addition, a positive judgment to a word is impeded and a negative judgment facilitated following a positive judgment to a word of the same syntactic class, suggesting a negative criterion shift in the familiarity component of the recognition process. The functional bases of these phenomena are discussed in terms of what may be the primary real-life manifestation of episodic recognition—the identification of repeated words in discourse.

11:20–11:35 (323)

What Does It Take to Implicitly Prime Low-Frequency Category Exemplars? R. REED HUNT, *University of North Carolina, Greensboro*—Very low frequency exemplars are resistant to implicit repetition priming on category production tasks, a fact that would not be surprising in most theories of priming. A mild startle response might be elicited, however, by the data to be presented, which show that the items resistant to repetition priming can in fact be primed implicitly following a single study trial. The results of two experiments suggest that implicit priming of very low frequency items requires a prior experience biasing the comprehension of the category label. Presentation of the category label in a sentence biasing the low-frequency interpretation of the label yielded reliable priming, even though the exemplar was not presented explicitly. Explicit presentation of the exemplar at study, even when accompanied by the label, was not sufficient to produce reliable priming.

11:40–11:55 (324)

Dissociation Between Recognition of Prechange Objects and Change Detection. YEI-YU YEH, CHENG-TA YANG, & YING-CHIH HUNG, *National Taiwan University*—This study investigated how similarity between the pre- and postchange objects affects recognition of prechange objects and change detection. Experiment 1 replicated a previous study by showing that recognition of prechange objects was worse than recognition of postchange objects. Moreover, similarity benefited recognition memory. Assuming that little information is required to recognize a prechange object with intact representation, we manipulated in Experiment 2 whether the to-be-recognized test object was masked (2A) or the density of the mask (2B and 2C). The results showed that unless the test stimuli were densely masked, recognition was above chance when the two objects shared similarity. In contrast,

similarity reduced change detection. Experiment 3 investigated whether similarity benefit arose from memory retrieval by examining the proportion of false recognition on new distractors. The results from a log-linear regression analysis showed that false recognition was higher when new distractors shared similarity with the postchange objects.

Metamemory

Conference Rooms B&C, Sunday Morning, 10:00–12:00

Chaired by Harold Pashler, University of California, San Diego

10:00–10:15 (325)

Does Being Forced to Guess Make One Learn the Wrong Answer? HAROLD PASHLER, *University of California, San Diego*—If you do not know the answer to a question, should you avoid guessing, in order not to “stamp in” the wrong answer? Theorizing by Edwin Guthrie and others would seem to imply that you should. To test this question, on Day 1, subjects were taught obscure facts, and then given a test; on Day 2, they returned for a final test. When subjects indicated on Day 1 that they had no idea of the answer to a question, they were forced to guess on a randomly chosen subset of items. Regardless of whether there was immediate feedback (Experiment 1), no feedback (Experiment 2), or delayed feedback (Experiment 3), Day 2 performance suggested that the forced guessing had not impaired or contaminated memory. Follow-up studies will examine the generalizability of this result beyond fact memory.

10:20–10:35 (326)

The Cognitive Mechanisms of Errorless Learning in Younger and Older Adults. NICOLE D. ANDERSON & SAMY ARITA, *University of Toronto*—Recall is higher following learning without rather than with errors (Baddeley & Wilson, 1994), but previous studies exploring contributions of implicit and explicit memory to this effect have yielded mixed results. Verbal responses were made “typical” (e.g., *knee-bend*) or “atypical” (e.g., *knee-bone*) in a 384-pair training phase (following Hay & Jacoby, 1996). Participants in the “errorful” condition guessed (e.g., *knee-b_n_*), whereas in the “errorless” condition the pair was shown in full. In a study–test phase (16 lists of six typical and two atypical pairs), participants recalled the studied response word. Explicit recollection or implicit memory habit would evoke a *typical* response after studying a typical pair, but only implicit memory habits, in the absence of recollection, would evoke a *typical* response after studying an atypical pair. Explicit recollection was higher in younger than older adults, but implicit habit was greater following errorful than errorless learning. Errorless learning is mediated by implicit memory.

10:40–10:55 (327)

Familiarity Matching in Source Monitoring. NANCY FRANKLIN & CHUI-LUEN VERA HAU, *SUNY, Stony Brook*, JENNIFER L. BECK, *National Opinion Research Center*, & PAUL C. SYLVESTER, *SUNY, Stony Brook*—People often apply rational heuristics during source monitoring. For example, in probability matching, the distribution of source decisions about old items reflects the relative frequency of subjects' prior exposure to the different sources. We introduce a more sophisticated but related heuristic, familiarity matching. We base our explanation of the effect on the argument that in the real world, individual sources tend to produce redundant content (e.g., George Bush produces multiple messages over time about Iraq, and the deli guy tells you on different occasions about available coffee flavors). The greater expectation that familiar rather than unfamiliar content will come from a high-frequency source leads to an interaction between source frequency and content familiarity: People attribute more items to frequent than to infrequent sources, and this effect is increased for familiar items. We find such a familiarity matching effect even when the experience of familiarity is artificially inflated at test through simple priming.

11:00–11:15 (328)

Decision Strategies and Criterion Shifts in Eyewitness Identification. STEVEN E. CLARK, SHERRIE DAVEY, & RYAN GODFREY, *University of California, Riverside*—One of the concerns about eyewitness identification is that witnesses may feel pressure to make an identification, even when they are not sure. The present research addresses two main questions: First, why do witnesses hesitate to make an identification? Is their hesitation due to poorer memory or a higher criterion, relative to witnesses who do make identifications? Second, when reluctant witnesses are nudged into making identifications, do they simply lower their decision criterion or do they change their decision strategies in more fundamental ways? To address these two questions, we reanalyzed a previous meta-analysis (Stebly, 1997) that appeared to rule out a criterion shift explanation and also conducted three new studies in which the specifics varied as to how participants were nudged. Our results did not support the “bad memory” view of the reluctant witness. Whether participants lower their criterion or change their strategy depends on the specifics of the pre-lineup instructions.

11:20–11:35 (329)

A Signal Detection Model of Eyewitness Identification. MATTHEW J. DUNCAN, *Defence R&D Canada*—Procedurally, an eyewitness identification task is a case of uncertain detection plus identification. Although much has been done to examine the effect of various pretest factors, development of formal mathematical models seems noticeably absent. This is unfortunate, because the nature of the eyewitness identification task is one in which sensitivity and bias are potentially

confounded. Monte Carlo simulations and formal analysis of Clark’s (2003) WITNESS model showed it to conform to normal distribution assumptions and an uncertain detection plus identification framework. Consequently, a detection plus identification SDT model was developed and fit to data from a number of experiments. A variety of detection and identification decision rules were assessed, and the fit of the model was compared with simulations of WITNESS.

11:40–11:55 (330)

Misinformation Effects in Product Identification Testimony. J. TRENT TERRELL & CHARLES A. WEAVER III, *Baylor University* (read by Charles A. Weaver III)—Although research on the reliability of eyewitness memory for criminal events has been extensively studied, eyewitness memory in civil cases has not. We have developed a paradigm with which to study memory for product identification, a common question in civil cases involving product liability. Subjects were shown a videotaped cooking show and later were asked to identify the specific brands of products used. Subjects given intentional memory instructions were more accurate initially, but not after a delay. In a second experiment, misinformation regarding a brand was introduced in incidental questioning. One week later, subjects were more likely to select the suggested brand than the brand actually used. This was especially true for familiar items: When the suggested brands were highly familiar (but still wrong), false alarm rates were nearly 70%. Furthermore, these false alarms to suggested items were recalled with greater subjective confidence, indicating an inverse confidence–accuracy relationship.

POSTER SESSION I

Sheraton Hall, Thursday Evening, 6:00–7:30

• SPATIAL COGNITION •

(1001)

The Contributions of Ordinal Structure and Visual Landmarks to Navigation. HUIYING ZHONG, MARIANNE C. HARRISON, & WILLIAM H. WARREN, *Brown University*—We compare the contributions of ordinal structure and visual landmarks to navigation when walking in an immersive virtual hedge maze. The maze contains a set of places and paths with distinctive landmarks at some junctions. Participants first freely explore and then walk from a home location to specified places; on probe trials, the maze is manipulated. In Experiment 1, the path layout remains constant while landmarks are shifted along the main corridor or rotated around a radial-arm section. In Experiment 2, paths are added to or subtracted from the maze, while landmark positions remain constant. Participants relied heavily on the ordinal structure of paths in the first experiment. In the second experiment, we determined whether they would continue to do so when landmark positions were more reliable. The results suggest a dependence on spatial knowledge of the ordinal structure of paths and places over visual landmarks in active navigation.

(1002)

Influence of Environmental Axes on Spatial Memories Acquired Through Language. CHIARA MENEGHETTI, *University of Padua*, JULIA SLUZENSKI & BJOERN RUMP, *Vanderbilt University*, JENNIFER LABRECQUE, *Duke University*, & TIMOTHY P. McNAMARA, *Vanderbilt University*—Prior research has demonstrated the influence of salient environmental axes on spatial memory learned from vision (Shelton & McNamara, 2001). We examined this influence on spatial memory acquired through language. In Experiment 1, participants learned object locations by reading a route text describing a path through a baseball field. The imagined path was either aligned or misaligned with the axis through home plate and the pitcher's mound. Participants remembered object locations best when they imagined standing with the same heading as in the text. In Experiment 2, participants learned both the aligned and the misaligned texts. Participants who first learned the aligned text remembered this heading better than novel headings, whereas those who first learned the misaligned text remembered all headings equally well. These findings suggest that salient axes have less of an influence on spatial memory learned from language than on spatial memory learned through vision.

(1003)

Roles of Layout Geometry and Viewing Perspectives in the Selection of Intrinsic Frames of Reference in Spatial Memory. WEIMIN MOU & MINTAO ZHAO, *Chinese Academy of Sciences*, & TIMOTHY P. McNAMARA, *Vanderbilt University* (sponsored by Weimin Mou)—Four experiments investigated the roles of layout geometry and viewing perspectives in the selection of intrinsic frames of reference in spatial memory. Participants learned the locations of objects in a room from two or three viewing perspectives. One view corresponded to the axis of bilateral symmetry of the layout. Judgments of relative direction using spatial memory were quicker for imagined headings parallel to the symmetric axis than for those parallel to the other viewing perspectives. This advantage disappeared when the symmetric axis was removed. Judgments of relative direction were not equally fast for the two oblique experienced headings. These results indicate that layout geometry affects the selection of intrinsic frames of reference and that two oblique intrinsic directions cannot be selected simultaneously.

(1004)

Spatial Memory of Briefly Viewing a Desktop Scene. WEIMIN MOU & CHENGLI XIAO, *Chinese Academy of Sciences*, & TIMO-

THY P. McNAMARA, *Vanderbilt University*—Two experiments investigated participants' spatial memory and spatial updating after they briefly viewed a scene. Participants in a darkroom saw an array of five phosphorescent objects on a table and, after a short delay, indicated whether a probed object had been moved. Participants made their judgment from the original or from a new viewing perspective. In one condition, the objects other than the probed one moved (different spatial context), and in the other condition the other objects stayed untouched (same spatial context). Performance was better in the same-context than in the different-context condition, and better when the testing perspective was the same as the viewing perspective than when it was different. These findings indicated that interobject spatial relations were mentally represented in terms of an intrinsic frame of reference and that the orientation of the intrinsic frame of reference was not changed during locomotion.

(1005)

Failure to Integrate Spatial Information in a Virtual Environment Foraging Task. BRADLEY R. STURZ, KENT D. BODILY, JEFFREY S. KATZ, & LEWIS M. BARKER, *Auburn University*—A 3-D virtual environment was constructed for humans as an open-field analogue of Blaisdell and Cook's (2005) pigeon foraging task to determine whether humans, like pigeons, were capable of integrating separate spatial maps. Subjects searched a virtual environment for a goal located in a 4×4 grid of raised cups. In Phase 1 training, subjects learned to locate the goal between two landmarks (Map 1: blue *T*, red *L*) and in Phase 2 training, down and left of a single landmark (Map 2: blue *T*). During testing, subjects were required to make nonreinforced choices in the presence of the red *L* alone. Cup choices during testing assessed subjects' strategies: generalization (Map 2), association (Map 1), or integration (combination of Maps 1 and 2). Results suggested that subjects used a single landmark generalization strategy, which was confirmed by control groups. Comparative implications of the results are discussed.

(1006)

Formulating Spatial Descriptions in Scenes With Multiple Objects. PATRICK L. HILL & LAURA A. CARLSON, *University of Notre Dame*—In order to describe the location of a target, a speaker may specify its spatial relation with respect to a reference object. This requires selecting an "easy-to-find" reference object and an "easy-to-compute" spatial term. However, given a display with numerous objects and spatial relations, it is not clear how such selection occurs. First, speakers could initially select the most appropriate reference object, with this selection constraining the spatial term that is subsequently selected. Second, speakers could select the most appropriate spatial term, with this selection constraining the reference object that is subsequently selected. Third, speakers could jointly consider and select from object-term pairs. Using rating and production tasks in which we manipulate attributes of the objects and their spatial relations, we demonstrate that speakers are influenced by both the appropriateness of the objects and the appropriateness of the spatial term, supporting the idea that these are jointly considered.

(1007)

What's Up? Reference Frames and Spatial Transformations. BYUNG CHUL YOON & AMY L. SHELTON, *Johns Hopkins University*—Object-based and perspective transformations of bodies/objects are characterized by different temporal properties (Zacks & Michelon, in press): object-based transformations show a linear relationship between the angular disparity of two figures and response latency, whereas perspective transformations show greater orientation invariance. However, for room stimuli, a perspective transformation task has shown an attenuated linear relationship with response latency, suggesting that participants may automatically reconcile the scene with their upright position. We investigated this interpretation by disrupting the congruence among the gravitational, local, and egocentric reference frames and asking which frame defines "upright" for room

stimuli. Participants performed object-based and perspective-based judgments for rooms and bodies in different combinations of reference frame congruence, defined by the position of the person and the computer monitor. Rather than showing one dominant reference frame, results revealed that upright coincided with any two congruent reference frames, suggesting flexibility in reference frame use for spatial problem solving.

(1008)

Perspective and Instruction Effects on Mentally Representing a Virtual Environment. HOLLY A. TAYLOR, *Tufts University*, & FRANCESCA PAZZAGLIA, *University of Padua* (sponsored by Holly A. Taylor)—How do instructions to focus on particular aspects of an environment and learning from different spatial perspectives affect one's cognitive map? Participants learned an urban virtual environment from either a survey or a route perspective and were instructed to focus either on landmarks or on intersections. The route group learned the environment by watching a virtual person walking through it, whereas the survey group learned by watching a dot moving through a map. While learning, participants were stopped at critical points, and their attention was focused on either landmarks or intersections. After learning, all participants performed several spatial tasks: navigation, map drawing, and pointing. Individual differences in the cognitive style of spatial representation were recorded. Results showed that spatial perspective, instructions, and individual differences in spatial representations interacted to affect performance. These results will be discussed in the context of spatial mental models and their influences.

(1009)

Encoding Direction During the Processing of Proximity Terms. AARON L. ASHLEY & LAURA A. CARLSON, *University of Notre Dame*—A target's location may be described by spatially relating it to a reference object. Different types of spatial terms emphasize different aspects of this spatial relation, with projective terms (e.g., "above") explicitly conveying direction (but not distance), and proximity terms (e.g., "near") explicitly conveying distance (but not direction). It has been suggested that only aspects of the relation that are explicitly conveyed by the spatial term are encoded when interpreting a spatial description. However, recent research has demonstrated that distance information is encoded during the processing of projective spatial relations, because such information is important for finding the target. In the present research, we demonstrate that direction information is similarly encoded during the processing of proximity terms that convey a close distance ("near," "approach"), but not for those conveying a far distance ("far," "avoid"), in support of the idea that multiple aspects of the spatial relation are encoded when they assist locating the target.

(1010)

The Effect of Recipient Perspective on Direction-Giving Processes. ALYCIA M. HUND & KIMBERLY M. HOPKINS, *Illinois State University*—Getting to unfamiliar destinations often involves relying on directions from others. These directions contain several cues, including landmarks, streets, distances, and turns. The goal of this project was to understand the cues people use when giving directions for navigation. In particular, does the information provided depend on whether a route or survey perspective is employed? Sixty-four participants provided directions to help a fictitious recipient get from starting locations to destinations in a fictitious model town. On half of the trials, the recipient was driving in the town (a route perspective). On the remaining trials, the recipient was looking at a map of the town (a survey perspective). As predicted, people included significantly more landmarks and left/right descriptions when addressing a recipient driving in the town. In contrast, they used significantly more cardinal descriptors when addressing a recipient looking at a map. These findings suggest that perspective affects direction-giving processes.

• COGNITIVE SKILL ACQUISITION •

(1011)

The Separation of Words and Rules: Implicit Learning of Abstract Rules for Word Order. ANDREA P. FRANCIS, *Michigan State University*, GWEN L. SCHMIDT & BENJAMIN A. CLEGG, *Colorado State University*—Artificial grammar learning studies have implied that people can learn grammars implicitly. Two studies using word strings, rather than traditional letter strings, examined the incidental learning of three-word orders. English speakers practiced unfamiliar strings ordered as either "verb noun noun" or "noun noun verb." Despite possible prior associations between the words and the "noun verb noun" order, self-timed reading speed decreased following exposure to the unfamiliar rule. This pattern generalized beyond the specific instances encountered during practice, suggesting that learning of the structure was abstract. A second experiment found learning when nouns were replaced with pseudowords, showing that learning was possible in the absence of preexisting meaning and meaningful relationships between items. These findings suggest that word orders can be learned implicitly and that words and orders can be dissociated during learning. These results extend artificial grammar learning to more 'language-like' materials and are consistent with accounts emerging from structural priming research.

(1012)

Implicit Learning of Artificial Grammars: Under What Conditions? ESTHER VAN DEN BOS & FENNA H. POLETIEK, *Leiden University*—Numerous artificial grammar learning (AGL) experiments have shown that memorizing grammatical letter strings enables participants to subsequently discriminate between grammatical and ungrammatical strings at least as well as does looking for underlying rules. The present study examined the circumstances triggering implicit learning. We suggest that implicit learning occurs during memorizing, because structure knowledge facilitates this task. In general, we propose that implicit learning occurs whenever structure knowledge contributes to fulfilling a person's current goal. This goal directedness hypothesis was tested in an AGL study. Adults and children performed an induction task to which knowledge of the grammar could be more or less functional. Both groups showed the same pattern of performance on a subsequent grammaticality judgment test: Functional conditions (identifying semantic referents, memorizing) outperformed nonfunctional conditions (identifying different semantic referents, rating likeability, computing values associated with sentences). These results suggest that implicit learning is goal directed, occurring whenever structure knowledge facilitates one's current task.

(1013)

Movement Matters: Enhancing Artificial Grammar Performance With Animation. BILL J. SALLAS, ROBERT C. MATHEWS, & SEAN M. LANE, *Louisiana State University*, & RON SUN, *Rensselaer Polytechnic Institute*—When learning abstract material, one approach involves exposure to many examples of the corpus (memory-based), while a second approach involves learning the underlying structure (model-based). Research (Domangue et al., 2004) using an artificial grammar task has found that memory-based processing leads to fast but relatively inaccurate performance and model-based processing leads to slow but accurate performance at test. Attempts to integrate memory- and model-based training to facilitate fast and accurate performance were unsuccessful. The present experiment utilized a computer-animated training task, whereas previous research used a pen-and-paper task. Training with an animated representation, or diagram, of the grammatical rules led to fast and accurate performance at test. Animation without this explicit representation led to fast but inaccurate performance. Our results suggest that it is possible to integrate memory- and model-based processing to enhance performance. In addition, our results bear on the current debate on the utility of animation for learning.

(1014)

Transfer in Artificial Grammar Learning. YAEL POZNANSKI, *Achva Academic College*, & JOSEPH TZELGOV, RAN AIZENBERG, & TAL BEN-YEHUDA, *Ben-Gurion University of the Negev* (sponsored by Sam S. Rakover)—The transfer effect in implicit learning of artificial grammar is often used as an indication of rule learning. This effect was criticized for various reasons—for instance, for the use of accuracy as an indication of learning or the lack of control groups. In this work, the transfer effect of intentionally retrieving knowledge acquired incidentally (implicitly) was examined with regard to these critics, using signal detection's d' as a measure of performance. Two experiments were conducted, Experiment 1 with 10 presentations during the learning phase (short learning) and Experiment 2 with 50 presentations (extended learning). Whereas old patterns presented in transferred stimuli were judged as legal after short learning, the classification of new patterns as legal was achieved only after extended learning. This result was interpreted as evidence for two-stage learning: learning of superficial relations at the first stage and of deep structure at the second.

(1015)

Individual Differences in Skill Acquisition on a Logic Gate Task. MICHAEL F. BUNTING, *University of Missouri, Columbia*, & DAVID W. HATCHER, SCOTT R. HINZE, & JAMES PELLEGRINO, *University of Illinois, Chicago*—As individuals successfully acquire a cognitive skill, performance shifts from intentional to automatic processing. This experiment explored task and person factors that can influence an individual's ability to acquire a complex cognitive skill. We manipulated difficulty in a logic gate task by varying working memory load and instance presentation frequency in a 2 (load) \times 2 (instance) between-subjects design. In addition, we assessed various cognitive abilities to explore the role of multiple sources of individual differences in skill acquisition. The between-subjects manipulations interacted to influence the speed and accuracy of skill acquisition, indicating that both internal and external memory load manipulations influence task difficulty. In agreement with Ackerman's (1988) three-phase model, working memory capacity was most important as subjects began to acquire a skill but was displaced by other factors later in acquisition. The implications of these results for theories of skill acquisition will be discussed.

(1016)

Transfer of Training for Cognitive Skills: An Investigation of Use-Specificity. TIMOTHY J. NOKES, *Beckman Institute, University of Illinois, Urbana-Champaign*—Learning a cognitive skill requires learning both procedural and declarative knowledge. Previous work on skill acquisition has argued that procedural knowledge will only transfer to tasks that use that knowledge in the same way (Singley & Anderson, 1989). However, research suggests that declarative knowledge can be transferred to new tasks regardless of use. In the present study, I examine both use-specific and use-general knowledge transfer of a cognitive skill. Participants were trained on one of two skill subcomponents for solving sequence extrapolation problems (pattern detection versus pattern extrapolation) and then solved a target problem. Participants given detection training were faster to find the target pattern, whereas participants given extrapolation training were faster to articulate the target sequence, and both groups were faster than a control group for their respective nontrained components of problem solving. The results suggest that participants transferred both use-specific and use-general knowledge from training to test.

(1017)

Distributed Practice and Long-Term Retention: A Ratio Rule for Optimal Interstudy Interval to Retention Interval? NICHOLAS J. CEPEDA, *University of Colorado, Boulder*, & HAROLD PASHLER & EDWARD VUL, *University of California, San Diego*—Despite years of distributed practice studies, little is known about how interstudy interval and retention interval interact over long durations—information that is critical for the practical application of distributed practice re-

search. We report data from a large-scale Internet-based study examining four different retention intervals, ranging from 1 to 50 weeks, combined with interstudy intervals (ISIs) ranging from 0 days to 15 weeks. Participants learned a set of obscure facts and were tested for both recall and recognition memory during a final test. Based on data from more than 1,000 participants, our results indicate (1) that non-monotonic lag functions arise over these long intervals (i.e., each retention interval has an optimal ISI) and (2) that optimal ISI increases as a predictable ratio of retention interval.

(1018)

Differential + Associative Processing: A New Strategy for Learning Confusing Concepts. BRENDA A. HANNON & GREG LOZANO, *University of Texas, San Antonio*—In educational settings, students are often expected to learn pairs of concepts such as fluid intelligence and crystallized intelligence. For many students, these concepts are difficult to learn because they have highly similar definitions that are easy to confuse. The challenge of learning these highly similar yet often confused concepts is even further complicated by the fact that students are often examined about differences between the concepts in a pair. This research tests a new strategy for learning highly similar yet often confused concepts. This new strategy—called differential + associative processing—is an integration of two well-established cognitive theories that requires: (1) the explicit identification of differences between highly similar pairs of concepts (e.g., fluid intelligence decreases with age, whereas crystallized intelligence increases with age) and (2) that each part of the identified difference (e.g., decreasing with age) to be associated with its respective concept (e.g., fluid intelligence). The results of three experiments show the effectiveness of differential + associative processing and validate the need for both the differential and associative components.

• WORKING MEMORY •

(1019)

Domain-General Versus Domain-Specific Resources in Working Memory. RYAN J. KENNY & M. JEANNE SHOLL, *Boston College* (sponsored by M. Jeanne Sholl)—In Baddeley's (2003) working memory model, a central executive (CE) allocates cognitive resources to separate verbal and visuospatial storage systems for the temporary maintenance and manipulation of information. We report two experiments that used an interference paradigm to test whether the cognitive resources allocated by the CE are domain-specific or domain-general. In both experiments, participants maintained 3, 4, 5, 6, or 7 items in either verbal or visuospatial short-term store while simultaneously processing either verbal or visuospatial information. The domain-general hypothesis predicts interference under sufficient memory load when verbal (visuospatial) memory is paired with visuospatial (verbal) processing. In contrast, the domain-specific hypothesis predicts interference when memory and processing are paired within the same domain but not when paired between domains. Although they are not clearly consistent with either hypothesis, the results inform models of resource sharing in working memory.

(1020)

Allocating Attention to Cross-Domain Stimuli in Working Memory. CANDICE C. MOREY & NELSON COWAN, *University of Missouri, Columbia*—A controversy in working memory is whether information is stored entirely in modules operating effortlessly for different codes and modalities, or whether they are supplemented by attention used for general storage. The latter theory should result in competition between, say, visuospatial and auditory-verbal information. We argue for this competition. Morey and Cowan (2004, in press) showed that maintaining verbal materials in memory interferes with visuospatial working memory. However, opponents of the attention-as-storage view still could argue that verbal rehearsal contributes to spatial recall, or that levels of task difficulty are uncontrolled. To address these concerns, we did further experimentation using (1) series of tones in-

stead of spoken digits, and (2) a constant level of difficulty but a manipulation of the relative monetary rewards for the visual versus auditory tasks. Accuracy on each task increased with higher rewards, and we observed performance tradeoffs indicating that central attention is used as storage.

(1021)

Context Maintenance and Working Memory Capacity. THOMAS REDICK & RANDALL W. ENGLE, *Georgia Institute of Technology*—Individual differences in working memory capacity (WMC) are important in a variety of memory, attention, and intelligence tasks. Engle and Kane (2004) proposed an account of WMC based upon the ability to maintain goals and resolve response competition. Interestingly, Braver, Barch, and Cohen (2002) have proposed a similar theory to explain cognitive impairments seen in schizophrenia, Alzheimer's disease, and aging. We tested high and low spans on the AX-CPT in order to compare the controlled-attention view of WMC and the context-maintenance view of schizophrenia and aging. The results were partially consistent with the idea that low spans suffer from impaired context representation, but performance differed in meaningful ways from what would be predicted from a strict context-maintenance view. The results are consistent with the notion that high and low spans differ in their ability to control attention, even on a task modified to reduce attentional demands.

(1022)

Individual Difference in Change Detection. SCOTT D. BROWN & MARK STEYVERS, *University of California, Irvine* (sponsored by Mark Steyvers)—We measure the ability of human observers to predict the next datum in a sequence that is generated by a simple statistical process undergoing change at random points in time. Accurate performance in this task requires the identification of changepoints. We assess individual differences between observers both empirically and using two kinds of models: a Bayesian approach for change detection and a family of cognitively plausible fast and frugal models. Some individuals detect too many changes and hence perform suboptimally because of excess variability. Other individuals do not detect enough changes, and perform suboptimally because they fail to notice short-term temporal trends.

(1023)

Controlled Attention as a Mechanism for Processing Inefficiency Among Math Anxious Individuals. J. RUDINE & DOUGLAS A. WARING, *Appalachian State University*—Cognitive deficits associated with math anxiety are often explained using processing efficiency theory, suggesting that working memory becomes inundated with worrisome thoughts impeding task performance. One drawback to this theory is the lack of a specific mechanism through which these deficits are produced. The controlled attention view of working memory may offer a solution to this problem. This view proposes that individuals with lower WM capacity have more difficulty inhibiting distracting cues and focusing on a task than do individuals with higher WM capacities. The present study used the antisaccade task to assess math anxious individuals' ability to inhibit distracting information. Analysis of reaction times and accuracy rates indicated that high math anxiety individuals were slower and less accurate than low math anxiety individuals on trials requiring inhibition. Contrary to predictions, reflexive trials took longer than inhibition trials. Possible reasons for these counterintuitive results and implications for future research are discussed.

(1024)

Working Memory Capacity Predicts Attentional Blink. M. KATHRYN BLECKLEY, ALLISON R. HOLLINGSWORTH, & WILLIAM S. MAKI, *Texas Tech University*—Working memory capacity (WMC) has predicted performance in a number of attention tasks (Kane, Bleckley, Conway, & Engle, 2001; Kane & Engle, 2002), and working memory has been suggested as the limiting mechanism in attentional blink (AB; Chun & Potter, 1995; Giesbrecht & Di Lollo, 1998;

Vogel & Luck, 2002). We present here a study that supports the contention that WMC is the limiting mechanism in AB.

(1025)

Eye Movements in the Reading Span Task. JOHANNA K. KAAKINEN, *Florida State University*, & JUKKA HYÖNÄ, *University of Turku*—The present study examined eye movement patterns during the reading span task (Daneman & Carpenter, 1980). The results showed that in low memory load conditions there were very few differences between low and high span groups. However, when we compared the different span groups at their maximum performance levels, we found that participants with lower spans tended to pause on the first word of the sentence, whereas participants with the highest spans did not spend extra time on the first word. Span groups did not differ in the time spent on the to-be-remembered word. In contrast to previous findings (Carpenter & Just, 1989; Engle, Cantor, & Carullo, 1992), these results indicate that performance differences in the reading span task cannot be accounted for by the time spent on the to-be-remembered information.

(1026)

The Relationships of Auditory Distraction and Measures of Working Memory. JILL A. SHELTON, EMILY M. ELLIOTT, SHARON D. LYNN, & THOMAS J. DOMANGUE, *Louisiana State University*—Recent research has examined the relationship between auditory distraction effects in serial recall and working memory (WM). The purposes of the present study were to expand upon this research by examining the effect of auditory distractions on the performance of one WM task and to assess the relationships among three WM tasks. Participants completed the operation—word span, size judgment span, and *n*-back tasks. In the control condition, participants completed all tasks without auditory distraction. In the treatment condition, a cell phone rang during one specific trial of the size judgment span task. Comparisons were made between this trial in the treatment condition and the same trial in the control condition, and the results revealed that the cell phone ring significantly disrupted performance on this trial in the treatment condition. In addition, correlational analyses demonstrated that performance on all three WM tasks was significantly correlated.

(1027)

The Word Length Effect and Stimulus Set Specificity. TAMRA J. BIRETA, IAN NEATH, & AIMÉE M. SURPRENANT, *Purdue University*—Lists of items that take less time to pronounce are recalled better than otherwise equivalent lists of items that take more time to pronounce, the so-called word length effect. Contrary to theories based on the phonological loop, Hulme et al. (2004) found that long items presented in a list with short items were recalled as well as were short items presented in a list of only short items. In contrast, Cowan et al. (2003) found that long items in mixed lists were recalled less well than short items in pure lists. The experiments reported here suggest that the different empirical findings are due to particular properties of the stimulus sets used: one stimulus set produces results that replicate the findings of Cowan et al., whereas all other sets so far tested yield results that replicate the findings of Hulme et al.

(1028)

Age-Related Differences in the Phonological Similarity Effect: The Contribution of Sensory Acuity. AIMÉE M. SURPRENANT, LISA A. FARLEY, & IAN NEATH, *Purdue University*—The experiments reported here explore age-related differences in recall of phonologically similar and dissimilar items in pure and mixed lists. In addition to basic sensory acuity, movement, transposition, and confusion errors were examined in order to model the data from the two groups. Sensory acuity accounted for some, but not all, of the variance, particularly in the similar conditions. These data suggest that multiple nonlinear interactions among factors underlie age-related differences in memory performance and reinforce the usefulness of simulation modeling in the area of cognitive aging.

(1029)

Different Balance of Good and Bad Effects of Phonological Similarity for Words and Nonwords. EMILIA L. LUOTONIEMI, *University of Helsinki*, ELISABET M. SERVICE, *University of Helsinki and Dalhousie University*, & SINI E. MAURY, *University of Helsinki* (sponsored by John Connolly)—This study explored whether earlier results of differential effects of similar syllables at the beginning (harmful) or end (helpful) of nonwords on the short-term memory for lists of these nonwords could be replicated for real words. We studied lists with phonologically redundant syllables located either at the beginning or end of two-syllable words or nonwords. The results showed that redundancy at the end did not impair memory for nonwords but harmed the recall of words. Irrespective of lexicality, lists of beginning-redundant items were more difficult to recall than those of end-redundant items. According to the results, the balance between helpful and harmful effects of redundancy seems different in short-term recall of words versus nonwords. The harmful effect of similarity might be related to recalling the order of multiple items, whereas the helpful effect, which was seen at the syllable level, could be the consequence of more successful reintegration of the redundant part of the stimulus.

(1030)

The Facilitatory Effects of Phonological Similarity on Immediate Serial Recall. BYRON MURPHY, BRANDON ABBS, & PRAHLAD GUPTA, *University of Iowa* (sponsored by Prahlad Gupta)—The phonological similarity effect (PSE) in immediate serial recall can be facilitatory, especially for lists of nonwords and when item recall scoring is used. However, few studies have demonstrated this effect for strict serial scoring of lists of real words, and the PSE has rarely been examined with polysyllabic stimuli. We investigated the facilitatory PSE employing lists of two-syllable words and strict serial scoring. Using visual and auditory presentation, Experiments 1 and 2 found higher recall for rhyming than for dissimilar lists, but lower recall for alliterative than for dissimilar lists (i.e., a classic PSE), suggesting that the position of the similarity between list items influences the direction of the PSE. Experiment 3 showed that the benefit of rhyming similarity was not due to differences in amounts of feature overlap between items in rhyming and alliterative lists. The results suggest that the PSE varies considerably with the properties of the list stimuli.

(1031)

Processing Domain, Working Memory, and Reasoning Ability. JING CHEN, *Grand Valley State University*, & SANDRA HALE & JOEL MYERSON, *Washington University*—Undergraduates ($N=207$) were tested on psychometric reasoning tests and simple and complex span tasks (two verbal and two visuospatial in each case). Complex and simple span tasks used the same items, but complex span tasks required additional processing involving transformation of items or irrelevant secondary tasks. This additional processing resulted in complex span scores significantly lower than their simple span counterparts. The overall trend was for verbal spans to predict spatial reasoning better than spatial spans predicted verbal reasoning. Both simple and complex spans predicted reasoning in the same domain, but only complex spans predicted across domains. Although factor analysis revealed spatial and verbal factors, but not simple and complex span factors, the fact that only complex spans predict reasoning in the opposite domain supports the hypothesis that such tasks uniquely tap an important ability. Interestingly, complex spans involving transformations predicted opposite-domain reasoning better than did complex spans with secondary tasks.

(1032)

Effects of Working Memory and Domain Knowledge in Overcoming Mental Sets in Creative Problem Solving. TRAVIS R. RICKS, *University of Illinois, Chicago*, & KANDI JO TURLEY-AMES, *Idaho State University*—The present study assessed whether individual differences in working memory (WM) impact mental sets created by ex-

pertise. Wiley's adaptation of the remote association task (RAT) was used to create mental sets in baseball experts; half of the participants, both experts and novices, solved baseball-consistent items, and the other half solved baseball-misleading items. Number of RAT items solved and reaction time were evaluated on the basis of version, WM span, and expertise. Contrary to previous research (Wiley, 1998), WM was related to RAT performance, but expertise was not. For Study 2, a warning was given to investigate whether recruiting methods created mental sets for novices in Study 1, in a way analogous to Wiley's warning study. Results for the Study 2 were similar to those of Study 1 and Wiley's study. Again, a main effect was observed for WM. The importance of considering WM span and recruitment techniques when studying how experts overcome mental sets is discussed.

(1033)

Does Domain Knowledge Moderate Effects of Working Memory on Chess Performance? THOMAS J. WAGNER & DAVID Z. HAMBRICK, *Michigan State University*—Previous research has demonstrated that both working memory (WM) and domain-specific knowledge contribute to individual differences in higher level cognition. This study investigated the interplay of these two factors using chess as the venue for research. The specific question was whether high levels of chess knowledge attenuate effects of WM on domain-relevant performance, which would agree with a compensation hypothesis of the relationship between these two factors. Participants representing wide ranges of WM and chess knowledge performed tests of WM and chess knowledge, in addition to two chess-related criterion tasks. One task was to remember the locations of briefly presented chess positions, and the other involved finding chess moves that would force checkmate. Both WM and chess knowledge predicted performance on the chess tasks. However, inconsistent with the compensation hypothesis, there was no interaction. This finding suggests that WM and domain knowledge may operate independently to determine cognitive performance under some circumstances.

(1034)

Encoding Strategies and the Mixed-List Paradox in Serial Recall. CAROLINE MORIN, *University of Warwick*, MARIE POIRIER, *City University, London*, CLAUDETTE FORTIN, *Université Laval*, & CHARLES HULME, *University of York*—In free recall tasks, when low- and high-frequency items are mixed within the to-be-remembered lists, the usual recall advantage found for high-frequency words is eliminated or reversed. Recently, this mixed-list paradox has also been demonstrated for short-term serial recall (Hulme, Stuart, Brown, & Morin, 2003). Although a number of theoretical interpretations of this mixed-list paradox have been proposed, it has also been suggested that it could simply be a result of participant-controlled strategies (Watkins, LeCompte, & Kim, 2000). The present study was designed to assess whether this explanation can be applied to immediate and delayed serial recall. The results showed that high-frequency items were better recalled than low-frequency items in pure lists but that this effect was eliminated in mixed lists, whether they were given under intentional or incidental learning conditions. This pattern is not consistent with the view that the mixed-list paradox can be explained by participant-controlled strategies.

• FALSE MEMORY •

(1035)

Deficits in Frontal Function Restrict Effective Use of Individual Item Information. AYANNA K. THOMAS, *Colby College*, & MARK A. MCDANIEL, *Washington University*—Recent studies suggest that age differences in false memories may be mediated by deficits in frontal lobe functioning (Butler et al., 2004). The present study examined whether older adults who perform poorly on test designed to assess frontal function were less likely to benefit from manipulations designed to reduce false memories. Participants were presented with semantically related items in the context of sentences that

converged on either the dominant or the subordinate meaning of a nonpresented critical theme word. Only younger adults and high frontal functioning older adults benefited from the contextual information provided by the dominant meaning conditions and showed reductions in false memory susceptibility. However, when gist-based processing of list items was made less accessible, as in the subordinate meaning condition, all groups showed similar reductions in false memory susceptibility. These results suggest that low frontal functioning older adults encode item information but overrely on accessible gist information.

(1036)

Hybrid False Recollection: Evidence From ERP. STEVEN HAMILTON, *University of Sussex*, ROBYN E. HOLLIDAY, *University of Kent*, & FAY JOHNSON & BRENDAN S. WEEKES, *University of Sussex* (sponsored by Brendan S. Weekes)—Two experiments examined whether semantic and phonological false memory effects are additive by using hybrid lists of written words presented using the DRM paradigm. Hybrid lists were constructed so that each critical lure was related in both meaning and sound to studied words. In Experiment 1, 36 adults were tested, and results showed a reliable false memory effect with the semantic, phonological, and hybrid lists. However, there was no evidence of an additive effect across lists. In Experiment 2, EEG recordings were taken while participants performed the same tasks. The results showed differential ERP patterns during recognition performance across the hybrid and nonhybrid items. Of most interest was a pattern of bilateral activation during false recollection for hybrid items that was not observed during semantic and phonological false recollection. We interpret the data in terms of models of recollection and argue that hybrid lists generate a stronger sense of gist-based recollection than do nonhybrid lists.

(1037)

“Hybrid” False Memories Following Primed Naming: Expectancy at Encoding or Bias at Retrieval? PATRICK A. O’CONNOR, CHISHING TSE, & JAMES H. NEELY, *SUNY, Albany* (sponsored by James H. Neely)—False memories of *mail* in recognition are higher when the semantically related prime HAMMER and the form-related target *mail* have been incidentally studied together versus separately in a prior naming task. This contiguity-based increase in semantic-form “hybrid” false memories (HFMs) occurs at a 750-msec prime–target SOA with a high, but not with a low, study phase relatedness proportion (RP; Humphreys, Burt, & Lawrence, 2001). We find this contiguity-based increase in HFMs with a high RP at both a 760-msec SOA (6% increase) and a 175-msec SOA (10% increase), but not with a low RP and a 175-msec SOA (1% decrease). Because the 175-msec SOA should minimize expectancy at encoding, the large 10% contiguity-based increase in HFMs obtained in the high-RP/175-msec SOA condition favors a bias-at-retrieval account over an expectancy-at-encoding account of why contiguity inflates semantic-form HFMs only when the study phase RP is high.

(1038)

The Development of False Memories in Bilingual Children and Adults. NADINE GAGNON, *Lakehead University*, MARK L. HOWE, *Lancaster University*, & LISA PAQUETTE, *Lakehead University* (sponsored by Mark L. Howe)—The effects of bilingual (English–French) study and test on rates of children’s and adults’ true and false memories were examined. Children aged 6 through 12 and university-aged adults participated in a standard DRM false memory task using free recall. The results showed that (1) both true and false memories increased with age, (2) true recall was higher in unilingual than in bilingual conditions for all ages, and (3) there were fewer false memories in bilingual than in unilingual conditions for the youngest children, no differences for the 7- and 12-year-olds, and among adults, more false memories in bilingual than in unilingual conditions. These findings are discussed in the context of language organization models and bilingual memory development.

(1039)

The False Recall Effect Following Multitrial Serial Learning. JOHN P. TAYLOR, KARA DESOUZA, SARA HABER, & WILLIAM P. WALLACE, *University of Nevada, Reno*—Lists of associates to key words produce large intrusion rates of the key words during later free recall. Participants with a well-practiced retrieval plan for a learned list should be able to exclude intrusions from recall. In the present experiment, nine lists of the 12 most frequent associates to key words (e.g., *sour, candy, sugar*, etc., for the key word *sweet*) were taken from Roediger and McDermott (1995). Three lists were presented for one, three, and eight trials each. Twenty-four participants read each word aloud, and 24 attempted to anticipate the next word in the series. Lists were cued for final recall by presenting the first word on each list. On final recall, the proportion of key-word intrusions following the eight trials of serial anticipation was .21. For all other conditions, values ranged from .44 to .49. Imposing serial order on recall over eight trials considerably reduced the intrusion rates commonly found with associate lists.

(1040)

Congruency Effect of Presentation Modality on Haptic, Visual, and Auditory False Memory. TOMOHIRO NABETA, *Hiroshima University*, KEIJI OKADA, *Aichi University*, & JUN KAWAHARA, *Hiroshima University*—False recognition of an item that is not presented (the lure) can be produced when participants study and are then tested on their recognition of a list of items related to the lure, which is not included in the list. False recognition has been shown to be reduced when the study and test modality are congruent (e.g., both visual) rather than being different (e.g., visual study and auditory test). The present study examined whether such a congruency effect occurs for visual, haptic and auditory modalities. After studying items presented haptically, visually or auditorily, participants took a recognition test in one of the three modalities. The congruency between the study and test modalities reduced false recognition when studied haptically or visually. These results suggest that distinctive cues encoded through the haptic and visual modality help the participants to recognize the studied words more accurately, resulted in less false recognition.

(1041)

Memory Illusions and Repeated Testing in Children: The “Reversed” DRM Effect. ROBYN E. HOLLIDAY, *University of Kent, Canterbury*, TIMOTHY N. ODEGARD, *University of Texas, Arlington*, & CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*—The Deese/Roediger–McDermott (DRM) paradigm was used to investigate the effects of an encoding manipulation (read versus generate) and a retrieval manipulation (test repetition) on 10- to 12-year-olds’ true and false recognition. Children studied two blocks of four DRM lists, one “read” (i.e., whole words) and the other “self-generated” (word fragment completion). Each block was followed by either one or three recognition tests. False recognition of critical distractors was lower in the generation condition than in the read condition. These false-memory responses were doubly dissociated by encoding condition and test repetition: Repetition increased false alarms in the read condition but decreased them in the generate condition. Such findings are consistent with fuzzy-trace theory’s opponent processes account of false memory.

(1042)

Dissociations in Children’s True and False Recall. MARK L. HOWE, *Lancaster University*—Across three experiments, the role of associative versus categorical relations in children’s veridical and false memories was examined. Children studied DRM lists or categorized word or picture lists, with or without category labels as primes. For veridical recall: (1) There were developmental increases in recall regardless of list type, presentation modality, or priming; (2) regardless of age, categorized lists were better recalled than DRM lists, regardless of modality or priming. For false recall: (1) There were developmental increases in recall, except for pictures; (2) no differences were pres-

ent for categorized and DRM lists, regardless of priming; and (3) false memories were suppressed for pictures. As with the adults, children's false memories are based on interitem associative connections, not across-item thematic relations, but their veridical memories depend on both. This dissociation is inconsistent with models that rely on thematic relations to explain the DRM illusion but is consistent with knowledge- and resource-based models of memory development.

(1043)

More Detailed Real Memories Can Give Rise to More Detailed False Memories. KEITH B. LYLE & MARCIA K. JOHNSON, *Yale University*—When memory for imagined events is tested, feature information from similar perceived events may be inadvertently reactivated and misattributed to the imagined events, producing false memories that contain actually perceived details (Lyle & Johnson, in press). Here, we examined the content of false memories as a function of opportunity to bind together features (shape and location) of perceived events. Drawings of objects were randomly presented in four peripheral locations for either 1 or 4 sec. In a center location, participants imagined object drawings, half of which (e.g., a lollipop) had shape features similar to those in a real drawing (e.g., a magnifying glass). Location memory for drawings was greater in the 4- than in the 1-sec condition. When falsely remembered as seen, imagined objects were systematically attributed to the location of similar drawings in the 4-sec condition only. Thus, feature binding increases the variety of perceived detail in both real and false memories.

(1044)

Context Reinstatement and False Recall in the DRM Paradigm. KERRI A. GOODWIN, KRISTIN MEHR, CAROLINE NORRIS, BRIANNA RYCYK, & KRISTEN CESIRO, *Loyola College in Maryland*—Goodwin reported that when participants engaged in elaborative encoding in the DRM paradigm, they were more likely to restate their original encoding strategy than when they were engaged in rote rehearsal. The present study experimentally investigated the effects of retrieval instructions that either matched or mismatched encoding conditions. Participants were randomly assigned to study lists using either elaborative encoding or rote rehearsal. At recall, participants re-created their original encoding for half of the lists and performed a mismatched retrieval strategy for the other half. Preliminary results indicate a crossover interaction for false recall in which participants engaged in elaboration showed more false recall when encoding and retrieval conditions matched than when they mismatched, and in which those engaged in rote rehearsal showed the opposite pattern. Results are discussed in terms of source monitoring and attribution memory processes.

• EYEWITNESS MEMORY •

(1045)

Distinctiveness of Encoding Determines Susceptibility to False Memories. HEATHER R. COLLINS & RICHARD E. MAYER, *University of California, Santa Barbara*—The distinctiveness heuristic suggests that participants use an expectancy of distinctive information at retrieval to reduce false memories. We hypothesize that distinctiveness can also affect false memories for an event. At encoding, participants heard a verbal narration (nondistinct) or saw a slideshow with narration (distinct) about a home burglary. During manipulation, participants received false information presented by a narration (nondistinct) or a slideshow with narration (distinct). Conditions were based on information presented during encoding and manipulation: distinct/distinct, distinct/nondistinct, nondistinct/distinct, and nondistinct/nondistinct. Although participants in all conditions exhibited false memories, those who encoded information in a distinctive manner had fewer false memories than did those who encoded nondistinct information. Presenting distinct information during manipulation did not increase false memories. We observed an interaction showing increased remember judgments for conditions with fewer false alarms (distinct

encoding) and decreased remember judgments for conditions with more false alarms (nondistinct encoding). Encoding can thus impact false memories more than manipulation.

(1046)

Eyewitness Memory for Own- and Other-Race Faces: The Mitigating Effects of Sequential Presentation and Conservative Instructions. JESSICA L. MARCON & CHRISTIAN A. MEISSNER, *University of Texas, El Paso*, & TARA L. MITCHELL, *Lock Haven University*—Meissner et al. (in press) recently introduced a novel lineup recognition paradigm in which participants encode a series of faces and are later tested via a series of six-person lineup arrays in which one of the targets is either present or absent. This paradigm allows researchers to estimate signal detection parameters while examining phenomena relevant to application in eyewitness memory. The present study extends this research by using this lineup recognition paradigm to investigate the cross-race effect in memory for faces (Meissner & Brigham, 2001). Hispanic participants were asked to encode a series of black and Hispanic faces and subsequently to identify these faces from a series of lineup arrays. The present study examined whether variation in lineup presentation method (simultaneous vs. sequential) and lineup instructions (standard vs. conservative criterion) might mitigate the influence of the cross-race effect in eyewitness identification. Results are discussed for their theoretical and applied implications.

(1047)

Creating and Reducing Memory Intrusions From an Unrelated Event That Precedes a Witnessed Crime. PATRICK O. DOLAN & VERONICA ZAK, *Drew University*—The eyewitness memory literature has repeatedly demonstrated intruded memories from postevent misleading information. Following Lindsay and colleagues (e.g., Lindsay et al., 2004), we investigated the likelihood of eyewitness memory intrusions from an unrelated event that preceded the witnessed crime. Participants first listened to a narrative describing a school field trip to a palace that included details of items inside the palace (e.g., swords on the wall). After 30 min of filler activities, participants viewed a video clip of a museum robbery that included views of other museum artifacts (e.g., urn on a pedestal). Results from a surprise recognition memory test suggest that participants falsely remembered items from the palace tour as being seen in the robbery video. However, participants who were given either a strict warning before the test or a source-monitoring test had significantly fewer extra-event intrusions. These results are discussed in light of the source monitoring framework and their practical implications.

(1048)

Photograph Review and False Memory for Recent Events. QUIN M. CHROBAK & MARIA S. ZARAGOZA, *Kent State University*—The influence of photograph review on the development of false memories for confabulated events was investigated. After viewing a movie clip, participants were forced to confabulate answers to false-event questions. Half of the participants were shown pictures that corresponded to either the characters or events being referred to in each question (photo group) and half were not (no-photo group). One week later, participants had developed false memories for confabulated responses. In addition, participants in the photo group were more likely to develop false memories in the absence of confirmatory feedback than were participants in the no-photo group. The results extend those of Lindsay, Hagen, Read, Wade, and Garry (2004) by showing that photograph review can facilitate the development of false memories for recent events as well as for those from the distant past.

(1049)

Creating False Memories in a Group Setting at a College Dormitory Hall Reunion. JOANNA L. SMUTZLER, MARGARET L. CHARLE-ROY, SEYEDETH S. HASHEMINEJAD, RYAN M. JONES, & TERRY R. GREENE, *Franklin & Marshall College*—College juniors attended reunions of their freshmen dormitory halls and were told they would

be participants in a memory experiment. Experimenters had devised three types of events to work into conversations during the reunions: (1) true events, (2) false events *consistent* with the personalities of residents and/or with hall events schemata, and (3) false events *inconsistent* with personalities and events. A questionnaire was administered to participants 3 days after the reunion. Events discussed at the reunion were listed, and subjects responded whether they remembered the event (exactly, slightly differently, or were not there but remembered hearing about it at the time) or did not remember the event. The results revealed that 94% of the true events were remembered, as were 78% of the false consistent and 38% of the false inconsistent events. These results are discussed with respect to schema consistency. Elaboration of false information by students during reunion conversations is also addressed.

(1050)

False Associations of Actors With Actions as a Result of Mugshot Viewing. ALAN W. KERSTEN, JULIE L. EARLES, ELISSA KLEIN, & FARRIN JONAS, *Florida Atlantic University*—This research investigated whether viewing a person's photo in the context of questioning about a particular action leads to a specific association between that person and that action or to a more general feeling of familiarity for the person. Participants saw video clips involving 75 different actors performing 75 different actions. Participants then viewed mugshots of individual actors and were asked whether each such actor had performed a particular action. One week later, participants were tested for recognition of the video clips. The critical test items involved an actor seen at encoding performing an action that had been performed by a different actor at encoding. Participants were particularly likely to falsely recognize such items if a picture of the actor in the test item had been presented along with a question about the action in the test item, suggesting a specific association between that actor and action.

(1051)

Multiple Culprits: An Examination of Familiarity and Recollection in Eyewitness Identification. DEBRA L. TOWER & SCOTT GRONLUND, *University of Oklahoma*—An ongoing debate concerns whether accurate eyewitness identification is automatic and based on familiarity or whether recollection is involved. Although some research has shown that quick identifications tend to be more accurate than those with a longer latency, other research refutes this. Our experiments used multiple culprits at encoding to test the premise of automaticity. If the target face “pops out,” it should do so regardless of the number of culprits originally viewed. Instead, we found a shift in peak differentiation dependent on the number of faces seen at encoding, contrary to a reliance on automaticity. Subsequent experiments tested for a contribution of recollection by including associative information and controlling the total number of faces encoded by presenting several categories of faces within a trial. The results point to a complex interplay between familiarity and recollection in eyewitness identification that is not captured by a dichotomy between these two constructs.

• METACOMPREHENSION •

(1052)

The Effect of Perceived and Actual Retention Intervals on Judgments-of-Learning. MICHAEL J. MCGUIRE, ANGELA M. BURRELL, & GWENDOLYN M. MEINECKE, *Washburn University*—Will students factor in “forgetting over time” when making judgments-of-learning (JOLs)? Two experiments were conducted to see whether duration of retention interval affects JOLs for word pairs. For both experiments, participants studied word pairs, made JOLs, and then received a cued-recall test. In Experiment 1, participants made JOLs for one of three ‘perceived’ retention intervals: 15 min, 24 h, or 1 week. Participants, however, always received their test approximately 15 min after study. In Experiment 2, participants made JOLs for one of two “actual” retention intervals: 48 h or 1 week. The procedure was similar to that of Experiment 1, except that participants returned after 48 h

or 1 week to receive a test of the studied materials. Retention interval had little effect on JOL resolution, but not so for JOL magnitude. Further results are discussed in the context of a two-factor theory underlying metacognitive judgments.

(1053)

When Do Judgments of Learning Show Overconfidence With Task Practice? CHRISTOPHER HERTZOG, *Georgia Institute of Technology*, & DAYNA R. TOURON, *Appalachian State University*—Previous research (Koriat, Sheffer, & Ma'ayan, 2002) has indicated that individuals' judgments of learning (JOLs) become increasingly underconfident with practice (UWP) after multiple study–test trials for paired associate (PA) recall. Research by Touron and Hertzog (2004) found overconfidence in JOLs for PA recall after transfer from an associative recognition task to PA recall. We report results from two experiments evaluating whether the shift in memory test format explains the divergent outcomes. In the second experiment, participants completed study–test trials in four conditions: (1) recognition then recall, (2) recall then recognition, (3) recognition throughout, or (4) recall throughout. Results suggest that participants fail to account for the possible effects of transfer to different test conditions, overgeneralizing from accurate performance monitoring from one study–test outcome to scale JOLs collected in the next study trial. Failure to anticipate learning contributes to but does not account for the UWP effect.

(1054)

Overestimation of Associative Memory for Identical Items. ALAN D. CASTEL, DAVID P. MCCABE, & HENRY L. ROEDIGER III, *Washington University*—The present study examined the influence of associative strength and item similarity on judgments of learning (JOLs) in a cued recall task. We hypothesized that item similarity would cause a foresight bias, such that participants would overestimate recall of identical pairs (*scale–scale*) compared to strong associates (*weight–scale*) or unrelated pairs (*mask–scale*). In Experiment 1, JOLs for identical word pairs were higher than for related and unrelated pairs, but later cued recall of identical items was lower than recall of related pairs. In Experiment 2, the effect of encoding fluency (inferred from self-paced study time) was examined, and a similar pattern of results was obtained, with identical pairs receiving the least amount of study time. We conclude that overconfidence for identical pairs reflects a reliance on perceived item similarity and encoding fluency when making JOLs during study, despite associative strength being a better predictor of later retrieval.

(1055)

Effects of Proactive Interference and Release From PI on Judgments of Learning. MICHAEL DIAZ & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—Judgments of learning (JOLs) typically underestimate the memorial consequences of “extrinsic” manipulations of learning, such as repetition, study time, or depth of processing. A recent example is the underconfidence-with-practice effect, in which the repetition of cue–target pairs leads to smaller increases in JOLs than in recall across study–test trials—thus leading to increasing underconfidence across trials. We used a proactive interference paradigm in which the repetition of cues but not targets led to a decrease in recall across trials. Contrary to the usual pattern of underestimation, JOLs decreased either an appropriate or a greater amount with repetition than did recall performance. Most impressively, JOLs continued to decrease on a final trial on which the introduction of new cues and consequent release from proactive interference led to a substantial increase in recall performance. These results suggest that metacognizers' naive theories of remembering and forgetting do not appropriately reflect the influence of cue-specific interference.

(1056)

Metacognitive Monitoring in Skill Acquisition: The Effect of Expertise Level. ANIQUE B. H. DE BRUIN, REMY M. J. P. RIKERS, HENK G. SCHMIDT, & INGMAR H. A. FRANKEN, *Erasmus Uni-*

versity Rotterdam—Several studies have demonstrated the accuracy of judgments of learning (JOLs) to be an adequate performance predictor in understanding text materials. However, recent research has shown that in cognitive skill acquisition (e.g., learning to play chess), the effect of metacognitive judgments is not unequivocal. In certain cases, JOLs have even proved detrimental to skill acquisition. The question arises how the discrepancy in effectiveness of JOLs between learning text material and acquiring a skill can be explained. To examine this question, both expertise level and timing of JOL were manipulated. The higher complexity of the study material for skill acquisition, as compared with the text material usually used in metacognitive monitoring research, provides a possible explanation for the lack of a delayed JOL effect. Because of this, and because we found better monitoring accuracy in the experienced group, a cognitive load explanation is proposed that focuses on working memory capacity limitations.

(1057)

The Effect of Retrieval Practice on the Relative Accuracy of Judgments of Learning. YOONHEE JANG & THOMAS O. NELSON, *University of Maryland, College Park* (sponsored by Thomas S. Wallsten)—To investigate what variables could increase the relative accuracy of judgments of learning (JOLs), we manipulated both (1) delay between study and JOL trials and (2) study-alone repetition versus study-with-test repetition. We examined the hypotheses that repetition with test but not without test improves the relative accuracy of JOLs and that the effects of delay and test repetition are mediated by a similar process. Our experiments revealed that relative to study-alone repetition, study-with-test repetition increased the relative accuracy of JOLs and that this relative advantage was different from the advantage caused by delay. These results are discussed within retrieval hypothesis (e.g., Bjork, 1988; Dempster, 1996) and cue utilization frameworks (Koriat, 1997).

(1058)

Should Allocation of Study Time Be Based on Judgments of Learning? YARON SHLOMI, JAMES P. VAN OVERSCHELDE, & THOMAS O. NELSON, *University of Maryland, College Park* (sponsored by Harry P. Bahrick)—The allocation of study time can be based on objective (i.e., correct recall) or subjective (i.e., judgments of learning, or JOLs) measures of the learner's progress. However, because JOLs take time to generate, their use detracts from studying other material. The benefit of using JOLs for study time allocation was assessed using a test–study acquisition methodology during which half of the participants generated JOLs after correct recall and half did not. For both groups, additional study time was allocated to an item if it was recalled incorrectly. For the JOL group, additional study time was also allocated to an item if it was recalled correctly and the JOL was below a certain value. A retention test occurred after 1 or 4 weeks. Results from four experiments indicated that both study time allocation methods yielded comparable levels of long-term retention. Thus, subjective measures (e.g., JOLs) do not always optimize the allocation of study time.

(1059)

Delaying Feedback Does Not Diminish the Hypercorrection Effect. LISA K. FAZIO & ELIZABETH J. MARSH, *Duke University* (sponsored by Elizabeth J. Marsh)—The hypercorrection effect refers to the surprising finding that, with feedback, subjects are better able to correct high-confidence errors than low-confidence errors (Butterfield & Metcalfe, 2001). In two studies, we replicated the hypercorrection effect. We explored one possible explanation for the effect—namely, that subjects are more surprised by the feedback when they discover a high-confidence answer is wrong, and that this arousal translates into deeper encoding of the correct answer. We manipulated when subjects received feedback, assuming that surprise would be greater when feedback was received immediately after one's wrong answer. However, the hypercorrection effect was equally robust regardless of the timing of the feedback.

(1060)

Fluency Misattribution and Visual Hindsight Bias. DANIEL M. BERNSTEIN, *University of Washington*, ERIN M. HARLEY, *UCLA*, & AIMEE N. HA, *University of Washington*—We tested the fluency misattribution theory of visual hindsight bias and examined how perceptual and conceptual fluency contribute to the bias. Experiment 1 subjects identified celebrity faces that began degraded and clarified (baseline forward) or indicated when faces that began clear and degraded were no longer identifiable (baseline backward). In a memory test, subjects viewed the celebrities again and indicated the point at which they stopped each face in the baseline conditions. Subjects showed hindsight bias by stopping faces in the forward condition at a more degraded level than they had stopped the faces at during baseline. These same subjects avoided hindsight bias in the backward condition by stopping faces at the exact point where they stopped the faces during baseline. In Experiment 2, memory test faces were either upright or inverted. We found bias for both conditions, but it was greater for upright faces. Thus, both conceptual and perceptual fluency contribute to hindsight bias.

(1061)

Does a Time Monitoring Deficit Factor Into Older Adults' Delayed Skill Acquisition? JARROD C. HINES & DAYNA R. TOURON, *Appalachian State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (sponsored by Dayna R. Touron)—When performing skill acquisition tasks that involve a transition from rule-based to retrieval-based processing, older adults shift strategies slower than do younger adults. Touron and Hertzog (2004a; 2004b) used the noun pair (NP) lookup task to demonstrate that older adults are reluctant to rely on a retrieval strategy despite adequate learning, amplifying observed age differences in rates of skill acquisition. In order to develop a mental model of the NP task that emphasizes the utility of shifting to retrieval, individuals must understand the relative costs and benefits of a lookup strategy and a retrieval strategy. If older adults do not accurately monitor the latencies of their responses for each strategy, they might not perceive the greater efficiency associated with retrieving during the NP task. The present study investigated the possibility that older adults possess a general time-monitoring deficit when performing the lookup and retrieval strategies in the NP task.

(1062)

Nicotine and Beliefs About the Cognitive Effects of Cigarettes. WILLIAM L. KELEMEN, *California State University, Long Beach*—This study examined the role of nicotine in standard cigarettes (0.6 mg) versus new cigarettes containing only trace amounts of nicotine (0.05 mg) on sustained attention, memory, and metacognition. Participants learned Swahili–English vocabulary items and made judgments of learning either immediately after study or following a delay, followed by a test of sustained attention, and then a cued-recall test. The nicotine level of the cigarettes varied between subjects in a double-blind procedure. Consistent with past research, the sustained attention test was most sensitive to the effects of nicotine: Participants who received nicotine responded significantly faster than those in the control condition. Despite the double-blind procedures, participants were able to discriminate the type of cigarette they received at levels exceeding chance. The relative merits of double-blind versus balanced-placebo designs are discussed with regard to the role of expectancy in research on nicotine and cognition.

(1063)

Rhesus Monkeys (*Macaca mulatta*) Monitor Uncertainty During Numerosity Judgments. MICHAEL J. BERAN, *Georgia State University*, DAVID SMITH & JOSHUA S. REDFORD, *SUNY, Buffalo*, & DAVID A. WASHBURN, *Georgia State University*—Two rhesus macaques (*Macaca mulatta*) judged arrays of dots on a computer screen as having more or fewer dots than a center value that was never presented in trials. After learning a center value, monkeys also were given an uncertainty response that let them decline to make a numerosity judgment on any trials they chose. Across center values

(3–7 dots) that shifted across sessions, errors occurred most often for sets adjacent in numerosity to the center value. The monkeys also used the uncertainty response most frequently on these difficult trials. A second experiment showed that the animals' numerosity judgments and uncertainty responses reflected numerical magnitude and not the surface-area illumination of the displays. This research shows for the first time that animals' uncertainty-monitoring capacity extends to the domain of numerical cognition. It also shows animals' use of the purest uncertainty response possible, uncontaminated by any secondary motivator.

(1064)

Does Multimedia Improve Metacomprehension Accuracy for Text Content? MICHAEL J. SERRA & JOHN DUNLOSKY, *Kent State University*—Prior research has established the learning advantage that multimedia materials (e.g., text with diagrams) produce over single-media materials (e.g., text alone). However, whether multimedia formats also support better metacomprehension is currently unknown. The present research was undertaken to establish more firmly the patterns of judgment accuracy associated with these two types of material. Participants studied science texts composed of either text paragraphs with corresponding diagrams or text paragraphs alone. Per-paragraph judgments of learning (JOLs) made for multimedia materials were more accurate than those made for text alone, but global JOLs predicted the test performance of the two study groups equally well. Potential explanations for these results and their implications for theories of learning, multimedia learning, and metacomprehension are discussed.

(1065)

Why Delayed Summarization Improves Metacomprehension Accuracy. KEITH W. THIEDE, *University of Illinois, Chicago*, & MARY ANDERSON, *College of DuPage*—Metacomprehension accuracy influences the effectiveness of regulation of study and overall reading comprehension (Thiede, Anderson, & Theriault, 2003). One way to improve metacomprehension accuracy is to have readers write summaries of texts prior to judging their comprehension of the texts; however, accuracy only improves when summaries are written after a delay, not when written immediately after reading (Thiede & Anderson, 2003). We will present the results of an experiment that suggest accuracy differs because readers focus on different aspects of the texts when summaries are written after a delay versus immediately after reading. The results will be discussed within a cue utilization framework of metacognitive monitoring (Koriat, 1997).

(1066)

Methods for Promoting and Assessing Readers' Metacomprehension Monitoring. THOMAS D. GRIFFIN, JENNIFER WILEY, & KEITH W. THIEDE, *University of Illinois, Chicago*—Accurate performance prediction, the typical measure of metacomprehension, can be affected by use of both internal and external cues. However, metacomprehension is conceptually defined as monitoring internal cues about one's own representations. Thus, prediction of relative test performance is an indirect and potentially unreliable indicator of metacomprehension. Although previously unused, a simple statistical method can create accuracy scores that are unaffected by use of external, non-metacognitive cues. This approach allows for more valid inferences about whether differences in prediction accuracy actually reflect differences in monitoring mental representations. This approach was used to compare two intervention groups that showed higher typical prediction accuracy than did controls. When variance due to the use of nonmetacognitive cues was eliminated, only one group still showed superior accuracy. The difference between the groups was predicted on the basis of whether the interventions increased attention to internal comprehension cues or external text features.

(1067)

Metacognitive Sophistication About Desirable Difficulty: Implications for Acquisition of Complex Materials. MATT HAYS, *UCLA*,

LINDSEY E. RICHLAND, *University of California, Irvine*, & ROBERT A. BJORK, *UCLA*—Certain conditions of practice introduce difficulties for the learner during acquisition but, unintuitively, can enhance long-term retention and transfer. Such “desirable difficulties” (Bjork, 1994, 1999) include interleaving rather than blocking practice on separate topics and testing rather than reading as the learning event. This study examines the relationship between learners' metacognitive awareness of interleaving and test effects and their acquisition of educational materials. A metacognitive questionnaire revealed that only 12% of 71 undergraduates understood the advantages of interleaving, and only 7% of them used it during study. Understanding was higher for test effects, for 32% of learners predicted that rereading material would be more useful than test events, and 67% preferred testing. Importantly, learners' metacognitive sophistication was correlated with their retention after 1 week [$r(71) = .26, p < .05$], indicating that learners who understand desirable difficulties may be better able to disentangle performance during acquisition from retention over time.

(1068)

Raising the Bar for Computer-Based Research Methods. RICHARD R. PLANT & ANNIE L. TRAPP, *University of York*, & NICK V. HAMMOND, *Higher Education Academy* (sponsored by Jonathan Vaughan)—There have been many previous attempts to construct freely available libraries of experiment generator scripts for reuse within the wider academic community. Often these have relied on philanthropic gestures from active researchers willing to donate their own paradigms. Unfortunately, this utopian dream has not been fulfilled, because of the closely guarded nature of the research community. Within the teaching community, however, there remains the need for such script libraries for educational and training purposes. Moreover, teachers want access to scripts that can operate across platforms and packages so that a range of options can be evaluated. In this poster, we outline a new approach, in which a library is being constructed with gaps filled by commissioning scripts. The new Web-based library should also allow researchers to evaluate the learning and teaching impact of use and how computer-based research methods are taught at degree level. A unique feature will be its best-practices sections.

• SELECTIVE ATTENTION •

(1069)

The Effect of Conscious and Unconscious Presentation Duration in a Global–Local Task on Facilitation and Interference. ALLISON ANDRES, *University of Western Ontario*, & MYRA A. FERNANDES, *University of Waterloo*—Past research has demonstrated a global advantage in the perception of visually presented hierarchical stimuli such that on incongruent trials, the global form interferes with responses to the local level (Kimchi, 1992). In the present study, 24 adults performed alternating blocks of global or local identification of hierarchical letter stimuli in which the global and local letters were congruent, incongruent, or neutral. Stimuli were presented randomly at either an unconscious (17 msec) or conscious (100 msec) exposure duration. A global advantage was demonstrated at both durations. Facilitation in identifying the local letter, defined as a decrease in errors and reaction times on congruent in comparison with neutral trials, was found only at the conscious exposure duration. Interference, an increase in errors and reaction time on incongruent in comparison with neutral trials, was found at both exposure durations. Results suggest that facilitation requires conscious perception, whereas interference does not. The role of attention in mediating these processes is discussed.

(1070)

Action Affordances Promote Recovery From Extinction. JANE RIDDOCH & GLYN W. HUMPHREYS, *University of Birmingham* (sponsored by Glyn W. Humphreys)—Three factors on recovery from extinction in patients with posterior parietal lesions were assessed: (1) whether objects were frequently used together in action versus whether they could be used in action together; (2) whether there were

effects of positioning objects for action; and (3) whether the surface properties of objects mediated performance. There was greater recovery from extinction for objects used frequently together, along with effects produced by objects that could be used together. There were also positive effects of correctly positioning objects for action. There were no effects of surface information on the benefit of reporting both members of a pair. The results provide positive evidence for an effect on attention of affordances based on objects falling in plausible colocations for action. Such affordances may also be influenced by the frequency with which objects are used together and can be generated from edge-based representations of objects.

(1071)

Action Planning Effects in Visual Motion Perception. OLIVER LINDEMANN & HAROLD BEKKERING, *Radboud University Nijmegen*—In this study, we investigated the effects of action planning on visual perception. Participants prepared to grasp an X-shaped object along one of the two diagonals. Action execution was triggered by a visual go-signal, which was either a dot or a bar in the same orientation as the to-be-grasped diagonal (grip consistent) or orthogonal to it (grip inconsistent). Experiment 1 showed shorter response latencies for grip-consistent stimuli. In Experiment 2, an object manipulation task was introduced. That is, participants prepared to grasp the X-shaped object and to turn it afterward clockwise or counterclockwise. Action execution was triggered by stable stimuli or by stimulus rotations in different directions. Interestingly, in this experiment the perception of visual motions consistent with the prepared object manipulation was facilitated—that is, shorter response latencies toward compatible stimulus rotations. These findings emphasize the anticipation of sensory consequences in action planning and its effects on visual perception.

(1072)

Action Affordances and Inhibition of Return. HELEN M. MORGAN & STEVEN P. TIPPER, *University of Wales, Bangor*—In complex environments, it is important that action is directed toward relevant information. Inhibition of return (IOR) prevents attention from returning to previously examined items, in order to encourage the examination of new information. Research has shown that IOR can operate according to an object-based frame of reference. In addition, viewing an object can activate motor representations of the action associated with that object (e.g., Tucker & Ellis, 1998). The present study focused on whether action-related properties of task-irrelevant objects can influence IOR. Attention was oriented to either the affording or the non-affording side of an object via an exogenous cue. Then a target requiring a rapid localization response appeared at the cued or the uncued location. IOR was greater when the response was compatible with the action afforded by the object. This provides further evidence for the idea that IOR acts on object-based representations.

(1073)

Inhibition of Return Following Response Execution and Observation. TIMOTHY N. WELSH, *University of Calgary*, JIM LYONS, *McMaster University*, DANIEL J. WEEKS, *Simon Fraser University*, J. GREG ANSON, *University of Otago*, ROMEO CHUA, *University of British Columbia*, & DIGBY ELLIOTT, *McMaster University*—Inhibition of return (IOR) refers to the slowing of a response to a target that appears at the same location as a preceding event. Studies of IOR have generally investigated the behavior of a single individual responding to the location of a target that appears at the same location as the previous target or an unrelated cue (within-person IOR). Recently, we found that IOR is also present when participants move to the location to which their partner has just moved (between-person IOR) (Welsh et al., in press). In agreement with the idea that observation of any part of the response can cause between-person IOR, the present research revealed that between-person IOR was evoked when the observer's view of their partner's response was limited to the end point (Experiment 1) or a middle section (Experiment 2) of the movement trajec-

tory. Implications for interactive behavior and possible underlying neural mechanisms will be discussed.

(1074)

The Time Course of Object- and Location-Based IOR in Static Displays. JIM E. MCAULIFFE, ANNAMARIA T. SOVIERO, & MICHELLE WINDSOR, *Lakehead University*—People react more slowly to targets at cued rather than uncued locations when the time between the cue and target (SOA) is greater than 300 msec. This phenomenon is known as inhibition of return (IOR). Greater IOR effects have been found when an object is cued at a location than when only a location is cued. This result has been used to support the notion that IOR operates on separate object- and location-based frames of reference. To dissociate the two frames of reference, we examined the time course of each component using five different SOAs (400, 700, 1,000, 2,000, and 3,500 msec). Although object- and location-based IOR declined over the range of SOAs, we failed to find evidence for separate time courses for object- and location-based IOR. The results further define the boundary conditions for realizing separate object- and location-based IOR in static displays.

(1075)

The Semantic Attentional Blink in Bilingual Individuals. GUY L. LACROIX, NORMAN SEGALOWITZ, & JENELLE JOB, *Concordia University*—The mechanisms underlying the semantic attentional blink (SAB; Barnard et al., 2004) were explored in two RSVP experiments involving bilingual participants (L1, English; L2, French) and sets of English and French words. In Experiment 1, participants identified a single categorically defined target embedded in filler words. On experimental trials, a distractor from a related category preceded the target. The results revealed an SAB, but paradoxically, it was smaller for L2 than for L1. Follow-up regression analyses revealed that magnitude of the L2 SAB was related to the efficiency of L2 lexical access. Experiment 2 was similar to Experiment 1, except that participants had to identify a first target from one category and determine whether a second target from a related category was present or absent. The preliminary results are similar to those of Experiment 1. Our experiments suggest that ballistic word meaning processing may play an important role in generating SABs.

(1076)

Negative Priming Is Dependent Upon the Preceding Trial. TODD A. KAHAN, *Bates College*, JAMES H. NEELY, *SUNY, Albany*, & KEITH B. HENGEN, *Bates College*—In negative priming, RTs are slower to stimuli if the stimuli were previously ignored. However, in the Stroop paradigm, when a large proportion of trials contain Stroop-congruent stimuli, Neumann, Schooler, Caplan, and Roberts (2002, this meeting) found positive rather than negative priming. To determine whether this reversal reflects global-list or trial-by-trial processing changes, we used prime-probe couplets and put list-context and prior-trial effects “in opposition.” In a list with a small percentage of Stroop-congruent trials (which should yield negative priming), when the probe on the immediately preceding trial was Stroop-congruent, positive priming was now obtained; when it was Stroop-incongruent, negative priming occurred. This result disfavors explanations based on global-list processing changes.

(1077)

Perceptual and Working Memory Load Effects on Flanker Task Distractor Processing. DAVID GILSDORF & PAUL HAERICH, *Loma Linda University*—Perceptual loading and working memory loading are suggested to have different effects on attentional selectivity and the likelihood of processing a distracting stimulus. In this theory, increasing perceptual load is associated with a decrease in distractor processing, whereas increasing working memory load is associated with the opposite, an increase in distractor processing. An experiment was conducted using an orthogonal design in which three levels of working memory load and three levels of perceptual load were varied within subjects. Par-

Participants performed a flanker response-competition task including 1, 3, or 6 items in the target display while holding 0, 5 sequentially ordered, or 5 randomly ordered digits in working memory. In a replication of previous work by Lavie and others, increased perceptual load produced increased interference in the flanker task. However, the effects of working memory load did not appear to be additive or independent.

(1078)

Task Reconfiguration and Carryover Effects of Switching Between Stimulus Sets. SHULAN HSIEH & POYUI CHEN, *National Chung Cheng University*—The aim of this study was to extend our previous studies of task switching with response-set paradigms. In this study, we measured both event-related potentials and lateralized readiness potentials. In addition, we have used a stimulus-set switching rather than a response-set switching paradigm. The results showed that task switching may involve both reconfiguration and carryover effects, but they may take place at different stages in time. Task reconfiguration specific to task switching may take place before the onset of a switched task, as reflected on a difference wave between repeat and switch trials during the response–stimulus intervals; the carryover effect remains, however, regardless of preparation, and results in prolongation of response selection processing, as reflected by the stimulus-locked lateralized readiness potentials.

(1079)

Effects of Oculomotor Inhibition Across the Life Span. BETTINA OLK, *International University Bremen*, & ALAN F. KINGSTONE, *University of British Columbia*—We investigated the effects of oculomotor inhibition on saccadic reaction times (SRT) of pro- and antisaccades, on saccade direction errors, and on the ability to maintain fixation. The degree to which inhibition was placed on the oculomotor system was varied systematically between conditions. In a no-inhibition condition, prosaccades to a target were required on every trial. In low–high inhibition conditions, prosaccades and trials on which fixation was maintained (10%–50% of trials) were randomized. In low–high inhibition/volitional saccade conditions, an eye movement was required on every trial, since prosaccade and antisaccade trials (10%–50% of trials) were randomized. With increasing inhibition, SRT of prosaccades gradually increased, and the ability to maintain fixation improved. SRT of antisaccades decreased, as did the amount of saccade direction errors, reflecting sensitivity of SRT and saccade errors to oculomotor inhibition. Elderly participants initiated saccades more slowly and showed more saccade direction errors on antisaccade trials than did younger participants.

(1080)

Electrophysiological Activity Elicited by Attention-Directing Cues: Preparatory Visual Activity or Mechanism for Shifting Attention? JESSICA J. GREEN, JOHN J. McDONALD, & DANIEL J. WEEKS, *Simon Fraser University*—When a central symbolic cue is used to direct attention to a lateralized location prior to a target, the cue-elicited event-related potential (ERP) is more positive over the posterior scalp on the side contralateral to the to-be-attended location. This enhanced contralateral ERP may reflect preparatory activity in visual cortex or activity in parietal cortex related to the shifting of attention. To better isolate the cue-elicited activity of interest, we compared leftward- and rightward-directing cues with a neutral cue (Experiment 1). We also sought to determine whether the enhanced contralateral ERP reflects activity in a retinotopically mapped visual area by comparing the cue-elicited ERPs for shifts of attention to the upper and lower visual fields (Experiment 2). The results indicated that the enhanced contralateral ERP arises primarily in occipital cortex, thereby supporting the notion that it reflects preparatory modulation of neural activity prior to the appearance of a target.

(1081)

Effects of Background Music on Spatial and Linguistic Processing. LESLIE A. ANGEL, DONALD J. POLZELLA, & GREG C. ELVERS,

University of Dayton—College students were trained according to one of two standardized task protocols: spatial (mental rotation) or linguistic (letter classification). Testing consisted of multiple randomized trials with and without background music (classical piano) at two levels of task difficulty. Raw data for both tasks were response time and accuracy. Background music increased the speed of spatial processing at both difficulty levels, whereas accuracy of processing remained unaffected. In contrast, background music increased the accuracy of linguistic processing, whereas speed of processing remained unaffected. These findings, integrated with those of a previous experiment from our laboratory, suggest that (1) regardless of an individual's predilection, background music can affect aspects of human performance, and (2) the specific effects, whether enhancing or disrupting, appear to reflect the similarity between the task demands and certain objective characteristics of the background music.

(1082)

Effects of Tempo on Rhythmicity of Auditory Attention. W. J. DOWLING, *University of Texas, Dallas*, & BARBARA TILLMANN, *CNRS-UMR 5020 Lyon*—In 2004, we reported that following a knowledge-based cue (a melody pointing up or down in pitch, 80% valid), the convergence of an implicit beat with cue validity led to RT benefits for identification of targets presented after brief delays. Targets were fast (8-Hz) or slow (3-Hz) amplitude modulation warbles, and participants made speeded identification judgments. The tempo of the implicit beat was 72 beats/min. In the present study, we varied the tempo of the implicit beat between 58 and 102 beats/min. RT benefits were strongest around 72 beats/min and disappeared gradually as the tempo was increased. This suggests that if the cue-validity benefits arise from the entraining of an internal oscillator by the implicit beat in the stimulus, entrainment occurs most easily when the beat rate is close to a “comfortable” rate for the perceiving system. Ongoing experiments are testing slower tempi.

• TASK SWITCHING •

(1083)

Hierarchical Control of Cognitive Processes in Task Switching. DARRYL W. SCHNEIDER & GORDON D. LOGAN, *Vanderbilt University*—Hierarchical control of cognitive processes was studied by investigating the interaction between higher level sequence processing and lower level task processing in task switching performance. In four experiments, subjects performed explicit, memorized task sequences in the absence of external cues. Switch costs (differences in response time between task switches and task repetitions) were strongly affected by sequence initiation costs (slower performance for the first serial position of a task sequence), to the extent that negative switch costs were observed for some task sequences. Sequence initiation costs were found to be sensitive to sequence complexity (as indexed by the number of within-sequence task switches), preparation time, and the type of sequence transition (sequence repetition or sequence switch). These findings suggest that task performance is guided by hierarchical control structures and that higher level sequence processing dominates lower level task processing.

(1084)

Mapping the Time Course Function of Preparation for Predictable and Unpredictable Task Switching Paradigms: A Meta-Analysis. CHRISTINA V. WASYLYSHYN, MARTIN J. SLIWINSKI, & PAUL VERHAEGHEN, *Syracuse University* (sponsored by Paul Verhaeghen)—A meta-analysis of 71 studies (with 141 independent participant groups) was conducted to estimate the time course function of preparation in unpredictable (explicit task cuing) and predictable (alternate runs) task switching paradigms. Latency (nonswitch RT, switch RT, and switch costs) served as the dependent variable. Reduction of the switch cost with advance knowledge is commonly thought to reflect executive control processes—that is, the intentional preparation for a task switch. A negative exponential function was modeled to describe

how switch costs decrease as preparation time increases in both paradigms. Differences were found in the nature of switch costs in terms of their rate, asymptote, and gain parameters. Mixed models of the nonswitch and switch trial data further highlight the underlying differences in switch costs between paradigms and lend support to the notion that an executive control component may play a role in switch costs for predictable but not for unpredictable task switching.

(1085)

Stimulus-Based Priming of Tasks in Task Switching. IRING KOCH & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*, & ALAN ALLPORT, *University of Oxford*—Performance costs when switching tasks are related to interference. One determinant of task interference is whether the stimuli have previously occurred in the context of competing tasks. To explore the role of prior stimulus–task association in task interference, we used bivalent stimuli but had subjects practice them with only one of two tasks (“consistent mapping,” CM), or with both tasks (“varied mapping” of stimuli to tasks, VM). In alphabet arithmetic tasks, we found greater performance costs for VM than for CM stimuli. This suggests increased interference when stimuli are associated with both tasks because such stimuli prime the competing task. Using numerical judgment tasks, we had subjects practice only CM stimuli and then, after practice, reversed the consistent stimulus–task mapping. Mapping reversal resulted in massive stimulus-priming effects. These stimulus-priming effects were reduced by cue-based task preparation, suggesting a precedence of cue–task over stimulus–task associations.

(1086)

Cue-Based Preparation Effects on Switch Costs and the Contents of Task Set. AGATHA LENARTOWICZ, *Princeton University*, NICK YEUNG, *Carnegie Mellon University*, & JONATHAN D. COHEN, *Princeton University*—This study considers both whether cue-based preparation affects switch costs and the degree to which this process interacts with task-set contents. Schuch & Koch (2003, *JEP:HPP*) have shown that in a no-go paradigm, cue-based preparation preceding a no-go trial does not affect switch costs, thus suggesting that task execution is the primary contributor to switch costs. In this study, we found that both the inclusion of active no-go trials and the nature of the task sets switched between can affect cue-based preparation. We tested participants using two variants of a task-switching paradigm: varying the no-go trials from active to passive, and varying the task sets from number judgments (i.e., odd/even, greater/less than 5) to semantic judgments (i.e., living/nonliving, large/small). Passive no-go trials and semantic judgments resulted in larger switch costs relative to active no-go trials and number judgments. We show that cue-based preparation without task execution can affect the magnitude of switch costs.

(1087)

Shift Costs and Benefits Following Errors and Error Corrections. MARCO STEINHAUSER & RONALD HÜBNER, *University of Konstanz*—When participants alternate randomly between two tasks, performance is impaired in task shift trials relative to task repetition trials. We hypothesized that a portion of this shift cost is caused by the strengthening of task-related associations that took place on the previous trial when the response was produced. Therefore, shift effects following errors and error corrections were investigated in a series of three experiments, in which a task-shifting paradigm with a deadline procedure was applied. As predicted by our strengthening account, shift benefits instead of shift costs were observed following a specific type of error (Experiment 1). The same pattern of results occurred when participants explicitly indicated the detection of an error (Experiment 2). In contrast, shift costs were observed when the errors were corrected (Experiment 3). It was concluded that the shift effects in task-shifting are due to the strengthening of associations contingent to the production of an overt response.

(1088)

Alternating Between Verbal and Spatial Memory Tasks: Costs and Benefits. CINDY CHAMBERLAND & KATHERINE GUÉRARD, *Université Laval*, FABRICE B. PARMENTIER, *University of Plymouth*, ROBERT ROUSSEAU, *Defence R&D Canada*, & SÉBASTIEN TREMBLAY, *Université Laval* (sponsored by Robert Rousseau)—There is ample evidence for a performance cost in alternating between tasks (e.g., Rogers & Monsell, 1995). Most of the research has so far focused on the impact of switching task set between identification tasks that share the same source of information and require no memory load. In the present study, we examined whether the task switch cost also applies by alternating between verbal and spatial memory tasks. The procedure required the reproduction of a sequence of stimuli: letters for the verbal serial recall task and spatially distributed dots for the spatial serial recall task. A recall performance cost was observed in the spatial task, but a benefit emerged in the verbal task. This asymmetric pattern is modulated by the memory set size and the number of alternations. Our findings are informative with regard to the relative contributions of interference and reconfiguration to performance.

(1089)

The Effect of the Cue-to-Stimulus Interval on Transferable Improvement in Task Switching. MEREDITH E. MINEAR, *Washington University*, & PRITI SHAH, *University of Michigan, Ann Arbor*—Earlier work has demonstrated that task-switching performance can improve with practice (Kray & Lindenberger, 2000) and that this improvement can transfer to a new switching context (Minear et al., 2002). In this experiment, we examined the extent to which the amount of time given to prepare for a switch affects the training and transfer benefits seen. We manipulated the cue-to-stimulus interval (200 vs. 600 msec) used during training and transfer. With a short interval (200 msec), individuals who received practice on switching showed transferable improvement in comparison with a control group. However, with a long interval (600 msec), in which preparation is hypothesized to be complete, individuals who received switching practice did not differ from a control group on a transfer task. This suggests that transferable improvements seen after practice on switching tasks relate to the preparatory component of switching but do not affect the residual switch costs seen after preparation is complete.

(1090)

Effects of Bilingualism and Task Switching on Hemispheric Interaction. SUZANNE E. WELCOME & CHRISTINE CHIARELLO, *University of California, Riverside*—People perform complex tasks more efficiently when relevant information is presented to separate hemispheres (the across-hemisphere advantage). In this study, we investigated whether variation in bilingual language experience affects control of hemispheric interaction. Monolinguals, bilinguals who frequently interact with other bilinguals, and bilinguals who primarily interact with monolinguals performed two divided visual field tasks. Participants received a less complex digit-matching task and a more complex addition task with matching items shown in the same or opposite visual fields. On half of the trials, the task was the same as the previous trial, and on half the task switched across trials. There were no language group differences in task-switching cost. However, language group moderated the effect of task complexity on the across-hemisphere advantage. Bilingualism may alter how processing is coordinated across hemispheres.

(1091)

Sequential Dependencies in a Task-Switching Paradigm. ANDREW P. HANLIN, SUSAN LAGRONE, & DANIEL H. SPIELER, *Georgia Institute of Technology*—Traditional response time (RT) experiments are interested primarily in variation in RT due to experimental manipulations. Residual variability in RT is often treated as random “noise.” Recent evidence has been presented that there are sequential patterns in RTs over the course of an experimental session (Gilden,

2001; Wagenmakers, Farrell, & Ratcliff, 2004). Specifically, there appear to be slowly decaying correlations between successive trials that are consistent with the presence of long-range dependencies (LRDs). Gilden (2001) suggested that these dependencies may arise when individuals maintain a consistent mental task set and that switching between tasks may eliminate these LRDs. We conducted two experiments that required individuals to switch between two (Experiment 1) and three (Experiment 2) tasks. The sequences from participants in both experiments contained evidence of LRDs. These results suggest that maintenance of a single task set is not required for performance to exhibit LRDs.

(1092)

Top-Down Expectancy and Prior Task Interference During Task Switching. MARK E. FAUST & ADAM YORK, *University of North Carolina, Charlotte*—Prior task interference (PTI), the deleterious influence of a relevant stimulus attribute from a prior switched-from task (e.g., naming one of two words based on font color) on the performance of the switched-to task (e.g., naming one of two words based on category membership), was assessed during a task-switching paradigm. Participants were cued with two performance tasks (of four possible tasks) for each four-trial sequence and switched tasks between the second and third trials in each sequence. Manipulation of the proportion of postswitch trials in which PTI was possible resulted in differential effects on PTI for task-switch trials and for $n + 1$ trials (i.e., the trial following a switch trial). The results suggest that cognitive control over PTI is lowered directly following a task switch and that inhibitory control over processes associated with a switched-from task is a capacity-limited operation.

(1093)

Do Errors Betray Executive Control in Task Switching? JASON IVANOFF, CATHERINE M. ARRINGTON, & ALEX GOTTLER, *Vanderbilt University*—Task switching generates RT costs that have been taken to reflect the time needed for a control system to implement task-set reconfiguration. In typical explicit task cuing paradigms, each task is cued by one cue, creating a confound between switching tasks and switching cues. Logan and Bundesen (2003) resolved this concern with a four-cue/two-task procedure, demonstrating much larger costs for switching cues than for switching tasks. They argued that task-switch costs may not reflect the duration of control processes. Here we revisit this design with a focus on errors under different levels of speed stress. The results from the error analysis reveal a pattern for switching tasks and switching cues unlike that for RTs. The distinctive patterns in RTs and error rates leave open the possibility that “true” switch costs can be found in explicit task cuing procedures and highlight the importance of considering multiple measures of performance.

• VISUAL WORD RECOGNITION •

(1094)

Do Subtypes Exist Among Nondyslexic Readers? STACY L. BIRCH & DANIEL J. PRINCE, *SUNY, Brockport*—Recent studies have suggested that individuals with developmental dyslexia, similar to those with acquired dyslexia, can be classified into subtypes, for instance those with phonological or surface dyslexia. These subtypes are based on dissociations between component reading skills such as phonological coding and orthographic processing. For instance, an individual with particular difficulty in orthographic processing might be classified as having the surface subtype of dyslexia. In the present study, we investigated to what extent nondisabled readers demonstrate dissociations among component reading skills similar to those of the subgroups of dyslexic readers. Nondisabled readers completed standardized word identification and spelling tasks along with computerized reaction time tasks measuring phonological coding, orthographic processing, and rapid naming of symbols. Of these readers, 18% showed a pattern of dissociations in reading skills similar to the

phonological subtype of dyslexia, and 15% showed a surface subtype pattern. Implications of these results for subtyping in developmental dyslexia are discussed.

(1095)

The Level Repetition Effect in Semantic Processing: The Role of Attention and Inhibition. GWEN L. SCHMIDT & CAROL A. SEGER, *Colorado State University*—We explored the role of attention to levels of semantic relatedness (close vs. distant) in semantic processing. Balota et al. (2001) suggested that attention is focused on different semantic levels depending on the task. We hypothesized that when processing semantic information at high or low levels of semantic relatedness, a priming effect would be obtained based on the preceding semantic level, similar to the level repetition effect with visual stimuli (Robertson, 1996). In two experiments, subjects responded to high- and low-association word pairs or familiar and unfamiliar metaphors. Both experiments demonstrated a significant interaction: for high-association/familiar stimuli, there was a priming effect of level of relatedness; for low-association/unfamiliar stimuli, there was a negative effect, with slower reaction times for a repeated level. These results suggest that both attention to and inhibition of semantic relatedness levels are important aspects of semantic processing at both word and sentence levels.

(1096)

The Regularity Effect and Repetition in Printed Word Processing. LEONARD KATZ, STEPHEN D. KATZ, & KENNETH R. PUGH, *Haskins Laboratories*—Our research program has studied changes in cognition and brain processing as initially unfamiliar printed words become more familiar. Katz et al. (2005, *Neuropsychologia*) suggested that phonological assembly (as indexed by the regularity effect, RE) was the means by which low-frequency words were initially recognized in a lexical decision task, but that assembly was replaced by a nonanalytic process as words were repeated. In contrast, when the task was naming, the RE persisted longer under word repetition. The present study replicated and extended the original results. It supports the interpretation of a decreasing RE with repetition as a reduction in phonological assembly. The introduction of 50% pseudohomophones into the set of nonwords in lexical decision and naming decreased the persistence of the regularity effect, although more so in lexical decision than in naming. Pseudohomophones suppress phonological assembly by making it an inefficient mechanism for discriminating between words and nonwords.

(1097)

Phonological Neighborhood Density and Frequency in Visual Word Recognition. LAWRENCE LOCKER, *Georgia Southern University*, GREG B. SIMPSON, *University of Kansas*, & PAUL MATTSON, *Washington State University*—Phonological neighborhood density and frequency were investigated in three word recognition tasks. The results of a lexical-decision experiment revealed that words with high-frequency neighbors were responded to more rapidly than words with low-frequency neighbors, although this effect was restricted to words with many neighbors. A semantic-categorization task revealed some evidence of competitive effects of high-frequency neighbors, although this effect was again a function of neighborhood density. In contrast, the results of a rhyme detection task revealed facilitative effects of both neighborhood density and frequency. This pattern of results suggests that the influence of phonological neighborhood on word processing varies as a function of the level of analysis as determined by task requirements. The implications of these results for word processing are discussed.

(1098)

Masked Priming With Orthographic Neighbors: An Interaction Between Relative Prime–Target Frequency and Neighborhood Size. MARIKO NAKAYAMA & CHRISTOPHER R. SEARS, *University of Calgary*—In models of visual word identification that incorporate inhibitory competition among activated lexical units, a word’s higher

frequency neighbors will be the word's strongest competitors, and pre-activation of these neighbors will delay the word's identification. Using the masked priming paradigm (Forster & Davis, 1984), Segui and Grainger (1990) reported that, consistent with this prediction, a higher frequency neighbor prime delayed responses to a lower frequency target, whereas a lower frequency neighbor prime did not delay responses to a higher frequency target. In our experiments, using English stimuli, we found this was true only when the primes and targets had few neighbors—when the primes and targets had many neighbors, higher frequency primes delayed responses to lower frequency targets and lower frequency primes delayed responses to higher frequency targets. We offer several possible explanations for these findings and discuss their theoretical implications.

(1099)

The Effect of a Word's Orthographic Neighborhood on Eye Movement Latencies During Reading. MELISSA CROCKER & CHRISTOPHER R. SEARS, *University of Calgary*, & PAUL D. SIKALUK, *University of Northern British Columbia*—Many studies have examined how the identification of a word is affected by its orthographic neighbors. This research is motivated by the fact that, for most models of word identification, the number of neighbors and the existence of higher frequency neighbors have important processing implications. Reports of neighborhood size effects (faster responding to words with many neighbors) and neighborhood frequency effects (slower responding to words with higher frequency neighbors) are consistent with the notion that a word's neighbors play an important role in the lexical selection process. But most of this research has used the lexical decision task—surprisingly little is known of how the identification of a word is affected by its neighbors during normal silent reading. In our experiments, participants' eye movements were monitored while they read sentences, and the effect of a word's neighbors on eye movement latencies (first-fixation and gaze durations) was examined.

(1100)

Components of Word Familiarity: Orthography Controls Eye Movements During Reading. JESSICA R. NELSON, ERIK D. REICHLER, & CHARLES A. PERFETTI, *University of Pittsburgh*—The E-Z reader model of eye movement control (Reichle et al., 2003) posits two stages of word identification: an early stage (familiarity) that triggers eye movements to the next word, and a later stage that shifts attention. We hypothesized that the early stage reflects orthographic processing, but that the latter stage reflects orthographic, phonological, and semantic processing. To test these predictions, participants were first taught the spellings and pronunciations, spellings and meanings, or pronunciations and meanings of new (unknown) words, and then they read sentences containing these words while their eye movements were recorded. The results of this eye-tracking experiment supported our hypothesis: Orthographic knowledge shortened first-fixation durations on the trained words, but orthographic, phonological, and semantic knowledge shortened gaze durations. These results are consistent with cognitive models of eye movement control (e.g., E-Z reader) and support the hypothesis that orthographic processing largely determines when the eyes will move during reading.

(1101)

The Role of Orthographic Neighbors as Parafoveal Previews in Reading. CARRICK C. WILLIAMS, *Mississippi State University*, MANUEL PEREA, *Universitat de València*, & ALEXANDER POLLATSEK & KEITH RAYNER, *University of Massachusetts, Amherst*—In two boundary change experiments, we presented parafoveal previews that were either identical to the target word, a word that was an orthographic neighbor of the target (e.g., *sweet* as a preview for *sleet*), or an orthographically matched nonword (e.g., *speet*). In Experiment 1, the low-frequency word in the orthographic neighbor word pair was the target and the high-frequency word was the preview, and in Experiment 2, the roles were reversed. In Experiment 1, the high-frequency orthographic neighbor word preview provided as much ben-

efit as the identical preview and greater benefit than the nonword preview, whereas in Experiment 2, the low-frequency orthographic neighbor word preview provided no greater benefit than the nonword preview. These results indicate that the frequency of the preview influences the extraction of the letter information without setting up significant competition between the lexical entries of the preview and target.

(1102)

Do Readers Obtain Parafoveal Information Two Words to the Right of Fixation? BARBARA J. JUHASZ, SARAH J. BROWN, & KEITH RAYNER, *University of Massachusetts, Amherst*—Useful information is obtained one word to the right of fixation during reading (word $n + 1$), which aids recognition of the word once fixated. If word $n + 1$ is completely visible in the parafovea, fixation durations once it is fixated are shorter than when it is masked (see Rayner, 1998). The present experiment addressed whether useful information about a word two words to the right of fixation (word $n + 2$) can also be obtained. Adjective–noun pairs (e.g., *simple problem*) were embedded in sentences. Prior to fixating the noun, a preview was provided of the noun itself (e.g., *problem*), a different word (e.g., *furlong*), or random letters (e.g., *gnahfin*). This preview was given when the noun was word $n + 1$ or word $n + 2$. Parafoveal preview effects were obtained for word $n + 1$ but not for word $n + 2$. These findings have implications for the role of attention during reading and for models of eye movements in reading.

(1103)

Rereading and Eye Movements. CYNTHIA H. NULL, *NASA Langley Research Center*, & TIMOTHY J. SLATTERY, *University of Massachusetts, Amherst*—Rereading a text has been shown to increase comprehension of it. In addition, reading rate increases during subsequent readings. We explored the nature of rereading benefits as well as how long they may last by having participants read single sentences once a week for 3 weeks while tracking their eye movements. Experimental sentences contained a target word controlled for frequency and length. In Weeks 2 and 3, the target word in a third of the items changed, but no item changed more than once. Half of the changes kept the sentence meaning the same, the other half caused the sentence meaning to change. Target word and sentence reading times in Weeks 2 and 3 indicated significant rereading benefits for items that were not changed and for items that did not change meaning. We discuss these results and their implications for abstractionist and episodic accounts of rereading.

(1104)

RT Distributional Analyses of Priming and Degradation Effects in Word Recognition. MELVIN J. YAP & DAVID A. BALOTA, *Washington University*—Stimulus quality and semantic relatedness interact robustly in visual word recognition, with larger priming effects observed for visually degraded words. According to additive factors logic, this finding suggests that stimulus quality and semantic relatedness influence a common early process in word recognition. We manipulated stimulus quality and semantic relatedness in lexical decision and naming, and replicated the interaction in both tasks. Distributional analyses revealed that priming effects in the clear condition reflect mainly distributional shifting, whereas priming effects in the degraded condition reflect both shifting and skewing. In contrast with the view that degradation and relatedness primarily influence a common early stage, these variables appeared to also influence later processes en route to word recognition. The findings are discussed within extant models of semantic priming and current accounts of the interactive effects of semantic priming and visual degradation.

(1105)

Effects of Repeated Letters and Lexical Status in the Overlap Model. PABLO GOMEZ, *DePaul University*, MANUEL PEREA, *Universitat de València*, & ROGER RATCLIFF, *Ohio State University*—We present an application of the overlap model to two experiments. In one experiment, the model accounts for a forced choice task in which sub-

jects had to choose, between two strings of letters, the one that was flashed on the screen. Subjects had higher accuracy for words than for nonwords. The parameters of the overlap model associated with the encoding of letter positions did not change dramatically from words to nonwords; hence, the word superiority effect might be related to processes that occur after the positions of the letters are encoded. In the second experiment, the model accounts for performance in a forced choice task in which one or both alternatives have repeated letters. Repeated letters have been a problem for models of encoding of letter position. The overlap model can account for the data in this experiment by assuming that contiguous repeated letters are encoded as a unit.

(1106)

The Effect of Mask Category on Letter Detection and Identification. STEVEN J. HAASE, *Shippensburg University*, GARY D. FISK, *Georgia Southwestern State University*, & ERIC SZELENYI & JOSEPH HARKINS, *Shippensburg University*—Following up on our study from last year, we continue testing Snodgrass, Bernat, and Shevrin's model of unconscious perception (*P&P*, 2004). Their model predicts above-chance identification given chance detection, under certain task and strategy combinations. We compared detection and identification of one of four letters (*D, J, K, M*). In one experiment, the masks were numbers (e.g., 2, 5, 8); in the other, the masks were letters (e.g., *F, Q, Z*). Both detection and identification sensitivity were much higher in the number mask experiment. Identification was accurately predicted from detection according to signal detection theory, indicating no evidence for unconscious perception. In partial support of their model, we found above-chance identification when participants preferred and used the "look" strategy ($M = 0.315, p = .012$) in the letter mask experiment, where overall detection sensitivity was not significantly above chance. However, the "look" strategy is defined as one involving conscious perceptual processes.

(1107)

The Influence of Multiple Reading on the Missing-Letter Effect Revisited. JEAN SAINT-AUBIN, *Université de Moncton*, RAYMOND M. KLEIN, *Dalhousie University*, & ANNIE ROY-CHARLAND, *Université de Moncton*—When participants search for a target letter while reading, they make more omissions if the target letter is embedded in frequent function words than in less frequent content words. According to the GO model, this occurs because high-frequency function words are processed faster than low-frequency content words. This hypothesis was tested in two experiments ($n = 24$ and $n = 72$) by increasing word processing speed through text repetition which should translate into higher omission rates. Participants either read the text once while performing the letter search task or read it three times and performed the letter search task on the third reading. Contrary to the predictions of the GO model, omission rate did not increase over repetition, and it even decreased when readers knew from the first reading which letter would be used for the letter search task on the third reading.

• DISCOURSE PROCESSES •

(1108)

The Contributions of Lexico-Semantic and Discourse Influences to the Resolution of Ambiguous Categorical Anaphors. TALIT DITMAN & PHILLIP J. HOLCOMB, *Tufts University*, & GINA R. KUPERBERG, *Massachusetts General Hospital*—The present studies employed event-related potentials (ERPs) to examine the time course for the integration of lexico-semantic and discourse information—namely, the resolution of categorical anaphors. Scenarios were constructed to include three potential antecedents. Anaphors were semantically ambiguous in that two of the potential antecedents were exemplars of the anaphor. Final sentences resolved the anaphor with the correct (associatively related/contextually appropriate), incorrect (associatively related/contextually inappropriate), or control antecedent (associatively unrelated/contextually inappropriate). We examined the amplitude of

the N400 waveform, which is thought to reflect the ease of semantic integration, at several points following the anaphor. Results demonstrated that (1) the N400 is sensitive to the integration of multiple types of information at the discourse level, (2) readers use lexico-semantic and discourse-level information in integrating incoming words into a larger discourse, and (3) following an anaphor, a correct antecedent is more easily semantically integrated into the preceding context.

(1109)

The Role of Connectives in Maintaining the Local Coherence of a Text. ALEXANDRIA E. GUZMÁN, *University of New Haven*—The hypothesis that connectives aid in the maintenance of local coherence by allowing readers to form expectations regarding the nature of the unfolding text was tested in four experiments. In Experiment 1, when readers were asked to continue a story, the presence of a temporal connective (*meanwhile*) led them to form specific expectations about the nature of the continuations. In contrast, the results of a recognition task in Experiment 2 indicated that readers do not form specific expectations about the forthcoming text when they encounter the temporal connective. Finally, data from a reading time task in Experiments 3 and 4 indicated that although connectives do not seem to allow readers to generate expectations about the unfolding text, they do aid readers in the integration of the texts they link. These data suggest that readers often form underspecified, incomplete representations of a text rather than a detailed analysis of its content.

(1110)

Distance Effects on the Resolution of Inconsistent Anaphors in Discourse Processing. KATHRYN H. CHACE, JEROME L. MYERS, & KEITH RAYNER, *University of Massachusetts, Amherst* (sponsored by Nancy A. Myers)—Previous research (Cook, 2003) has explored distance effects on anaphoric resolution across passages with consistent and inconsistent antecedents. In a self-paced reading task, Cook found no effects of distance on how long it took to read the line containing the anaphor or the spillover line. We used eye tracking to examine these effects further. Thirty-six passages were used in a 3 (distance: close vs. intermediate vs. far) \times 2 (anaphoric congruency) repeated measures design. In agreement with Cook's results, there were no main effects or interactions in first-pass measures of the anaphor and spillover regions. However, when total time and regressions into the antecedent region were examined, there were both a main effect of congruency and an interaction in which more time was spent reading the incongruent close antecedent than the congruent close antecedent. These results suggest that eye-tracking data are necessary to get a complete picture when studying anaphoric resolution.

(1111)

Processing Temporal Information in Narratives: Evidence From Eye Movements. KRISTIN M. WEINGARTNER & JEROME L. MYERS, *University of Massachusetts, Amherst*—In one eye movement experiment, we examined how the temporal contour of narrative events influences comprehension. On the basis of the findings from self-paced reading and recognition probe studies (e.g., Zwaan, 1996; Zwaan, Madden, & Whitten, 2000), there were two main predictions: First, time adverbials that signal a time shift (*after an hour* versus *after a moment*) will lead to an increased processing load, resulting in longer reading times on the time adverbial. Second, the duration of an event will influence its accessibility following a time shift. More specifically, reading times on anaphoric references to event information will be longer following a time shift for discontinued events (*the student stopped studying*) than for ongoing events (*the student was studying*) that typically persist beyond the temporal boundaries imposed by the time shift. The results provide partial support for these predictions and are discussed in the context of theories of situation model updating.

(1112)

Inference Specificity and Its Effect on the Encoding of Predictive Inferences. MARK A. CASTEEL, *Pennsylvania State University, York*—

A number of studies examining predictive inferences have found evidence that they can be activated immediately after a biasing story context. More recent research has also shown that in some situations, predictive inferences can be encoded into memory. Although the nature of the memory representation for predictive inferences is somewhat unclear (i.e., specific inferences vs. general state changes), it is clear that predictive inferences can be stored in memory. The present study expanded upon earlier research and examined how inference specificity affects the encoding of predictive inferences. Participants read stories that have previously been shown to result in the encoding of predictive inferences in one of three versions: one that was altered to make the inference less compelling, one that mentioned a general “state change” outcome, or one that explicitly mentioned the inference outcome. Following a backgrounding second paragraph, a target line explicitly mentioned the inference outcome, and reading times were measured. Results are compared with previous findings and implications for theories of discourse processing are considered.

(1113)

Predictive Inferences: The Interacting Influence of Context and General World Knowledge. SABINE GUERAUD, *University of New Hampshire*, ISABELLE TAPIERO, *University of Lyon 2*, & EDWARD J. O'BRIEN, *University of New Hampshire*—Previous research has demonstrated that the activation of predictive inferences can be affected both by the immediately preceding context and information contained in an earlier portion of the discourse model. Experiments 1 and 2 demonstrated that the same immediate context can result in the activation of very different inferences when different character trait descriptions of the protagonist are presented in an early portion of the passage. Experiment 3 demonstrated that the trait descriptions were sufficient to produce activation of only one specific inference; this occurred even though the immediately preceding context in isolation lead to the activation of a very different inference. Results of all three experiments are discussed within the memory-based view of text processing.

(1114)

Resolving Inconsistencies During Reading. ANNE E. COOK, *University of Utah*, & SABINE GUERAUD & EDWARD J. O'BRIEN, *University of New Hampshire*—Previous research has shown a slowdown in reading times on a target sentence (e.g., *Mary ordered a cheeseburger and fries*) when that sentence was inconsistent with earlier information (e.g., Mary was a vegetarian). The present study investigated how readers resolved that inconsistency. A second target sentence was added later in the text that was also inconsistent (e.g., *Mary decided she wanted to eat a steak*). In Experiment 1, reading times did not slow down on this second target sentence, but did slow down on the spillover sentence. In Experiment 2, the degree of inconsistency was explicitly reduced (e.g., with the information that *Mary used to be a vegetarian*). The slowdown in reading times became evident on the target sentence. Thus, the slowdown in reading for the second-target-sentence conditions was greater and more immediate when the text provided a resolution for the first target sentence than when the reader needed to generate one.

(1115)

Visual Perspective Taking in Narratives. ANGELA S. RALANO & CELIA M. KLIN, *SUNY, Binghamton*—Horton and Rapp (2003) found that readers sometimes encode information from the visual perspective of story protagonists. The goal of the present research was to replicate and extend these findings. In Experiment 1, we found that after reading a narrative, participants responded more slowly to a question about a target object if that object had been visually occluded from the protagonist's view (e.g., surfers occluded by fog). In Experiment 2, we used a recognition probe task and found that participants responded more slowly in the occluded version than in a nonoccluded version to a probe word representing the target object (e.g., *surfers*). In Experiment 3, we measured reading time on a line that reintroduced the targeted object. As in Experiments 1 and 2, reading times were

slower in the occluded version. We conclude that occluded objects are less accessible in readers' memory representations.

(1116)

Interactions Between Reader Characteristics and Text Properties in Comprehension of Scientific Principles. PANAYIOTA KENDEOU & PAUL VAN DEN BROEK, *University of Minnesota*—We investigated the effects of accuracy of prior knowledge and text structure on comprehension of scientific texts. Think-aloud and reading-time results indicated that differences in prior knowledge affected online inferential processing, but only in terms of content and not in terms of the processes per se. In addition, readers with inaccurate knowledge engaged in conceptual change processes, but only when the text structure foregrounded misconceptions (refutation structure). These online effects were independent of readers' working memory capacity and need for cognition, although each of these factors influenced specific reading situations (e.g., when the text was difficult). The results of a recall task indicated that differences in prior knowledge, but not in text structure, influenced readers' memory for the texts. These offline effects were also independent of readers' working memory capacity and need for cognition.

(1117)

Inferences and Cognitive Resources: A Knowledge Domain Issue? CONNIE SHEARS, *Chapman University*—Cognitive resources are required to form knowledge-based inferences. Comprehension relies on our ability to form inferences from many knowledge domains. Thus, specifying the resource differences between domains of knowledge is important for understanding when comprehension processes may be slowed or unsuccessful. Claims that cognitive resources are differentially relied upon for types of inferences (predictive vs. explanatory) have been examined, yet resource requirements may differ at a more fundamental level. The knowledge drawn upon to form inferences may itself depend on varying amounts of cognitive resources to support the formation of causal inferences. I hypothesized that brief narrative texts based on physical versus planning knowledge would elicit differences in comprehension if these two knowledge domains require varying amounts of cognitive resources. Results indicated that answers to comprehension questions were faster and more accurate for texts based on physical knowledge rather than planning knowledge. However, probe measures of inference processing were not different between knowledge domains. These findings suggest that cognitive resource differences may be specific to knowledge domains rather than to the inference process itself.

(1118)

The Role of Attention in Perspective Taking. SHUHONG LIN & BOAZ KEYSAR, *University of Chicago*—Dual-process theories of cognitive processing state that two systems—automatic versus controlled—interact and affect behavior. We propose that perspective taking in conversation uses a similar dual process. Failure to take another's perspective happens when one relies on automatic, readily accessible processing; taking another's perspective requires more effortful, controlled processing. We tested this hypothesis through two experiments that manipulated the attentional capacity of the participants while they played a referential communication game. In Experiment 1, participants performed a concurrent secondary task, inducing either a high or low cognitive load. In Experiment 2, participants with either high or low working memory span played the same communication game. We found that participants' comprehension is more egocentric when under a high-load manipulation than under low load, and participants with lower working memory span behave more egocentrically than those with high span. This demonstrates that perspective taking is an effortful process.

(1119)

Does Mental Imagery Improve Text Comprehension? LAURA MOTYKA & DAVID W. ALLBRITTON, *DePaul University*—An experiment investigated the effectiveness of mental imagery instructions

for facilitating text comprehension in college undergraduates. Participants read texts in one of four instruction conditions: image, paraphrase, understand (a neutral baseline condition), and count (counting the number of nouns). Performance on a subsequent comprehension test reflected a classic levels of processing effect, with deep encoding (image and paraphrase conditions) leading to higher scores than shallow encoding (count condition) and the neutral “read to understand” condition falling somewhere in between. There was, however, no comprehension advantage for mental imagery instructions over paraphrasing. The results cast doubt on the value of mental imagery as a strategy for improving text comprehension.

(1120)

Situation Model Updating for Different Narrative Perspectives. DAVID E. COPELAND & LINDSEY L. OSTERMAN, *University of Southern Mississippi*—Studies of narrative comprehension have shown that readers often adopt the perspective of characters in the text. This study examined effects that have been previously observed (e.g., greater accessibility of associated than of dissociated items) as the perspective of the text was manipulated. Specifically, comparisons were made between third-person (e.g., he/she) and second-person (i.e., you) perspectives. Within- and between-subjects designs revealed that people are more likely to show an effect in the second-person perspective when presented with both perspectives. Implications for situation model theory are considered, particularly for more recent studies in which event memory has been examined when people are actively involved in the situation (e.g., in a virtual environment).

(1121)

The Effect of Narrative Time Shifts on the Representation of Goal-Related Information. WILLIAM H. LEVINE, JOEL A. HAGAMAN, CARI ANNE BOGULSKI, REBECCA R. GREEN, & DORTHE S. ORTIGO, *University of Arkansas, Fayetteville*—Experimental investi-

gations of situation model construction have typically focused on single dimensions (e.g., time). The experiments that we conducted examined the effect of changes in one dimension, time, on the representation of information from another dimension, intentionality (i.e., character goals). In the first experiment, participants read vignettes in which a character’s time-limited goal (e.g., meeting an application deadline) was or was not completed. Following the goal completion manipulation, there was a short or long time shift, with the latter moving the narrative action close to the time by which the goal had to be completed. The results of a recognition probe task suggest that time shifts had a somewhat paradoxical effect: Goal information became more active after the long time shifts. A follow-up experiment examined the role of the nature of goals on this effect. The results are discussed with respect to the construction of multidimensional situation models.

(1122)

Changing Beliefs Based on Information in Fictional Narratives. MIJA M. VAN DER WEGE, *Carleton College*, & AMY KURIVCHACK & DAVID N. RAPP, *University of Minnesota*—Nonfiction sources (i.e., textbooks, documentaries, lectures) are usually designed to convey facts and concepts. Individuals, though, often learn facts from fiction sources (see, e.g., Marsh, Meade, & Roediger, 2003), and their existing beliefs about facts can be influenced by statements made in fictional narratives (see, e.g., Prentice, Gerrig, & Bailis, 1997). Interestingly, Prentice et al. found that university students’ beliefs were more likely to be influenced by reading fictional accounts set at rival institutions rather than fictional accounts set at home institutions. In their study showing general persuasion by fiction, however, Wheeler, Green, and Brock (1999) failed to replicate cross-institution effects. In this project, we test several explanations of these discrepant results. Our replication included participants at comparable liberal arts institutions, as well as at a large state institution. We discuss our results with respect to general underlying mechanisms of knowledge acquisition.

POSTER SESSION II

Sheraton Hall, Friday Afternoon, 12:00–1:30

• AUDITORY PROCESSING •

(2001)

An Investigation Into Nonverbal Auditory Stroop. LAUNA C. LEBOE & TODD A. MONDOR, *University of Manitoba*—The Stroop effect is defined as the slowed naming of an ink color when it is presented in the context of an inconsistent color word. This has been taken as evidence that it is not possible to completely ignore an irrelevant dimension. Whereas there have been hundreds of investigations of the Stroop effect in the visual domain, relatively few studies have been conducted on an analogous auditory Stroop effect. Previous investigations of auditory Stroop have been based on examining a conflict between a verbal label and a physical dimension (i.e., the word *high* in a low pitch). In contrast, the present project was undertaken to determine whether an auditory Stroop effect may be observed when both dimensions of the sound are nonverbal. If so, this may indicate that an auditory Stroop effect for nonverbal sounds results from the inability to ignore an irrelevant dimension of a sound.

(2002)

One More Time: Repetition Effects for Auditory What and Where Responding. BENJAMIN J. DYSON, *University of Sussex*, & PHILIP T. QUINLAN, *University of York*—Although preservation may seem unappealing, repetition in the environment may facilitate processing in the face of continuously changing surroundings. Three experiments are described in which responses to auditory stimuli varying in pitch (what) and location (where) were analyzed according to various inter-trial contingencies. Experiment 1 examined Garnerian classification; Experiment 2 examined classification when target features were selected within a single dimension or across two dimensions; and Experiment 3 compared feature and conjunction processing. Experiment 1 showed that the relative separability/integrality between location and frequency was determined by the relationship across trials. Experiment 2 demonstrated how both cases of within- and between-dimensional processing may be observed from the same (between) condition. Experiment 3 revealed the locus of the bypass rule to be later than the top-down influence of a blocked design. The study of repetition highlights important constraints in stimulus processing that are often overlooked by simpler approaches that ignore inter-trial contingencies.

(2003)

Perception of Complex Auditory Events: A Modeling Approach to Understanding the Source-Perception Loop. RICHARD E. PASTORE, JEREMY R. GASTON, JESSE D. FLINT, & MATTHEW J. SOLOMON, *SUNY, Binghamton*—When making decisions about complex acoustic events, human listeners utilize differential weightings of multiple acoustic properties, although not necessarily in the same manner or in an optimal fashion. Our research takes a broad approach to the whole source-perception loop. The completed work on posture contrast in human gait has defined the statistical distribution of acoustic properties that reflect not only the posture contrast, but also other source event attributes that may represent noise to the decision process. These distributions allowed us to develop simple ideal observer models to predict performance for each walker on the basis of each of a variety of acoustic properties. The comparison of across-walker patterns of performance for individual models and human listeners allowed us to begin to identify what properties listeners might have used to make posture decisions. Our present research utilizes more complex models that attempt to better approximate the complexity of human perceptual decision making.

(2004)

Making Up for Lost Time: Is Fast Speech Even Harder for Older Adults With Hearing Loss? SANDRA L. McCOY & PATRICIA A. TUN, *Brandeis University*, L. CLARKE COX, *Boston University*

School of Medicine, & ARTHUR WINGFIELD, *Brandeis University*—Older adults have difficulty comprehending fast speech, likely due to both age-related cognitive and hearing changes. We have shown that when time is restored to time-compressed speech, older adults can benefit from this additional processing time, although at faster compression rates they do not benefit as much as young adults (Wingfield, Tun, Koh, & Rosen, 1999). The present work studied the relative contributions of aging, hearing acuity, and cognitive abilities to comprehension of time-compressed speech and the benefit from time restoration. We used four participant groups: young normal-hearing adults, young hearing-impaired adults, older normal-hearing adults, and older hearing-impaired adults. Listeners recalled narrative passages that were uncompressed, time compressed, or time compressed with restored time. Results for the four groups showed a different pattern of performance for time-compressed speech as well as a benefit from time restoration, demonstrating effects of both age and hearing acuity on the comprehension of time-compressed speech.

(2005)

Mismatch Negativity for Local and Global Auditory Processing: Is It Lateralized? ALEXANDRA LIST, *University of California, Berkeley*, TIMOTHY JUSTUS, *University of California/VANCHCS*, SHLOMO BENTIN, *Hebrew University of Jerusalem*, & LYNN C. ROBERTSON, *Veterans Affairs Medical Center, Martinez, and University of California, Berkeley*—The left and right cerebral hemispheres have been asymmetrically implicated in local and global auditory processing, respectively. Here, we tested this hypothesis using mismatch negativity (MMN), an electrophysiological index of auditory change detection. The stimuli were sequences of tones that distinctively allowed independent manipulation of local and global patterns (Justus & List, 2005). Local and global variations occurred over short and long temporal intervals (300 and 900 msec), respectively. The stimuli were blocked such that either a local or a global repetitive pattern (standard) was compared with rarely occurring deviant patterns over the same interval. Importantly, within local standard blocks, global patterns were continuously changing, whereas within global standard blocks, the local patterns were continuously changing. Consequently, the elicited MMN indices could be unequivocally attributed to changes occurring only at the level of interest (local or global). We examined the MMN for local and global processing, with specific attention to lateralization.

(2006)

Selective Attention to Spatially Distributed Environmental Sounds. STEPHEN LAKATOS, *Washington State University*, ALEXANDER A. STEVENS, *Oregon Health & Science University*, & PERRY R. COOK, *Princeton University*—Attention to spatially distributed environmental sounds was examined using a signal processing system that incorporated head tracking and simulation of first-order reflections. Participants were cued to a target at one of three simulated locations in the horizontal plane and determined whether the target occurred at the cued location during subsequent streams presented at all three locations. Four conditions were tested: baseline (no head tracking), head tracking, addition of reflection cues, and orientation of participant's head toward the target. Unexpectedly, head movement cues did not improve detection, and adding reflection cues and orienting toward the target impaired performance. Detection was best predicted by each sound's perceptual "salience," measured by post hoc sorting and labeling tasks, and, to a lesser extent, by its spectral content. Results suggest that attending to a naturalistic sound in a spatially distributed context may depend less on the richness of available localization cues than on the attended sound's perceptual distinctiveness.

(2007)

Differences in Loudness Processing Between Female and Male Listeners. ELAD SAGI, *DeVault Otologic Research Laboratory, IUPUI*, & LISA M. D'ALESSANDRO & KENNETH H. NORWICH, *University of Toronto* (sponsored by Kenneth H. Norwich)—Loudness exponents were compared in 8 female and 7 male participants using pure

tone stimuli. Exponents were measured by assessing the errors made in identifying the intensity of tones. Participants were required to identify the intensity of tones to the nearest decibel, given that the intensity would lie in a specified range (e.g., 1–30 dB or 1–70 dB). A listener's error in identification (standard deviation in decibels) tends to increase as the stimulus range is increased, and the exponent for loudness is given by the slope of the resulting regression line. We measured exponents in this manner over six auditory frequencies between 125 Hz and 8 kHz, and found that the exponents for females exceeded that for males, implying for the former a greater sensitivity to changes in loudness. Our exponents were obtained from a measure of sensory memory and are indicative of loudness processing.

(2008)

Spatialized Sound Localization and Body Roll Tilt. JEAN-MICHEL PRIEUR, *Peugeot-PSA/DRIA*, LIONEL PELLIEUX, *IMASSA-SC*, CHRISTOPHE BOURDIN, *UMR 6152 Mouvement et Perception*, & PATRICK M. B. SANDOR, *IMASSA-SC* (sponsored by Cheryl Frenc-Mestre)—Body roll tilt is controversially described as promoting a lateral shift in the perceived position of sound sources, depending on designation condition. After the whole body had been laterally and infralaterally tilted in complete darkness ($\pm 15^\circ$ maximum), the localization of a single source was explored. Spatialized sound sources were generated by earphones as coming from the frontal space ($\pm 30^\circ$ azimuth; $\pm 20^\circ$ elevation in a head-centered spherical grid, 10° steps). The participant indicated the perceived sound origin verbally (which quadrant of the frontal space) or by hand pointing; where the right-hand finger was directed toward the source, that position relative to the head was calculated. In azimuth, tilting position affects verbal designation of central sources (0°), but not of lateral sources. In elevation, sources were globally shifted up, independently of tilt. Tilt influenced the pointing responses—the azimuth component by a systematic lateral shift and the elevation component by a systematic overestimation.

• SPATIAL COGNITION •

(2009)

Navigation and Memory of a Real and Virtual Maze. JOHN G. JEWELL, *St. Joseph's University*—Virtual environments are being increasingly used for training purposes because of their flexibility and cost effectiveness. The ecological validity of virtual environments is often called into question. The present investigation was an attempt to examine whether naive participants would construct similar spatial representations for a real and a virtual maze. Participants were asked to navigate through a real maze, cut into a cornfield, or an identical virtual maze. After reaching the end of the maze, participants were asked to reproduce, using paper and pencil, the path that had brought them to the end of the maze. No differences were found between the spatial representations for the real and the virtual mazes. Memory of the legs of the maze leading to a successful exit showed a serial position effect.

(2010)

Effects of Disorientation on Memory for Object Locations. JESSE SARGENT, JOHN PHILBECK, & STEPHEN DOPKINS, *George Washington University*—Human subjects learned the location of four objects in a room and practiced pointing to them from the center of the room. Subjects were then seated in a chair, blindfolded, and asked to point to the objects, after each of a series of 70° or 200° turns in the chair. Subjects started the series of turns either with intact orientation or after having been disoriented as a consequence of multiple turns in the chair. The results of several analyses suggested that the pointing errors that occurred for the individual objects as a consequence of subject disorientation were highly correlated with one another. That is, rather than “drifting” from their true locations in random, unrelated directions as subjects lost orientation, objects appeared to “drift” as an ensemble. This is taken as evidence that object-to-object (allocen-

tric) information about objects is stored in memory and used in pointing responses.

(2011)

The Effects of Long-Term Practice and Training on Mental Rotation. MELISSA S. TERLECKI, *Cabrini College*, & NORA S. NEWCOMBE, *Temple University*—A series of studies investigated the effects of long-term practice and training on mental rotation. Longitudinal assessments of MRT performance were conducted for men and women, people with greater or lesser levels of spatial experience, and people randomly assigned to 12 h of videogame training or a control task. *SEM* analyses showed that, although males and people with the greater levels of spatial experience had greater initial mental rotation ability than did females and people with lesser levels of spatial experience, over time, females and people with lesser levels of spatial experience demonstrated greater rates of mental rotation growth. However, growth curves between males and females and between people with varying levels of spatial experience did not converge in the course of the study. People with and without videogame training did not differ in initial mental rotation ability, although in the training study, people assigned to videogame experience did show an advantage in rate of mental rotation growth over time (yet again, no convergence between groups). The results suggest that mental rotation performance is profoundly affected by experience; the practice and training effects were much larger than the gender effects. Implications for ceiling effects, asymptotic performance, and future directions are discussed.

(2012)

Viewer Rotation Is Not Always Easier Than Object Rotation. MADELEINE M. KEEHNER & MARY HEGARTY, *University of California, Santa Barbara*—In three experiments, participants viewed a display showing a circular table with an object on top. An arrow indicated the direction and distance of a rotation they were to imagine. There were two conditions: mental rotation (MR; imagine that the table rotates) and perspective taking (PT; imagine that you move around the table). In Experiment 1, participants were asked, “Will the table look like this (after the rotation)?” MR was both faster and more accurate than PT. However, the images (before and after rotation) were presented sequentially. To exclude working memory load, in Experiment 2 the images were presented simultaneously, and the superiority of MR was replicated. In Experiment 3, we asked, “Will the object be on your left or your right?” Here, the patterns of data were reversed (PT was easier than MR). These findings challenge previous claims that perspective taking (viewer rotation) is consistently easier than mental rotation (object rotation).

(2013)

Is Active Control Better Than Passive Viewing? It Depends on What You See. MADELEINE M. KEEHNER, CHERYL A. COHEN, DANIEL R. MONTELLO, PETER KHOOSHABEH, & MARY HEGARTY, *University of California, Santa Barbara*—Participants viewed a fictitious 3-D structure in both printed 2-D images and a 3-D computer visualization. A vertical or horizontal line on the images indicated where they should imagine that the structure had been sliced. The task was to draw the resulting cross-section. In Experiment 1, active participants (who were allowed to control the visualization with a mouse interface) performed significantly better than passive participants (who viewed the object rotating continuously). Spatial ability strongly predicted performance, especially in the passive condition. In Experiment 2, we controlled the visual input, using a yoked pairs design. Active participants manipulated the visualization using an intuitive interface, and their rotations were later played back to passive participants. Under these conditions, there was no difference between the groups, and the contribution of spatial ability was attenuated. A third experiment explored the hypothesis that performance depends on access to informative views of the object rather than on active control per se.

(2014)

Representational Momentum: Impervious to Error Feedback?

SUSAN E. RUPPEL & CARMEN N. FLEMING, *Francis Marion University*, & TIMOTHY L. HUBBARD, *Texas Christian University*—Finke and Freyd (1985; Freyd, 1987) claimed that representational momentum was impervious to error feedback. However, this claim was based on presentation of feedback during a limited number of practice trials and on use of inducing stimuli that were identical across experimental trials. The present experiments examined potential effects of the amount of feedback, while varying direction and location of inducing stimuli across trials. Experiment 1 presented the same limited feedback as that in Finke and Freyd's study and showed no effect of feedback on representational momentum. Experiment 2 included four groups, each of whom received two blocks of trials. Each group received either (1) no feedback, (2) feedback on the first but not the second block, (3) feedback on the second but not the first block, or (4) feedback on both blocks. A consistent effect of feedback on representational momentum was not observed in Experiment 2. Implications for theories of representational momentum are discussed.

(2015)

Sharing Eyegaze Is Better Than Speaking in a Time-Critical Consensus Task.

MARK B. NEIDER & XIN CHEN, *SUNY, Stony Brook*, CHRISTOPHER A. DICKINSON, *University of Delaware*, & SUSAN E. BRENNAN & GREGORY J. ZELINSKY, *SUNY, Stony Brook*—We explored collaboration in a 2-person target-detection task where the first person to find the target had to communicate its location to a partner. Two partners (A, B) communicated verbally using an intercom (shared voice, SV) or visually using gaze cursors (shared gaze, SG). In the SG condition, a yellow ring (gaze cursor) representing A's eye position was superimposed over B's search display, and vice versa. The partners' task was to attain mutual gaze (consensus) on a sniper target. The target, a single red pixel, appeared randomly in the windows of buildings in a pseudorealistic city scene. Time to consensus was faster with SG than with SV, and the interval between first and second partners fixating the target was shorter as well. These results suggest that sharing eyegaze can be more efficient than speaking, when people collaborate on tasks requiring the rapid communication of spatial information.

(2016)

Shared Representational Processes in Spatial Language and Spatial Working Memory.

JOHN J. LIPINSKI, JOHN P. SPENCER, & LARISSA K. SAMUELSON, *University of Iowa*—Research by Crawford et al. (2000) suggests a strong division between representations in spatial working memory and spatial language, consistent with a broader theoretical division between “sensorimotor” and “cognitive” systems (Bridgeman, 1999; Bridgeman et al., 2000; Brungart et al., 2000). In three experiments, we provide evidence that spatial language and spatial working memory rely on shared underlying representational processes. Experiments 1 and 2 show that response delays yield analogous effects in a spatial working memory task and when participants give linguistic “above” ratings. Experiment 3 shows that the introduction of enhanced perceptual structure along the vertical midline symmetry axis of the task space reduces the impact of this delay in both tasks. We propose a new model to account for these effects that builds on the process-based dynamic field theory of spatial working memory (Spencer & Schöner, 2003, 2005).

(2017)

Valence-Based Spatial Categories: The Role of Stimulus Distribution and Orientational Metaphor. L. ELIZABETH CRAWFORD & JOHN T. DRAKE, *University of Richmond*—In a study of inductive spatial category learning, we manipulated the spatial distribution of valenced stimuli to examine whether people form spatial categories that capture regions of common stimulus valence, and whether category learning is supported when the distribution is consistent with the orientational metaphor *good is up*. Participants viewed positive and

negative stimuli in various locations and then reproduced each location from memory. Some saw positive stimuli in the top half and negative stimuli in the bottom half of space (metaphor congruent), some saw the opposite pattern (metaphor incongruent), and some saw a random distribution of stimuli. In the clustered conditions, but not in the random condition, estimates were biased toward the centers of the top and bottom halves of the screen, indicating that participants categorized the space into valence-based regions. This category effect was significantly stronger in the metaphor-congruent than in the metaphor-incongruent condition.

(2018)

Spatial Navigation Response to Social Objects in a Virtual Environment.

MARC M. SEBRECHTS, ANDREAS E. FINKELMEYER, & CHERYL Y. TREPAGNIER, *Catholic University of America*—Eight participants were asked to navigate through a virtual mall in order to locate objects in stores, and paths and comments were recorded. The virtual mall included both social (two persons conversing) and nonsocial (two similarly spaced but inanimate) objects. Participant comments indicated that the environment was treated in a realistic manner. Individuals typically chose paths that represented the least distance to their objectives, even when this required passing between two persons. When distance cost for alternative routes was minimized and simulated speech between virtual figures was made audible, participants modified their paths to avoid passing between the represented persons. The utility of this approach for assessing social awareness and responsiveness is discussed.

• RETRIEVAL INHIBITION •

(2019)

Conditions Influencing Retrieval-Induced Forgetting in Episodic Memory.

DAVID P. YELLS, *Utah Valley State College*, & KENNETH A. DEFFENBACHER, *University of Nebraska, Omaha*—Retrieval-induced forgetting (RIF) occurs when practicing a subset of items from a study list reduces subsequent retrieval of the remaining items from that list. We attempted to demonstrate RIF in an episodic memory paradigm using abstract nouns, several different intermediate practice procedures, and a final recall task. In Experiment 1, RIF occurred when the practice task was based on the initial letter of the study items. In Experiment 2, RIF did not occur when the practice task was based on the color of the study items. In Experiment 3, RIF did not occur when the practice task was based on the background color of the study list. Our results further support our contention that in episodic memory paradigms, the occurrence of RIF is a function of the nature of the study items, the type of practice task, and the type of final retrieval task.

(2020)

Retrieval Induced Facilitation: Manifestation of the Testing Effect on Previous Untested Materials.

JASON C. K. CHAN, KATHLEEN B. McDERMOTT, & HENRY L. ROEDIGER III, *Washington University*—Three experiments used educationally relevant prose materials to examine how taking initial tests affects later memory for materials not initially tested (but related to the materials that were tested). Experiments 1 and 2 showed that taking two initial tests on a subset of the studied materials enhanced accurate recall performance on the initially untested materials 24 h later, as compared with conditions in which no retrieval practice had occurred. Importantly, this facilitative effect was not seen when subjects were given additional study opportunities (but not retrieval practice), suggesting a retrieval-specific facilitative mechanism. Experiment 3 demonstrated this facilitative effect in a single-day design in which tests followed in immediate succession. These results are in line with some findings from the educational literature (Rickards, 1979) and predictions emerging from associative memory theories (e.g., Collins & Loftus, 1975), but are opposite to predictions emerging from the retrieval-induced forgetting literature (Anderson et al., 1994).

(2021)

Is Retrieval Success a Necessary Condition for Retrieval-Induced Forgetting? BENJAMIN C. STORM, JOHN F. NESTOJKO, ROBERT A. BJORK, & ELIZABETH LIGON BJORK, *UCLA*—When information is retrieved from memory, it becomes more recallable than it would have been otherwise. Other information associated with the same cue or configuration of cues, however, becomes less recallable. Such retrieval-induced forgetting (Anderson, Bjork, & Bjork, 1994) appears to reflect the suppression of competing nontarget information, which, in turn, may facilitate the selection of target information. But is success at such selection a necessary condition for retrieval-induced forgetting? Using a procedure in which some cues pose an impossible retrieval task for participants, we have obtained evidence that the attempt to retrieve, even if unsuccessful, can produce retrieval-induced forgetting. This finding, we believe, lends additional support for the suppression/inhibitory account of retrieval-induced forgetting.

(2022)

Retrieval-Induced Forgetting in Relation to Study Time, Gender, and Time of Day. IAN M. McDONOUGH, BETHANY J. CAUGHEY, JERLYN M. TOLENTINO, ELIZABETH LIGON BJORK, & ROBERT A. BJORK, *UCLA*—Retrieving information from memory, while increasing the later accessibility of that information, can result in the reduced accessibility of other information associated to the same cue or configuration of cues (Anderson, Bjork, & Bjork, 1994). Via a meta-analysis of four experiments involving over 300 UCLA undergraduates, we examined whether retrieval-induced forgetting might relate to three factors: study time, time of day, and gender of participants. Our findings suggest that retrieval-induced forgetting (1) decreases as study time increases, (2) may be greater for female than for male participants, and (3) might be greater for participants tested in the morning than for participants tested in the afternoon. In our view, the observed negative relationship between study time and amount of retrieval-induced forgetting reflects, at least in part, the additional opportunities afforded for elaborative encoding and integration of the studied materials as study time increases.

(2023)

Distinctive Experiences Can Cause Forgetting. JASON P. LEOBE, MELISSA VICKAR, & TIFFANY HELGASON, *University of Manitoba*—According to a *retrieval inhibition* account (Anderson & Spellman, 1998), retrieval-induced forgetting (RIF) occurs because the effort to bring one category exemplar to mind requires inhibition of related exemplars. The outcome is that participants have more difficulty recalling related, unpracticed items during a later test. We investigated whether distinctive encoding alone might heighten forgetting of related exemplars. At study, some exemplars from a subset of categories were presented as anagrams (anagram exemplars), while the other half were merely read (read-related exemplars). Participants also read all exemplars from the remaining categories (read-unrelated exemplars). At test, read-related exemplars were less likely to be recalled than read-unrelated exemplars. Since an anagram's meaning is unknown prior to arriving at its solution, retrieval inhibition could not contribute to forgetting in our study. We suggest that RIF may reflect a more general influence of distinctive experiences in reducing access to related, less-distinctive memory representations.

(2024)

Retrieval-Induced Forgetting of Perceptual Memory Representations. GINO CAMP, DIANE PECHER, HENK G. SCHMIDT, & JAN W. VAN STRIEN, *Erasmus University Rotterdam*—Retrieval-induced forgetting (RIF) has been demonstrated with the retrieval-practice paradigm if, during both retrieval-practice phase and test phase, tasks are used that rely on processing of conceptual properties of the stimuli. Anderson (2003) predicts similar results if both the retrieval-practice phase and the test phase involve orthographic tasks that rely on processing of perceptual properties of the stimuli. In three experiments,

we used different combinations of orthographic tasks in the retrieval-practice phase and the test phase. We did not find RIF in any of these experiments. The implications of these results for the scope of RIF in memory retrieval will be discussed.

(2025)

What Makes Things More Forgettable in Directed Forgetting? LILI SAHAKYAN, *University of North Carolina, Greensboro*, & LEILANI B. GOODMON, *University of South Florida* (sponsored by Lili Sahakyan)—Despite extensive research on directed forgetting showing that recall is impaired as a result of instructions to forget previously studied information, the role of preexisting item characteristics known to affect memorability has been overlooked. For example, research shows that items have a memory advantage when they have smaller neighborhoods of associates (set size), more densely connected neighborhoods (connectivity), and greater numbers of resonating links (resonance) (Nelson & McEvoy, 2004). The present experiments investigated the effects of the aforementioned item characteristics on the magnitude of directed forgetting. In contrast to prior directed forgetting studies that used free recall and recognition, an extralist cued recall test was used to determine whether (1) directed forgetting can be obtained with this method and (2) whether the strength of the cues moderates the magnitude of directed forgetting. Results revealed that preexisting item characteristics, as well as the strength of the cues, influence the directed forgetting effect.

(2026)

Directed Forgetting in the List Method Affects Recognition Memory for Context. LAWRENCE R. GOTTLÖB & JONATHAN M. GOLDING, *University of Kentucky*—The effects of list method directed forgetting on recognition memory were explored. In each of two experiments, two lists of 10 words were presented. After List 1, half of the participants (F) were instructed that they were to forget List 1; the other half (R) were not given the forget instruction. Two types of recognition performance were measured: lexical recognition, which was recognition of the list words, and context recognition, which was recognition of the list words plus encoding context. In Experiment 1, the encoding context was the type cases of the words, and in Experiment 2, it was the colors of the words. In both experiments, there was an effect of directed forgetting on context recognition, but not on lexical recognition. The forget instruction affected the strengths of the memory representations for the word contexts, which would be consistent with various mechanisms for directed forgetting, including differential rehearsal and context change.

(2027)

Electrophysiological Correlates of Voluntary Suppression of Episodic Retrieval. ZARA M. BERGSTROM, ALAN RICHARDSON-KLAVEHN, MAX VELMANS, & JAN DE FOCKERT, *Goldsmiths College, University of London*—We investigated neurocognitive processes of voluntary retrieval suppression in the Anderson and Green (2001) “think/no-think” paradigm, in which participants either retrieve or suppress a previously exposed paired associate. Event-related potentials during the “think/no-think” phase were separated on the basis of previous learning success versus failure. This separation yielded a temporal and topographic dissociation between the neural correlates of a retrieve versus suppress strategy (from 200 to 400 msec poststimulus), which was independent of learned/not-learned status, and the neural correlates of item-specific retrieval versus suppression (from 500 to 700 msec). For the latter, the late left parieto-temporal positivity indexing recollection was abolished by voluntary suppression of successfully learned items. We also demonstrate the oscillatory correlates of these effects, examined using wavelet and partial least-squares analysis. The data show an electrophysiological separation between retrieval attempt and retrieval success and show that the late positive recollection effect is not automatically generated to cues associated with recollectable responses.

(2028)

The Importance of Preexisting Long-Term Memory Representations in Directed Forgetting. KIRSTEN BURGHARDT & FABRICE B. PARMENTIER, *University of Plymouth*—In a directed forgetting task using verbal stimuli, Oberauer (2001) showed that participants are slower to reject to-be-forgotten items than new probes. This “intrusion cost” was attributed to a slowly decaying residual activation of long-term memory traces corresponding to the to-be-forgotten stimuli. The present study tested this assumption by using spatial stimuli for which participants had no existing memory representations and the same spatial stimuli when participants had developed transient representations of these items. The results showed that the intrusion cost was mediated by the existence of stable memory representations for the stimuli: Participants unfamiliar with the stimuli showed no distinction between to-be-forgotten and new probes, whereas participants trained to learn the set of locations showed the intrusion cost. This finding is discussed with regard to current models of memory.

• FEEDBACK AND MEMORY •

(2029)

The Testing Effect: Enhanced Retention or Attenuated Forgetting? SHANA K. CARPENTER, HAROLD PASHLER, & JOHN T. WIXTED, *University of California, San Diego*—The present study investigated the effect of an intervening memory test versus a restudy opportunity on the rate of forgetting of obscure facts. After encoding 60 facts, participants completed a cued-recall test with feedback over half of the facts and received an additional study presentation over the other half. A final cued-recall test over all of the facts was given after 5 min, 1 day, 2 days, 7 days, 14 days, or 42 days. At each of the six intervals, the proportion of items retained from test versus restudy conditions was calculated, and power functions were fit to the data to describe the rates of forgetting following test versus restudy trials. Results help to answer the question of whether the typical advantage in retention for tested over restudied items is due to enhanced retention or attenuated forgetting for tested items relative to restudied items.

(2030)

Successfully Applying the Testing Effect in a College Classroom. KAREN S. CLIFTON, DAVID L. TRUMPOWER, & STEVEN P. MEWALDT, *Marshall University*—Repeated testing has been found to improve recall of a list of words and of simulated classroom material in laboratory settings. The present study evaluated the effect of prior testing on subsequent performance on unit exams in eight introductory psychology classes across 12 weeks of class. Approximately halfway through a 4-week unit and near the end of a unit, students took an online quiz consisting of fill in the blank type multiple choice questions that were easy or relatively difficult; in a control condition, subjects read statements with the blanks filled in, or they received no practice. Both easy and hard quiz items significantly improved performance on the unit exams, when compared with the control items.

(2031)

Can Controlled Processes Improve Performance in the Misinformation Paradigm? JOHN B. BULEVICH, *Washington University* (sponsored by Mitchell Sommers)—Misleading postevent information often produces erroneous recollection of memory for an original event (Loftus, Miller, & Burns, 1978). Furthermore, susceptibility to misinformation is modulated by age of the participant, with older adults demonstrating poorer memory for the original event after misinformation than younger adults (Mitchell, Johnson, & Mather, 2002). The present study examined whether subjective experience and cognitive control could reduce age differences in misinformation susceptibility. In three experiments, participants viewed an original event and received misinformation. Utilizing a multiple test procedure (Koriat & Goldsmith, 1996), participants received a forced report test with con-

fidence ratings followed by a free report test where they were allowed to pass. Retrieval demands and performance incentives were manipulated across experiments. The results demonstrate that both older and younger adults can improve their performance when allowed to pass and that older adult’s deficits are largely driven by miscalibration of their subjective experience.

(2032)

Suspicious Minds Reduce the Postidentification Feedback Effect. JEFFREY S. NEUSCHATZ, *University of Alabama, Huntsville*, MICHAEL P. TOGLIA, *SUNY, Cortland*, CHARLES A. GOODSSELL, DEAH S. LAWSON, & JESSICA K. SWANNER, *University of Alabama, Huntsville*, & JOSEPH S. NEUSCHATZ, *Roger Williams University*—We examined techniques designed to diminish the postidentification feedback effect. Participants viewed a video event and then were asked to identify a suspect from a target-absent photo lineup. Following their identification, some participants were told that their selection was correct, whereas others were not given feedback concerning the accuracy of their identification. Some participants who received confirming feedback were also given reasons to entertain suspicion regarding the motives of the lineup administrator, either immediately (Experiment 1) or after a 1-week retention interval (Experiment 2). Suspicious subjects did not demonstrate confidence inflation effects typically associated with confirming postidentification feedback. In Experiment 3, the confidence prophylactic effect was tested both immediately and after a 1-week delay. The impact of the confidence prophylactic procedure varied with retention interval. That is, it eliminated the effects of postidentification feedback immediately, but not after the retention interval. Both theoretical and practical implications of the results are discussed.

(2033)

Retaining Versus Replacing Incorrect Choices in Multichoice Items: Implications for Learning. DOMINIC A. SIMON, *New Mexico State University*—A feature of multiple-choice test items is that the incorrect responses may become associated with the question and later may be wrongly thought to be the correct answer, particularly when endorsed for items for which the correct answer was not known a priori. This possibility was explored in an experiment in which participants ($n = 77$) saw 60 multiple-choice general information items. The questions were presented in random order over four rounds. If correctly answered twice, an item was dropped from the pool. Items that were apparently not known a priori were treated in two ways across subsequent rounds: The original alternatives were retained, or the wrongly endorsed choice was replaced. Contrary to prediction, replacement/retention of incorrect alternatives did not affect the probability of correct responding on a test of all the original items following a filled delay ($p = .093$). Number of presentations was related to test performance ($p < .001$).

(2034)

Feedback Benefits Correct Responses Made With Low Confidence. ANDREW C. BUTLER & HENRY L. ROEDIGER III, *Washington University* (sponsored by Jason M. Watson)—The level of confidence in a response has a substantial effect on the perception and use of feedback. For example, high-confidence incorrect responses lead to longer feedback study times and tend to be “hyper-corrected” on subsequent tests. Although most contemporary investigations of verbal learning focus on the role of feedback as a mechanism for error correction, the present research sought to demonstrate the importance of feedback on the retention of correct responses, especially those made with low confidence. Participants took an initial four-alternative multiple-choice test on general knowledge facts, indicating their level of confidence after each response. Feedback was given for half of the responses. Learning was assessed on a delayed (5 min) cued recall test. The results indicate that feedback provides substantial benefit to the retention of correct responses, especially those made with low confidence.

(2035)

Why Does Feedback Improve Recognition Memory for Unfamiliar Melodies, but Not for Words? JUSTIN KANTNER & D. STEPHEN LINDSAY, *University of Victoria*—The question of whether trial-by-trial feedback at test (without test item repetition or repeated study–test cycles) can improve recognition memory bears on both theoretical accounts of recognition and the development of rehabilitation programs for individuals with memory impairments. Yet the effect of feedback on recognition memory has received little empirical attention. A series of experiments in our lab using words as stimuli failed to show any effect of feedback on recognition accuracy or confidence, a result consistent with theories characterizing recognition as strictly familiarity based but inconsistent with those suggesting that inferential processes inform recognition memory judgments. In two experiments using highly complex and structured but unfamiliar materials (short clips of traditional Korean music), however, feedback did improve recognition accuracy: Subjects receiving feedback showed significantly lower false alarm rates than did controls. Potential explanations for this pattern of findings, as well as implications for single- versus dual-process theories of recognition, are considered.

(2036)

Improving Memory for Information From Text: Benefits of Retrieval Practice With and Without Re-Presentations. CATHERINE O. FRITZ, PETER E. MORRIS, PETER J. HAMPSON, & CAROLINE WADE, *Lancaster University*—Retrieval practice can be effective in improving memory for information from expository texts. We briefly summarize recent research and present new data. Participants read a short expository text and then practiced answering questions of fact based on the text. Retrieval practice improved memory for the information, as measured by criterion tests shortly after the practice session and 1 week later. For some participants, practice tests were accompanied by immediate re-presentation of the correct information. The inclusion of re-presentations did not lead to a lazy response style (i.e., being less likely to produce the answers) during practice. With re-presentations, performance improved with each practice event. Following practice with re-presentations, performance was better on the initial criterion test and remained better across the delay. Although re-presentations led to better recall, there was little evidence that they retarded loss over the intervening week.

(2037)

Self-Generated Versus Experimenter-Supplied Mediators in Learning and Remembering Indonesian–English Word Pairs. ROBERT J. CRUTCHER, *University of Dayton*—An important issue in memory research is the effectiveness of self-generated versus experimenter-supplied mediators in remembering unfamiliar material. In the present study, subjects learned Indonesian–English word pairs (e.g., *bulan–moon*) using the keyword method (e.g., the keyword *bullet* sounds like *bulan* and can be used to imagine a bullet shot through the moon). For half of the pairs, subjects studied the Indonesian word and its English translation using supplied keywords (e.g., *bulan–bullet–moon*). For the other half of the pairs, subjects saw only the Indonesian and English word pair (e.g., *bulan–moon*) and had to generate their own keyword mediator while learning the pair. Subjects were tested on the word pairs within a cued recall paradigm. Results showed significantly higher recall of the Indonesian–English pairs learned with self-generated keyword mediators than of the pairs learned with experimenter-supplied mediators.

(2038)

Item and Relational Information Theory: Applied Evidence From Commercial Sponsorship. CLINTON S. WEEKS, MICHAEL S. HUMPHREYS, & T. BETTINA CORNWELL, *University of Queensland* (sponsored by Michael S. Humphreys)—Einstein and Hunt's (1980; Hunt & Einstein, 1981) item and relational information propositions regarding semantic relatedness and orientation toward encoding were examined in the applied setting of commercial sponsorship.

Theoretically, congruent sponsor–sponsee pairings (e.g., sportswear brands sponsoring sporting events) should be encoded automatically as relational information, whereas incongruent pairings (e.g., telecommunications brands sponsoring sporting events) should be encoded automatically as item information. Improved memory should result from orienting individuals toward encoding the alternative form of information. Using a 2×3 within-subjects experimental design, participants listened to 12 (congruent and incongruent) sponsorship press announcements, each of which incorporated either relational (sponsor–sponsee linking), item (sponsor-specific and sponsee-specific), or filler information about a sponsor–sponsee pairing. Supportive of Einstein and Hunt's propositions, results showed that providing item information enhanced recall of congruent sponsors, but not of incongruent sponsors, and that providing relational information dramatically enhanced recall of incongruent sponsors and had lesser impact on recall of congruent sponsors.

(2039)

Effect of Computer Display on Executing Navigation Instructions. VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado, Boulder*, IMMANUEL BARSHI, *NASA Ames Research Center*, & JAMES T. PARKER, *University of Colorado, Boulder*—Subjects heard navigation instructions for movement within a three-dimensional space consisting of four stacked 4×4 grids. They repeated the instructions aloud and then followed them, using six labeled keys (right/left, up/down, forward/back). Three computer displays were compared. The bird's eye display showed a bird's eye view of the entire space. The desktop VR display showed only what might be visible inside the space at any given instant. The blank screen display showed nothing at all. Subjects were trained on one display and were retrained 1 week later on either the same display or one of the other displays. Execution performance improved across weeks. At retraining, subjects who saw the same display both weeks and those who had the bird's eye view the second week performed better than did subjects in all other groups. The results are discussed in terms of the subjects' spatial representations formed during training and retraining.

(2040)

Cued Repetition of Self-Directed Actions in Macaques: Evidence for Episodic Memory? ANNIKA PAUKNER & JAMES R. ANDERSON, *University of Stirling*, PIER F. FERRARI, *University of Parma*, & DAVID I. DONALDSON, *University of Stirling*—Recent work examining episodic memory abilities in nonhuman animals suggests that episodic memory may not be specific to humans. However, reliance on recognition paradigms in this context is problematic because nonepisodic (e.g., semantic or implicit) memory processes may influence recognition performance. Here, we report a new experimental recall paradigm that allows episodic memory to be tested in monkeys. Two pig-tailed macaques were trained to perform three self-directed actions in response to auditory cues and to repeat behaviors after hearing an abstract *repeat* cue. We tested the monkeys for multiple memory dimensions, long-term recall, and spontaneous transfer of the repeat signal to novel behaviors. Both monkeys showed evidence of multiple memory dimensions but failed to show evidence of long-term recall and spontaneous transfers. Even though the monkeys cannot be attributed with episodic memory abilities on the basis of the present results, the paradigm offers a new, nonverbal assessment method for comparative research.

• METAMEMORY •

(2041)

Metamemory Predictions Under Conditions of Implicit Interference: Age-Related Differences in Cue Set Size Effects. DEBORAH K. EAKIN, *Mississippi State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—We evaluated the impact of implicit interference on memory and metamemory for younger and older adults. The degree of implicit interference was manipulated by

presenting cues with either a small or a large number of semantic associates (set size), using either an extralist (target studied alone) or an intralist (cue–target studied together) cuing procedure. Set size effects were obtained for both younger and older adults for extralist cuing and were eliminated for younger adults for intralist cuing. However, for older adults, cue set size effects were not eliminated, indicating that older adults were not able to discount associates not related to both the cue and the target. Metamemory sensitivity tracked recall for both age groups. Metamemory accuracy was evaluated for both recall and recognition memory. Predictions of adults in both age groups were equally accurate. Predictions were less accurate for recognition than for recall. The findings are discussed in terms of potential theoretical implications.

(2042)

How Does Performing a Dual Task Influence Imagination Inflation? ERIKO SUGIMORI & TAKASHI KUSUMI, *Kyoto University*—How does performing a dual task influence imagination inflation? In Experiment 1, participants enacted or imagined enacting each task either once or three times with or without a dual task. Imagination inflation increased as the number of enactments increased in the dual-task condition. Experiments 2 and 3 involved three phases: learning, performing, and monitoring. During the learning phase, participants enacted each task either once or three times. During the performing phase, they either enacted or imagined enacting the tasks with or without a dual task. During the monitoring phase, they judged whether they were successful in carrying out the tasks in the performing phase. Monitoring errors increased as the number of enactments increased during the learning phase in the dual-task condition. We concluded that the dual task reduced the amount of cues for judging memory sources, thereby forcing participants to rely on memory strength to determine whether they enacted or imagined enacting the tasks.

(2043)

Strategy Adaptivity in Long-Term Recall: Relation to Individual Differences in Working Memory. AINSLEY L. MITCHUM, COLLEEN M. KELLEY, & EDWARD T. COKELY, *Florida State University*—We explore the relation between individual differences in working memory as measured by complex span tasks, encoding strategy, and strategy adaptivity in long-term free recall. Participants first studied a list of words and were tested via free recall; they then studied and were tested on a second list. We propose that high-span participants are more likely to change from a relatively ineffectual to a more efficient encoding strategy in response to poor performance on a first test. Complex span scores were positively correlated with recall on the second list, but not with recall on the first list. Concurrent and retrospective verbal protocols, as well as postexperimental questionnaires, were used to assess the role of encoding strategies in these relationships. In addition, we discuss whether encoding strategies mediate resistance to interference.

(2044)

Strategic Use of Report Option in Episodic Recognition: Multiple Criteria or Monitoring System? JEFFREY J. STARNES, SEAN M. LANE, JILL ALONZO, & CRISTINE ROUSSEL, *Louisiana State University*—In memory tasks employing a report option, people can decide whether or not they will attempt a memory decision based on their confidence that they will be correct. The Koriat and Goldsmith (1996) model proposes that confidence judgments are made by a monitoring system separate from the retrieval system. In signal detection theory (SDT), confidence is based directly on the familiarity of the retrieval probe. In three experiments, we tested the ability of SDT to accommodate performance on memory tasks with a report option. The models were able to fit the report option data by adjusting a low and a high criterion and declining to attempt a recognition decision for test items that fell between the two criteria. The results suggest that report option performance can be explained with an initial retrieval process using strategic placement of response criteria along the familiarity continuum, without relying on a separate monitoring system.

(2045)

Remember and Know Judgments for True and False Memories in Autobiographical Memory Reports. KATINKA DIJKSTRA & MINE MISIRLISOY, *Florida State University*—The study investigated how well people recognize alterations in their original memory records. Thirty-five older participants (mean age = 72.63 years) were given a survey including 16 memories that they had to evaluate as being or not being the same memory as the one that they had provided a year ago. Four of these 16 memories were authentic, 4 were memories in which one component was altered (activity, participant, location, or time component), rendering the memory false, and 8 were fillers. Memories were evaluated on remember–know and confidence judgments and a subset of the Memory Characteristic Questionnaire by Mather et al. (1997). Percentage of “yes” answers to true memories, false memories, and filler memories were 84%, 39%, and 14%, respectively. Altering the “time” information resulted in more false memories than did altering other dimensions (activity, participant, or location). In addition, results showed that remember–know and confidence judgments did not differentiate between true and false memories.

(2046)

The Recognition Without Cued Recall Phenomenon: Familiarity-Based Recognition? ANNE M. CLEARY, *Iowa State University*—Recognition without cued recall is the finding that, in the absence of cued recall, participants give higher recognition confidence ratings to cues that resemble studied items than to cues that do not (Cleary, 2004). For example, *bushel* will receive higher ratings when *bashful* was studied than when no word looking like it was studied, even when the word *bashful* cannot be recalled in response to *bushel*. In Experiment 1, this phenomenon was shown to extend to a yes–no testing situation. Experiment 2 used a remember–know variation of the yes–no testing situation. Here, the recognition without cued recall effect was shown to emerge in the form of “know” judgments: “Know” judgments discriminated between cues that resembled studied words and cues that did not, which is consistent with the idea that subjective feelings of familiarity underlie this effect. Also examined were the effects of divided attention and the correlations between memory measures.

(2047)

A Novel Item Analysis of JOLs and Recall Performance. CATRIONA M. MORRISON & CHRISTOPHER J. A. MOULIN, *University of Leeds*, & TIMOTHY J. PERFECT, *University of Plymouth* (sponsored by Karl-Heinz Bäuml)—Judgments of learning (JOLs) are estimates of the likelihood of future recall. Debate focuses on the bases on which JOLs are made. In a novel items analysis design, we examined intrinsic features of word stimuli and their predictive strength for JOLs and recall, with a view to establishing the mnemonic basis of JOLs. Correlational analyses suggested that a model that includes JOLs is a better fit to recall data than is a model with stimulus characteristics alone, suggesting a mnemonic basis for JOLs and privileged access to memory processes. There were notable differences in the analyses of JOLs and recall: Word familiarity and age of acquisition were key predictors of JOLs and recall; imageability was significant for recall, not for JOLs; and word frequency did not influence either. This is discussed in relation to theoretical accounts of memory monitoring and recall. The roles of lexical measures, including age of acquisition, are considered.

(2048)

Electrodermal Recognition Without Identification: A Relation Between the Autonomic Response and Familiarity-Based Recognition? ALISON L. MORRIS, ANNE M. CLEARY, & MARY L. STILL, *Iowa State University*—Recognition without identification is the finding that, on tests of recognition, participants can discriminate between studied and nonstudied items when the items are presented in such a way that their identification is hindered. In each of four study–test blocks, participants viewed 15 study words at a rate of 2 sec each and were then presented with a 30-item recognition test list; 15 items were

studied and 15 were not. Each test item appeared for 30 or 50 msec, in between 100-msec pre- and postmasks. Skin conductance responses (SCRs) were measured at test stimulus onset. Following stimulus offset, participants were asked to rate their confidence that the quickly flashed item was studied, using a scale of 0 (*definitely not studied*) to 10 (*definitely studied*). Then they were asked to identify the word. Among items that went unidentified, both the SCR latencies and the recognition ratings discriminated between studied and nonstudied items.

(2049)

Source Memory in the Absence of Successful Cued Recall. GABRIEL I. COOK, *Claremont McKenna College*, RICHARD L. MARSH, *University of Georgia*, & JASON L. HICKS, *Louisiana State University*—The authors used a paired associate learning paradigm in which cue–target word pairs were studied and target recall was requested in the presence of the cue. When target recall failed, participants were asked to make a predictive source judgment of whether a male or a female had spoken the item. In general, predictive accuracy was at or very close to chance. By contrast, if cue–target pairs were studied multiple times or participants knew in advance of learning that a predictive judgment would be required, predictive source accuracy was well above chance. These data suggest that context information may not play a very large role in metacognitive judgments, such as feeling-of-knowing ratings or putting one into a tip-of-the-tongue state, without strong and specific encoding procedures.

(2050)

The Effect of Wishful Thinking on Source-Monitoring Ability in Older and Younger Adults. RUTHANNA GORDON, *Illinois Institute of Technology*, & MARA MATHER, *University of California, Santa Cruz*—When making source-monitoring decisions, people are often biased to misattribute desirable claims to reliable sources and undesirable claims to unreliable sources (Gordon, Franklin, & Beck, 2005). This “wishful thinking effect” is one way that emotional investment leads to biased reasoning. Emotional goals may play a greater role in memory attribution processes as we age (e.g., Mather & Johnson, 2000). We compared younger and older adult source-monitoring abilities when emotional preferences were present. Participants read desirable and undesirable predictions made by reliable and unreliable predictors. Later, they were asked to say, for each prediction, which source had originally produced it or whether it was new. Both populations showed a wishful thinking effect; however, the effect size was larger for older than for younger adults. Increases in this type of error with age have implications for both information evaluation processes and subsequent decision making.

(2051)

Metamemory Monitoring and Parkinson’s Disease. CELINE SOUCHAY, *University of Leeds*, MICHEL ISINGRINI, *University of Tours*, & ROGER GIL, *University of Poitiers* (sponsored by Martin A. Conway)—Metamemory monitoring (i.e., subjects’ ability to predict their memory performance) in Parkinson’s disease was assessed with both before-study prediction (global prediction), reflecting subjects’ beliefs concerning their memory, and after-study prediction (feeling of knowing), reflecting subjects’ ability to monitor their memory performance. Subjects were given cued recall and recognition tests of 20 cue–target words. The global prediction consists of asking participants, prior to the study phase, to predict the number of words they could recall. The feeling-of-knowing prediction consists of asking participants, during the recall phase, to predict their capacity to recognize on a subsequent recognition test the nonrecalled words. Prediction accuracy was measured by comparing the prediction with the memory performance. The results showed that for Parkinson patients, feeling-of-knowing predictions are inaccurate at predicting future performance, whereas global predictions are accurate at predicting future performance. These results suggest that Parkinson patients are particularly impaired in monitoring their memory performance.

• ATTENTION •

(2052)

The Role of Search Mode in Dimension Weighting on Visual Feature Search. TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology*—In a visual feature search task, it is known that reaction times to a singleton target were shorter when the defining features of targets were known in advance than when they were unknown (Müller, Heller, & Ziegler, 1985). However, the prior-knowledge effect of targets was eliminated when a target discrimination task was performed, instead of a simple detection task (Kumada, 2001). In this study, I examined whether the prior-knowledge effect in a target discrimination task was affected by a participant’s search mode (Bacon & Egeth, 1994). When participants performed a target discrimination task with a singleton detection mode, no prior-knowledge effect was found, consistent with a previous study. However, when the task was performed with a feature search mode, the prior-knowledge effect was found. This suggests that the dimension weighting of a target-defining feature was modulated by the participant’s mode of visual search. I discuss implications of these effects for the mechanism of top-down control of visual feature search.

(2053)

Early Selection in Visual Search: Evidence From Event-Related Potentials. CLAYTON HICKEY & JOHN J. McDONALD, *Simon Fraser University*, ROBERT W. TAIT, *University of Northern British Columbia*, & VINCENT DI LOLLO, *Simon Fraser University*—Electrophysiological research has shown that attentional selection in visual search can occur within 200–300 msec of display onset. Earlier event-related potential effects have been observed but have been attributed to methodological factors, such as imbalances in sensory activity arising from the use of asymmetrical search displays. Here, we investigate whether selection in visual search can occur at latencies shorter than 200 msec when sensory imbalances are minimized by using stimuli that are isoluminant with the background. When an isoluminant stimulus served as the target, an enhanced P1 component was found, showing that selection began within the first 100 msec. When the same stimulus served as a distractor, no such P1 effect was found, indicating that the P1 difference was unrelated to display imbalances. These results allow for the possibility that early, feedforward signaling in the visual cortex can be influenced by attention.

(2054)

Methods for Solving the Serial/Parallel Issue in Visual Attention. THOMAS L. THORNTON & DAVID L. GILDEN, *University of Texas, Austin* (sponsored by David L. Gilden)—In this work, we show how the serial/parallel issue in visual attention may be decided, using an improved variant of search based on multiple targets (van der Heijden, La Heij, & Boer, 1983). Data from an ensemble of 29 search tasks are analyzed within a novel computational framework where sequential sampling models with parallel and serial architectures compete to explain observed patterns of search speed and error. The method and analysis are extremely powerful and provide (1) a continuous ordering of experiments in terms of attentional limitation and (2) a principled categorization of tasks into serial and parallel classes on the basis of likelihood. Ensemble analyses reveal that the majority of search tasks are best explained using a parallel, limited-capacity architecture. These tasks are contrasted with an isolated subset of searches based on rotation direction and spatial configuration, which are better explained as serial processes.

(2055)

New Objects Can Capture Attention Without a Unique Transient. CHRISTOPHER C. DAVOLI & RICHARD A. ABRAMS, *Washington University*—Recent findings suggest that new objects may capture attention only when they are accompanied by a unique transient. To test this, we inserted a pattern mask between a placeholder display and a search display that contained a new object, so that the new object

appeared in the absence of a unique luminance transient. We found that the new object benefit was maintained. In subsequent experiments, we investigated why others have not found attentional capture by new objects that lacked a unique transient.

(2056)

The Parting Shot: Effects of Offsets on Attentional Orienting. SHU-CHIEH WU, *NASA Ames Research Center*, & ROGER W. REMINGTON, *Johns Hopkins University*—Theories of attentional capture often ascribe special status to stimuli with abrupt onset transients, attributing this status variously to specialized attentional mechanisms (Theeuwes, 1994; Yantis & Hillstrom, 1994) or activation of the saccade system (Wu & Remington, 2003). However, onset properties apparently do not tell the whole story. It has also been observed that the magnitude and time course of capture and spatial cuing is affected by whether or not the abruptly onset cue offsets prior to the target. This is a curious result that seems disconnected from current accounts that attribute capture to salience, new objects, or top-down contingencies. Here, we report experiments that examine whether the offset effect is attributable to mechanisms of spatial attention, saccadic eye movements, or changes in phasic alertness.

(2057)

One Plus One Equals One: The Effects of Merging on Object Files. STEPHEN R. MITROFF, *Duke University*, & BRIAN J. SCHOLL & KAREN WYNN, *Yale University*—A critical task in visual processing is keeping track of objects as the same persisting individuals over time, and these operations can be assessed in terms of the effects of various manipulations on mid-level object file representations. Here, we explore perhaps the most important principle of object persistence: Objects must maintain a single unified boundary over time (the *cohesion principle*). We do so by measuring *object-specific preview benefits* (OSPBs), wherein a preview of information on a specific object speeds the recognition of that information at a later point, when it appears again on the same object. Object files were dramatically affected when two objects smoothly merged into one: The information from only one object survived this cohesion violation to produce an OSPB (whereas OSPBs from both original objects remained in control displays without cohesion violations). These results demonstrate the power of the cohesion principle in the maintenance of mid-level visual representations.

(2058)

What Do We Learn From Binding Features? Evidence for Multilevel Feature Integration. LORENZA S. COLZATO, *Leiden University*, ANTONINO RAFFONE, *University of Sunderland*, & BERNHARD HOMMEL, *Leiden University*—Four experiments were conducted to investigate the relationship between the binding of visual features (as measured by their aftereffects on subsequent binding) and the learning of feature conjunction probabilities. Both binding and learning effects were obtained, but they did not interact. Interestingly, (shape–color) binding effects disappeared with increasing practice, presumably due to the fact that only one of the features involved was task relevant. However, this instability was observed only for arbitrary combinations of simple geometric features, but not for real objects (colored pictures of a banana and strawberry), where binding effects were strong and practice resistant. Findings are interpreted in a neurocognitive framework that makes a distinction between integration at low-level feature maps, short-term acquisition of frequency-based expectations, and Hebbian learning of object representations.

(2059)

Attention Degrades and Enhances Visual Temporal Resolution. JEFFERY R. NICOL, SCOTT WATTER, & DAVID I. SHORE, *McMaster University*—Relative to the effects of attention on spatial resolution, a paucity of research has investigated the effect of attention on temporal aspects of perception. In the present experiments, observers made temporal order judgments reporting, in separate exper-

iments, either where the first of two stimuli was presented or what it was. Here, we demonstrate both an improvement and a decrement in temporal precision on the *where* and *what* tasks, respectively, and argue for qualitatively different effects of attention on the dorsal and ventral visual processing streams.

(2060)

Effects of Distractor Size on Interference and Negative Priming: Comparison Between Shape and Phoneme Selection Tasks. JUN-ICHI NAGAI, *University of the Sacred Heart, Tokyo*, & YUKI KOBAYASHI, *University of Tokyo*—The effects of distractor size on interference and negative priming were investigated to examine the relation between these two phenomena. We compared two tasks (shape vs. phoneme selection) using the same letter stimuli. In Experiment 1, where the participants judged whether the target letter had a rectilinear or a curvilinear shape (shape task), small-sized distractors produced both interference and negative priming. However, in Experiment 2, where the participants judged whether the target letter was a vowel or a consonant (phoneme task), small distractors produced interference, but not negative priming. The results suggest that negative priming depends on the behavioral goal of the current experimental task (see also Tipper, Weaver, & Houghton, 1994), whereas distractor interference reflects several processing levels of the distractor stimuli.

(2061)

Examining Negative and Perceptual Priming Using a Go/No-Go Same/Different Task. EDDY J. DAVELAAR, *University of Maryland, College Park*, CHRISTOPH T. WEIDEMANN, *Indiana University*, & DAVID E. HUBER, *University of Maryland, College Park* (sponsored by David E. Huber)—In a typical negative priming paradigm, ignored stimuli are difficult to respond to on subsequent trials. In contradiction to this finding, Weidemann, Huber, and Shiffrin (2005) observed a bias to respond with ignored words in a perceptual identification task. Attempting to reconcile these differences, we developed a new paradigm that combines perceptual and response priming within a single experiment. This was achieved with a *same/different* task (is the target word the same as the cue word) with go/no-go responding (e.g., go only on *different* trials). Because only some words are responded to on trial n , this allows measurement of response priming on trial $n + 1$. Because determination of *same* versus *different* is inherently a perceptual task, RTs include perceptual priming effects. Our results reveal both a general response readiness effect and an item-specific effect with facilitation for primed cues but deficits for primed targets.

(2062)

Schematic Activation Influences Accuracy and Confidence in Change Blindness Tasks. SHARON L. HANNIGAN, ALAN SEARLEMAN, EVAN SLATER, & MEREDITH A. PRIDGEN, *St. Lawrence University*—This study examined the effects of attention on participants' confidence and overall accuracy in a visual change detection task. Employing a within-subjects design, 46 participants attended to either a featural level (counting the number of objects that contained either of two colors) or a semantic level (generating a name to describe the theme of the objects) when viewing a photographed set of 10–13 semantically related objects. The results indicated that participants were more likely to correctly claim to have noticed a semantically related or unrelated addition of an object than either a color change or no change. A task \times type of change interaction showed that participants were more confident about nonsemantically related additions during the theme generation task but were more confident seeing color changes during the color count task. When asked to identify the specific change observed, participants were most accurate in detecting nonsemantically related additions.

(2063)

Priority Setting Modulates Allocation of Object-Based Attention. GARY C.-W. SHYI, HSING-YI HSIEH, & YUAN-CHI TSENG, *National Chung Cheng University*—One main source of evidence for

object-based attention comes from the spatial-cuing paradigm popularized by Egly et al. (1994). An invalidly cued location enjoying attentional benefits may be due to the fact that the spread of attention is faster and/or more efficient within an object than across different objects. However, manipulation of cue validity in the cuing paradigm typically causes the invalidly cued location to have a higher processing priority, which also could account for the same-object benefit (Shomstein & Yantis, 2002, 2004). Here, in three experiments, we examine whether or not priority setting can modulate allocation of object-based attention. The results indicate that when the cued objects enjoyed a relatively high priority, the typical same-object effect was obtained. As the processing priority for the cued object declined, however, the same-object benefit was eliminated. A two-mechanism hypothesis is proposed to provide an integrated account for object-based attention demonstrated by the cuing paradigm.

(2064)

Attention to Multicolor Patterns: A Binary Mapping Principle. LIQIANG HUANG & HAROLD PASHLER, *University of California, San Diego* (sponsored by Harold Pashler)—We suggest that people can directly apprehend the spatial arrangement of different colors in a pattern only through the iterative creation of separate “binary maps,” each encoding the spatial arrangement of just a single color (e.g., the red elements or the green elements). To test this, observers judged whether two simultaneously presented four-color figures matched or not. Two conditions were compared: ABBA (e.g., change a red square to blue and change a blue square to red) or ABCD (e.g., change a red square to blue and change a green square to yellow). Binary mapping predicts that ABCD mismatches should be substantially easier to find, because here a mismatch will be discovered in the first binary map checked. This prediction was confirmed. The potential relevance of binary mapping to various theoretical issues in visual attention and to multidimensional data visualization will be pointed out.

(2065)

Limits of Redundancy Gain and Coactivation in Three-Dimensional Visual Stimuli. SONJA ENGMANN & DENIS COUSINEAU, *Université de Montréal* (sponsored by Denis Cousineau)—Response times of participants in a visual object recognition task decrease significantly if targets can be distinguished by several redundant attributes. Statistical facilitation models predict such a gain (Townsend & Ashby, 1983). However, coactivation models give a better approximation of the strength of gain (Miller, 1982). Triple redundancy effects have been found with stimuli from different modalities (tactile, visual, and auditory; Diederich, 1992) but are difficult to obtain with purely visual stimuli. The present research examines the influence of varying visual attributes, using three-dimensional redundant stimuli. We study the increase in gain with each added attribute and its dependence on attribute type. We also investigate whether masking influences coactivation as the cause of gain. Results show that redundancy gain of a third attribute depends on the degree of overlap of processing pathways. The perceived gain could be attributed to coactivation. However, the masking effects contradict all present theories of coactivation.

• DIVIDED ATTENTION AND AUTOMATIC PROCESSING •

(2066)

Combined Action Effects Determine the Simon Effect Obtained With Wheel Rotation Responses. DONG-YUAN DEBBIE WANG, *University of North Florida*, & ROBERT W. PROCTOR & DAVID F. PICK, *Purdue University*—Four experiments investigated how irrelevant action effects influence response selection in an auditory Simon task, for which stimulus location was irrelevant and responses were wheel rotations. In addition to the action effects of wheel and hand movement produced inherently by turning the wheel, wheel movement also caused left or right movement of a visual cursor in several conditions. Experiments 1–3 showed that the size of the Simon effect decreased when opposing action effects coexisted and suggested that the

opposite action effects were combined before the initiation of a motor program. Experiment 4 demonstrated that the size of the Simon effect could be changed gradually by manipulating the period in the task sequence during which the wheel controlled the cursor. A combined action effect model is proposed to account for the size change of the Simon effect when action effects are in opposition.

(2067)

Stimulus–Response Associations in Dual-Task Stroop. MARK G. VAN SELST, JENNIFER CHENG, & TAO-CHUNG (TIM) WANG, *San Jose State University*—In a continuing series of experiments, the role of stimulus–response compatibility in dual-task Stroop interference is examined. Prior work indicates Stroop interference to be additive across SOA in the PRP paradigm, despite presenting half of the stimuli with each letter individually rotated 180° in the picture plane. This finding holds for verbal, as well as manual, responses and when the response is “red” versus “not red,” rather than “red” versus “green.” In contrast to some expectations, the patterns of data do not support the notion that the “red” versus the “not-red” condition produces qualitatively different processing than the “red” versus “green” condition, even in the manual response condition, to yield the weakest S–R connection.

(2068)

New Analysis of Stroop Matching Task Calls for Theory Reevaluation. AVISHAI HENIK & LIAT GOLDFARB, *Ben-Gurion University of the Negev*—In Stroop matching tasks, participants match between an object color and the meaning of a colored color word. Previously, it was concluded that interference between two incongruent representations of the same attribute (ink color) appears prior to the response stage. This conclusion is based on questionable data analysis. We suggest analyzing the data by separating “same” and “different” responses and then analyzing three congruency conditions within the “different” responses: (1) congruent word color–word meaning, (2) congruent word color–object color, and (3) incongruent word color, word meaning, and another object color. This analysis reveals that responding is slowest in the first condition. This pattern of results does not fit with previous conclusions regarding this task but supports the contributions of task conflict and response competition. This analysis has implications for matching tasks other than the Stroop matching task.

(2069)

Lateralized Readiness Potential Evidence for Parallel Response Selection in Dual Tasks. SCOTT WATTER, JUDITH M. SHEDDEN, & JENNIFER J. HEISZ, *McMaster University*—Recent work (e.g., Hommel, 1998; Watter & Logan, 2005) shows that in a typical psychological refractory period (PRP) dual-task paradigm, the manual response to a later Task 2 can influence Task 1 responding, suggesting that response information for Task 2 is available prior to completion of Task 1 response selection, violating Pashler’s (1994) response selection bottleneck framework. We employed ERP methods to assess the timing and cross-task influences of response selection processes in a PRP paradigm. Building on critical earlier lateral readiness potential (LRP) information processing work by Osman and Moore (1993) and Gratton et al. (1988), we sought to better quantify critical Task 2 to Task 1 response compatibility effects—previously observed in RT measures and taken as evidence for parallel operation of response selection processes—by investigating LRP latencies and amplitudes for these priming effects. Priming of Task 1 response selection from Task 2 response information was observed, along with LRP morphologies reflecting Task 2 to Task 1 influence of response selection.

(2070)

The Role of Perceptual Emergent Features in Dual-Task Performance. KIM-PHUONG L. VU, *California State University, Long Beach*, & ROBERT W. PROCTOR, *Purdue University*—For dual-task performance with all combinations of compatible and incompatible stimulus–response mappings, performance is better when the map-

pings for the tasks are consistent than when they are not, even when both are incompatible. The benefit for consistent mappings has been attributed to an emergent choice between mapping rules that slows performance for inconsistent mapping conditions. However, perceptual emergent features could also contribute to the benefit. A pair of two-choice tasks was used to examine the role of emergent perceptual and mapping choice features in dual-task performance. When the stimuli for both tasks were visual, the benefit of the consistent incompatible condition over the inconsistent conditions was apparent at short SOAs, but not at long ones. Furthermore, this benefit was not evident when the stimuli were auditory for Task 1 and visual for Task 2. Thus, for two-choice tasks, the benefit for consistent incompatible mappings is mainly due to the perceptual emergent features.

(2071)

Effects of Sequential Congruency on Blindness for Congruent Stimuli. BILJANA STEVANOVSki, *Dalhousie University*, CHRIS ORIET, *University of Regina*, & PIERRE JOLICEUR, *Université de Montréal*—Blindness to congruent stimuli is the finding that the identification of an arrow target (e.g., right arrow) is poorer when presented during the execution of a congruent response (e.g., right keypress) than during the execution of an incongruent response (e.g., left keypress; Müssele & Hommel, 1997; Stevanovski, Oriet, & Joliceur, 2003). We investigated the effects of congruency between the response and the target from the preceding trial on the blindness effect on the current trial. The results from these sequential congruency analyses suggest that response–target pairs become associated within an episodic trace. Furthermore, these results suggest that repeating one component (response or target) of the preceding trial activates this episodic trace and facilitates or impairs target identification performance on the current trial. The effects of episodic trace activation depend on whether this trace matches or conflicts with current trial events. The results are discussed within a feature-binding framework.

(2072)

The Role of Response-Specifying Precue in Blindness to Response-Compatible Stimuli. KAZUHIKO YOKOSAWA & AKIO NISHIMURA, *University of Tokyo*—Perceiving a visual stimulus is more difficult when a to-be-executed response is compatible with that stimulus. This phenomenon is interpreted as a temporary blindness to a stimulation that shares common codes with the response. This blindness effect, however, might be due to a direct intramodal interaction between a response-specifying precue and the following to-be-identified target and could be interpreted from a typical repetition blindness approach. The present study explored how the precue could affect the occurrence of the blindness effect. In our experiments, on the basis of the precue presentation, participants generated their responses endogenously. Target identification rates constantly suffered from precue–target compatibility, as compared with incompatibility, even though the response-specifying feature of a precue was independent of target identification. This finding would contradict the interpretation of previous reports, in which the blindness effect should have resulted only from response–target compatibility. The theoretical implications of the finding are discussed.

(2073)

The Interfering Effect of Cell Phone Conversations Is More Than Just Talk. JEFF DRESSEL & PAUL ATCHLEY, *University of Kansas*—This work continues our investigation regarding which types of conversational tasks produce the most interference for visual attention. In the present experiments, participants performed the useful field of view task while making ending-letter–contingent responses to words empirically demonstrated to have positive or negative emotional valence (Experiment 1) or while responding to a given word with the first semantically related word that came to mind (Experiment 2). Previous work showed large interference when participants responded to cardinal directional terms with their vertical plane analogues (e.g., responding “upper left” when hearing “northwest”), and

smaller interference when they made an ending-letter–contingent response to nonvalent words. Negatively valent words led to the most interference in all tasks, whereas producing semantically related words led to the least. This suggests that the input to the conversation, and not just the output, is an important factor in the amount of interference.

(2074)

Anger Superiority: Effects of Facial Surround and Similarity of Targets and Distractors. DEAN G. PURCELL, *Oakland University*, & ALAN L. STEWART, *Stevens Institute of Technology*—The anger superiority effect (ASE) occurs when a search through a crowd of neutral faces yields a shorter reaction time for an angry target face than for a happy target face. Ohman et al. (2001) demonstrated an ASE with schematic faces. Using the same facial features, we show that removing the facial outline made search easier and decreased the ASE by 40 msec. Removing the surround also eliminated the affect \times row interaction found with the original Ohman faces (Purcell & Stewart, 2002). The neutral and emotional faces of Ohman differed at the feature level. We created neutral faces with the same features as the emotional targets. This made search more difficult and increased the magnitude of the ASE by 61 msec. That the ASE is modulated by variables other than facial affect is inconsistent with the idea that the ASE is due solely to facial expression.

(2075)

Attentional Capture for Sexual, but Not Threat-Related, Words: Dissociating Effects of Arousing Words. JENNIFER M. AQUINO & KAREN M. ARNELL, *Brock University*—There is debate as to whether emotionally charged words receive preferential attentional processing in normal individuals. Using a digit parity task, Harris and Pashler (2004) found that threat-related words captured attention on only the first trial, suggesting no attention capture for emotional words aside from an initial surprise reaction. We examined whether sexually explicit words would be more effective at capturing attention in a similar task. Replicating Harris and Pashler, threat-related words did not lead to an increase in reaction time on the parity task relative to emotionally neutral words. However, sexually explicit words led to a marked increase in RTs for over 100 trials. Words’ arousal ratings, but not their valence ratings, predicted the amount of interference. Digit RTs for individual words were also related to memory for the word on a surprise memory test. Sexually explicit words may have more potential to capture attention than do threat-related words.

• WORD PROCESSING •

(2076)

The Time Course of Speaking Rate Specificity Effects in the Perception of Spoken Words. CONOR T. McLENNAN & PAUL A. LUCE, *SUNY, Buffalo*—We previously examined specificity effects in spoken word recognition by examining the circumstances under which speaking rate variability affects spoken word perception. Our research focuses on whether time course of processing modulates the role that variability plays in spoken word recognition. On the basis of previous work, we hypothesized that speaking rate variability would affect only later stages of recognition. Our results confirmed this hypothesis: Specificity effects were obtained only when processing was relatively slow. However, our previous stimuli also differed in articulation style (casual and careful). Therefore, in the present study, we sought to determine whether we would obtain the same results with stimuli that differed only in speaking rate (i.e., in the absence of articulation style differences). Moreover, to further generalize our time course findings, the stimuli were produced by a different speaker. The results add to our knowledge of the circumstances under which variability affects the perception of spoken words.

(2077)

Contextual Diversity, Not Word Frequency, Determines Word Naming and Lexical Decision Times. JAMES S. ADELMAN, GOR-

DON D. A. BROWN, & JOSE F. QUESADA, *University of Warwick*—Word frequency is the most important known predictor of word naming and lexical decision times. It is, however, confounded with contextual diversity, the number of contexts in which a word has been seen. With a normative, corpus-based measure of contextual diversity, word frequency effects were eliminated by contextual diversity (but not vice versa) across three naming and three lexical decision data sets, using any of three corpora to derive the frequency and contextual diversity values. This result is incompatible with existing models of visual word recognition, which attribute frequency effects directly to frequency, and is particularly problematic for accounts in which frequency effects reflect learning. It is argued that the result reflects the importance of likely need in memory and that the continuity with memory suggests using principles from memory research to inform theorizing about reading.

(2078)

Hemispheric Asymmetries for Accessing the Phonological Representation of Single Printed Words. CHRIS H. DOMEN, ANNETTE COLANGELO, & LORI BUCHANAN, *University of Windsor*—The differential abilities of the cerebral hemispheres to access the phonological representations of printed words were investigated using a divided visual field task in which participants performed a lexical decision task for target words primed by semantic associates (e.g., *toad-frog*), homophones of words semantically associated to target words (e.g., *towed-frog*), and unrelated control letter strings (e.g., *fink-frog*, *plasm-frog*). At a short stimulus onset asynchrony (i.e., 165 msec), priming was obtained for semantic associates regardless of visual field of presentation. However, for homophones of words semantically associated to the target words, priming was obtained only for prime-target pairs presented to the right visual field/left hemisphere, indicating that only the left hemisphere initially has access to the phonological representations of printed words. These results diverge from previous studies that indicate both hemispheres initially have access to the phonological representations of printed words.

(2079)

Hemispheric Differences in the Retention of Verbal Material Over Time: Behavioral and Electrophysiological Investigations. KAREN M. EVANS & KARA D. FEDERMEIER, *University of Illinois, Urbana-Champaign*—The ability of the right (RH) and left (LH) hemispheres to retain verbal information over time was investigated in a series of experiments recording recognition judgments and event-related potentials (ERPs) during a continuous recognition task with varying study-test lags. Experiment 1 used lateralized test words to examine effects at retrieval. Although recognition judgments replicated the oft-reported LH advantage for verbal material, comparisons of the old-new ERP memory effect failed to reveal any difference, suggesting that behavioral advantages may be driven by perceptual factors, rather than by memory. Experiment 2 used lateralized study words to examine encoding effects. Items initially encoded by the RH and tested at long lags showed decreased response times and enhanced P2 responses in the ERP relative to LH-encoded items. Together, these results suggest that the RH may retain verbal material better than has been assumed and may be especially important for retention over relatively long study-test lags.

(2080)

Can Hypnosis Turn Off Reading? Hypnotic Versus Posthypnotic Modulation of the Stroop Effect. LYNETTE HUNG & AMANDA J. BARNIER, *University of New South Wales*—Hypnotic suggestions appear to influence information processing by producing experiential and/or cognitive alterations. This experiment investigated the precise impact of the hypnotic effect on one form of information processing, word reading—in particular, hypnotic modulation of the Stroop effect. Before hypnosis, high and low hypnotizable participants (tested in a real-simulating paradigm) performed a Stroop task (waking Stroop) in which they were presented with congruent, incongruent, and neu-

tral trials. During hypnosis, participants received a combined word agnosia and color hallucination suggestion aimed at disrupting semantic word processing. Participants' responses to the suggestion were tested via a visual test and a second Stroop task, either during hypnosis (hypnotic Stroop) or after hypnosis (posthypnotic Stroop). Findings indicated that the suggestion altered participants' experiential, but not cognitive, processing. These findings are discussed in terms of implications for reading and automaticity, as well as for claims that hypnosis can disrupt perceptual and cognitive processing.

(2081)

Early Spelling Skills of Diglossic and Nondiglossic Malay-Speaking Children. SAJLIA BINTE JALIL & SUSAN J. RICKARD LIOW, *National University of Singapore*—To investigate the relationship between oral language and children's invented spellings in a shallow orthography, a list of high-familiarity Malay words was dictated with standard pronunciation to diglossic Singaporean children (6–7 years of age). As was predicted, letter name and English phoneme replacements were rare, and frequent vowel substitutions were invariably transcriptions of the nonstandard Malay spoken at home. The same spelling test, together with a battery of control tasks, was then administered to nondiglossic Indonesian children to confirm that vowel errors were the outcome of routine aural exposure to nonstandard phonology. The results extend previous work showing the influence of dialects on English spelling development (Treiman, Goswami, Tincoff, & Leevers, 1997) to the effects of diglossia. Even when phoneme-grapheme correspondences are transparent, kindergarten children still use their own speech representations in working memory to support early writing skills, rather than the adult-dictated standard phonology.

(2082)

Dissociating Among Concrete, Abstract, and Emotion Words in Immediate Serial Recall and Recognition. CHI-SHING TSE & JEANETTE ALTARRIBA, *SUNY, Albany* (sponsored by Deborah L. Best)—Emotion words (e.g., *happy*) are often treated as a type of abstract word in various studies of memory. The present study attempted to dissociate certain mnemonic characteristics among concrete, abstract, and emotion words in an immediate serial recall (ISR) task and a recognition test. Participants completed six study-test ISR trials. Each of their seven-item study lists consisted of concrete, abstract, or emotion words. They then participated in an unexpected yes/no recognition test. The descending order of performance in the ISR tasks was emotion = concrete > abstract (scored using a strict criterion) and in the recognition tests was concrete > abstract > emotion (measured in d'). Thus, we replicated the concreteness effect with a purer set of abstract words and revealed a dissociation across abstract and emotion words in both memory tasks. Implications for the role of interitem association in ISR and recognition tests will be discussed.

(2083)

Do Older Adults Show Positive Biases When Processing Emotional Words? GABRIELLE OSBORNE, *Claremont Graduate University*, & DEBORAH M. BURKE, *Pomona College*—Older, but not young, adults direct attention away from faces with negative expressions and remember more faces with positive than with negative expressions (e.g., Mather & Carstensen, 2003). We investigated whether this pattern of processing emotion extended to emotional words in a Stroop task. Twenty-four positive, 24 negative, and 24 neutral base-words were presented in four different colors. Both young and older adults produced longer color naming times for negative base-words than for neutral and positive base-words, suggesting greater attention to negative base-words. In a surprise recall test, both young and older adults recalled more negative base-words than neutral or positive base-words, and young, but not older, adults recalled more positive than neutral base-words. In contrast to previous studies with emotional images, older adults showed no attentional or memory bias toward positive, rather than negative, emotional words.

(2084)

Interlingual Homophone Effects in Bilinguals. CORINNE A. HAIGH & DEBRA JARED, *University of Western Ontario*—A series of experiments investigated whether bilinguals activate phonological representations from both of their languages when reading silently in one. The critical stimuli were interlingual homophones (e.g., *sank* in English and *cinq* in French). An English lexical decision task was used to test both French–English and English–French bilinguals. French–English bilinguals had significantly shorter decision latencies for interlingual homophones than for matched English control words. In two subsequent experiments, the homophone facilitation effect disappeared when cognates and interlingual homographs were added to the experiment and when distractors were changed to pseudohomophones. In contrast, English–French bilinguals revealed little evidence of an interlingual homophone effect. Several attempts were made to increase the saliency of the nontarget language (French); however, none of these manipulations produced a measurable interlingual homophone effect. These results indicate that the activation of phonological representations can appear to be both language specific and nonspecific, depending on whether a bilingual is reading in the weaker or stronger language.

(2085)

Emotional Stroop Effects in Monolingual and Bilingual Speakers. TINA M. SUTTON, JEANETTE ALTARRIBA, JENNIFER L. GIANICO, & DANA M. BASNIGHT BROWN, *SUNY, Albany*—The emotional Stroop effect was examined in two populations: monolingual English speakers and bilingual Spanish–English speakers. Participants were required to identify whether a word appeared in blue or green by pressing one of two keys. The first experiment replicated the standard emotional Stroop effect for monolingual speakers. Negatively valenced emotion words (e.g., *scared*) interfered more with color identification than did categorized neutral words (e.g., boat parts: *paddle, anchor*). In the second experiment, Spanish–English bilinguals viewed both types of words in English and Spanish. The emotional Stroop effect was obtained in both languages. The implications of these results are discussed with reference to theories of emotion word representation both within and between languages.

(2086)

Effects of Mood Incongruity on Eye Fixations in Reading. HSUAN-CHIH CHEN, YIU-KEI TSANG, & HOI-YEE LEE, *Chinese University of Hong Kong*—Previous research using lexical tasks has typically shown a mood-congruent facilitation in the recognition of emotional words (e.g., *joy* is recognized more quickly in a happy mood than in a sad mood). An eye-monitoring study was conducted to investigate whether or not the same result can be obtained when the emotional words are embedded in text. We found reliable mood incongruity effects (i.e., fixation times on happy/sad words were shorter when readers were in an incongruent mood than when they were in a neutral mood), but not congruency effects. Some possible factors responsible for producing the effects obtained are discussed.

(2087)

Effects of Age of Acquisition on Lexical Processing in Chinese. MEILING HAO, YOUYI LIU, & HUA SHU, *Beijing Normal University*, LI HAI TAN, *University of Hong Kong*, & BRENDAN S. WEEKES, *University of Sussex*—Three experiments examined the effects of age of acquisition (AoA) of a word on word recognition in Chinese. In the first experiment 40 Chinese speakers were asked to read aloud early acquired characters taught in elementary school texts and late acquired words that did not appear in the texts. Items were matched for frequency, using token word counts and cumulative values. Results showed a significant effect of AoA and evidence of an interaction between character consistency and AoA on reading. In the second experiment, items were classified according to rated AoA values, and a similar pattern of results was observed. In the third experiment, Chinese speakers performed a visual lexical decision task and were simultaneously scanned using fMRI. Results show that early and

late acquired words are processed differently, and we suggest that late acquired words require greater semantic retrieval.

(2088)

Effects of Orthographic–Semantic Consistency for Japanese Kanji Words. YASUSHI HINO, *Waseda University*, STEPHEN J. LUPKER, *University of Western Ontario*, & PENNY M. PEXMAN, *University of Calgary*—The consistency of orthographic–semantic (O–S) mappings was investigated for Japanese kanji words. For two-character kanji words with living thing meanings, their orthographic neighbors were generated and classified as being a living thing or a nonliving thing. Next, kanji words were classified as O–S consistent if the summed frequency of the living thing neighbors was higher than that of the nonliving thing neighbors and O–S inconsistent if the reverse was true. In a semantic categorization task (i.e., living–nonliving decisions), a significant O–S consistency effect was observed for these kanji words. Specifically, living thing decisions were faster for the O–S consistent kanji words than for the O–S inconsistent kanji words. These results are similar to those reported by Forster and Hector (2002) and Rodd (2004). The locus of the O–S consistency effect is discussed.

• PSYCHOLINGUISTICS •

(2089)

How Ships Confront Storms: Processing and Representation of Entailment Transfer Metonymies. SEAN R. GREEN, GAIL MAUNER, & JEAN-PIERRE KOENIG, *SUNY, Buffalo* (sponsored by Gail Mauner)—*The ship confronted the storm* must be interpreted nonliterally, since confronting something requires intention. Unlike referential metonymy, which involves reference or property transfer, but consistent with predicative metonymy (Stallard, 1993), which predicts that verbs will undergo meaning adjustment when there is semantic strain, we hypothesized that *braves*' semantic entailment of intention is not associated with *the tank* but, rather, with its implied crew. Using an online reading task, we paired metonymies like *The ship confronted the storm* with rationale clauses, which require intentional agents in their adjoining clauses. Although 80% of metonymies were judged acceptable, judgments and reading times to their rationale clauses (i.e., *to prove the journey was possible*) patterned with inanimate subject controls (i.e., *The ship withstood the storm*), disconfirming transfer of intention to *the ship*. Further experiments showed both that fronted rationale clauses preclude metonymic interpretation and that these metonymies are processed at the verb (i.e., *confront*).

(2090)

Behavioral and Electrophysiological Measures of the Influence of Literal and Figurative Contextual Constraints on Proverb Comprehension. TODD R. FERRETTI & CHRIS SCHWINT, *Wilfrid Laurier University*, & ALBERT N. KATZ, *University of Western Ontario*—Proverbs are unique relative to other forms of figurative language, since their meanings are true both literally and figuratively (i.e., lightning really doesn't strike the same place twice). This property of proverbs entails that literal biasing contexts have more lexical–conceptual overlap with proverbial statements than do figurative biasing contexts. Despite this fact, previous research has failed to find differences in reading times for familiar proverbial statements when presented in the two forms of contexts. We investigate this issue further by (1) conducting a self-paced reading study involving a larger item set that controls for problems with previous item sets and (2) employing ERP methodology. Our results suggest that although people do not take longer to read proverbs in the two contexts, the ERP data show that people have more difficulty integrating statements in figurative than in literal contexts and that these differences emerge at the third word of the proverbs.

(2091)

Lawyers Are Sharks, But Are Sharks Lawyers? Directionality in Metaphor Processing. DAWN G. BLASKO, VICTORIA A. KAZ-

MERSKI, & SANDRA GRGIC, *Pennsylvania State University, Erie*—Metaphors require a semantic leap between terms, but the topic of directionality has been debated. The structure mapping approach suggests that in the earliest stages of metaphor processing, commonalities of the topic (subject) and vehicle (predicate) are extracted regardless of the order of terms, whereas in a later stage, directional inferences are drawn from the vehicle to the topic. But according to the categorization approach, metaphor processing is always asymmetrical, since the vehicle names the category created by the interaction of topic and vehicle (*vicious* and *predatory*). Behavioral data has provided support for both approaches, using different techniques. In this research, the time course of metaphor comprehension was analyzed using a sensitive online measure, event-related brain potentials. Participants read high- and low-similarity metaphors in normal or reversed order. In support of the categorization approach, differences were found very early in sentence processing.

(2092)

Feature Overlap Across the Cerebral Hemispheres: Testing the Conceptual Structure and Coarse–Fine Semantic Coding Theories. LEA PILGRIM & MARK JUNG-BEEMAN, *Northwestern University*—Distributed models of conceptual structure argue that living/nonliving concepts differ in their distribution of shared/distinctive features and the pattern of correlations between them. This suggests that any sensitivity to feature overlap may also interact with living/nonliving domain of knowledge. Furthermore, past research has suggested that the right hemisphere (RH) performs coarse semantic coding, in contrast to relatively finer semantic coding in the left hemisphere (LH). Consequently, the RH may be particularly sensitive to whether concepts have many shared, correlated features in common. We test these predictions by presenting, to each hemifield, word pairs that had many, few, or no features in common (e.g., *dog–sheep*; *dog–raven*; *dog–train*). In accord with differing conceptual structure across domains, participants were more accurate responding to living concepts with many shared features; there was no such advantage for nonliving concepts. Finally, although there was an overall LH advantage, hemifield did not interact with domain of knowledge.

(2093)

Influences of Offset Masking on Eye Movements in a Divided Visual Field Task. KEITH M. YOUNG, RUTH ANN ATCHLEY, & PAUL ATCHLEY, *University of Kansas*—A problem in divided visual field (DVF) language studies is horizontal saccades that could be due to changes in luminance that lead to either automatic/bottom-up processes or to top-down influences (i.e., selective attention). Past attention literature suggests that these saccades should be significantly reduced with the use of an offset mask, causing a reduction in attentional capture. We have examined the effectiveness of using an offset mask to reduce eye movements. Although we found no change in the number of saccades observed, a significant difference in latency did occur. Longer latencies were found during the offset block, as compared with the onset block, resulting in two different types of horizontal saccades. The onset condition produced bottom-up, or express, saccades, whereas the offset condition seemed to cause top-down saccades (programmed by the frontal eye fields). The present research continues this examination of masking manipulations to reduce saccades in DVF priming paradigms.

(2094)

ERP Correlates of Negation in a Sentence–Picture Verification Paradigm. JANA LÜDTKE, *Technische Universität Berlin*, CLAUDIA K. FRIEDRICH, *University of Konstanz*, & MONICA DE FILIPPIS & BARBARA KAUP, *Technische Universität Berlin*—In a sentence–picture verification paradigm, participants were presented (RSVP) with affirmative or negative sentences (e.g., “In front of the house there was a/no cat”). Response latencies, as well as event-related potentials (ERPs), were measured during reading and verification.

ERPs evoked by the object noun (i.e., “cat”) showed an enhanced negativity in negative, as compared with affirmative, sentences. When the ISI between sentence and picture presentation was short (250 msec), verification latencies, as well as ERPs evoked by the picture, showed a negation \times truth value interaction: After affirmative sentences, false pictures led to relatively long response times and high N400 amplitudes, whereas after negative sentences, true pictures led to relatively long response times and high N400 amplitudes. In contrast, when the ISI was long (1,500 msec), main effects of truth value and negation were observed in the N400 time window. Implications with respect to different processing models of negation are discussed.

(2095)

Grounding Natural Language Quantifiers in Visual Attention. KENNY R. COVENTRY, ANGELO CANGELOSI, STEPHEN NEWSTEAD, ALISON BACON, ROHANA RAJAPAKSE, & DAVI VANN BUGMANN, *University of Plymouth* (sponsored by Laura A. Carlson)—The literature on vague quantifiers in English (words like “some,” “many,” etc.) is replete with demonstration of context effects. Yet little attention has been paid to the issue of where such pragmatic effects come from. We explore the possibility that such effects are a result of a visual attentional bottleneck that limits the accuracy of judgments of number in visual scenes under conditions of time pressure. We present the results of six experiments that reveal a range of new context effects on the acceptability of vague quantifiers for describing a number of objects in a visual scene and show parallel effects on judgments of number, using the same visual scenes under speeded conditions. We also overview a new dual-route computational model for natural language quantifiers that grounds meaning direction in perception.

(2096)

Compounds Are Processed More Quickly Than Monomorphemic Words. HONGBO JI & CHRISTINA L. GAGNE, *University of Alberta*, & RACHEL J. J. K. KEMPS, *Utrecht University*—Previous research (Hudson & Buijs, 1995) has shown that derived words (e.g., *calculation*) are processed more quickly than morphologically simple words (e.g., *chimpanzee*). We examine whether this advantage for morphologically complex words extends to semantically transparent compound words. Three experiments demonstrate that lexical decision times to compounds (e.g., *rosebud*) are shorter than responses to matched monomorphemic words (e.g., *giraffe*). This suggests that complex structure aids, rather than hinders, lexical processing. The influence of morphological structure was further examined by manipulating the word frequency of the two constituents (high vs. low) while controlling the whole-word frequency of the compound. There was a main effect of the first constituent’s word frequency on lexical decision time but no effect of the second constituent’s frequency. Correlational analysis revealed an effect of the first constituent’s family size but no effect of the second constituent’s family size.

(2097)

The Psychological Reality of Atomic Propositions. SIMON J. DENNIS, *University of Adelaide*—Ratcliff and McKoon (1978) presented participants with sentences assumed to contain two propositions and showed that subsequent recognition priming was larger for within-proposition primes than for between-propositions primes. Typically, this evidence is taken as support for the reality of atomic propositions. However, there are a number of asymmetries in their data that undermine a simple propositional model. In this work, we replicate Ratcliff and McKoon (1978), focusing on the between-propositions comparisons and using a cloze priming task. Whereas the study sentences appeared in the active form, the cloze items appeared in the passive form, to reduce the likelihood that subjects were relying on a syntactic information. Both accuracy and reaction time data show significant asymmetries, with the activation of the first proposition providing a greater advantage to second-proposition processing than vice versa.

(2098)

Is Timing Everything? Grounding Costs in Speech and Typing. MICHELLE GUMBRECHT & HERBERT H. CLARK, *Stanford University*—How do conversations change when two partners use different media of communication? Do speakers communicating with typists take on more of the communicative load because they expend less effort to produce utterances? Previous work by Clark and colleagues focused on partners using only speech. Our present study assessed grounding costs of using different media (Clark & Brennan, 1991), coupled with the principle of least collaborative effort (Clark & Wilkes-Gibbs, 1986). Two partners completed a referential communication task, using either the same or different media of communication (speaking or typing). Results supported the communicative load hypothesis. Two speakers produced many more words than did two typists but finished faster. Speakers paired with typists produced more of the content and also asked questions that allowed brief answers from the typists. Two speakers exploited precision timing in interrupting and responding to each other. Speakers paired with typists could not, which added to their burden.

(2099)

Auditory Imagery for Talker-Specific Characteristics During Reading. JESSICA E. DUKE, LYNNE C. NYGAARD, & SABRINA K. SIDARAS, *Emory University*—The present study examined the role of text difficulty in auditory imagery during reading and its relationship to general auditory imagery ability. Participants were familiarized with a fast and a slow talker during a brief prerecorded conversation. Participants read a passage that they were told was written by either the fast or the slow talker. Speaking rate of the passage “author” significantly influenced reading times, but only for difficult texts. However, for the easy texts, a positive correlation was found between the effect of speaking rate and general auditory imagery ability. The results suggest that readers engage in auditory imagery more when reading difficult texts but that the spontaneous use of auditory imagery for easy texts is related to general auditory imagery abilities. This finding suggests that linguistic representations accessed during reading can include talker-specific characteristics of speech and seem to function as a type of auditory imagery.

(2100)

The Flexible Use of Eye Gaze in Face-to-Face Referential Communication. JOY E. HANNA, *Oberlin College*, & SUSAN E. BRENNAN, *SUNY, Stony Brook*—We investigated the time course and flexibility with which eye gaze is used in conversation. Naive *directors* and *matchers* were separated by a low barrier so they could see each other’s faces but not each other’s displays, which they knew held identical copies of objects located in mirrored or reversed orders. Directors followed nonverbal schematics to instruct matchers to move objects (e.g., “the red circle with ‘bx’”). Targets were unique or had a same-color competitor nearby or far away. With no or nearby competitors, matchers’ eye movements showed identification of targets after the linguistic point of disambiguation (LPOD). However, with mirrored displays holding far competitors, matchers identified targets ~600 msec before the LPOD, indicating a rapid ability to use directors’ eye gaze during reference resolution. Although far competitors competed substantially in reversed displays, matchers still identified targets before the LPOD, suggesting a strategic ability to remap directors’ eye gaze.

• PROBLEM SOLVING •

(2101)

Concepts and Novel Idea Generation. MAGDALENA G. GROHMAN & KRZYSZTOF T. PIOTROWSKI, *Jagiellonian University*, & THOMAS B. WARD, *University of Alabama*—Previous research on idea generation has shown that people tend to base their newly created ideas on highly accessible members of well-known categories. The question remains whether this tendency is a general and universal one. In this preliminary study, we compared American and Polish samples

in regard to this tendency. One hundred seventy-five middle school students participated in the Polish research (96 girls, 79 boys), from 14 to 17 years of age ($M = 14.8$, $SD = 0.97$). Subjects drew, described, and titled an imaginary animal (80 cases) or fruit (95 cases). In the “animal” group, Poles, like Americans, relied on specific exemplars of mammals (62%), including dogs (16%), cats (12%), invertebrates (14%), birds (10%), and insects (5%). In the “fruit” group, the subjects based their drawings on apples (26%) and pears (24%); the drawings also reflected the use of vegetables (3%) and animals (10%). Overall, the results suggest that structuring new ideas according to well-known concepts is indeed universal.

(2102)

It’s Not What You Know, It’s How You Know. BEN JEE & JENNIFER WILEY, *University of Illinois, Chicago* (sponsored by Jennifer Wiley)—Studies of experts with different specializations within a domain suggest that the goals one has while interacting with domain-related stimuli may play an important role in the acquisition of expert knowledge. Little experimental research, however, has addressed the direct influence of goal-related activity on the organization and use of expert knowledge. In the present study, naive participants acquire and utilize knowledge about a novel natural kind domain over a number of experimental sessions. Groups of participants are assigned different goals for their interactions with the experimental items, while experience with stimuli is kept constant across conditions. Differences in categorization and induction as a function of the goals that participants had during training are explored, and the extent to which goal-related biases appear across a variety of reasoning contexts is tested.

(2103)

Perceptual Comparisons Facilitate Representational Change. JEREMIAH J. TRUDEAU & JAMES A. DIXON, *University of Connecticut*—Recent work has affirmed that comparison plays a crucial role in representational change (Dixon & Bangert, 2003; Namy & Gentner, 2002). However, we also know that people can make different kinds of comparisons when left to their own devices. Domain novices tend toward perceptual comparisons, whereas more experienced individuals use functional or taxonomic categories. Does the nature of the comparisons impact subsequent representations? Participants compared pairs of gear systems on the basis of perceptual or functional commonalities and later solved individual systems for the turning direction of the terminal gear. Strategy usage and ability to transfer strategies to a functionally similar beam-tilting task were used to assess participants’ representation of gear–system relations. Participants who made perceptual comparisons extracted relational properties more quickly and transferred them more readily. This suggests that perceptual comparisons facilitate representational change in a novel domain, relative to functional comparisons.

(2104)

Are 2-D Spatial Categories Induced From Category Exemplars? DALE S. KLOPFER, *Bowling Green State University*—Studies have shown that when a dot is shown briefly in a frontal circular field, people remember it as being closer to the geometric center of the quadrant than it was, indicating a bias in memory for locations away from the horizontal and vertical (HV) axes. Huttenlocher and colleagues (e.g., Engebretson & Huttenlocher, 1996) have claimed that spatial categories are a priori, rather than being induced from category exemplars. Spencer and Hunt (2002) reported that the bias in memory for locations of objects placed on a table was influenced by the spatial distribution of exemplars. We found that varying the spatial distribution of exemplars in a frontal circular field can yield biases in memory toward the HV axes and away from geometric centers. The nature of perceptually derived or a priori categories is discussed.

(2105)

Differential Effects of Working Memory Load on Encoding and Use of Relational Concepts. ANIKET KITTUR, JOHN E. HUMMEL,

& KEITH J. HOLYOAK, *UCLA*—Relational thinking is a powerful and uniquely human ability, yet it is fragile, because of its heavy dependence on working memory (WM) resources. Categories defined by relations, although essential to such cognitive tasks as analogical reasoning, problem solving, and language comprehension, may thus be particularly susceptible to interference by concurrent tasks. This study explored the effects of a concurrent WM task on relational category acquisition and postlearning goodness-of-exemplar judgments. A dual task during category learning resulted in slightly impaired relational responding, relative to a nondual-task control, but preserved the basic pattern of postlearning judgments. By contrast, a dual task during the judgment phase completely disrupted relational responding. These results suggest that the learning and encoding of relational categories are relatively robust to WM interference, whereas postlearning category use that requires the integration of relations is highly sensitive to such disruption.

(2106)

Ideals and Typicality in Relational Categories: A Double Dissociation. ANIKET KITTUR, KEITH J. HOLYOAK, & JOHN E. HUMMEL, *UCLA*—Feature typicality is one of the most robust phenomena based in studies of category learning. However, human knowledge includes categories that are highly relational in nature. Although some studies have indicated that such relational categories also rely on typicality, others suggest that they may instead be based on ideals. This study examines the influence of typicality and ideals in relationally defined categories. The results show that participants base goodness-of-exemplar judgments on relational ideals, with no effect of feature-based typicality. In a recognition task, however, judgments were based solely on the typicality of the exemplars, with no influence of relations. Together, these data support a dual-process view of categorization, in which distinct relational and feature-based systems acquire information in parallel but compete for response control. The winning system appears to inhibit the loser, even when the winner does not provide a sufficient basis for a decision and the loser does.

(2107)

Learning Relational Systems of Concepts. CHARLES KEMP, *Massachusetts Institute of Technology*, THOMAS L. GRIFFITHS, *Brown University*, & JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology*—We present a computational framework for learning abstract relational knowledge, with the aim of explaining how people acquire intuitive theories of physical, biological, or social systems. The approach is based on a probabilistic model for relational data with latent classes. The model simultaneously determines the kinds of entities that exist in a domain, the number of these latent classes, and the relations between classes that are possible or likely. This model goes beyond previous psychological models of category learning that define categories in terms of their associated attributes, rather than the relationships those categories participate in with other categories. We show how this domain-general framework can be applied to model several specific unsupervised learning tasks, including learning kinship systems, learning causal theories, and learning to jointly cluster animal species and their features.

(2108)

Within- Versus Between-Category Knowledge Effects in Observational Learning. JOHN P. CLAPPER, *California State University, San Bernardino*—This research investigates the role of prior knowledge in observational (unsupervised) category learning. Knowledge is often assumed to facilitate category learning by increasing the relatedness or cohesion among features within individual categories. In these experiments, pairs of categories related to prior knowledge (familiar themes) were learned better than neutral categories when shown together in a randomly mixed sequence, but not when shown separately in a blocked sequence. Thus, thematic knowledge was helpful only when learners had to explicitly distinguish between separate categories—that is, in the mixed condition. In addition, pairs of categories

related to the same theme were learned no better than pairs of neutral categories; significant knowledge effects were observed only when the categories were related to different (contrasting) themes. Overall, thematic relevance appeared to facilitate learning in these experiments mainly by increasing between-category discriminability, rather than within-category cohesiveness.

(2109)

Does Feature Overlap and Feature Redundancy Influence the Level of Abstraction of the First Categories Learned? JADE GIRARD & SERGE LAROCHELLE, *Université de Montréal*—In two very similar sets of three experiments, participants had to learn a two-level hierarchy of artificial categories. In the first experiment of each set, the categories of both levels were defined by a single necessary and sufficient attribute. The second and third experiments investigated whether the two constraints identified by Gosselin and Shyns (2001) as determining categorization speed—namely, feature overlap and feature redundancy—also influence the level of abstraction of the first categories learned. Each of these factors favored either the more general or the more specific category level. The results were similar in all experiments of both sets. Learning to which category the stimuli belonged proceeded equally rapidly at both levels. However, participants learned more rapidly to reject membership in distant global-level categories than in neighboring specific-level categories. These results suggest that feature overlap and feature redundancy do not determine the first level of abstraction.

(2110)

Attention Allocation Strategies Early in Category Learning. AARON B. HOFFMAN & BOB REHDER, *New York University*—A category-learning study using eyetracking was conducted to assess subjects' attention allocation strategies early in learning. Rehder and Hoffman (in press) tested three-dimensional stimuli and found that learners usually attended all dimensions at the start of learning. Because subsequent performance implicated both similarity-based and rule-based learning mechanisms, we concluded that people maximize their information intake in order to maximize the number of learning mechanisms that can be brought to bear on a learning problem. In contrast, the present study tested five-dimensional stimuli and found that the typical learner attended a subset of the dimensions early in learning. We interpret this result as indicating that learners restrict their attention as a result of cognitive capacity limits. In addition, the study investigates (1) changes in performance as a function of rapid shifts in attention and (2) the relationship between selective attention assessed with theoretical model weights and that assessed with eye movements.

(2111)

Memory Systems That Underlie Exemplar Representation: Evidence for Multiple Systems in Category Learning. MICHAEL A. ERICKSON & JESSE S. BRENNEMAN, *University of California, Riverside*—There is substantial debate regarding the memory systems underlying category learning. Many theorists agree that category learning utilizes multiple memory systems. For example, Erickson and Kruschke (1998, 2002) provided evidence that rule-consistent stimuli are classified using rule-based representation, whereas exceptions are classified using exemplar representation. Still, the substrates of these different representational systems remain to be identified. We present three category-learning experiments that use a rule-and-exception category structure and dual-task procedures to provide evidence for stimulus-dependent representation and identify which memory systems are responsible for the classification of rule-consistent and exception training items. Using a response location switch procedure, Experiment 1 provides evidence that exemplar-based, but not rule-based, representation relies on procedural memory. Using a delayed mental rotation task, Experiment 2 provides evidence that exemplar representation relies on perceptual memory systems. Using a memory-scanning task, Experiment 3 provides evidence that rule, but not exemplar, representation relies on verbal memory systems.

(2112)

Motivational Influences on Rule-Based and Information Integration Category Learning. GRANT C. BALDWIN, W. TODD MADDOX, & ARTHUR B. MARKMAN, *University of Texas, Austin*—Markman, Baldwin, and Maddox (in press; *Psychological Science*) have shown more nearly optimal decision criterion learning when the motivational focus “fit” the environmental conditions. Promotion focus people are more sensitive to gains in the environment and performed best when gains were emphasized. Prevention focus people are more sensitive to losses in the environment and performed better when avoiding losses was emphasized. We report results that extend this work to classification learning—in particular, to rule-based and information integration category learning. One set of studies examined deterministic rule-based and information integration category learning, focusing primarily on trials to criterion. Prevention subjects reached criterion sooner than promotion subjects in an information integration, but not in a rule-based, task. A second set examined probabilistic rule-based and information integration category learning, focusing on percent correct. Promotion subjects performed better in rule-based, but not information integration, category learning. Implications for the neurobiology of motivation and category learning are discussed.

• PROBLEM SOLVING •

(2113)

Individual Differences in Cognitive Abilities: A Component Processes Account. MEREDYTH DANEMAN, *University of Toronto, Mississauga*, & BRENDA A. HANNON, *University of Texas, San Antonio*—In this study, we examined the extent to which the ability to integrate prior knowledge with new information can account for the variance that is typically shared among tests of cognitive abilities. Participants completed Hannon and Daneman’s (2001) component processes task that includes a measure of knowledge integration ability, as well as a battery of cognitive tests that assessed general fluid intelligence (e.g., Raven’s matrices) and specific abilities (e.g., verbal and spatial abilities). Not only was knowledge integration an excellent predictor of performance on the general and specific abilities tests, but it also tended to have better predictive power than two measures of working memory capacity (reading span, operation span). We argue that integrating prior knowledge with new information is a fundamental process that underlies skill in a range of complex cognitive tasks.

(2114)

The Adaptiveness of Strategy Choices and the Effect of Strategy Use Experience. AYAKA WATANABE & YUJI ITOH, *Keio University* (sponsored by Kathy Pezdek)—This study investigated the effect of strategy use experience on strategy choice. Participants were required to determine the number of target cells in a 7×7 matrix of black and gray cells. Two strategies could be applied: the counting strategy, in which the number of the target cells are counted, and the subtracting strategy, in which the number of the nontargets are subtracted from the total number of cells. When participants could choose the strategies freely, they adaptively chose the strategy that made the RT shorter. However, letting the participants use one of the strategies tended to increase the choice of strategy inadaptively in the subsequent phase, in which they could choose strategies freely. These tendencies were observed only for the condition in which there were no preferences between two strategies in the free-choice condition, and were greater when the participants had never used the other strategy in the previous phase.

(2115)

Verbal Intelligence or Verbal Expertise? Explaining Individual Differences in Scrabble Problem-Solving Performance. MICHAEL TUFFIASH, ROY W. RORING, & K. ANDERS ERICSSON, *Florida State University*—Although numerous laboratory studies have found strong relations between general cognitive abilities and verbal problem-solving performance, few investigators have studied experts in socially

recognized skill domains. We examined the relationship between general cognitive abilities and verbal problem-solving skill in the game of Scrabble. Elite- and average-level tournament-rated Scrabble players were asked to solve a series of realistic Scrabble game problems, as well as a series of anagrams of varying length. Each player also completed a battery of standardized verbal ability measures and a self-report survey of their past and present Scrabble-related practice activities. Preliminary analyses (23 elite and 14 average players) indicated strong positive relations between measures of Scrabble tournament performance and Scrabble-related problem-solving skills, but much weaker relations between measures of Scrabble problem-solving skills and aspects of general verbal intelligence. Additional analyses of biographical data suggested that Scrabble experts’ exceptional domain-specific problem-solving skills were largely a product of accumulated deliberate practice.

(2116)

Predicting Expert and Novice Anagram Solution. LAURA R. NOVICK, *Vanderbilt University*, & STEVEN J. SHERMAN, *Indiana University*—Several experiments examined the predictors of two measures of anagram solution: solution time and the proportion of subjects who generated pop-out solutions (defined as solutions that occurred within 2 sec of stimulus presentation). The subjects were college students who were selected on the basis of their performance on a scrambled words pretest: They were either quite good or not good at solving anagrams. Of particular interest is whether different aspects of the solution words (e.g., fit to the constraints of English spelling, word frequency, number of syllables) and the anagrams (e.g., similarity to the solution word) predict measures of performance for experts versus novices.

(2117)

Traveling Salesman Problem: The Role of Clustering Operations. ZYGMUNT PIZLO, JOHN SAALWEACHTER, & EMIL STEFANOV, *Purdue University*—We will present a pyramid model, which provides near-optimal solutions to the traveling salesman problem (TSP) in a time that is a low-degree polynomial function of the problem size. In this model, hierarchical clustering of cities is first performed by using an adaptive method. The solution tour is then produced by a sequence of coarse-to-fine approximations, during which the model has high-resolution access to the problem representation only within a small area, simulating the nonuniform distribution of visual acuity across the visual field. The tour is produced by simulated movements of the eyes. We will discuss the role of two types of clustering operations: detecting blobs and detecting smooth contours. The model was applied to TSPs of size 6, 10, 20, and 50, and its performance was fitted to that of 5 subjects by using one free parameter representing the extent of local search.

(2118)

Models of Human Performance on the Traveling Salesperson Problem: The Shortest Route to Falsification. SUSANNE TAK, MARCO PLAISIER, & IRIS VAN ROOIJ, *Technische Universiteit Eindhoven*—The task of finding the shortest tour visiting a set of points, known as the traveling salesperson problem (TSP), is notorious for its computational complexity. Nonetheless, people show remarkably good performance on the task. MacGregor, Ormerod, and Chronicle (2000) have proposed a computational model to describe the human strategy for solving TSPs. Studying only random point sets, these authors claimed empirical support for their model. We argue that random point sets do not instantiate critical tests of model performance, since both the model and people are known to perform well on random TSPs. We designed six (nonrandom) point sets as a critical test bed for the MacGregor et al. model. We observed a systematic misfit between human and model performance for five of the six points sets. Our findings falsify the MacGregor et al. model. We discuss some methodological lessons for testing computational models of human problem solving in general.

(2119)

Goal-Induced Decrements in the Accuracy of Action- and Observation-Based Problem Solving. MAGDA M. OSMAN, *University College London* (sponsored by David Shanks)—Recently, studies of problem solving that used a dynamic environment (e.g., Burns & Vollmeyer, 2002) have shown that performance is adversely affected by a specific goal instruction, as compared with a nonspecific goal instruction. We discuss findings from an experiment that was designed to replicate and extend the original work of Burns and Vollmeyer. In Burns and Vollmeyer's study, the learning phase of the problem-solving task was action based, whereas in the present study, participants learned to solve the task under either observational or action conditions. In accord with the original findings, this study shows that goal specificity affects the accuracy of problem solving in the same way when the learning phase of the task is observational, rather than action based. Contrary to previous findings in problem solving and causal structure learning, the present study did not find differences in performance between action and observation learning conditions.

(2120)

Representational Change and the Selective Activation of Problem Constituents. MICHAEL ÖLLINGER & ANDREAS WOHL-SCHLÄGER, *Max Planck Institute for Cognitive and Brain Sciences*—As Knoblich et al. (1999) have suggested, for solving insight problems, a representational change is necessary. They identified two processes that can trigger a representational change: constraint relaxation, which breaks constraints imposed by prior knowledge, and chunk decomposition, which decomposes the automatically built-up constituents of the problem. Little is known about how the activation of particular problem constituents interact with representational change. In four groups ($N = 4 \times 30$), participants solved matchstick arithmetic tasks that required representational changes to a different extent. Between the groups, we varied the direct perceptual access of problem elements, by removing systematically parts of the equation. That is, the values (Group 1), the operators (Group 2), or the whole equation (Group 3) disappeared after an initial encoding phase, whereupon in the control group, the equation remained unchanged. We found that the probability of a representational change depends critically on the selectively activated elements.

(2121)

A Behavioral Assessment of Relations Between Handedness and Magical Ideation. GINA M. GRIMSHAW, *California State University, San Marcos*—Magical ideation (MI) is a hallmark of schizotypal disorders, but it is also prevalent in the general population, even among individuals with advanced levels of education. Although MI has been linked to personality, social, and cultural factors, recent theorists have suggested that MI has neuropsychological origins. Specifically, MI has been associated with a reduced degree of handedness and with an increase in right-hemisphere activity. However, previous handedness research has assessed both handedness and MI with questionnaire measures. It is possible that the same people who are willing to consider the possibility of “magical” events are also willing to consider the possibility of using their nondominant hand. Thus, the association between MI and handedness could be an artifact caused by a questionnaire effect. The present study circumvented this problem by using a behavioral measure of handedness, a skilled pegboard task. Implications for the neuropsychology of belief are discussed.

(2122)

Sentences Compared With Pictures as Clues for Solving Pictorial Insight Problems. PATRICIA M. SCHWERT, *SUNY, Brockport* (sponsored by Robert James Miller)—Sentences and pictures, designed to be equivalent in information content, were compared as clues for solving pictorial insight problems (doodles). A 3 (test condition: informed, uninformed, control) \times 2 (clue type: sentence, picture) design was used. Participants completed, in order, an information acquisition task, a doodle problem-solving task, free recall of acquisition stimuli, and a questionnaire. This methodology extended prior research by using pictorial, rather than verbal, insight problems and comparing sentences and pictures as clues. Pictures clues were equally useful for informed and uninformed participants. The functional utility of sentence clues was reliably higher for informed participants. Recall rates were higher for picture clues. An explanation consistent with these findings is that picture clues, which have similar surface features to the problems, are used automatically by all problem solvers. Sentence clue use is not automatic. Sentence clues are more useful when problem solvers are aware that there is a connection between clues and problems.

POSTER SESSION III
Sheraton Hall, Friday Evening, 5:30–7:00

• TOUCH •

(3001)

Training Reduces the Crossed-Hands Deficit in Temporal Order Judgments. JAMES C. CRAIG & ADRIENNE N. BELSER, *Indiana University*—It has been shown that crossing the hands results in tactile temporal order thresholds that may be more than three times larger than those with uncrossed hands, a crossed-hands deficit (CHD). These results suggest that with crossed hands, subjects have difficulty remapping the tactile inputs to correspond with the spatial positions of the hands. The effect of training on the CHD was examined. At the beginning of training, the crossed threshold was 458 msec and the uncrossed threshold was 65 msec, a CHD of 393 msec. At the end of training, the comparable values were 111 and 50 msec, a CHD of 61 msec. In another experiment, the CHD initially was 79 msec, dropping to only 16 msec in the last session. Training did not eliminate but did greatly reduce the CHD. The implication is that significant remapping occurs with modest amounts of training.

(3002)

The Effects of Force and Conformance on Tactile Sensitivity. GREGORY O. GIBSON & JAMES C. CRAIG, *Indiana University* (sponsored by Gabriel P. Frommer)—The effects of force and conformance on intensive and spatial processing were examined with several measures of tactile sensitivity. Measures were made at two locations (fingerpad, fingerbase) that differ in sensitivity and density of innervation. Psychometric functions were generated for two measures of spatial sensitivity and one measure of intensive sensitivity at two forces (50 and 200 g). Results indicated that increasing force led to improvement on the intensive task, but not on the spatial tasks. Skin conformance measurements were made at both test sites. Conformance was found to be a joint function of force and groove width. Furthermore, performance on the intensive task could be predicted by conformance. The results are consistent with the view that increasing conformance increases neural activity in the afferent fibers; this increase improves performance on intensive tasks but has little effect on the quality of the spatial image.

(3003)

Haptic Concepts in the Blind. DONALD HOMA, KANAV KAHOL, PRIYAMVADA TRIPATHI, LAURA BRATTON, & SETHURAMAN PANCHANATHAN, *Arizona State University*—The acquisition of haptic concepts by the blind was investigated. Each subject—either blind or normally sighted—initially classified eight objects into two categories, using a study/test format, followed by a recognition/classification test involving old, new, and prototype forms. Each object varied along three relevant dimensions—shape, size, and texture—with each dimension having five values. The categories were linearly separable in three dimensions, and no single dimension permitted 100% accurate classification. The results revealed that blind subjects learned the categories slightly more quickly than their sighted controls and performed at least as well on the later memory tests. On the classification test, both groups performed equivalently, with the category prototype classified more accurately than the old or new stimuli. On the recognition test, all subjects, including the blind, false alarmed to the category prototype more than to any new pattern. These results are discussed in terms of current views of categorization.

• MULTISENSORY INTEGRATION •

(3004)

Kinesthetic Egocenter Is Used in Visually Directed Manual Pointing. KOICHI SHIMONO, *Tokyo University of Marine Science and Technology*, & ATSUKI HIGASHIYAMA, *Ritsumeikan University*—We examined the hypothesis (Howard, 1982; Shimono & Higashiyama, 2005)

that if we point a target manually without viewing our hands, its direction is judged from the kinesthetic egocenter, but not from the visual egocenter. For each of 8 observers, we estimated locations of the visual and the kinesthetic egocenters by using the Howard and Templeton method and required them to point to a near or far target without viewing their hands. The angle, which was formed by the sagittal plane going through the egocenter (visual or kinesthetic), with the line joining the egocenter and the pointed position, was determined for each target. The angles for the near targets were better described as a function of the angle for the far targets when they were represented using the kinesthetic, rather than the visual, egocenter.

(3005)

Contrast Effects Between Concurrently Perceiving and Producing Movement Directions. JAN ZWICKEL, MARC GROSJEAN, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Schubö, Aschersleben, and Prinz (2001) proposed a model to account for the contrast effects (CEs) that arise during the concurrent perception and production of feature-overlapping events. For example, the model can explain why producing a medium-amplitude movement while simultaneously watching a large-amplitude motion leads to a reduction in size of the produced movement (i.e., a CE in action) and to an increase in size of the perceived motion (i.e., a CE in perception). Using movement direction as the overlapping perception–action dimension, the present experiments sought to evaluate two untested predictions of the model: (1) The size of the CEs in perception and action should be monotonically related and (2) the size of the CEs should depend on the angular proximity between perceived and produced movements. In agreement with the model, CEs were found in both perception and action; however, neither of these specific predictions were confirmed.

(3006)

Cross-Modal Interactions in the Perception of Auditory Spatial Sequences. SHARON E. GUTTMAN, LEE A. GILROY, & RANDOLPH BLAKE, *Vanderbilt University*—To create meaningful descriptions of reality, the perceptual system must combine inputs from multiple sensory modalities. Previously, we have shown that one consequence of multimodal integration is cross-modal encoding: Temporal information presented through visual input automatically becomes represented using an auditory code. Here, we investigate the converse and ask whether spatial information presented through auditory input is automatically represented using a visual code. Participants made *same/different* judgments regarding two auditory sequences consisting of white noise bursts presented serially at four distinct spatial locations. Auditory/visual interactions suggested cross-modal encoding: Incongruent visual–spatial information diminished task performance relative to a baseline condition, whereas congruent visual–spatial information improved performance. Further experimentation suggested that this cross-modal interference is partially attributable to visual capture of the auditory spatial information. Together, these results indicate that the perceptual system employs multiple, situationally dependent strategies to create unitary representations from multimodal input.

(3007)

Differentiable Effects of Size Change on Repetition Priming in Vision and Haptics. ALAN C. SCOTT & RANDOLPH D. EASTON, *Boston College*—Previous research has demonstrated that object identification on repeated exposures is performed more quickly than initial identification—a phenomenon referred to as *priming* (e.g., Cave & Squire, 1992). Introducing a size change between study and test has no effect on the facilitating effects of repeated exposures when items are presented visually but does reduce facilitation when items are presented haptically. In recent research, we have demonstrated haptic-to-visual cross-modal priming with no effects of size change, thereby suggesting the existence of bimodal object processing. It was believed that if object processing was entirely bimodal in nature, increasing the delay between study and test would eliminate the unique effects of

size change on priming in the two modalities. However, the differentiable effects persisted with a 5-h delay. This suggests that object processing that subserves identification priming maintains modality specificity, even though cross-modal haptic–visual identification priming has been demonstrated.

(3008)

Change Blindness as a Multisensory Phenomenon: Evidence From Tactile Change Detection. ALBERTO GALLACE, *University of Oxford and Università degli Studi di Milano-Bicocca*, HONG Z. TAN, *Purdue University*, & CHARLES SPENCE, *University of Oxford*—Given the evolutionary importance of successful environmental change detection, it is surprising that people are so poor at detecting changes to successively presented visual scenes (the phenomenon of “change blindness”). We explored people’s ability to detect tactile change by sequentially presenting two vibrotactile arrays consisting of one to three stimuli over the body surface. We investigated the detection of changes to the number of stimuli presented and changes to the location of the stimuli, using a tactile analogue of the flicker paradigm. Change detection performance was good when the patterns alternated continuously, but poor when they were separated by a 110-msec gap. We also compared performance under conditions of unimodal (visual or tactile) versus bimodal (visual and tactile) change. Our results demonstrate the existence of tactile change blindness and are discussed in relation to other recent findings (e.g., on tactile numerosity judgments) that also highlight severe limits on tactile information processing.

(3009)

Dissociation of Egocentered Reference Frames Alters Auditory–Visual Fusion in Space. DAVID HARTNAGEL, *IMASSA and Université Paris 8*, & ALAIN BICHOT & CORINNE ROUMES, *IMASSA* (sponsored by Muriel Boucart)—Auditory–visual (AV) fusion studies permit us to investigate space perception without localization response bias; they have shown that perception of unity varies across space in azimuth. Humans make numbers of gaze movements that induce dissociation between auditory and visual reference frames. Question arises as to the effect of this dissociation on variation of AV fusion in the 2-D frontal space. Two psychophysical experiments were performed to determine fusion thresholds (in darkness and in light). Gaze position was controlled by an eye tracker in order to guarantee the dissociation between reference frames at stimulus onset. The 500-msec bimodal stimulation consisted of a 1° spot of light (or a laser beam in darkness) displayed on an acoustically transparent screen in synchrony with a 49-dB (A) broadband pink noise provided by one of 35 loudspeakers. Results showed that the reference frame of AV fusion is neither head nor eye centered, but results from cross-modal dynamic interaction.

(3010)

Learned Cross-Modal Integration of Novel Visual Cues With Auditory Speech. JOSEPH D. W. STEPHENS & LORI L. HOLT, *Carnegie Mellon University and Center for the Neural Basis of Cognition*—The integration of information across modalities is a key component of behavior in everyday settings. However, little is known about the extent to which experience affects mechanisms of multimodal integration. In the present study, participants were trained for more than 10 sessions on audiovisual combinations of speech sounds and corresponding movements of an animated robot, whose features bore no resemblance to speech articulators. Participants’ use of auditory and visual information was tested periodically throughout the experiment. During training, identification of acoustically presented consonants began to be influenced by simultaneous presentation of trained visual stimuli. The nature of this influence changed by the end of training, suggesting that further experience altered perceptual mechanisms for combining information. A subsequent experiment manipulated relations between the trained visual stimuli, such that they were more incompatible with the structure of natural visual speech. The findings are relevant to theories of speech perception and multimodal integration.

(3011)

Eyes, Ears, and Cars: Errors and Illusions in Motion Perception. TAMARA L. BOND & RANDOLPH D. EASTON, *Boston College* (sponsored by Randolph D. Easton)—The present research examines the ability of individuals to identify the direction of motion and the location of vehicles, using auditory, visual, and bimodal stimulus cues. Vehicles were presented using surround sound audio, video, and bimodal audiovisual tracks. Participants pressed a button to indicate the direction of motion when they perceived each vehicle crossing their midline. Individuals were also presented with a directional conflict paradigm, where visual and auditory information flowed in opposite directions. Preferential attention to auditory and visual information was also manipulated. Approximately one third of the individuals detected the presence of the directionally conflicting stimuli, and this predicted accuracy in auditory tasks. Accuracy for directional information was better for visual and bimodal trials than for audio trials, indicating directional ambiguity for auditory motion. Differences in localization ability were exhibited for auditory, visual, and bimodal stimuli.

(3012)

Cybersickness and Vection Induced by an Expanding and Contracting Optical Flow Pattern. ANDREA BUBKA & FREDERICK BONATO, *Saint Peter’s College*, & STEPHEN A. PALMISANO, *University of Wollongong*—Cybersickness (or simulator sickness) often occurs in vehicle simulators and other virtual environments. Unlike typical motion sickness, cybersickness does not depend on physical motion. It is often accompanied by visually induced self-motion perception (vection). In the present study, the effects of an expanding and contracting optical flow pattern on cybersickness and vection were measured. Observers viewed a pattern on an LCD computer monitor that alternately expanded and contracted, flow direction changing every 5 sec, or that steadily expanded (control condition). Cybersickness and vection were assessed after 5 min using established subjective scales. The results were that the contracting and expanding pattern yielded significantly more severe cybersickness and vection was perceived as an oscillating forward and backward self-motion. These results suggest that cybersickness is associated more with vection that changes in direction and not with vection magnitude per se. Results will be discussed in the context of several motion sickness theories.

(3013)

What Is the Provocative Stimulus for Motion Sickness? FREDERICK BONATO & ANDREA BUBKA, *Saint Peter’s College*—The most well-known theories of motion sickness (MS) are based on sensory conflict, but what kinds of conflicts lead to MS? The subjective vertical mismatch theory asserts that MS results only when the sensed vertical conflicts with the expected gravitational vertical (based on past experience). We propose a rival theory that asserts that the sensed and the expected effects of motion alone can lead to MS; a vertical mismatch is not necessary. In two experiments using an optokinetic drum, a subjective vertical mismatch was avoided, since rotation direction and velocity were manipulated. MS onset was fastest and symptoms more severe when rotation direction or velocity changed. Under these conditions, visual input leads to self-rotation perception that also changes direction and velocity, but the vestibular system indicates that the observer is stationary. These results support a theory based on sensed and expected motion and seriously undermine the general applicability of the subjective vertical mismatch theory.

• TIMING AND COUNTING •

(3014)

Developmental Differences in Individuation: Containment and Connection. ELIZABETH F. SHIPLEY & BARBARA SHEPPERSON, *University of Pennsylvania*—Individuation by 4-year-olds and adults was examined in tasks requiring a count of the “things” in arrays of 3-D objects. Participants were asked to count arrays (1) that included

familiar toys and transparent boxes, either empty or containing familiar objects, and (2) that included separate balls, pairs of balls with rigid or flexible connectors (dumbbells), and balls in bags. Children never counted filled containers, neither transparent boxes nor bags. Adults consistently counted both filled and empty transparent boxes; some also counted filled bags. Children did count empty containers if they were the only objects presented on a trial and on trials following all empty-container trials. Children never counted the dumbbell connectors in the dumbbells (i.e., they never counted a dumbbell as three things); adults did. Apparently, a relationship of containment or connection with a salient object masks the individuation of the less salient object for preschoolers, but not for adults.

(3015)

Breaking Weber's Law: Systematic Deviations in Temporal Production and Discrimination in Pigeons and Rats. FEDERICO SANABRIA, *Arizona State University*, LEWIS A. BIZO, *Southern Cross University*, & PETER R. KILLEEN, *Arizona State University*—Weber's law is frequently purported to be a ubiquitous feature of time perception. In two experiments, we tested the timing performance of rats and pigeons, using two timing tasks (temporal discrimination and production) across a wide range of intervals (from milliseconds to tens of seconds). The performance of both species systematically deviated from Weber's law in both timing tasks: Coefficients of performance variation were relatively high for very short durations and then decreased to a minimum for a range of intermediate intervals, as is predicted by generalized Weber's law; however, they then increased for longer durations. A model based on a radix counter that allows for lost pacemaker counts from an internal clock (Killeen & Taylor, 2000; Killeen & Weiss, 1987) accommodated the U-shaped pattern.

(3016)

Psychological Time Distortions in Judging Minute-Long Intervals Retrospectively. SIMON GRONDIN & MARILYN PLOURDE, *Université Laval*—Fifty participants were asked to perform five different cognitive tasks lasting 2, 3.5, 5, 6.5, and 8 min, respectively. After completing the series of tasks, they were asked to estimate retrospectively the duration of each one. Psychophysical analyses linking psychological time to physical time revealed that the value of the slope, when expressed with the power law, was about .48. The coefficient of variation, or the ratio of variability to estimated time, ranged from .38 (at 2 min) to .28 (at 8 min). A task effect was observed only at Position 1 for estimated time, whereas no position effect was observed for each task. There was no significant position or task effect for the coefficient of variation. At the individual level, the results revealed severe psychological time distortions. For instance, 2 and 8 min were sometimes estimated as the same duration.

(3017)

Varying Duration and Location of a Tone in Time Production. JULIE CHAMPAGNE & CLAUDETTE FORTIN, *Université Laval*—Manipulating location of signals in time productions lengthens produced intervals in proportion to the duration for which the signal is expected. This effect was attributed to attention sharing between the timing and the monitoring of the source of the signal. The present study examines whether the location effect is influenced by the processing requirements of the signal. A tone was used in a high- or low-frequency discrimination task, the tone being either short (10 msec) or long (150 msec). Participants were tested in two sessions with conditions of tone duration counterbalanced. The location effect was stronger when participants were tested first in the short-tone condition than when they were tested first in the long-tone condition. This was explained by a sampling strategy developed in the first experimental session that participants maintain during the whole experiment.

(3018)

Remembering the Rate and Duration of Naturalistic Events. MARYLYN G. BOLTZ, *Haverford College*—In everyday behavior, there are

many situations that require one to judge an event's rate and/or total duration. The purpose of the present research is to compare the recognition memory for these two temporal dimensions. Experiment 1 revealed that people are able to incidentally learn the inherent rate of various ecological sounds that vary in their structural characteristics. Experiment 2 further demonstrated that rate information is both better remembered and acquired after a fewer number of learning trials than is event duration. Lastly, Experiment 3 systematically manipulated participants' attending to rate, duration, and pitch information in order to assess whether these three structural dimensions are jointly or independently encoded into memory. This relationship, in turn, has both practical and theoretical implications.

(3019)

Assessment of Numerosity by Tamarins. JULIE J. NEIWORTH, ALISON LEWIS, & MAREN SONSTEGARD, *Carleton College*—Tamarins were trained in two different tasks, one involving a discrimination of a particular number presented simultaneously on a three-dimensional visual array and one involving a discrimination of a particular number of sequentially presented items. Tests of generalization verified relative numerosity assessment in both tasks initially. With more training of two particular numbers in each task, generalization tests showed tamarins subitizing, rather than assessing, relative numerosity. As Wright, Colombo, and others have found with categorization tasks, training with multiple items shifted tamarins' assessment to a more complex method.

(3020)

Scalar Effects in Birds' Visual Discrimination of Numerosity. JACKY EMMERTON & JENNIFER RENNER, *Purdue University*—Several models of numerical discrimination posit scalar effects—that is, an increase in the variance of behavioral choices proportional to stimulus magnitude (numerical value). Pigeons were trained to discriminate pairs of anchor numerosities (ranging from 2 vs. 7 to 20 vs. 80). They demonstrated both interpolation and extrapolation of their choices in tests with novel values. Psychophysical functions were similar within a given ratio of anchor values when absolute numerosities differed. Points of subjective equality (PSEs) conformed to geometric means of the anchor numerosities, and difference limens increased in proportion to PSEs. Birds' performance was robust under various control conditions, including randomizing the array configurations and array element sizes and equating across arrays for summed brightness and area. Effects found across a range of numerosities with these visual arrays were similar to those previously reported across species when discrimination of number (as well as time) was based on sequential, nonvisual items.

(3021)

Absolute Timing. JONATHON D. CRYSTAL, *University of Georgia*—Independent groups of rats were trained with a 100-sec ($n = 14$), 24-sec ($n = 7$), or 12-sec ($n = 7$) fixed interval (FI) procedure. The postreinforcement pause (PRP; latency to the first response after food) was measured. Temporal uncertainty differed between the three conditions when measured on a relative time scale (i.e., PRP/FI); temporal uncertainty was approximately the same when measured on an absolute time scale (i.e., FI - PRP). Timing was optimal (PRP = FI) for the 100- and 12-sec groups. The data provide support for the absolute timing hypothesis (i.e., temporal uncertainty is constant in absolute time, rather than in relative time).

(3022)

Testing a Basic Assumption of Interval Models of Short-Interval Timing: Does the Internal Clock Work Like a Stopwatch? J. DEVIN MCAULEY, LORI CURTINDALE, & KEVIN C. H. PANG, *Bowling Green State University*—Interval models of short-interval timing posit three independent processing components: an internal clock used to estimate duration, a reference memory used to store information about duration, and a comparison mechanism used to judge relative dura-

tion. One assumption about the internal clock is that it can be started and stopped arbitrarily, much like a stopwatch. The present study tested this assumption in two experiments. Participants first learned to reproduce 1-sec, 2-sec, or 4-sec target durations, using a fixed-interval training procedure, and then were tested on their ability to reproduce the target duration in the presence of a perturbation tone. Under run instructions, participants ignored the perturbation tone and responded as during training. Under reset instructions, participants restarted timing following the perturbation tone. Inconsistent with the arbitrary start/stop assumption, temporal productions under run and reset instructions were strongly affected by the phase of the perturbation and were dependent on the target duration.

(3023)

Timing of Cross-Modal Intervals in the Ranges of Milliseconds and Seconds: Evidence for a Single Mechanism of Temporal Information Processing. THOMAS RAMMSAYER, *University of Göttingen*, & JUDITH NITSCHKE & ROLF ULRICH, *University of Tübingen*—Several lines of research suggest two distinct timing mechanisms underlying temporal processing (distinct timing hypothesis): a sensory mechanism for processing of durations in the subsecond range and a cognitive one for processing of longer durations. In three experiments, subjects discriminated between the duration of a standard stimulus and the duration of a variable comparison stimulus. On congruent trials, both stimuli were presented to the same sensory modality (i.e., both visual or both auditory), whereas on incongruent trials, each stimulus was presented to a different modality. According to the distinct timing hypothesis, sensory incongruity should lower temporal discrimination performance for brief, but not for long, standards. Contrary to this prediction, sensory compatibility affected performance more for long than for short durations. It is concluded that a single-clock mechanism based on neural counting provides a better account for these results than does the distinct timing hypothesis.

(3024)

Interruption in Time Reproduction: An Analysis of Interference Between Specific Processes. LOBNA CHÉRIF & CLAUDETTE FORTIN, *Université Laval* (sponsored by Claudette Fortin)—The impact of an interruption on a time reproduction task involving the encoding and reproduction of time intervals was investigated in this experiment. Participants were trained to reproduce time intervals during which a tone was presented. The tone was interrupted either during the encoding or during the reproduction phase of the task. Participants were instructed to reproduce the tone duration while ignoring the time for which it was interrupted. Results show that expecting the interruption causes an underestimation of the tone duration but that the effect was stronger when the interruption occurred in the reproduction phase of the task than when it occurred in the encoding phase. These findings suggest that the effect of expecting an interruption in timing varies, depending on the specific operations required in the timing task, and they are discussed within a framework that emphasizes the processes involved in the encoding and reproduction phases of time reproduction.

• AGING AND MEMORY •

(3025)

Aging and Qualitative Characteristics of Memories. SUZANNE M. BLOISE, MARCIA K. JOHNSON, CAROL L. RAYE, & KAREN J. MITCHELL, *Yale University*, & LINDA M. BARTOSHUK & DEREK J. SNYDER, *Yale University School of Medicine*—We investigated age differences in memory for complex pictures, using objective and subjective memory measures. In preliminary analyses, given labels of pictures, older adults showed poorer old/new recognition than did younger adults, but gave higher ratings on some subjective memory measures. We compare memory characteristic questionnaires (McQ), using a typical McQ rating scale (Johnson et al., 1988) or using a variant of the general linear magnitude scale (Bartoshuk et al., 2002), and

discuss their relative advantages and disadvantages for comparing across age groups and types of features of memory.

(3026)

Age, Implicit Motives, and Memory for Positive and Negative Social Information. ANGELA H. GUTCHESS, *Harvard University*, & CAROLYN YOON & OLIVER C. SCHULTHEISS, *University of Michigan*—Elderly adults exhibit poor memory for negative emotional information, but less impaired memory for positive emotional information (Charles, Mather, & Carstensen, 2003). We tested whether this finding extends to social information. Sixty young and 60 elderly adults incidentally encoded 60 words and 90 pictures that were neutral, positive social (e.g., “together”; depictions of group interactions), or negative social (e.g., “apart”; depictions of isolated individuals). Positive and negative social pictures, but not words, were better recognized, relative to control pictures, for young and elderly adults, but elderly adults were not disproportionately impaired on negative social stimuli. However, elderly adults more motivated by affiliation and intimacy (as assessed by the Picture Story Exercise; Schultheiss & Brunstein, 2001) showed a greater relative memory advantage for social stimuli, relative to control stimuli. The relationship was not present for young adults, suggesting that individual differences in motivation have a greater contribution to memory with age.

(3027)

Collaborative Facilitation in High-Functioning Older Adults. MICHELLE L. MEADE & DENISE C. PARK, *University of Illinois, Urbana-Champaign*—We tested the hypothesis that retrieval strategy and repeated trials would reduce collaborative inhibition in young and older adults. Subjects recalled unrelated word lists on their own or in collaboration with another subject and developed strategies (individually or collaboratively) to improve memory across repeated study–test trials. Collaborative inhibition obtained on the first recall trial for both young and older adults but persisted across trials only for young adults (whose individual memory did not decline). For older adults, individual recall performance declined across trials, but collaborative recall performance did not decline. This pattern of collaborative facilitation was obtained only for high-functioning older adults; the mechanism for collaborative facilitation was the suggestion of more effective strategies (not necessarily collaborative strategies) that require a baseline level of cognitive capacity to implement. In cases where individual memory declines, it may be advantageous to look to a collaborator for more effective retrieval strategies.

(3028)

Retrieving the Names of Cartoon Characters: Effects of Name Descriptiveness and Aging. LORI E. JAMES & KETHERA A. FOGLER, *University of Colorado, Colorado Springs*—Few studies have tested why a person’s name is more difficult to retrieve than other information about that person. Names usually lack meaningful reference to individuals, and this has been suggested to contribute to the difficulty of names. Large age differences have been identified in memory for names, and this experiment tested whether the arbitrary assignment of names to individuals contributes to the age decrement in name memory. Young and older adults named pictures of cartoon characters with descriptive (depicting personality or appearance; e.g., Pink Panther) and nondescriptive (e.g., Garfield) names. For percent correct, older adults demonstrated pronounced deficits in recalling nondescriptive names, as compared with descriptive ones. This interaction suggests that part of the often-obtained age deficit in name memory occurs because names generally lack meaningful reference to individuals. Findings are interpreted within current theories of cognitive aging, and practical applications of the results are suggested.

(3029)

Verbal Intelligence: Over the Hill and Picking Up Speed. AMY L. SIEGENTHALER, *Tokyo University of Social Welfare*, BOB UTTL,

University of Tamagawa, & NOBUO OHTA, *Tokyo University of Social Welfare*—Raw scores on intelligence tests have been rising at a fast rate, especially for older adults. One explanation is that increases in intelligence parallel increases in educational attainment. In Study 1, we searched for studies reporting WAIS–R Vocabulary raw scores from January 1986 to December 2003 and plotted raw scores by publication year. From the 1960s, verbal intelligence scores for older adults have risen sharply, until reaching test ceilings in the 1990s. In contrast, scores for younger adults have risen only minimally and have begun to decline. In Study 2, we confirmed substantial verbal intelligence declines in young adults over the last decade. In combination, VIQ score trajectories mimic the trajectories of educational attainment by the two age groups, combined with anecdotal evidence of decline in education quality. These results suggest that the days of the Flynn effect, at least for verbal intelligence, may be over: it's all downhill from here.

(3030)

Adult Age Differences in Episodic and Semantic Retrieval: A Diffusion Model Analysis. JULIA SPANIOL & DAVID J. MADDEN, *Duke University Medical Center*, ANDREAS VOSS, *Albert-Ludwigs-Universität Freiburg*, & SARA E. MOORE, *Duke University Medical Center*—This study investigated adult age differences in episodic and semantic long-term memory retrieval, as a test of the hypothesis of specific age-related decline in context memory. In Experiment 1, old–new recognition served as an episodic retrieval task, and living/nonliving decisions served as a semantic retrieval task. Older adults were slower and had lower episodic accuracy than did younger adults. Fits of the diffusion model (Ratcliff, 1978) revealed age-related increases in the length of nondirectional response time components for both episodic and semantic retrieval. There was also an age-related decrease in the rate of accumulation of decision-driving information (drift rate) for episodic retrieval, but not for semantic retrieval. A substantial portion of the age-related variance in episodic drift rate was shared with perceptual–motor speed. A second experiment contrasted episodic and semantic retrieval mechanisms, using a more context-dependent episodic task (source memory judgments).

(3031)

The Influence of Age and Sport Expertise on Memory for Visual, Verbal, and Enacted Information. CLARE MACMAHON, KATINKA DIJKSTRA, & MINE MISIRLISOY, *Florida State University*—Subject-performed tasks (SPTs), such as the action of waving, are recalled better than verbal instructions (“wave”) and show smaller age-related differences (Bäckman, 1985). This study assessed whether previous experience with certain motor actions further facilitate or attenuate the SPT effect. Forty-eight older and younger experienced golfers and 48 older and younger control participants were compared in their memory for golf-related (e.g., “putt to the hole”) and non-golf-related (e.g., “turn on the lamp”) items. Items were presented verbally (read aloud) or visually (video clip) or were subject performed. Preliminary findings show an interaction between information type and expertise in retention. Specifically, experienced golfers remember more golf-related information than do controls. As well, older adults demonstrate smaller declines in delayed retention for golf-related information than do younger adults. These findings support the idea that experienced golfers develop elaborate perceptual–motor knowledge specific to their area of expertise (Starkes, Cullen, & MacMahon, 2004).

• AUTOBIOGRAPHICAL MEMORY •

(3032)

Verifiable Autobiographical Memory: Recall of Lies. STEPHANIE A. BERGER, *College of Mount St. Vincent*—This diary study of autobiographical memory examined the accuracy with which students recalled their own lies. Students submitted each lie they had told every day for 7 days to a confidential online diary. Along with each lie, they

also recorded the reason for the lie and completed subjective rating scales, including the seriousness of the lie, the amount of advanced planning before telling the lie, and their feelings about the lie. Participants recalled .81 of all lies on an unexpected cued-recall test that was completed in the lab 2 weeks after the last lie had been submitted. Significant differences between the characteristics of the lies that were recalled and of those that were not provide evidence of the functional nature of autobiographical memory.

(3033)

Remembrance of French Things Past. LILLIAN H. PARK & JOHN F. KIHLLSTROM, *University of California, Berkeley*—Two experiments with French–English bilinguals investigated the relationship between language and memory. When subjects were asked to write in French, they retrieved more memories from the period in their lives when they spoke French; when they wrote in English, they retrieved more memories from the period in which English dominated their speech. Autobiographical memories narrated in a different language from that in which the events had been experienced did not have fewer details than did those told in the same language. Autobiographical memories that were narrated in the same language in which the event had been experienced were more expressive and emotional than those narrated in the other language. Bilingual speakers retrieved and preferred to remember autobiographical memories in the same language in which the event had been experienced. Language acquisition history and habitual use of the two languages affected the strength of these language effects.

(3034)

The Reminiscence Bump in Autobiographical Memory: Effects of Age and Culture. STEVE M. J. JANSSEN & JEROEN G. W. RAAIJ-MAKERS, *University of Amsterdam*—We investigated the age distribution of autobiographical memories with the Galton–Crovitz cuing method through the Internet. Participants from different countries, such as Australia, Belgium, Canada, the Netherlands, the U.K., and the U.S., were presented with 10 cue words. They were asked to recall personal memories that were associated to the cue words and to date these personal events. We were able to remove the recency effect from the empirical age distributions with a method that allows separate estimation of memory encoding and forgetting. We found strong evidence for a “reminiscence bump” in all subpopulations at all ages. People stored more events (or they store events better) between the ages of 10 and 20 years. However, we also found that the reminiscence bump becomes more pronounced as participants become older. Events that occurred between the ages of 10 and 20 years are recalled more often, making them even more persistent.

(3035)

The Specificity and Organization of Autobiographical Memory. MATTHEW D. SCHULKIND, *Amherst College*, TAMARA A. RAHAL, *University of Massachusetts, Amherst*, & MEGAN R. KLEIN & SAMANTHA R. LACHER, *Amherst College*—Younger adult subjects were asked to describe autobiographical events in response to cue narratives that varied in terms of general life period, emotional valence, and theme. Sixty percent of the subjects’ narratives described specific, on-one-day events, and nearly 40% described specific episodes within such events. As well, the subjects’ narratives matched the cue narratives in terms of theme and valence more often than they matched them in terms of general life period. These data contradict previous research showing that people tend to report general events spanning several days, rather than specific events that occurred on a single day. The data also contradict theories arguing that autobiographical knowledge is organized hierarchically, with *general life periods* anchoring the top of the hierarchy. Therefore, current theories must be altered to account for the fact that retrieval cues/conditions influence both the way autobiographical knowledge is accessed and the specificity of the events retrieved from memory.

(3036)

Retellings of Autobiographical Memories. MICHAEL B. HUTSON & ELIZABETH J. MARSH, *Duke University* (sponsored by Ian Dobbins)—People tell their autobiographical memories to different people and for different reasons. In lab studies, retelling a story to a different audience or for a different purpose changes what (and how much) information is included (Hyman, 1994; Marsh, Tversky, & Hutson, in press). The present research examines whether retellings of personal memories also show evidence of shifting for different goals. Study 1 involved collection of scripts for typical events and application of the scripts to retellings told to entertain. Stories contained fewer actions, but what actions were mentioned conformed to script predictions. Study 2 involved collection of typical instances of events (to provide converging evidence for the scripts collected in Study 1) and retellings of personal memories to inform versus to entertain. Informative and entertaining retellings differed in proportion of script events included, as well as the language used.

• FALSE MEMORY •

(3037)

Effects of Bilingual Processing on Veridical and False Memory. YVONNE WAKEFORD, *Tufts University*, MICHAEL T. CARLIN, *University of Massachusetts, Worcester*, & MICHAEL P. TOGLIA, *SUNY, Cortland*—The Deese/Roediger–McDermott (DRM) paradigm was utilized to assess the effect of bilingual processing on veridical and false memory. Thirty-two English–Spanish bilingual participants were tested in two within-language conditions, with acquisition and test in the same language (English–English and Spanish–Spanish), and two cross-language conditions, with acquisition and test in a different language (English–Spanish and Spanish–English). In each condition, participants were presented with 48 words (four lists of 12 associated words). A free recall test was followed by a recognition test. Results indicated a significant interaction; veridical recall and recognition rates were lower in the cross-language conditions, and false recall and recognition rates were higher in the cross-language conditions. This pattern of results indicates that bilingual processing has an adverse effect on memory accuracy and is consistent with spreading-activation theory and gist processing.

(3038)

The (Un)Reliability of False Memories. MANILA VANNUCCI, *University of Florence*, & GIULIANA MAZZONI, *University of Plymouth* (sponsored by Giuliana Mazzoni)—False memories are usually displayed only in a subset of participants. This has led to a search for the correlates of false memory development. Underlying this search is the tacit assumption that individual differences in false memories are reliable. Blair et al. (2002) reported adequate test–retest reliability of false memories for semantically related words (DRM). In a follow-up study, we found significant test–retest reliability only when the same set of DRM lists was presented in the same order. These data suggest that the apparent reliability of DRM false memories may be a contextually mediated artifact.

(3039)

The Role of Sublexical Activation in Phonological False Memories for Nonwords. MCKENZIE R. BALLOU & MITCHELL S. SOMMERS, *Washington University* (sponsored by David A. Balota)—Many accounts of false memories in the Deese/Roediger–McDermott (DRM) paradigm include the assumption that activation accrues on lexical representations of the critical item (CI). However, recent findings that false memories can be produced using lists of nonwords phonologically related to a nonword CI suggest that activation on sublexical, rather than lexical, representations may also contribute to false remembering in the DRM paradigm. To test this hypothesis, two experiments were conducted in which participants' memory for lists of aurally presented nonwords differing in phonotactic probability (PP) was tested. The facilitative effects of PP (faster and more accurate responding for high than for low PP) for nonword processing are thought to reflect sub-

lexical activation, because the unit of analysis in computing PP is either positional or biphone frequency. Results suggest that false memories for nonwords vary as a function of PP, with higher PP producing increased rates of false memory.

(3040)

Effects of Associative Processes on False Memory: Evidence From DRM and Category Lists. MINE MISIRLISOY, *Florida State University*, & HASAN G. TEKMAN, *Middle East Technical University*—The study investigated the effects of test-induced priming on false memories evoked by converging associates (DRM lists) and category associates (category lists) procedures. Participants (mean age = 19.65) were given 18 lists of 12 items to study. This was followed by a recognition test of 297 items, composed of 216 list items, 36 critical items, and 45 filler items. The experiment involved the manipulation of the test order of the critical items in relation to the list items from their corresponding lists. The subjective experience accompanying the memory was also measured by remember/know judgments. The results demonstrated a significant effect of list type (category vs. DRM) in false memories. Critical lures from DRM lists had higher proportions of false memory than did those from category lists, and they received more remember judgments. Results are discussed with respect to the differential effects of encoding and retrieval processes on DRM and category lists.

(3041)

Heuristic Influences on the False Recollection of Imagined Events. HEATHER M. KLEIDER, *Georgia State University*, & STEPHEN D. GOLDINGER, *Arizona State University*—When recollection is difficult, people rely on heuristic processing, rather than on effortful processing. Heuristics increases reliance on perceptual cues when the source of retrieved information is determined. As such, perceptual elaboration of suggested event details is likely to increase false memories (Drivdahl & Zaragoza, 2001). Extending these findings to person memory, this study investigated whether heuristic processing increases false alarms to imagined events by manipulating the delay between witnessing and recalling an event and the stereotype-consistency of a person's role in the event. In two experiments, participants watched slide shows and imagined people performing stereotype-consistent and -inconsistent actions, followed by immediate or delayed memory tests. Results showed that after a delay, people more often remembered seeing imagined actions and misremembered the stereotype-consistent person as the actor. In addition, falsely remembering the stereotype-consistent actor was more often attributed to actual memory in a remember/know test.

(3042)

Lexical Association and False Memory in Two Cultures. YUH-SHIOW LEE & HSU-CHING HUNG, *National Chung Cheng University*—This study examined the relationship between language experience and false memory produced by the DRM paradigm. The word lists used in Stadler et al. (1999) were first translated into Chinese. False recall and false recognition for critical nonpresented targets were tested on a group of Chinese users. The average co-occurrence rate of the list word and the critical word was calculated on the basis of a large Chinese corpus. List-level analyses revealed that the correlation between the American and the Taiwanese participants was significant only in false recognition. The co-occurrence rate was significantly correlated with false recall and recognition of Taiwanese participants, and not of American participants. On the other hand, the BAS based on Nelson et al. (1999) was significantly correlated with false recall of American participants, and not of Taiwanese participants. Results are discussed in terms of the relationship between language experiences and lexical association in creating false memory.

(3043)

Memory Monitoring Reduces, but Does Not Eliminate, False Memories. JEFFREY S. ANASTASI, *Arizona State University, West Cam-*

pus, MATTHEW G. RHODES, *Washington University*, & HARPREET BAHIA, *Arizona State University, West Campus*—The present study investigated the impact of memory monitoring on false recognition in the DRM paradigm (Deese, 1959; Roediger & McDermott, 1995). Participants were given either a recall test or an opposition task immediately after each list presentation. In the opposition task, participants were instructed to write down words that were related to the presented word list but that had not themselves been previously presented. The opposition task was employed to encourage memory monitoring. Participants were later given a yes/no recognition test in order to assess memory for the presented lists. Results indicated that the opposition task was effective at reducing false memories, but only for those critical lures that were identified as nonpresented items during encoding.

(3044)

Does Distinctive Visual Information Enhance Monitoring of False Memories? JASON ARNDT, *Middlebury College*, ASHLEY OSBORNE, *Duke University*, & MEGHAN STONE, JOHN CARNEY, & KAREN LEE, *Middlebury College*—Two experiments evaluated the role of encoding-based and retrieval-based factors in the production of false recognition in the DRM paradigm. The first experiment varied the association of unusual-looking fonts with DRM themes (correlated or not correlated) and the duration of time allotted for subjects to utilize retrieval monitoring. The second experiment manipulated whether the font in which an unstudied lure item was presented at test was used to present strong or weak associates of the lure, as measured by backward associative strength. The combined results of these experiments suggest that subjects utilize visual format as a retrieval cue in an effort to distinguish between studied and unstudied items but that this monitoring strategy can be harmful when lure activation during encoding leads to the development of associations between fonts used to present study items and lure item representations.

(3045)

False Recall in the DRM Paradigm for Word and/or Pseudohomophone Lists. MICHAEL J. CORTESE & ILIJA VELJKOVIC, *College of Charleston*, & MAYA M. KHANNA, *University of Michigan*—The role of plausibility in false recall in the DRM paradigm was examined using free recall. Presentation lists consisted of words, pseudohomophones (e.g., *dreem*), or both words and pseudohomophones. When participants were instructed to write down items as they appeared during study (Experiment 1), the proportion of false recall was higher for both word and mixed lists than for pseudohomophone lists. However, in verbal recall (Experiment 2), the three list conditions produced similar levels of false recall. We posit that Experiment 1 yielded less false recall for pseudohomophone lists because items activated in memory were correctly spelled and, thus, represented implausible events in a pseudohomophone context. Interestingly, in the pseudohomophone condition, when participants did report critical items, they usually spelled them as pseudohomophones. In Experiment 2, critical items activated in memory were indistinguishable from list words in the pseudohomophone condition, because the task probed verbal, rather than orthographic, information.

(3046)

Differences in False Recognition From DRM and Categorized Lists: Associative Activation or Gist? BENTON H. PIERCE, *Texas A&M University, Commerce*, DAVID A. GALLO, *University of Chicago*, & DANIEL L. SCHACTER, *Harvard University*—False recognition from DRM lists (e.g., *core, orchard, pie, . . .*) is consistently found to be greater than that from categorized lists (e.g., *pear, peach, orange, . . .*). To test whether this difference (DRM > categorized) is attributable to differences in associative strength or to differences in semantic gist, we created DRM lists and categorized lists that were related to the same critical lure (e.g., *apple*) and were equated on backward associative strength (via association norms). Using a standard old/new recognition test, we found equivalent levels of false recognition for the

two list types. A meaning recognition test, however, revealed that critical lures from categorized lists cued the gist of the list more frequently than did DRM critical lures. This interaction supports the idea that stronger associative connections, as opposed to greater semantic gist, are responsible for the greater false recognition levels commonly found for DRM-type lists than for categorized lists.

(3047)

Impact of Exposure to Evidence on False Confessions to Actions. MICHELLE CARBUTO & LINDA A. HENKEL, *Fairfield University*—Certain interrogation tactics (e.g., showing suspects pictures from a crime scene) can contribute to the incidence of false confessions. Using an experimental paradigm modeled after “imagination inflation” studies, this experiment investigated the impact of the presentation of false evidence on people’s memory for which actions were actually performed. Subjects performed and imagined performing various actions that would leave behind evidence that the action had been completed (e.g., tear the card in half, crumple the paper). Later, they were exposed to photographs (zero, one, or three times) showing some of the imagined actions in a state of completion. One week later, they had to indicate which actions had been actually performed. Results indicated that the presentation of evidence increased source errors for imagined events: Subjects were more likely to falsely claim to have performed actions that were in fact imagined when photographic evidence of the completed actions had been shown.

(3048)

Emotion Above Semantic Relatedness: Explaining Memory Illusion. LILIAN M. STEIN, GUSTAVO ROHENKOHL, & RENATO F. SANTOS, *Pontifical Catholic University, Rio Grande do Sul*—Semantic relatedness has been used to explain false memory phenomena in the Deese/Roediger–McDermott paradigm. The present experiment tested the effect of emotional valence on memory illusion independently of semantic relatedness. Two hundred eighty-five Brazilian college students were presented with 12 lists of semantic associates (3 positive, 6 neutral, 3 negative). Semantic relatedness (backward and forward association strength) was equated across the three emotional valence groups of lists. Results indicated that emotional valence seemed to produce a differential effect on true and false recognition. An immediate memory test yielded more false recognition responses to critical nonpresented associate words in negative lists than to those in both neutral and positive lists. Turning to veridical memory, participants produced higher hit rates for presented words from both positive and negative lists, as compared with neutral lists. The differential effect of emotional valence on true and false recognition is explained in light of current theories of memory.

(3049)

The Effect of Gesture on Memory and the Creation of False Memories. JENNIFER L. TOMES & KAREN G. NICHOLSON, *Mount Allison University*—In the Deese/Roediger–McDermott paradigm, subsequent to learning semantically related words (*bed, dream, etc.*), participants falsely remember other semantically related words not on the original lists (*sleep*; i.e., “critical lures”). We examined whether producing gestures that relate to each word during learning would reduce false memory for critical lures. Participants ($n = 150$) were presented with 10 lists of 10 semantically related words. Half the participants were asked to generate a related gesture for each word. Subsequently, participants were asked to make *old/new* discriminations for items on a test list. Results showed that the gesture group correctly recognized significantly more words that were actually on the lists than did the no-gesture group. In contrast, the no-gesture group falsely recognized significantly more critical lures than did the gesture group. The results are discussed in terms of how gesture production might influence the activation of semantic networks thought to mediate the false memory effects.

(3050)

The Effects of Retrieval Practice on False Recall. KIMBERLY K.

WEAR, *High Point University*, DAVID S. GORFEIN, *University of Texas, Arlington*, & CHARLES J. BRAINERD, *Cornell University* (sponsored by David S. Gorfein)—Contrasting predictions for false recall were generated for the retrieval-induced-forgetting model (Anderson, 2003) and the recollection rejection model (Brainerd, Reyna, Wright, & Mojadin, 2003). These predictions were tested by having participants differentially practice different portions of DRM lists (Stadler, Roediger, & McDermott, 1999). Retrieval-induced forgetting (Anderson, 2003) predicts that the practice of any item will suppress its strongest competitors. Therefore, practicing items highly associated to the critical lure should suppress the recall of the lure. Recollection rejection (Brainerd, Reyna, Wright, & Mojadin, 2003) predicts that the practice of low associates forms a different gist than that of high associates and that the resulting gist is not similar enough to include the critical lure. In a test phase, free recall of previously studied items was collected to assess the effects of differential practice.

• DIVIDED ATTENTION AND AUTOMATIC PROCESSING •

(3051)

The Involuntary Attentional Blink May Be an All-or-None Phenomenon. VERONICA J. DARK & AMY L. RAMOS, *Iowa State University*—An involuntary attentional blink (AB) is observed when participants alternate between an imagery task (form an image of the object named by a word) and a digit identification task (identify the masked digit in an RSVP stream of pictures). The digit is the only target, but identification is lower if a picture of the imagined object occurs before the digit, suggesting that the picture captures attention as if it were another target. Last year, we showed that, unlike a standard AB, the magnitude of the involuntary AB does not vary with SOA. However, picture duration and SOA were confounded. Follow-up studies are reported in which this confound was removed and in which the picture actually was an intentional target. The take-home message remains substantially unchanged: The involuntary AB is relatively stable in magnitude. It functions more like an all-or-none phenomenon than does the standard AB obtained in two-target procedures.

(3052)

The Attentional Blink: Control Procedures and Relationship to Contingent Capture. LAURA J. FALCON, THOMAS M. SPALEK, & VINCENT DI LOLLO, *Simon Fraser University*—Identification of the second of two targets is impaired if it is presented less than about 500 msec after the first. This attentional blink (AB) occurs under dual-task conditions in which observers are required to report both targets. AB magnitude has been estimated by subtracting the accuracy scores in the dual task from the corresponding scores in a single task in which observers are instructed to ignore the first target. Four experiments showed this subtraction procedure to be inappropriate, because the single task reveals a second-target deficit similar to that in the dual task, implying that the first target cannot be ignored. In addition, as is the case in dual tasks, the single-task deficit is directly related to target–distractor similarity, suggesting that the two deficits may stem from common underlying mechanisms. A parallel with the deficit obtained with the contingent-capture paradigm is discussed.

(3053)

Absence of Perceptual Processing During Task Set Reconfiguration: Evidence From the Attentional Blink and Associative Priming. FRANÇOIS VACHON, MARIE-LAURE B. LAPOINTE, & SÉBASTIEN TREMBLAY, *Université Laval*, & DYLAN M. JONES, *Cardiff University*—When two visual targets (T1 and T2) are presented in a rapid sequence of distractors, processing of T1 produces an attentional blink. Typically, processing of T2 is markedly impaired, except when the targets are adjacent (Lag 1). However, if a shift of task set—a change in task requirements from T1 to T2—occurs, performance at Lag 1 is substantially reduced. The present study sought to determine the fate of T2, when presented during reconfiguration, due to task switching (i.e., at Lag 1). We used an associative priming tech-

nique in which T1 could be either related or unrelated to T2. Priming of T2 by T1 diminished dramatically at Lag 1 when a switch in location (Experiment 1) or in task (Experiment 2) was involved between the targets but remained unaffected at other lags. These results suggest that perceptual processing of T2 cannot be carried out in parallel with task set reconfiguration.

(3054)

A Psychological Refractory Period Investigation of Mental Hand Rotation. ELIZABETH A. FRANZ, TOM NORRIS, & SHELLEY FORD, *University of Otago*—A psychological refractory period (PRP) approach was applied to investigate whether observation of biologically realistic hands might result in direct response activation of the corresponding motor systems. Task 1 required high–low tone discriminations, and Task 2 consisted of left-hand–right-hand discriminations performed under egocentric (easy) and allocentric (difficult) orientations. The interaction between the PRP effect and task difficulty was additive when the response mode involved multiple levels of response selection, referred to as *hierarchical selection* (Experiments 2A and 2B). This interaction was strongly underadditive when a direct stimulus–response (S–R) mapping was used rather than hierarchical selection (Experiments 3A and 3B). Replacing hand stimuli with symbolic arrows (Experiments 4A and 4B) again resulted in strict additivity. We conclude that some central bottleneck operations can be bypassed, provided that hands are used as stimuli and the S–R mapping is direct. These findings provide a cognitive framework for understanding the operation of mirror neurons.

(3055)

The Psychological Refractory Period: Is Response Execution Part of the Processing Bottleneck? ROLF ULRICH & SUSANA RUIZ, *University of Tübingen*, INES JENTZSCH, *University of St. Andrews*, BETTINA ROLKE & HANNES SCHRÖTER, *University of Tübingen*, & HARTMUT LEUTHOLD, *University of Glasgow*—The standard bottleneck model of the psychological refractory period (PRP) assumes that the selection of the second response is postponed until the selection of the first response has been finished. Accordingly, dual-task interference is attributed to a single central processing bottleneck involving decision and response selection, but not the execution of the response itself. In order to critically examine the assumption that response execution is no part of this bottleneck, we systematically manipulated the temporal demand for executing the first response, in a classical PRP paradigm. Contrary to the assumption of the standard bottleneck model, this manipulation affected the reaction time for Task 2. Specifically, reaction time in Task 2 increased with the execution time in Task 1. This carryover effect from Task 1 to 2 provides strong evidence for the notion that response execution is part of the processing bottleneck, at least when Task 1 involves a continuous movement.

(3056)

The Role of Singleton Priming in Visual Search for a Known Feature. DOMINIQUE LAMY & YOAV BAR-ANAN, *Tel Aviv University*, & HOWARD EGETH, *Johns Hopkins University*—We examined three visual search tasks in which the target was defined by a known feature. The target was a singleton on only a minority of the trials, so that singletonness was not a defining feature of the target. We report a new type of intertrial repetition priming that we call *singleton priming* (SP), by which visual search is speeded if the target is a singleton on consecutive trials. We observed SP regardless of whether the target was a singleton on the defining dimension or on an irrelevant dimension. We also provide support for an alternative interpretation of previous findings held to demonstrate that subjects adopt a default singleton detection or salience-based search mode in search for a known singleton: We propose that search for a known singleton relies on a feature-based search mechanism and benefits from implicit memory of the target's salience on previous trials—that is, from singleton priming.

(3057)

Does Memory Retrieval Interference Require A Verbal Competing Task? ANA M. FRANCO-WATKINS, TIM C. RICKARD, & HAROLD PASHLER, *University of California, San Diego*—Fernandes and Moscovitch (2000) found that a (verbal) memory retrieval task suffered interference from a verbal competing task, but not from a numerical competing task. We examined both verbal and numerical competing tasks with varying levels of difficulty. Each of these competing tasks was performed either alone or paired with a memory retrieval task. In addition to analyzing overall performance levels, we conducted a more microscopic analysis of the relative timing of responses on the two tasks in order to shed light on the degree and nature of interference. The results provide little support for the view that memory retrieval is especially susceptible to interference from concurrent verbal processing.

(3058)

Attentional Limits in Memory Retrieval—Revisited. COLLIN GREEN & JAMES C. JOHNSTON, *NASA Ames Research Center*, & ERIC RUTHRUFF, *University of New Mexico*—Carrier and Pashler (1995) concluded that memory retrieval is subject to a central bottleneck. Using locus-of-slack logic in a dual-task paradigm, they provided evidence that memory retrieval (both recall and recognition) on Task 2 was delayed until after the bottleneck caused by performing a tone discrimination Task 1 occurred. New experiments explored the limitations of Carrier and Pashler's conclusions. To increase the likelihood of observing parallel processing during memory retrieval, our experiments used more typical dual-task instructions and used preferred stimulus–response modality pairings. In addition, we considered the hypothesis that central resources are required for the initiation and/or termination of memory retrieval, but not for the retrieval process itself.

(3059)

Probing the Link Between Orienting and IOR Using a Dual-Task Procedure. TROY A. W. VISSER, *University of British Columbia, Okanagan*, ROBERT BOURKE, *University of Melbourne*, & JENEVA L. OHAN, *University of British Columbia, Okanagan*—A nonpredictive visual cue presented at the same location as a target facilitates responses when the interval between cue and target (cue–target onset asynchrony; CTOA) is short (e.g., 100 msec) but slows responses when the CTOA is longer (e.g., 800 msec). This slowing is commonly referred to as *inhibition of return* (IOR). Although, IOR is clearly linked to the attentional shift caused by the appearance of the cue, the relationship between attention and IOR is still unclear. To investigate this issue, the present work combined a conventional cuing paradigm with a dual-task procedure. Observers were presented with a central letter target, followed by a nonpredictive peripheral cue and a peripheral target. The interval between the target letter and the cue was manipulated to vary attentional availability for the cue. Results suggest that limiting attention influenced early facilitation and later IOR, indicating that both effects were subsumed by common mechanisms.

• SPEECH PERCEPTION •

(3060)

The Effect of Word/Emotion Congruency on Dichotic Laterality Effects. CHERYL TECHENTIN & DANIEL VOYER, *University of New Brunswick* (sponsored by Daniel Voyer)—The present study investigated the effect of word/emotion congruency in dichotic listening. Eighty participants were dichotically presented with pairs of words expressing emotions in one of two report conditions (blocked or randomized). Words and emotions were combined in congruent (e.g., “glad” pronounced in a happy tone) and incongruent (e.g., “glad” in a sad tone) pairs. Participants identified the presence of either a target word or an emotion in separate blocks or in a randomized fashion. In addition to an overall right-ear advantage (REA) for words and a left-ear advantage (LEA) for emotions, a material (word or emotion) ×

congruency × ear interaction was obtained only for randomized testing. It indicated an REA for words congruent with the expressed emotion, whereas emotions showed an LEA only for incongruent stimuli. Implications of these findings for research claiming functional complementarity in the cerebral representation of verbal and nonverbal tasks are discussed.

(3061)

Word and Subword Units in Speech Perception. IBRAHIMA GIROUX & ARNAUD REY, *LEAD-CNRS, Université de Bourgogne, Dijon* (sponsored by Arnaud Rey)—Saffran et al. (1996) found that human infants are sensitive to statistical regularities corresponding to lexical units when hearing an artificial spoken language. In order to account for this early word segmentation ability, Simple Recurrent Networks (SRN; Elman, 1990) suggest that associations between subword units are strengthened with time. Alternatively, according to Parser (Perruchet & Vinter, 1998), only lexical units are strengthened independently from the weight of subword units. In the present study, we compared word and subword recognition performance of adults after hearing 2 or 10 min of an artificial spoken language. The data are consistent with Parser's predictions showing improved performance on words after 10 min, but not on subwords. This result suggests that word segmentation abilities are not simply due to stronger subword units' associations but to the emergence of stronger lexical representations during the development of speech perception processes.

(3062)

Using Pronunciation Data to Constrain Models of Spoken Word Recognition. LAURA DILLEY & MARK A. PITT, *Ohio State University*, & KEITH JOHNSON, *University of California, Berkeley*—Many of the mysteries of how spoken words are recognized have evolved out of the observation that the acoustics of speech are highly variable, yet perception is amazingly stable (i.e., listeners perceive the words intended by talkers). Proposed solutions to this perceptual constancy problem can be process oriented, in which mental processes restore or recover the intended word form en route to lexical memory, or representation oriented, in which the variation itself is encoded in the word's lexical entry. The viability of both approaches was examined by studying the phonological and acoustic variability found in the Buckeye corpus of conversational speech, specifically in environments associated with regressive assimilation (“green” becomes “greem” in “green ball”). The results highlight obstacles that models of both classes must overcome.

(3063)

The Perception and Representation of an R-Dropping Dialect. MEGHAN SUMNER & ARTHUR G. SAMUEL, *SUNY, Stony Brook*—Much variation a listener is exposed to is due to differing phonological characteristics of dialects. For example, in American English, speakers of the Long Island dialect (LID) regularly drop the “er” sound word finally (e.g., “mother” sounds similar to “moth-uh”). An important question is how listeners within and across dialects perceive and store such variation. Four speakers from two different dialect groups (LID and non-LID) were used to address this question. Listeners participated in either a long-term priming task or a semantic priming task, with two speakers from each dialect. Examining dialectal variation in this way enabled us to see whether speakers of an r-dropping dialect stored representations similar to their own productions (regardless of the input form). It also clarified whether the predictability of the variation enables non-LID listeners to encode these variants into the already existing representations of their own dialect, or whether they created new speaker- or dialect-specific representations.

(3064)

Orthographic Influence in Phonological Variant Recognition. LARISSA J. RANBOM & CYNTHIA M. CONNINE, *SUNY, Binghamton* (sponsored by Cynthia M. Connine)—Although spoken word recognition is influenced by phonology, orthographic characteristics

of a word may affect the process of spoken word recognition. Two cross-modal recognition priming experiments examined word-final flapping, in which a final /t/ is expressed as a more /d/-like flap. In Experiment 1, a smaller priming effect was found for flapped productions of words such as *eat*, as compared with the typical form. The priming disadvantage for the flapped production may result from the presence of phonological mismatch, the presence of orthographic mismatch, or the presence of both types of mismatch. Experiment 2 used a second class of words, such as *looked*, with a typical spoken form (/lokt/) that does not correspond with their orthography. Flapped productions of these words result in an orthographic match but a phonological mismatch. The flapped productions yielded priming effects comparable to those of the typical productions, suggesting that both phonology and orthographic characteristics influence spoken word recognition.

(3065)

Learning New Phonological Variants in Spoken Word Recognition: Episodes and Abstraction. ELENI N. PINNOW & CYNTHIA M. CONNINE, *SUNY, Binghamton*—We investigated phonological variant acquisition (schwa vowel deletion) for two- and three-syllable words with high and low deletion rates. During training, schwa-deleted variants were presented with a visual version. The test, a lexical decision task, occurred without training (control) or with identical (repetition) or new (transfer) words. Three-syllable words (low deletion) showed a repetition effect, as compared with the control. Two-syllable low-deletion words showed equivalent accuracy gains for repetition and transfer conditions. The transfer effect for two-syllable low-deletion words was replicated using segmentally matched training and test sets. A delay between training and test did not eliminate training effects. Increased stimulus repetition during training did not alter accuracy rates but facilitated responses for low-deletion stimuli. Changing talker voice from training to test did not alter accuracy or reaction time effects. Results are discussed in terms of episodic and abstract representations of spoken words.

(3066)

Performance on a SPIN Task by Second-Language Learners: Effects of Age of Acquisition and Time of Exposure. KIRSTEN M. WESTERGARD & MAGDALENE H. CHALIKIA, *Minnesota State University, Moorhead*—Age of acquisition and time of exposure may account for different language abilities found among second-language learners. Phonological representation may be a more sensitive measure of age of acquisition, since speech-in-noise (SPIN) tasks have previously helped differentiate native from nonnative listeners and early from late bilinguals. College students and elementary school students were given a SPIN task. High- and low-frequency words were presented in silence and in noise. Time of exposure was a covariate. College students perceived significantly fewer words in noise, relative to the younger students, and fewer words in noise than in silence, a finding that was not significant for the younger students. Our results indicate that older students learning a language perform worse on a SPIN task than younger students do. This supports previous hypotheses that learning a language at a younger age can lead to a better phonological representation of L2.

(3067)

Perceptual Adaptation to Spanish-Accented Speech. SABRINA K. SIDARAS, *Emory University*, JENNIFER S. QUEEN, *Rollins College*, & JESSICA E. DUKE & LYNNE C. NYGAARD, *Emory University*—Recent research suggests that adult listeners are sensitive to talker-specific properties of speech and that perceptual processing of speech changes as a function of exposure to and familiarity with these properties. The present study investigates adult listeners' perceptual learning of talker- and accent-specific properties of spoken language. Mechanisms involved in perceptual learning were examined by evaluating the effects of exposure to foreign accented speech. Adult native speakers of American English transcribed English words produced by six native Spanish-speaking adults. Prior to this transcription

task, listeners were trained with items produced by Spanish-accented talkers or with items produced by native speakers of American English, or did not receive any training. Listeners were most accurate at test if they had been exposed to Spanish-accented speech during training. Similar results were found using sentence-length utterances. Even with brief exposure, adult listeners perceptually adapt to both talker-specific and accent-general regularities in spoken language.

(3068)

The Time Course of Audiovisual Integration and Lexical Access: Evidence From the McGurk Effect. LAWRENCE BRANCAZIO, *Southern Connecticut State University and Haskins Laboratories*, JULIA R. IRWIN, *Haskins Laboratories*, & CAROL A. FOWLER, *Haskins Laboratories and University of Connecticut*—Previous findings demonstrated lexical influences on the McGurk effect (visual influence on heard speech with audiovisually discrepant stimuli). We exploited this effect to test whether audiovisual integration precedes lexical activation. Experiment 1 paired auditory words/nonwords (*mesh, met; meck, mep*) with a visual spoken nonword (/nɛ/); participants sometimes perceived words/nonwords (*net, neck* vs. *nesh, nep*) not present in either modality. This McGurk effect was influenced by both auditory lexicality (fewer /n/ responses for *mesh, met* than for *meck, mep*) and integrated lexicality (more /n/ responses for *meck [neck], met [net]* than for *mesh [nesh], mep [nep]*); the latter finding indicates that audiovisual integration precedes lexical activation. Experiment 2 incorporated audiovisual asynchrony to address the time course of these processes. Auditory lead (100 msec) increased the auditory lexicality effect without modulating the integrated lexicality effect, indicating a complex relationship between uptake of auditory/visual phonetic information and lexical access. Implications for speech perception models are addressed.

(3069)

Motion Information Analogically Conveyed Through Acoustic Properties of Speech. HADAS SHINTEL & HOWARD C. NUSBAUM, *University of Chicago*—Language is generally thought of as conveying meaning using arbitrary symbols, such as words. However, analogue variation in the acoustic properties of speech can also convey meaning (Shintel, Okrent, & Nusbaum, 2003). We examined whether listeners routinely use speech rate as information about the motion of a described object and whether they perceptually represent motion conveyed exclusively through speech rate. Listeners heard a sentence describing an object (e.g., *The dog is brown*) spoken quickly or slowly. Listeners then saw an image of the object in motion or at rest. Listeners were faster recognizing the object when speech rate was consistent with the depicted motion in the picture. Results suggest that listeners routinely use information conveyed exclusively through acoustic properties of speech as a natural part of the comprehension process and incorporate this information into a perceptual representation of the described object.

(3070)

Recognition of Basic Emotions From Speech Prosody as a Function of Language and Sex. MARC D. PELL, *McGill University*, SONJA KOTZ & SILKE PAULMANN, *Max Planck Institute for Human Cognitive and Brain Sciences*, & AREEJ ALASSERI, *McGill University* (sponsored by Dorothee J. Chwilla)—This study investigated the vocal expression of emotion in three distinct languages (German, English, and Arabic) in order to understand factors that influence how listeners of each language identify basic emotions from native spoken language input. Two female and two male speakers of each language were recorded producing a series of semantically anomalous “pseudosentences” in seven distinct emotional tones, where the emotion was communicated strictly through vocal-prosodic features of the utterance. A group of 20 native listeners of each language then judged the intended emotion represented by a randomized set of utterances elicited by speakers of the native language in a perceptual judgment task. Findings were analyzed both within and across languages in order to eval-

uate the impact of speaker and listener sex on emotion identification judgments and to compare and discuss how factors of sex and language promoted systematic confusions in the perceptual rating of basic emotions communicated through vocal-prosodic expressions.

(3071)

Negative Emotion Processing: A Prosody-to-Face Interaction Study. LAURA MONETTA & MARC D. PELL, *McGill University* (sponsored by Daniel Levitin)—Previous findings on the facial affect decision task (FADT) suggest that prosodic emotions are processed implicitly and show congruency effects on the face (Pell, 2005). This study focused on the processing of negative emotions, which yield more errors and longer response times than do positive emotions (Pell, 2005). Using the FADT, three negative emotions (sadness, anger, disgust) were presented to 50 young adults, in order to establish whether negative emotional prosody and facial expressions interact differently on the basis of their underlying emotional congruity. Results established that emotional prosody facilitates the accuracy and speed of decisions about congruent face targets, suggesting that information about negative discrete emotions is shared across nonverbal channels. Among the incongruent targets, the results for the anger–disgust interaction shows an ambiguity in the treatment of these two signals.

• BILINGUALISM/SECOND LANGUAGE ACQUISITION •

(3072)

Role of Phrase Prosody and Marker Position in Acquiring a Novel Language. HENRIETTA LEMPERT, *University of Toronto*, & REBECCA L. STEWART, *Western University* (sponsored by Henrietta Lempert)—We examined whether phrase prosody would facilitate acquisition of an artificial language in two versions, a preposed marker dialect (*ie vab o hift wadim*) and a suffix dialect (*vabie hifto wadim*). Prosodic and syntactic boundaries correlated perfectly in the phrase prosody condition, whereas no relevant structural cues were imparted in the monotone prosody condition. No phrase prosody facilitation was detected in preposed marker learners either when written input supplemented auditory input (Experiment 1) or when no written input was available (Experiment 2). Phrase prosody was advantageous for suffix dialect learners but had somewhat specific benefits: It enhanced sensitivity to differences between syllables that could and could not occur at syntactic boundaries but did not seem to facilitate intraphrase analysis. The dialect difference suggests that phrase prosody was informative for learners taught on suffixes but redundant for preposed marker learners.

(3073)

Does Animacy Facilitate Acquisition of English Verb Agreement by Chinese First-Language (CL1) Speakers? HENRIETTA LEMPERT, ALIONA RUDCHENKO, EUGENE MA, & SALIMA SAYEED, *University of Toronto*—Previous research suggests that CL1s rely heavily on animacy to process word order relations in their native language. Do they use animacy to acquire English syntax? CL1s at advanced, intermediate, and low English second-language (EL2) proficiency completed preambles that varied in head noun number, local noun number, and animacy: animate–inanimate (*The sprinter(s) in the race(s) . . . fast*), inanimate–animate (*The letter(s) from the lawyer(s) . . . lost*), and inanimate–inanimate (*The piano(s) for the wedding(s) . . . tuned*). Advanced-EL2 CL1s produced more agreement errors in singular than in plural head fragments; default use of singular *be* resulted in greater plural than singular head agreement errors in low-EL2 CL1s and no head number asymmetry in intermediates. All CL1 levels produced more IA than AI or II errors in the PS condition. In low-EL2 CL1s, an IA > II > AI error pattern in plural head fragments suggests that they use animacy to find the subject of English sentences.

(3074)

With Us or Against Us: Acquiring Categorical Rules Based on Variable Input. MATTHEW GOLDRICK & MEREDITH LARSON,

Northwestern University—Language learners do not always match the variability present in their input (Singleton & Newport, 2004). This study reveals that categorical phonotactics (restrictions on sound sequences) can be acquired on the basis of variable input. In a task developed by Dell, Reed, Adams, and Meyer (2000), adults acquired new phonotactics by reading aloud sequences of syllables where the distribution of a consonant was restricted. Replicating previous results, when the consonant was categorically restricted to one syllable position (e.g., /s/ occurred in onset in 100% of the sequences) participants' speech errors reflected the acquisition of categorical phonotactics. Error outcomes were overwhelmingly restricted to the target syllable position (e.g., /s/ errors almost never appeared in coda). Extending these results, this study shows that when the language learners' input was variable (e.g., /s/ occurred in onset in 60%–80% of the sequences), speech errors were still categorically restricted to one position. Learners appear to assume categorical phonotactics in the presence of variability.

(3075)

The Effect of Gender Transparency on Learning Russian Case Marking. VERA KEMPE, *University of Stirling*, & PATRICIA J. BROOKS, *City University of New York*—In many richly inflected languages, case-marking paradigms (i.e., declensions) coincide with grammatical gender categories. Our study varied morphophonological gender-marking regularity to explore its effect on adult L2 learners' acquisition of Russian case marking. Group 1 encountered only nontransparently gender-marked nouns (i.e., masc and fem nouns ending in palatalized consonants): Here, the most successful learners associated prepositions with case inflections, as indicated by systematic gender confusion errors (e.g., producing the fem-locative instead of the masc-locative suffix). Group 2, encountering only transparently gender-marked nouns, committed mostly case confusion errors (e.g., producing the fem-dative instead of the fem-genitive suffix), which indicates that gender formed the basis for learning case marking. Despite overall superior performance in Group 2, rates of case confusion errors for novel nouns in a generalization test were comparable across groups: Apparently, discovery of underlying grammatical categories (even morphophonologically transparent ones) is difficult for adult L2 learners faced with morphological complexity, and learning is largely item based.

(3076)

Comparison of Implicit and Explicit Learning of Russian Grammatical Gender. YELENA A. KOSHELEVA, *University of Nebraska, Lincoln* (sponsored by John H. Flowers)—Participants naive to Slavic languages were presented with either a rule-based or an exemplar-based training session on Russian grammatical gender. Learning accuracy was then assessed with a gender decision task. A cue-to-category strength analysis was implemented (MacWhinney, 1987) to predict specific learning and error patterns. Model predictions matched the performance of the exemplar-based (implicit learning) training group but were unrelated to the performance of the rule-based (explicit learning) training group. Furthermore, the error patterns observed in implicit learning mirrored those in the normal course of grammatical gender acquisition by Russian children. These findings demonstrate that even following a very brief exposure to exemplars (but not to explicit grammatical rules), structure induction and resulting performance patterns take place in adult learning in a manner highly similar to that experienced by children in natural language learning.

(3077)

The Eyebrows Have It: Evidence for the Activation of Two Grammars in ASL–English Bilinguals. JENNIE E. PYERS, *University of California, San Diego*, & KAREN D. EMMOREY, *San Diego State University* (sponsored by Karen D. Emmorey)—Research with bilinguals indicates that the lexicons of both languages are always active even during language-specific production. However, it is not clear whether the

grammars of both languages are similarly active. Bimodal (sign–speech) bilinguals fluent in American Sign Language (ASL) and English can simultaneously produce signs and speech. To determine whether the syntax of ASL was active during conversations with monolingual English speakers, we examined the production of English conditionals in bimodal bilinguals. ASL signers syntactically mark conditionals by raising their eyebrows while signing the conditional clause. Ten bimodal bilinguals and 10 monolingual English speakers produced conditional sentences in conversation with a monolingual English speaker. When talking with a monolingual English speaker, bimodal bilinguals incorporated the facial grammar of ASL, whereas monolingual English speakers demonstrated no consistent use of facial expression during their production of conditionals. These results support a model in which the grammars of both of a bilingual's languages are active.

(3078)

Tip-of-the-Tongue States in Spanish–English Bilinguals. ELAINE C. FERNANDEZ & SHELIA M. KENNISON, *Oklahoma State University* (sponsored by Charles Abramson)—The research investigated the role of meaning and sound in the occurrence of tip-of-the-tongue (TOT) states in Spanish–English bilinguals. Participants were instructed to produce English words when cued with a definition, which was presented in English. When participants did not produce the correct target, a secondary task was performed. Participants rated a Spanish word for ease of pronunciation. Spanish words were related to the English target in meaning and sound (cognate), in meaning only (noncognate translation equivalent), or in sound, but not in meaning (false cognate). Following the secondary task, participants were shown the definition and were given a second try at producing the target. Performance was best following the rating of cognates, worst following the rating of noncognate translation equivalents, and intermediate following the rating of false cognates. The results demonstrated that both meaning and phonology contribute to the occurrence of TOT specifically and of word-finding difficulty in general.

(3079)

Cross-Language Activation of Phonology in Bilingual Production. NORIKO HOSHINO & JUDITH F. KROLL, *Pennsylvania State University* (sponsored by Viorica Marian)—Bilinguals are faster to name a picture in one of their two languages when the picture's name is a cognate translation (e.g., *guitar*–*guitarra*) than when the picture's name is a noncognate translation (e.g., *shirt*–*camisa*). In the present study, we asked whether cognate facilitation in picture naming would be obtained for bilinguals whose two languages differ in script and, therefore, do not share orthography. Spanish–English and Japanese–English bilinguals named cognate and noncognate pictures in English, their L2. Cognate facilitation was observed for both groups, suggesting that even when the bilingual's two languages do not share script, there is activation of the phonology of the nontarget language. Monolingual picture naming showed none of these effects. Implications for models of bilingual word production, particularly for the way in which script and orthography influence lexical selection, are discussed.

(3080)

Do Spanish Tables Have Curves? A Semantic Priming Investigation of Linguistic Relativity. TAMAR DEGANI & NATASHA TOKOWICZ, *University of Pittsburgh*, & BRIAN MACWHINNEY, *Carnegie Mellon University*—Do native speakers of a language with a grammatical gender system semantically process inanimate nouns in terms of their grammatical gender? For example, do native Spanish speakers think of tables as having feminine qualities because the Spanish word for table (“*mesa*”) takes the feminine gender? Native Spanish speakers named visually presented inanimate nouns that were primed by animate or inanimate nouns that either matched the target in gender (matched condition) or did not (unmatched condition). We reasoned that if grammatical gender is represented as part of the semantic representation, matched pairs would be treated as semantically related pairs and would be processed more quickly than unmatched pairs. Al-

ternatively, if the grammatical gender system is separate from the semantic representation, we would expect no priming effect for matched, relative to unmatched, pairs. Methodological efforts were made to minimize strategic processing. Results are discussed in relation to linguistic relativity and grammatical priming.

(3081)

Increased Inhibitory Control During Second-Language Immersion. JARED A. LINCK & JUDITH F. KROLL, *Pennsylvania State University*—Even the most proficient bilinguals are incapable of ‘turning off’ their L1 (e.g., Colomé, 2001; Dijkstra & Van Heuven, 2002), resulting in cross-language competition. Although some models of bilingual lexical access include a well-specified inhibitory control mechanism to resolve this competition (e.g., Green, 1998), its course of development throughout L2 acquisition remains unclear. This study tests the hypothesis that an immersion environment benefits L2 learners, because of the increased opportunities to effectively inhibit the L1. Participants included native English speakers studying abroad in Spain and a control sample from the same American university with similar classroom experience only. Evidence from translation recognition and verbal fluency tasks suggests that the L1 is more effectively inhibited in the immersion environment than in the classroom. We discuss the implications of these results for models of lexical access and inhibitory control in bilinguals and for developmental accounts of the acquisition of L2 lexical proficiency.

(3082)

Anaphoric Pronoun Resolution in French as a Second Language: ERP Evidence. ALICE FOUCCART & CHERYL A. FRENCK-MESTRE, *Université de Provence*—In two ERP experiments, we investigated the processes involved in agreement between an anaphoric pronoun and its referent. In the first, native speakers showed a significant P600 effect in response to anaphoric violations in French. In the second, results showed a significant P600 response for proficient German–French late bilinguals that was similar in amplitude and latency to that found for native speakers. The present ERP study thus suggests that the early processes involved in anaphoric pronoun resolution, both as a first and as a second language, tend to be more syntactic than semantic in nature. The similarity of patterns for the late bilinguals and native speakers mimics the results of previous bilingual ERP studies focusing on the processing of grammatical gender within the DP (Fouccart & Frenck-Mestre, 2004). These results are also consistent with models that propose that L2 grammatical processing, even when begun late, can achieve native-like levels (Herschensohn, 2000).

(3083)

About Boys and Girls: Learner Strategies in Foreign Language Learning. ANGELA BRUNSTEIN & JOSEF F. KREMS, *Technische Universität Chemnitz*—Adult L2 learners often encounter difficulties in learning the gender of nouns. Preceding studies have demonstrated that learners can use the sex of presented referents as a cue for choosing the correct article for unfamiliar nouns. The present study investigated whether or not this strategy is language specific. One hundred eighty participants rated the sex of persons out of the Harry Potter story for 42 name–picture pairs consisting of male or female names combined with pictures of male, female, or unidentifiable persons. In correspondence with studies on gender, participants integrated both sources of information in judging the sex of characters. They preferred one source of information for their choice—namely, the hint presented by the pictures, instead of the names. Moreover, their answers were biased to more “male” than “female” answers. Altogether, results of this study can count as evidence that learners can use language-unspecific heuristics for learning grammar in foreign languages.

(3084)

Statistical Word Segmentation in a Bilingual Environment. DANIEL J. WEISS & HENRY GERFEN, *Pennsylvania State University* (sponsored by Judith Kroll)—Word segmentation is a challenge for language

learners, especially given the absence of invariant cross-linguistic cues. However, studies using artificial language streams indicate that infants and adults can use statistics to correctly segment words from the speech stream. To date, studies have utilized a single input language. However, since bilingualism is common worldwide, it is crucial to determine how multiple language input might be segmented. Our study addresses this issue by employing artificial language streams to simulate the earliest stages of segmentation in adult L2 learners. In three experiments, we required participants to track multiple sets of statistics for two artificial languages. The results demonstrate that adult learners can track two sets of statistics simultaneously, suggesting that they can form multiple representations when confronted with bilingual input. This work addresses a central issue in bilingualism research—namely, determining at what point listeners can form multiple representations when exposed to multiple languages.

• DISCOURSE PROCESSES •

(3085)

Idiom Familiarity and Semantic Decomposition: Evaluating a Hybrid Model of Idiom Processing. MAYA LIBBEN & DEBRA A. TITONE, *McGill University* (sponsored by Debra A. Titone)—The hybrid model of idiom comprehension (Titone & Connine, 1999) hypothesizes that semantic decomposition effects decrease as idiom familiarity increases. We evaluated this hypothesis in a study where native English-speaking participants rated 221 “verb the noun” idioms (e.g., *meet your maker*) on several linguistic dimensions, including familiarity, meaningfulness, global decomposability, and decomposability of the verb and the noun individually ($n = 30$ per dimension). Multiple regression analyses indicated that global decomposability ratings significantly predicted meaningfulness for low-familiar idioms, but not for moderately or highly familiar idioms. Moreover, when global decomposability was partitioned into that of the noun or the verb individually, noun, but not verb, decomposability significantly predicted meaningfulness. These data suggest that semantic decomposition, largely driven by nouns in “verb the noun” idioms, occurs for low-familiar idioms that do not benefit from a robust phrasal representation. Speeded meaningfulness judgments are being obtained to determine whether these effects extend to online processing.

(3086)

On Reversing the Topics and Vehicles of Metaphor. JOHN D. CAMPBELL & ALBERT N. KATZ, *University of Western Ontario* (sponsored by Albert N. Katz)—Class inclusion theory asserts that one cannot reverse the topic and vehicle of a metaphor and still produce a meaningful metaphor based on the interpretive ground found for the metaphor in its canonical order. In two studies, we test that claim. We replicate the seminal study that provided support for the claim but now add conditions that place both canonical and reversed metaphors in discourse contexts supporting the interpretive ground used to interpret the canonical metaphors (Study 1). In Study 2, online processing of the metaphors in context were examined in a word-by-word reading task. Both studies indicate that metaphors can be reversed, contrary to claims of class inclusion theory. Nonreversibility cannot be taken as a necessary condition of metaphor.

(3087)

Representations of Argument Predicates. CHRISTOPHER KURBY & M. ANNE BRITT, *Northern Illinois University*, & CHRISTOPHER R. WOLFE, *Miami University* (sponsored by Christopher R. Wolfe)—While reading, people create multiple levels of representation simultaneously: a verbatim and a gist representation (Kintsch & van Dyke, 1978). According to the fuzzy trace theory, people reason from the least precise level that they can—that is, the most gist-like representation (Brainerd & Reyna, 1992). Despite the need for precision in representing argument, we found that undergraduates relied on a gist representation. Approximately 28% of the time, they could not state the specific predicate of the claim (i.e., stance) to which they had just

made an agreement or quality judgment. We rule out several alternative explanations (e.g., near-perfect recall of argument themes and event predicates). This lack of precision is specific to stances and, we believe, is a result of underdeveloped argumentation schemas (in the vein of pragmatic reasoning schemas and thematic frames). We present an analysis of several stance schema, such as legalize and harmful.

(3088)

Factors Influencing Cross-Language Word Transfer in Bilingual Text Processing. DEANNA FRIESEN & DEBRA JARED, *University of Western Ontario* (sponsored by Debra Jared)—The present study investigated bilinguals’ mental representations of texts, using a repeated reading paradigm. Specifically, it examined whether the memory representation formed after a text is read in one language includes surface form information that is available when a subsequent text is read in another language and whether such transfer depends on a repeated story context and second-language skill. Target words were cognates, which have the same surface form and meaning in two languages. Skilled and novice English–French bilinguals’ eye movements were tracked while they read five pairs of passages. Passages overlapped completely (language, story, words), in story and target cognates, in story only, in target cognates only, or not at all. Fixation latencies on cognates in the second passages in each pair depended on the nature of the overlap between passages in a pair, the language of the second passage, and second language skill. These results suggest that surface form information from a passage read in one language can influence subsequent reading in another language in some circumstances.

(3089)

The Influence of Partner-Specific Memory Associations on Picture Naming. WILLIAM S. HORTON, *Northwestern University*—According to the memory-based view of common ground (Horton & Gerrig, 2005), conversational partners automatically cue the retrieval of partner-specific information from memory. In two experiments, this claim was tested by having participants first complete a task during which each of two partners provided category clues (“a bird”) to help solve a series of visual word fragments (O_T_IC_). Then, participants named a series of pictures in the presence of each partner, and the current partner was either the same or a different individual as the person associated with each critical picture label (e.g., *ostrich*). A final memory test asked participants to identify the partner with whom they had seen the critical words during the first task. Participants were fastest to produce names associated with the current partner, and such partner-specific priming was not correlated with source recall. Domain-general implicit memory mechanisms can make partner-relevant information more immediately accessible during language processing.

(3090)

Impact of Speaker Coordination Varies With Speaker Perspective: Evidence From Request-to-Commit Dialogues. PAUL C. AMRHEIN, *Montclair State University*—The influence of perspective taking on the illocutionary strength of performative speech acts under conditions of variable speaker coordination was investigated. Participants judged speaker committedness (Experiment 1) or speaker imposition (Experiment 2) for request-to-commit dialogues; requesting verbs (e.g., *ask, suggest, challenge, demand*) and committing verbs (e.g., *promise, agree, hope, guess*) were systematically varied. Judgments were made from the requester’s or committer’s perspective. Results supported the posited independent contribution of speaker intentions (e.g., \pm desire, \pm ability) for requesting verbs (denoting requester-perceived enablers of, or obstacles to, the committer making an ideal verbal commitment) and committing verbs (denoting committer-acknowledged enablers or obstacles). Extent of mismatch in intention polarity between requesting and committing verbs reduced verb distinctiveness, especially from the committer’s perspective. When interverb intention polarity matched, speaker perspectives exhibited congruent judgments. These findings demonstrate how variance in speaker coordination can arise through conveyed verb meaning and how its impact depends on speaker agenda.

(3091)

The Pragmatics of Acknowledging “Thanks” for a Favor. ALBERT N. KATZ, MELONY LENHARDT, & KIRSTEN MITCHELL, *University of Western Ontario*—In two studies, we examined how and why people respond as they do when acknowledging thanks for doing a favor. From one perspective, these acknowledgments are not cognitively active and are, thus, interchangeable. From another perspective, acknowledgments are active and are, consequently, shaped to the discourse contexts in which they are embedded. In two studies, participants were asked to imagine a set of scenarios in which one person asked them for a favor and, after that favor had been performed, expressed “thanks.” Our participants either were asked to produce an acknowledgment (Study 1) or were to choose one of two possible acknowledgments (Study 2). Unknown to our participants, we manipulated the cost of the favor and whether it was made by a male or a female acquaintance. The data indicate that we shape our acknowledgments as a function of cost and the gender of our audience.

(3092)

Does Negated Understatement Act Like Irony? KRISTEN E. LINK & LINDS CONROW, *SUNY, Oswego*—The larger contrast inherent in using irony may be responsible for its ability to express condemnation, humor, and contrast better than understatement, whereas understatement protects the speaker better than irony (Colston & O’Brien, 2000). Research also suggests that negation weakens the interpretation of irony, rather than causing a literal interpretation (Giora et al., 2005). We hypothesized that negated understatement would be read as less understated (more ironic) than understatement and would accomplish discourse goals similar to irony. Participants read scenarios in which characters commented on situations, using irony, understatement, negated understatement, or literal statements, and rated the extent to which they were condemning, humorous, protective of the speaker, and contrasting of differences. Results for irony and understatement were consistent with previous research. Negated understatements were rated as more condemning and less protective of the speaker than were understatements. However, humor and contrast ratings for understatements and negated understatements were similar.

(3093)

Gestures and Diagrams for Thinking and Communicating. ANGELA KESSELL & BARBARA TVERSKY, *Stanford University* (sponsored by Gordon H. Bower)—What are gestures used for? Some say for thinking, whereas others say for communication. Here, participants were videotaped while solving spatial insight problems and then explaining their solutions. All participants were free to gesture, and half were provided with pen and paper. During silent solution, problems with high spatial memory demands elicited gesture and diagramming, suggesting that gestures serve like diagrams to alleviate spatial working memory. Similarly, during spoken explanation, participants used diagrams only for problems with high spatial memory demands. In contrast, during explanation, participants used gestures for all problems. Moreover, during explanation, all participants using a diagram gestured on it. Overall, it appears that gestures and diagrams serve thinking especially by alleviating spatial memory demands. Additional gestures adopted in communication appear to illustrate solution enactment and to advance the discourse.

(3094)

Um, the Effects of Pauses in Discourse on Comprehension. ADRIENNE Y. LEE, SARAH GILLIAM, CHERYL BIRON, JENNIFER SHODA, & PETER W. FOLTZ, *New Mexico State University*—This study examined the effects of *uh* and *um* on comprehension and whether gender of speaker played a role. Participants listened to one tape created by either a male or a female speaker, in which there were either *uhs* and *ums* inserted or no *uhs* and *ums*. Listeners answered comprehension questions, questions about the speaker, and questions about the number of *uhs* and *ums* heard. When asked how many *uhs/ums/errors* they had heard, participants in the *uh/um* conditions

heard more *uhs/ums/errors* than did those who heard the material without *uhs/ums*. The judgment of the speaker (such as *honest, educated, intelligent, articulate*, etc.) was higher when there were no *uhs/ums* and when a female spoke. Comprehension was higher when the speaker was judged more positively. No differences based upon participant gender were found. Thus, pauses in speech and the gender of the speaker indirectly affect comprehension.

(3095)

Comprehension of Speeded Discourse by Younger and Older Listeners. MICHAEL S. GORDON, *University of South Alabama*, & MEREDYTH DANEMAN & BRUCE SCHNEIDER, *University of Toronto, Mississauga* (sponsored by Meredyth Daneman)—This research examined the comprehension of connected discourse by younger and older adults. The participants were presented narratives of several minutes duration that were either unsped or doubled in speed. The method of speeding was designed to minimize sensory distortions to the signal, such that the changes would not disproportionately tax the older adults’ sensory abilities, relative to the younger adults’. It was found that older and younger adults suffered the same amount of performance degradation when the narratives were speeded, in both noisy and quiet conditions, and performed comparably throughout testing. The analogous performance of the older and younger adults may suggest that the rich context in discourse may partially alleviate age-related changes in hearing and cognition.

(3096)

Temporal Sequences and Causal Relations in Story Comprehension. JACQUELINE WANIEK, *Keio University*, & JOSEF F. KREMS, *Technische Universität Chemnitz* (sponsored by Josef F. Krems)—Previous studies have shown that discourse structure influences the comprehension of temporal order relations. We argue that the effect of discourse structure will diminish when temporal sequences are constructed on the basis of underlying causal relations. In Experiment 1, two event sequences varying in discourse structure were presented, and recall of temporal event sequences with and without underlying causal relations was tested. Discourse structure affected recall of temporal event sequences only when causal relations were absent. In a second experiment, before a text with backward discourse structure was read, preinformation (causal/temporal) was provided. Temporally prior information facilitated only recall of temporal event sequences without underlying causal relations. In contrast, causal preinformation facilitated only recall of temporal event sequences with causal relations. The results demonstrate that readers used causal information to construct temporal event sequences. The discourse structure affected understanding of temporal order relations only when causal cues were absent.

(3097)

Putting Things Together: Memory Mechanisms Underlying the Benefits of Multimedia Learning. TAD T. BRUNYE & HOLLY A. TAYLOR, *Tufts University*, & DAVID N. RAPP, *University of Minnesota*—Multimedia instructions may be ideal for learning assembly procedures, because they can explicitly convey verbal, spatial, and temporal relationships. Previous research has demonstrated general processing advantages for multimedia-based presentations but has ignored the cognitive systems that may underlie these advantages. The present work examines the role of working memory subsystems (Baddeley, 1992) during multimedia experience. Participants studied procedural instructions presented in picture-only, text-only, or multimedia formats. They simultaneously completed tasks designed to selectively interfere with working memory subcomponents or with overall updating processes. A general multimedia advantage for procedural learning was obtained. The results additionally revealed (1) dissociable involvement of working memory subsystems, depending on presentation format, and (2) general learning decrements when sequential updating was impeded. These results outline memory mechanisms that may underlie multimedia comprehension. They

also extend recent work on the benefits of multimedia learning (Gyselinck et al., 2002; Mayer, 2001).

(3098)

The Role of Conceptual Relations in Recognition Memory. LARA L. JONES, ZACHARY ESTES, & RICHARD L. MARSH, *University of Georgia*—We assessed whether conceptual relations (WOOL BLANKET: made of) facilitate recognition memory for the constituent concepts (WOOL and BLANKET), as suggested by the relational information hypothesis (Humphreys, 1976). In each experiment, participants judged the sensicality of word pairs prior to a surprise recognition memory test. Experiment 1 showed that recognition memory for word pairs was facilitated by relational information. In Experiment 2, relational information facilitated memory for the modifier (WOOL), but not for the head noun (BLANKET), and only when the same relation was instantiated at study and test. Experiment 3A replicated this result with individual, rather than paired, presentation of words at test. When the memory test was not a surprise, in Experiment 3B, conceptual relations did not facilitate memory. Results support the relational information hypothesis and suggest that relational information is more strongly associated with the modifier than with the head noun (Gagne & Shoben, 1997).

• REASONING •

(3099)

The Role of Interpretation in Causal Learning. CHRISTIAN C. LUHMANN, *Vanderbilt University*, & WOO-KYOUNG AHN, *Yale University* (sponsored by Woo-Kyoung Ahn)—When learning causal relations from covariation information, do people give causal interpretations to covariation as it is encountered, or is covariation simply recorded verbatim for later causal judgments? Participants in Study 1 performed a causal learning task and were asked to periodically interpret observations. Participants' interpretations were context sensitive; identical observations were interpreted differently when encountered in different contexts. These interpretations also predicted their final causal strength judgments. Those who were influenced more by initial covariation (primacy effect) tended to interpret later observations as consistent with initial covariation. Conversely, those who were influenced more by later covariation (recency effect) tended to interpret later observations as consistent with later covariation. When participants in Study 2 were required to predict the presence of the effect on each trial, overall recency effects were obtained, but interpretations were still context sensitive and predicted causal strength judgments. We discuss the difficulty these results pose for current models.

(3100)

The Influence of Virtual Sample Size on Confidence in Causal Judgments. MIMI LILJEHOLM & PATRICIA CHENG, *UCLA*—We investigated the extent to which confidence in causal judgments varied with virtual sample size—the frequency of cases in which the outcome is (1) absent before the introduction of a generative cause or (2) present before the introduction of a preventive cause. Participants were asked to evaluate the influence of various candidate causes on an outcome, as well as their confidence in judgments about those influences. They were presented with information on the relative frequencies of the outcome, given the presence and absence of various candidate causes. The study manipulated these relative frequencies, sample size, and the direction of the causal influence (generative vs. preventive). We found that confidence varied with virtual sample size and that both confidence and causal strength ratings showed a clear, and previously undocumented, asymmetry between the two causal directions.

(3101)

The Useful Application of a Discounting Heuristic in Causal Inference. KELLY M. GOEDERT, *Seton Hall University*, & SARAH A. LARSON, *Pacific Lutheran University*—Previously, we demonstrated

that people reduce their causal effectiveness ratings of a moderately effective cause in the presence of a highly effective one (i.e., discounting; Goedert & Spellman, 2005). Here, we assess whether participants recruit this discounting heuristic because it is useful. In positive outcome situations, finding one cause may be good enough. With negative outcomes, one must find all possible causes to eliminate an aversive event. Participants received contingency information about potential causes of either a positive outcome (medications leading to allergy relief) or a negative outcome (environmental irritants causing allergies) over 72 trials. In both situations, a moderately effective cause was learned about in the presence of an alternative that was either highly effective or not at all effective. Participants discounted the moderately effective cause in positive, but not negative, outcome situations. These results suggest that participants selectively recruit the discounting heuristic when finding that only one cause is sufficient.

(3102)

Darwin and Design: Do Evolutionary Explanations Require Understanding Evolution? TANIA LOMBROZO, *Harvard University* (sponsored by Yuhong Jiang)—Three experiments examined the relationship between knowledge of causal mechanisms and explanatory understanding. In Experiment 1, 64 participants identified statements that would falsify a functional explanation for an artifact (a product of human design) or a biological part (a product of natural selection). Although participants judged functional explanations for artifacts and biological parts equally satisfying, they were significantly worse at identifying statements that falsify evolutionary explanations. Experiments 2 ($N = 72$) and 3 ($N = 36$) showed that participants' judgments of the goodness of evolutionary explanations are uncorrelated with their ability to identify statements that falsify the explanation and that the inability to identify falsifying statements results from a poor understanding of the mechanisms by which natural selection operates. The feeling of understanding that accompanies an evolutionary explanation may result from knowledge that an underlying mechanism that parallels human design exists (namely, natural selection), no matter that the mechanism is not understood.

(3103)

Priming Category and Analogy Relations During Relational Reasoning. ADAM E. GREEN, JONATHAN A. FUGELSANG, KEVIN A. SMITH, & KEVIN N. DUNBAR, *Dartmouth College*—Green, Fugelsang, and Dunbar (2004) have demonstrated that the processing of analogies primes two kinds of underlying relations, category and analogy relations, and that these primed relations have an effect on subsequent tasks. In Green et al. (2004), we found that this priming interfered with performance in a Stroop task. Here, using a naming task and the same stimuli, we hypothesized that processing of analogies should facilitate reading of words that refer to category and analogy relations. Results were consistent with this hypothesis, and we discuss the results with respect to models of analogical reasoning and priming effects.

(3104)

Cue Competition With Continuous Cues and Outcomes. JASON M. TANGEN, BEN R. NEWELL, & FRED WESTBROOK, *University of New South Wales* (sponsored by Ben R. Newell)—The simplest measure of causal inference is based on the presence or absence of causes and effects. Traditionally, animal and human contingency learning experiments have investigated the role of these binary events that do not capture the nature of most everyday assessment tasks. In a basic two-phase design (Phase 1, A+/B−; Phase 2, AC+/BD+), animals tend to respond less to C (blocking) than to D (superconditioning). We employ this design with human participants and use continuous cues and outcomes, rather than binary events (i.e., different quantities of liquid resulting in various levels of plant growth). Under these conditions, we demonstrate that the differential treatment of C and D in the second phase disappears. Although conditional contingency has been discussed at length with respect to binary events, we will discuss the role of its continuous analogue in human covariation assessment.

(3105)

Emotion, Experiential Congruity, and Content Type in Conditional Reasoning. SHARON LEE ARMSTRONG, *La Salle University*—Neutral content has been shown to produce superior validity judgments in conditional arguments over content that is incongruent with real-world experience. This study additionally examined the role of the emotional content of conclusions. Forms of arguments and types of congruity relationships were varied (e.g., psychological laws, social rules, moral principles). Arguments with conditional premises that were consistent with life experiences were easier to evaluate than arguments posed in neutral terms, and difficulty increased when the content was incongruent with experience. The nature of the incongruity mattered; subjects were especially helped or hurt (relative to congruity) by the moral rules. Although conclusion affect had no effect, this does not mean that there were no emotional responses that mediated performance. States of affairs that violate certain expectations may evoke an emotional response that is more intense than the response to states of affairs judged pleasant or unpleasant out of context.

(3106)

Conditional Reasoning, Conditional Probability, and the “Fast” System. JOHN BEST, *Eastern Illinois University*—Dual-process theories of reasoning suggest that conditional reasoning may be accomplished by two systems: (1) a fast, associative system that operates probabilistically and (2) a slower system that may be cognizant of principles of logical necessity. When applied to conditional reasoning (If P then Q), dual-process theorists have suggested that the fast system may perform a conditional probability computation, converting the statement above to a computation of the Prob (Q/P). However, when people were invited to use conditional reasoning to draw deductions from an array of information in which the conditional probability of certain conclusions had been varied, the findings showed that the variability with which people drew particular inferences was not accounted for by variations in the actual conditional probability of those inferences. Rather, people’s deductions were based on much cruder measures of frequency and covariation, and such deductions were as likely to be inaccurate as they were to be correct.

(3107)

Availability in Inductive Reasoning. PATRICK SHAFTO, *Massachusetts Institute of Technology*, & JOHN D. COLEY & DAVID BALDWIN, *Northeastern University* (sponsored by John D. Coley)—Previous research presents conflicting evidence about novices’ use of context to selectively guide induction. We propose that patterns of inference result from the relative availability of different kinds of knowledge. We present three experiments examining the use of taxonomic and ecological knowledge in folk biological induction. In Experiment 1, familiarity with taxonomic and ecological relations was not sufficient to induce selective inferences about novel properties, diseases, and toxins shared by taxonomically and ecologically related species; novice participants relied disproportionately on taxonomic knowledge. In Experiment 2, novices’ judgments of similarity for ecologically, but not taxonomically, related species were sensitive to priming. In Experiment 3, time pressure disproportionately reduced novices’ ecological, but not taxonomic, inferences. Together, these studies show that mere possession of relevant knowledge is not sufficient for fostering context-sensitive inferences and that differences in the availability of taxonomic and ecological knowledge account for novices’ patterns of inference.

• JUDGMENT AND DECISION MAKING •

(3108)

Intuitive Judgments of Semantic Coherence Under Different Response Deadlines. ANNETTE BOLTE, *Technische Universität Braunschweig*, & THOMAS GOSCHKE, *Technische Universität Dresden*—Intuition is the ability to judge stimulus properties on the basis of information that is activated in memory but not consciously retrieved. We investigated one central feature of intuitive judgments—namely,

their speed. Participants judged whether or not three clue words were coherent, in the sense that they were weakly associated with a common fourth concept. To restrict the time available for conscious deliberation of possible solution words, participants had to synchronize their judgments with a response signal appearing at different lags after the clue words. In two experiments, participants discriminated coherent and incoherent triads reliably better than chance even if they did not consciously retrieve the solution word and even when the lag between clue words and response signal was as short as 1.5 sec. Results indicate that intuitive judgments can indeed be made very fast and without extended conscious deliberation. Possible mechanisms underlying intuitive judgments are discussed.

(3109)

Cheater Recognition and the Avoidance of Exploitation in Social Exchange. DAN L. BOYLL, SONYA M. SHEFFERT, STEVEN M. COLARELLI, & BRYAN GIBSON, *Central Michigan University*—An understanding of natural selection as a gene-level phenomenon requires that we understand group-directed behavior, such as cooperation, as having evolved because it is individually advantageous. This appears paradoxical in light of the possibility for ostensibly cooperative individuals to “cheat” by exploiting others’ cooperative actions. However, game theoretic models predict that cooperation can evolve if cooperators selectively avoid attempting to cooperate with known “cheaters.” Unfortunately, observed recognition biases favoring cheaters do not speak to a human capacity for cheater avoidance. However, these biases could nevertheless prove to have adaptive value if they somehow serve to facilitate cheater avoidance. The present study therefore attempted to replicate previous findings regarding two types of cheater recognition biases, which differ importantly in their operational definitions of “cheaters” and “noncheaters.” In addition, the present study directly measured cheater avoidance, in order to assess the possibility that such recognition biases could have adaptive value.

(3110)

Age Differences in the Influence of Belief and Evidence on Contingency Discrimination. SHARON A. MUTTER, LAURA M. STRAIN, & LESLIE F. PLUMLEE, *Western Kentucky University*—This study examined the impact of belief confirming and disconfirming evidence on young and older adults’ discrimination of contingent and noncontingent relationships. Participants completed contingency problems in which prior beliefs about the relationship between two events (i.e., positive, negative, unrelated, none) were combined orthogonally with new contingency evidence (i.e., positive, negative, zero). Baseline contingency estimates were influenced only by prior belief. After receiving new contingency evidence, older adults showed less accurate contingency estimation, especially for negative contingencies. Younger adults’ estimates improved when the evidence confirmed either a positive or a negative belief, whereas older adults’ estimates improved only when the evidence confirmed a positive belief. There were no age differences when evidence disconfirmed a negative belief, but older adults’ estimates were more biased when evidence disconfirmed a positive belief. These findings suggest that older adults are both less sensitive to negative contingencies and more influenced by prior positive beliefs.

(3111)

Resonance-Based Retrieval and the Hick–Hyman Law. RANDALL K. JAMIESON, *McMaster University*, & DOUGLAS J. K. MEWHORT, *Queen’s University*—Response latency is a linear function of stimulus uncertainty, a result known as the Hick–Hyman law. Although the law is highly reliable, the mechanism underlying it is unknown. By simulation, we show that a theory of retrieval based on a resonance metaphor captures Hyman’s (1953) classic demonstration of the law. The simulation demonstrates that complex rulelike behavior can be reproduced by applying a resonance-based retrieval mechanism to an instance-based record of experience.

(3112)

Behavior Guiding Perception: The Visual, Verbal, and Haptic Reports of Trained and Untrained Observers. ELIZABETH A. CAMPBELL & DAVID L. CARPENTER, *St. Bonaventure University*—Glider pilots, at some point, learn how to judge glide slope, yet it is unclear exactly how this is learned. Research has shown different levels of accuracy for different response modes in judging slopes. This study attempted to determine which modality is the most accurate. Another contradiction this study examined was that previous research shows differing glide slopes at which individuals perform the most accurately. Finally, it has been theorized that behavior causes perception, rather than the reverse, which perceptual-matching tasks exemplify and this study attempted to test. This study compared the judgment of glide slope for untrained and trained observers, while also examining the difference between three modes for responding: haptic (touch) perceptual matching, visual perceptual matching, and verbal reports of visual judgments for five glide slopes (25:1, 20:1, 12.5:1, 10:1, 5:1). It was determined that training has a significant effect on slope only within the verbal condition at the optimal slope, the 12.5:1 slope.

(3113)

Sampling and Choice Under Competition for Resources. RUSSELL C. BURNETT, YAAKOV KAREEV, & JUDITH AVRAHAMI, *Hebrew University of Jerusalem*—In such diverse contexts as stock trading and mate selection, choices are often made under competitive conditions where collecting more information about options incurs higher risk of losing desirable options to competitors. We examined how people approach this tradeoff between goodness of evidence and availability of options by having participants sample from urns containing different proportions of winning chips. The first to stop sampling and select an urn received payment based on the proportion of winning chips in that urn, leaving the other participant to receive payment based on a remaining urn. Preliminary findings include the following: (1) Competition for resources led people to make large sacrifices in goodness of evidence. (2) Nevertheless, people were not less confident in their decisions under competition. (3) People exhibited a tendency to sample from an urn that a competitor had not recently sampled from, apparently seeking out private knowledge.

(3114)

Understanding Randomness: Errors of Judgment in the Generation of Random Sequences. SUSAN F. BUTLER & RAYMOND S. NICKERSON, *Tufts University* (sponsored by Raymond S. Nickerson)—The generation of random sequences has been used as a means of demonstrating participants' misunderstandings of randomness. Critical criteria for comparison were generated from both computer simulations and actual flips of real coins. In either case, the sequences generated by participants were significantly different from the critical criteria for randomness generated by either the computer simulation or the coin tosses.

(3115)

Optimal Predictions in Everyday Cognition. THOMAS L. GRIF-FITHS, *Brown University*, & JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology* (sponsored by Joshua B. Tenenbaum)—Human perception and memory are often explained as an optimal statistical inference, informed by accurate prior probabilities. In contrast, cognitive judgments are usually viewed as following error-prone heuristics, insensitive to priors. We examined the optimality of human cognition in a more realistic context than those in typical laboratory studies, asking people to make predictions about the duration or extent of everyday phenomena, such as human life spans, the box-office take of movies, or how long they might wait for a bus. Our results suggest that everyday cognitive judgments follow the same optimal statistical principles as perception and memory and reveal a close correspondence between people's implicit probabilistic models and the statistics of the world.

(3116)

The Influence of Pre- Versus Postdecisional Advice on Likelihood Estimates. DAVID G. SMITH, JOSEPH V. BARANSKI, MATTHEW J. DUNCAN & DAVID R. MANDEL, *Defence R&D Canada*—When making judgments in complex and ambiguous environments, people often have the option of consulting an advisor. We report an experiment examining how novices make judgments in a naval air threat assessment simulation. On each trial, the participant integrates a series of probabilistic cues in an attempt to determine the likelihood that an aircraft is hostile (as opposed to friendly). We manipulated whether advice is given before or after the participant's initial judgment. Our results demonstrate that advice has a stronger impact on the final judgment if it is given after the participant's initial judgment. We discuss hypotheses as to why the timing of advice has a strong effect and explore implications.

(3117)

The Comparison-to-the-Strongest Heuristic in the Frequency Format. KUNINORI NAKAMURA & KIMIHIKO YAMAGISHI, *Tokyo Institute of Technology*—Recent studies have revealed that probability judgment is often sensitive to variations in how alternative outcomes are distributed, even when such variation have no bearing on the objective probability of the focal outcome. Windschitl and Wells (1998) pointed out that people use the comparison-to-the-strongest heuristic in probability judgment. In a typical task in these studies, participants answered how they felt about their chances of winning the gamble by single-event likelihood. This study investigated whether people use the comparison-to-the-strongest heuristic when questions of probability judgments are provided by frequency format ("If you play this gamble 100 times, how often would you feel you win this gamble?"). Participants estimated their winning probabilities of the gamble, and the type of the question formats were manipulated ("If you play this gamble 1 time/10 times/100 times"). The results indicated that the use of frequency format reduced the use of the comparison-to-the-strongest heuristics.

(3118)

Unbending the Inverse S-Shape: Testing an Adaptive Explanation for Probability Weighting. JING QIAN & GORDON D. A. BROWN, *University of Warwick* (sponsored by Evan Heit)—The probability weighting function (PWF) in prospect theory (Kahneman & Tversky, 1979) has received considerable empirical support but, arguably, lacks independent motivation. This paper offers an adaptive account for probability weighting, suggesting that the observed PWF may reflect the asymmetrical and bimodal distribution of probabilities encountered in typical experiments and in the natural world. On the basis of range frequency theory (Parducci, 1963, 1995), it is predicted that the extent of the over- and underweighting of probabilities directly reflects the density distribution of experienced contextual probabilities. In Experiment 1, this hypothesis is confirmed by modeling rated everyday occurrence frequencies of 99 probabilities. In Experiment 2, we collected subjective probabilities derived from a simple gambling experiment, in which the probabilities were samples from a bimodal distribution in one condition and from a unimodal distribution in another. The results again support the hypothesis.

(3119)

Context-Specific Schemata Affect Judgments of Witness Credibility. PAULA J. WADDILL, RICHARD ARLEDGE, & SHANNON MCBRIDE, *Murray State University*—Judgments of others' emotional reactions are influenced by the gender of the person displaying the emotion and the context in which it is displayed. Women are expected to be more emotional in interpersonal contexts, and men to be more emotional in achievement contexts (Kelly & Hutson-Comeaux, 1999). Furthermore, emotional display may result in negative sanctions if the display is judged inappropriate in degree or form (the emotional double-bind; Kelly & Hutson-Comeaux, 2000). In a set of two experiments,

we tested the hypothesis that context-specific gender–emotion schemata affect judgments of witness credibility. Participants listened to the testimony of either a male or a female witness displaying one of three emotional states in one of two contexts (character witness, eyewitness) and judged the credibility of the witness. Results indicated that different combinations of factors affected judgments in the two witness contexts. The findings highlight the contribution of gender–emotion–context schemata to judgments in forensic contexts.

(3120)

Representation in Decision Making: Individuation Affects Sensitivity to Relative Considerations. DANIEL M. BARTELS, *Northwestern University*, & RUSSELL C. BURNETT, *Hebrew University of Jerusalem* (sponsored by Douglas L. Medin)—Decisions often permit absolute and relative considerations, and these may favor different choices. Consider deciding between saving 60 of 240 lives at risk and saving 50 of 100 lives. The first maximizes absolute number saved; the second, proportion saved. Although sometimes nonnormative, people often base decisions such as these partly on relative considerations. We aim to explain this effect in cognitive terms, proposing that one determinant of the weights given to absolute and relative considerations is the degree to which resources are construed as individuals versus collections. We report several studies in which construal of resources was manipulated via perceptual triggers such as independent versus joint motion (which has been shown to promote construal as individuals vs. collections). Relative considerations were less influential when resources were construed as individuals, but this effect was moderated by framing (gains vs. losses) and by another perceptual factor (whether objects appeared discrete).

(3121)

Triplet Triangulator Calculator: Displays Data Triplets in a Triangle. ROBERT M. HAMM, *University of Oklahoma Health Sciences Center*—Many data sets include partitions into three categories: A, B,

and C. Readily available displays compare pairs of categories, such as A versus B or C, thus making some relations easier to see than others. Graphing a triplet of numbers ($0 < A, B, C < 1$; $C = 1 - A - B$) as a point in an equilateral triangle, using trilinear coordinates allows consideration of all relations, unbiased except for up/down and left/right perceptual preferences. An Excel calculator (TripTria.xls at <http://www.fammed.ouhsc.edu/robhamm/cdmcalt.htm>) produces such plots. Application to the following types of data is demonstrated: (1) allocations of time among three activities, (2) strength of preference among three options, (3) distribution of test responses among “right,” “wrong,” and “don’t know.” It is proposed that this display may enhance readers’ comprehension and recall of triplets of data and may facilitate decision making when there are three options and when outcomes are contingent upon three possible events.

(3122)

Extending the SNARC Effect: Spatial Components in the Mental Representations of Numbers, Symbols, and Percepts. SAMUEL SHAKI, *College of Judea and Samaria*, & WILLIAM M. PETRUSIC, *Carleton University* (sponsored by William M. Petrusic)—In each of four experiments requiring pairwise comparative judgments, SNARC effects were obtained. With comparison of the numerical magnitude of pairs of positive numbers, response times (RTs) were shorter with the left hand than with the right when the numbers were small, but they were longer with the left hand than with the right when the numbers were relatively large. This effect was obtained both with the instruction to select the smaller digit in the pair and with that to select the larger digit in the pair. Symbolic comparisons with perceptual referents (e.g., size of animals) and comparisons with stimuli on a perceptual continuum (visual extent) showed an instruction-dependent SNARC effect. With the instruction to select the stimulus lower on the underlying attribute, SNARC effects typically obtained with numbers occurred. However, with the instruction to select the stimulus higher on the attribute, reverse SNARC effects were obtained.

POSTER SESSION IV
Sheraton Hall, Saturday Noon, 12:00–1:30

• 3-D AND MOTION PERCEPTION •

(4001)

Visual Characteristics of Biological Motion: Investigations With a New Stimulus Set. JOHN A. PYLES, EMILY D. GROSSMAN, & DONALD D. HOFFMAN, *University of California, Irvine* (sponsored by Myron L. Braunstein)—Biological motion research typically uses *point-light* animations depicting highly constrained and familiar human movement. To investigate the visual characteristics critical for invoking perception of biological motion, we have created a new stimulus set based on computer generated *creatures* that possess novel, coherent motion and appear biological. Our results from a perceived animacy rating experiment confirm that the creatures are perceived as *alive*. In a second experiment, we measured noise tolerance thresholds for upright and inverted human, animal, and creature animations. Inversion of point-light animations reduces sensitivity to biological motion and is thought to reflect configural processing. We found a reduced inversion effect for creature and animal animations, relative to the human sequences. Our results provide evidence for the importance of motion in perceived animacy and of familiarity and body structure in biological motion perception.

(4002)

Is Action Observation Synonymous With Action Prediction? GERTRUDE RAPINETT, *Max Planck Institute for Human Cognitive and Brain Sciences*, GÜNTHER KNOBLICH, *Rutgers University, Newark*, MARGARET WILSON, *University of California, Santa Cruz*, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—When we observe someone performing an action, we can predict, to some extent, the outcome of the observed action. Action prediction may be a corollary of the involvement of the observer's action system during the perception of actions performed by conspecifics (Kilner, 2004). The aim of these experiments was to identify which attributes of an action enable an observer to anticipate the future consequences of actions. More specifically, we investigated whether the kinetics of an action (dynamic/static), the congruency between the action grip and the target object (power/precision), and the functional relationship between the action and the target object (related/unrelated) effect the accuracy of prediction. Participants were presented with images from different points in the movement trajectories and were required to predict the outcome. Kinetic information modulated most strongly the accuracy of prediction. Possible mechanisms involved in action prediction based on the observer's action system are discussed.

(4003)

Implicit Action Encoding Influences Personal Trait Attribution. PATRIC BACH, CHARLES E. LEEK, & STEVEN P. TIPPER, *University of Wales, Bangor*—To-be-executed actions and observed actions activate overlapping action representations. A consequence of this vision–action matching process is that producing actions one simultaneously observes will be easier than producing different actions. For example, when observing another person kick a ball, a foot response to identify a stimulus will be faster than a response with a finger. In contrast, observing a person press a key will facilitate a finger response relative to a foot response. We demonstrate that compatibility between perceived actions and executed responses can also influence the personality traits attributed to the viewed person. These vision–action–personality effects can be observed both with an explicit rating measure and when measured implicitly with a priming procedure.

(4004)

Improving Distance Estimation in Immersive Virtual Environments. ADAM R. RICHARDSON & DAVID WALLER, *Miami University* (sponsored by Yvonne Lippa)—It is well known that distances are un-

derestimated in computer simulated (virtual) environments, more so than in comparable real-world environments. Three experiments examined observers' ability to use explicit (Experiments 1 and 2) or implicit (Experiment 3) feedback to improve the accuracy of their estimates of distance in virtual environments. Explicit feedback (e.g., "You estimated the distance to be 2.4 meters, the actual distance was 4.5 meters") improved the accuracy of observers' distance estimates, but only for the trained type of distance estimate (egocentric or exocentric) and the trained type of response (direct or indirect blindfolded walking). Interestingly, brief closed-loop interaction with the virtual environment (i.e., implicit feedback) also resulted in near-veridical distance estimation accuracy.

(4005)

Misperceived Heading and Steering Errors Occur When Driving in Blowing Snow. BRIAN P. DYRE & ROGER LEW, *University of Idaho*—Driving through blowing snow creates a transparent optical flow with two foci of expansion (FOEs). Previous research showed that such optical flow produces systematic errors in judgments of the direction of heading when the FOEs are misaligned (nonrigid). Here, we examined whether these errors generalize to control of heading in a more realistic simulation: driving across a textured ground plane through blowing snow. Participants were instructed to steer a simulated vehicle such that they maintained a straight path while crosswinds caused snow to move at varying angles (0°–64°) relative to the initial direction of translation. For nonzero angles, a pattern of systematic steering errors was found where smaller angles biased steering away from the FOE defined by the snow, and larger angles biased steering toward the snow's FOE. These results show that misperception of heading from nonrigid transparent optical flow can cause systematic errors in the steering of simulated vehicles.

(4006)

Perceptual Learning and the Visual Control of Collision Avoidance. BRETT R. FAJEN, *Rensselaer Polytechnic Institute*—What distinguishes experts from novices performing the same perceptual–motor task? The superior performance of experts could be attributed, in part, to a form of perceptual learning known as *perceptual attunement*. In this study, perceptual attunement was investigated using an emergency braking task in which participants waited until the last possible moment to slam on the brakes. Biases resulting from the manipulation of sign radius and initial speed were used to identify the optical variables upon which participants relied at various stages of practice. I found that biases that were present early in practice diminished or were eliminated with experience and that the optical variables to which observers became attuned depended on the range of practice conditions and the availability of information. Perceptual attunement resulting from practice on emergency braking transferred to normal, regulated braking, suggesting that perceptual attunement plays an important role in learning to perform a visually guided action.

• MUSIC COGNITION •

(4007)

Repetition Priming in Music Performance. SEAN HUTCHINS & CAROLINE PALMER, *McGill University*—Four experiments addressed the role of implicit memory in a music production task. Singers heard short melodies of predetermined length and sang the final tone as quickly as possible. We manipulated whether the final tone (target) was a repetition of a previous melodic tone (prime) and the distance (intervening tones) between prime and target tones. Experiment 1 manipulated prime–target distance along with stimulus length, whereas Experiment 2 manipulated prime–target distance independently of stimulus length. Experiments 3 and 4 also manipulated the stimulus rate (tempo). Experiment 1 showed a significant benefit of repetition priming on singers' response latencies. Experiment 2 showed a benefit for repetition at shorter prime–target distances and a benefit for expected (tonic) endings over less expected (nontonic) endings. Re-

sponse latencies in Experiments 3 and 4 showed entrainment to stimulus rate, and repetition priming was modulated by tonal expectedness. We discuss cognitive factors that can affect auditory repetition priming.

(4008)

Is Categorical Perception of Musical Intervals a Short-Term Memory Phenomenon? SINI E. MAURY, *University of Helsinki*, & ELISABET M. SERVICE, *University of Helsinki and Dalhousie University* (sponsored by Elisabet M. Service)—This study explores whether categorical perception of musical intervals can vary as a function of immediate memory load caused by interference from other sounds in a sequence. In a two-interval same–different discrimination task, musicians heard melodic intervals in isolation or embedded in four-note sequences. Half of the interval pairs were similar, and half were derived either from the same or from a different interval category. The results showed that discriminability measured by d' was significantly higher for intervals straddling the category boundary. This effect was even more pronounced when intervals formed a part of a melodic sequence. This could mean that categorical perception is a short-term memory phenomenon in which degraded auditory traces are repaired with top-down categorical information. The results also imply that the categorical information retrieved in the repair process takes the form of the prototype of the category and is not general knowledge about category membership.

(4009)

Musicians, Intermediate Musicians, and Nonmusicians' Perception of Bitonality. MAYUMI HAMAMOTO, MARGARET P. MUNGER, & KYOTA KO, *Davidson College*—Bitonal music is characterized by a dissonant “crunch” sound that had been believed to be clearly audible by everyone (Wolpert, 2000). However, Wolpert found that nonmusicians did not identify bitonality in a free response task. The present study replicated Wolpert's findings but also had participants rate song clips for preference, correctness and pleasantness. Monotonal music was rated higher on all dimensions, independently of the individual's level of musical training. In addition, following a brief training session, nonmusicians (less than 1 year of musical training) identified the tonality of the final clips at equivalently high rates as the intermediate (mean, 2.4 years) and expert (mean, 9.2 years) musician groups.

(4010)

Cross-Modal Perception of Contour: The Role of Surface Correlation and Fourier Analysis Similarity. JON B. PRINCE & MARK A. SCHMUCKLER, *University of Toronto, Scarborough*—The perceived similarity of cross-modally presented contours was investigated with two experiments. The combination of surface correlation and Fourier analysis techniques allows quantitative descriptions of both global and local contour information. Experiment 1 investigated auditory–visual similarity by presenting a tonal melody followed by a line drawing and asking participants to rate the similarity between the two. Both stimuli were coded as integer series representing pitch or vertical height, respectively. Ratings were predicted by the surface correlation between the melody and the drawing (the correlation of the two integer series). Experiment 2 reversed the order of presentation by presenting the drawing first, followed by the melody. Surface correlation again predicted similarity ratings, in addition to amplitude and phase components derived from a Fourier analysis model. These results validate the Fourier analysis model of contour cross-modally, particularly when participants must attend to the global character of visual and auditory contours.

(4011)

Effect of Encoding Processes on Remembering Melodies. ESRA MUNGAN & ZEHR A. PEYNIRCIÖĞLU, *American University*—In this study, both musicians and nonmusicians were asked to study a list of highly familiar melodies, using four different orienting tasks. Two were conceptually driven (continuing the melody and judging the

mood conveyed by the melody), and two were data driven (counting the number of long notes and tracing the melodic shape). The study phase was followed by an incidental free-choice recognition test. Findings showed that for nonmusicians, conceptually driven orienting tasks led to better memory performance than did data-driven orienting tasks, whereas for musicians the reverse was true. These findings are discussed within the transfer-appropriate-processing framework.

(4012)

The Relationship Between Emotions Expressed and Elicited by Music and the Effect of Familiarity. OMAR ALI & ZEHR A. PEYNIRCIÖĞLU, *American University* (sponsored by Zehra F. Peynircioğlu)—We examined the effects of melodies on participants' ratings of emotionality. The intensity of the ratings was higher when participants were asked to judge the emotion that was expressed by a melody (i.e., how happy/sad/calm/angry is this music?) than when they were asked to judge the emotion elicited by the same melody (i.e., how happy/sad/calm/angry does this music make you feel?). This pattern held across all four of the emotions and also even when the melodies were made familiar through repetition. In addition, positive emotions (i.e., happy and calm) were rated higher than negative emotions (i.e., sad and angry). Finally, for both types of ratings (i.e., conveying or eliciting the emotion), the ratings in response to the repeated melodies were higher, but only for the sad and calm emotions.

• EVENT COGNITION •

(4013)

Time Estimation and Fluency in Event Perception. MACKENZIE GLAHOLT, AVA ELAHIPANAH, ANTHONY R. MCINTOSH, & EYAL M. REINGOLD, *University of Toronto, Mississauga*—Intervals in which familiar stimuli (e.g., words) are presented are judged as longer than equal duration intervals in which unfamiliar stimuli are presented (e.g., nonwords). This perceptual illusion may result from the misattribution of the enhanced perceptual fluency associated with processing familiar stimuli. We investigated whether a similar phenomenon occurs in the perception of events. To manipulate event familiarity, we used 2-sec video clips of collisions between hockey players, played forward or in reverse. Reversed clips were closely matched to forward clips in terms of low-level perceptual characteristics, but they depicted events that violated physical laws and, as such, were unfamiliar. Participants judged reverse clips as having shorter duration and faster motion, as compared with forward clips. These findings replicate and extend the findings with linguistic stimuli.

(4014)

From Seeing to Remembering Events in Time. SHULAN LU, *Texas A&M University, Commerce*—Everyday events have beginnings, ends, and intervals. These temporal parameters have different combinations, and events have dynamic temporal trajectories. Previous research tends to assume that events follow one another and that subevents occur sometime in between. Recently, studies have begun to suggest that people may make finer grained temporal links than we previously thought. What kind of temporal properties get preserved more robustly? Participants viewed animations of fish-swimming events, where test events were embedded in a schema. For example, a group of fish chased away other fish. In Experiment 1, participants made judgments about the temporal relation of two given events immediately after they had viewed each animation. In Experiment 2, participants made judgments after viewing each animation and then drawing a maze for 25 sec. The results showed that people did not remember the time interval that occurred between two events but robustly preserved the overlap between events.

(4015)

Event Recognition in Free View and at an Eyeblick. REINHILD GLANEMANN, CHRISTIAN DOBEL, & PIENIE ZWITSERLOOD, *Westfälische Wilhelms-Universität Münster*—Recent studies demonstrated that brief visual presentation (around 20 msec) of photoreal-

istic stimuli allowed for semantic categorization. We examined the uptake of visual information from highly complex scenes with two actors involved in a meaningful action (agent position was balanced). Participants' task was to indicate the patient's position by buttonpress. Eyetracking revealed the tendency to fixate agents and action regions first. In most cases, both actors were inspected before an overt response was made. However, brief presentation (150 msec) of stimuli also produced highly accurate answers (about 95% correct). Under this condition, correct naming of actions was achieved only where body posture allowed few alternative actions. Apparently, visual event recognition is characterized by a rapid analysis that allows for role identification and a subsequent period of attention shifts that are necessary for more complex processes, such as verb retrieval.

(4016)

Event Clustering and Event Chaining: Associations in Autobiographical Memory. JENNIFER M. TALARICO, *Duke University* (sponsored by David C. Rubin)—Previous research has identified “event-clusters” as groups of autobiographical memories that cue one another, that share narrative elements, and that are thought to inform our understanding of autobiographical memory organization. However, the way in which these memories are recalled (event cuing) may determine a specific retrieval strategy, and it may be this strategic retrieval that produces the similarities between memories, not overall memory organization. A similar paradigm, “memory chaining,” has been developed that relies on associatively cued memories that is believed to be a more effective procedure for revealing the structure of autobiographical memory.

(4017)

Do Observers Encode Goal–Subgoal Structure Through Embodied Simulation? BRIDGETTE MARTIN, SANDRA C. LOZANO, & BARBARA TVERSKY, *Stanford University*—Hierarchical encoding of activities—that is, segmenting them into discrete actions organized as goals and subgoals—enhances learning (Martin, Lozano, & Tversky, 2005). Surprisingly, segmenting and describing actions from the actor's perspective promotes hierarchical encoding and learning more than does segmenting and describing them from one's own perspective (Lozano, Martin, & Tversky, 2005). Are enhanced hierarchical encoding and learning achieved through embodied simulation of observed actions? To test this, participants segmented an assembly task that they later performed, without warning. Participants segmented and described the activity from an actor- or self-perspective while attending to (1) movements of objects to different table sides, (2) actions completed on different table sides, or (3) actions completed by different hands. In accord with embodied simulation, hierarchical encoding and learning were best for actor-perspective describers who attended to action by hand, then to action by table side and object movement. For self-perspective participants, the order was reversed.

(4018)

The Effects of Elaboration on Confidence Inflation for Counterfactual Events. DIANNE M. LEARNED & MARIA S. ZARAGOZA, *Kent State University* (sponsored by F. Robert Treichler)—Imagination Inflation is the finding that imagining counterfactual autobiographical events from childhood increases participants' confidence that the events transpired. Participants who imagine events are usually asked to elaborate on different aspects of the false events. However, it has been shown that participants are more likely to misattribute false events to a witnessed crime if they are asked to elaborate on the false events (Drivdahl & Zaragoza, 2001). The present study attempts to explore the effects of elaboration on confidence inflation for imagined counterfactual events. Three groups of participants were asked to imagine counterfactual events. The number of elaboration questions asked for each event varied between groups: six, three, or zero. The results of this study indicate that participants are more likely to increase in confidence and to endorse memories for counterfactual life events the more they are asked to elaborate on the events.

• IMAGE PROCESSING •

(4019)

Using Visual Masking to Explore the Nature of Scene Gist. LESTER C. LOSCHKY, *Kansas State University*, AMIT SETHI & DANIEL J. SIMONS, *University of Illinois, Urbana-Champaign*, & DANIEL OCHS, JEREMY CORBIELLE, & KATIE GIBB, *Kansas State University*—We used visual masking to explore scene gist acquisition and to determine whether the meaning of a mask or its spatial frequency amplitude spectrum contributes more to visual masking of scene photographs. We systematically varied the recognizability of scenes, as both targets and masks, by parametrically randomizing their image phase, while maintaining their spatial frequency amplitude spectra. Increasing phase randomization reduced scene recognition and induced less masking of other scenes. Several types of meaningless masks that varied in spatial frequency amplitude spectra were equally ineffective—all were substantially less effective masks than were recognizable scenes. Together, the results of four experiments suggest that scene meaning plays a greater role in masking visual scenes than does the match in the amount of energy at various spatial frequencies. This further supports the psychological construct of conceptual masking and calls into question the value of spatial frequency amplitude information for acquiring scene gist.

(4020)

Correlating Adjacent Local Texture Elements to Recognize Natural Scenes. HIROYUKI WASHINO, *Kyoto University*, & JUN SAIKI, *Kyoto University & JST*—Our visual system can rapidly recognize complex natural scenes in the visual world. An important issue is how much bottom-up processing alone can account for scene categorization. Some previous works proposed that statistics of spatial frequencies or local texture elements are useful for rapid scene categorization (e.g., *natural/artificial* or *forest/other*). In this study, we proposed a computational model of basic-level scene categorization (e.g., *forest, kitchen*, etc.) that used the correlation of adjacent local texture elements. To examine this correlation's efficiency in scene recognition, we investigated how people categorize a visual scene having only limited exposure time. Human accuracy data as a function of exposure time were well accounted for by the model using the number of sampled texture elements. The confusion matrices of humans and the model did not significantly differ. These results suggest that the correlation of local texture statistics can account for our scene categorization performance.

(4021)

Effects of Zoom and Field of View on Relative Distance Judgments. JOCELYN M. KEILLOR, PAYAL AGARWAL, & JENNIFER JEON, *Defence R&D Canada*, & MICHAEL E. PERLIN, *CMC Electronics*—When a nonorthogonal sensor image is projected onto a rectangular display, the observer is not typically shown the viewing frustum and may, therefore, be unable to compensate for the ensuing distortion. The present experiment was designed to evaluate whether this type of distortion affects relative distance judgments. In a synthetic environment, three different fields of view were selected by adjusting zoom such that the size of a central object remained the same in all three conditions but the surrounding objects were subject to differential foreshortening and size distortion as a function of condition. In addition, a moving sensor was simulated to determine whether motion parallax allowed viewers to overcome any effects of the different fields of view and zoom settings. Despite the presence of multiple cues to depth in the scene, relative depth judgments were affected by the distortion introduced by the projection, and the addition of motion parallax did not reduce this effect.

(4022)

“Lightning Bolts” Reveal Categorical Coding of Relative Orientation. ERIC E. COOPER, GLENN E. CASNER, & ALEXANDER M. O'BRIEN, *Iowa State University*—The research tested whether orientation is categorically coded during object perception for T-vertex,

L-vertex, and X-vertex angles. On each trial, subjects were first shown two cylinders with a particular angle between them (e.g., 70°). Subjects then decided which of two angles (one 5° greater than the first and one 5° smaller) was physically closer to the first. By examining the proportion of times the larger of the two angles was chosen, it is possible to determine exactly where the category boundaries for the coding of relative orientation occur during object perception. Strikingly, the location of the category boundaries was highly dependent on the type of angle tested, suggesting that the visual system is making sharp distinctions between the different angle types.

(4023)

When Does a Picture Become Interesting? JODI L. DAVENPORT, *Massachusetts Institute of Technology*—The gist of a picture is available in the first 100 msec. However, an unusual or especially interesting picture is likely to have a more detailed gist. Does additional conceptual information influence memory? If so, when? Pictures in the interesting condition were collected from the Most Emailed section of the Yahoo! website and were matched with a control from the same basic-level category. Experiment 1 tested short-term recognition memory after RSVP at SOAs of 160 or 320 msec. Memory for interesting and control pictures did not differ. Experiment 2 tested longer term recognition memory after long RSVP sequences at SOAs of 750 or 2,000 msec. Interesting pictures were now remembered more accurately than controls, suggesting that the meaning of a picture evolves over time. Conceptual information that makes a picture more interesting is available only with a longer look.

(4024)

Effects of Semantic Features on Processing of Words and Pictures. IAN S. HARGREAVES, JAMIE POPE, & PENNY M. PEXMAN, *University of Calgary*—In a feature-listing task, participants are able to list many semantic features for some concrete nouns (e.g., *lion*) and fewer for others (e.g., *lime*). Pexman, Holyk, and Monfils (2003) found a number of features (NOF) effect, such that words with more features produced faster processing in semantic tasks. In the present research, we examined two issues: (1) whether particular types of features (functional, distinctive, visual, etc.) are responsible for the NOF effect and (2) whether NOF effects could be elicited using pictorial stimuli. Tasks included semantic decisions about words and pictures, lexical decision, and picture naming. Results showed that NOF effects were not attributable to any particular feature type, except under conditions where certain feature types were highly task relevant. Results are interpreted as support for distributed representation of semantic information.

(4025)

The Time Course of Orientation Congruency Effects. MARKUS GRAF, *Max Planck Institute for Human Cognitive and Brain Sciences*, & SEBASTIAN HORN, *Albert-Ludwigs-Universität Freiburg*—Plane-rotated objects are recognized better when viewed in the same orientation as a different object presented immediately before. Therefore, it has been proposed that object recognition involves coordinate transformations—that is, an adjustment of a perceptual coordinate system that aligns memory and input representations (Graf, Kaping, & Bühlhoff, 2005). In the present study, we investigated the time course of the orientation congruency effect. Two plane-rotated objects from different categories were presented sequentially. The presentation time of the second object was adjusted such that accuracy was about 50% correct. The stimulus onset asynchrony (SOA) between the two objects was 50, 250, or 500 msec. Benefits for congruent orientations were found for 50- and 250-msec SOAs but were absent for an SOA of 500 msec. These results indicate that orientation congruency effects are relatively short-lived. This may explain why orientation congruency effects were absent in some previous experiments.

(4026)

The Oblique Effect in Drawing. ROBERT J. MILLER, *SUNY, Brockport*—In 88 museum paintings, Latto and Russell-Duff (2002) showed

that artists used more horizontal and vertical lines than oblique lines. They concluded that this was a reflection of the traditional “oblique effect.” Alternative explanations, however, are that a quadrilateral frame may induce such preferences and/or the fact that most of the paintings were representational and the real world is more horizontal and vertical than oblique. Sixty-three undergraduates drew two pictures, one representational and the other abstract, on round sheets of paper (eliminating any quadrilateral framing influence). Fewer oblique than horizontal or vertical lines were used in representational drawings. However, for the abstract pictures there was no difference among the three orientations. Similar results occurred for line length. It was concluded that the “oblique effect” reported by Latto and Russell-Duff was, at least in part, a reflection of the subject matter of the paintings, rather than of an inherent preference for horizontal and vertical lines.

(4027)

Stability of Aesthetic Preference for Art in Alzheimer’s Patients. ANDREA R. HALPERN, *Bucknell University*, & MARGARET G. O’CONNOR, JENNIFER LY, & MEREDITH HICKORY, *Harvard Medical School*—Two studies explored the stability of preference orderings of art postcards in three different styles over 2 weeks among early-stage Alzheimer’s disease (AD) patients and age-matched control participants. Generally, both groups maintained about the same ordering over sessions, despite above-chance recognition memory in the controls and at-chance recognition memory in the patients. Among patients, degree of dementia predicted less preference stability, and memory and language performance predicted stability in styles in which objects could be named, but not for the abstract style. Since performance on a control task of size ordering pictures of objects was nearly perfect for everyone, we conclude that AD patients have enough visuospatial skills and aesthetic sense to respond to art in a consistent way. However, impaired naming and memory may affect response to some art styles.

(4028)

Do Members of Different Professions Have the Same Type of Imagery? OLESSIA BLAJENKOVA & MARIA KOZHEVNIKOV, *Rutgers University, Newark* (sponsored by Maria Kozhevnikov)—The goal of this research was to investigate differences in imagery abilities between various groups of professionals. Natural scientists, visual artists, architects, and humanities professionals were administered two types of visual imagery tests. Spatial imagery tests assessed participants’ abilities to process spatial relations and perform spatial transformations, whereas object imagery tests assessed participants’ abilities to process the literal appearance, color, shape, brightness, and texture of objects. The main distinction found was between scientists and visual artists: Visual artists scored highest on object imagery and lowest on spatial imagery tests, whereas scientists scored highest on spatial imagery and lowest on object imagery tests. Our findings suggest that even though both visual artists and scientists extensively use visual imagery in their work, they do not have the same visual imagery abilities and that they, in fact, tend to excel in only one type of imagery.

• PROSPECTIVE MEMORY •

(4029)

The Retrospective Component of Prospective Memory: Relationship to Prospective Component Success. LIANNA R. BENNETT & DEBORAH M. CLAWSON, *Catholic University of America*, & KATRINA S. KARDIASMENOS, *Catholic University of America & Washington Neuropsychological Institute*—Prospective memory, remembering to carry out planned actions, consists of two components: prospective (remembering to act at the correct time) and retrospective (remembering the correct action). Both components were examined using the “Virtual Week” board game. Unlike in previous experiments, on trials in which participants failed to act, the experimenter prompted for the retrospective component. The first prompt was nonspecific (“Is there something you forgot to do recently?”). A second prompt in-

cluded the specific cue (e.g., “Was there something you were supposed to do at 10:00?”). We found that participants using the implementation intentions strategy performed no differently than controls. Of the correct actions participants gave during prompting, 31% were in response to the nonspecific prompt. Participants gave the correct action on 86% of trials when they had remembered to act, but on only 32% of trials when they were prompted, evidence supporting the non-independence of the prospective and retrospective components.

(4030)

Evidence for Spontaneous Retrieval Processes in Prospective Memory. GILLES O. EINSTEIN, *Furman University*, MARK A. MCDANIEL, *Washington University*, & MATT LARSON, MATT McDERMOTT, & LEAH RUSINKO, *Furman University*—According to the multiprocess theory (McDaniel & Einstein, 2000), prospective memory retrieval can be accomplished by controlled monitoring for target events or by reflexive processes that spontaneously respond to the presence of target events. The purpose of this research was to test for the existence of spontaneous retrieval processes. In the first experiment, we discouraged monitoring by heavily emphasizing the speed of performing the ongoing task. Despite no significant costs of performing a prospective memory task on the ongoing task being found, prospective memory performance was high. In the second experiment, participants were given the prospective memory task of pressing a key whenever either of two target events occurred. They were then told to suspend this intention during an intervening task. Slowed responding to target items appearing in the intervening task suggested spontaneous retrieval. Taken together, these experiments provide evidence for the existence of spontaneous retrieval processes in prospective remembering.

(4031)

Monitoring in Event-Based Prospective Memory: Retrieval Mode Instantiation Plus Target Event Checks. MELISSA J. GUYNN, *New Mexico State University*—Prospective memory can be mediated by monitoring for the targets that indicate when it is appropriate to execute the intended action. A dual-process theory proposes that monitoring entails instantiating a retrieval mode plus checking for the targets. Two experiments provide evidence for these processes. Monitoring was indexed by impairment on nontarget trials of a reaction time task. Greater impairment on experimental trials (i.e., there was a goal to execute an intention) when a target could appear in five locations than when a target could appear in one location provided evidence for target checking. Greater impairment on control trials (i.e., there was not a goal to execute an intention) when participants had been instructed about the prospective memory task than when participants had not been so instructed, and the fact that performance on control trials was not affected by the one-location versus five-location instruction, provided evidence for instantiating a retrieval mode.

(4032)

Implementation Intentions and Prospective Memory. REBEKAH E. SMITH, *University of North Carolina, Chapel Hill*, & MELISSA D. MCCONNELL & JENNIFER C. LITTLE, *University of North Carolina, Greensboro*—Prospective memory involves remembering to perform an action in the future, such as remembering to stop at the store on the way home from work. Chasteen, Park, and Schwarz (2001) found that prospective memory performance could be improved with implementation intention instructions (Gollwitzer, 1999). The present study uses a multinomial model (Smith & Bayen, 2004) to investigate how implementation intention instructions affect the underlying cognitive processes that determine successful prospective memory performance.

(4033)

Prospective Memory, Instructions, and Personality. JIE GAO, CARRIE CUTTLER, & PETER GRAF, *University of British Columbia* (sponsored by Jonathan W. Schooler)—The main goal of the present study was to explore whether informing participants that prospective

memory (ProM) tasks have been assigned as an assessment of their memory influences subsequent ProM performance. Subjects were randomly assigned to two conditions; one was an informed condition, in which subjects were told that the ProM tasks had been assigned to assess their memory, and the other was a naive condition, in which subjects were not informed that the ProM tasks had been assigned to assess their memory. Subjects in the Informed condition performed better on one ProM task. Follow-up analyses explored whether the personality types that best predicted ProM performance varied across the instructional conditions. The results showed that neuroticism and conscientiousness predicted ProM performance in the naive condition, whereas neuroticism, extraversion, and self-oriented perfectionism predicted ProM performance in the informed condition.

(4034)

Obsessive-Compulsive Checking and Prospective Memory. CARRIE CUTTLER & PETER GRAF, *University of British Columbia* (sponsored by Peter Graf)—We explored whether individuals high in obsessive-compulsive checking (high checkers) have objective and/or subjective impairments in their prospective memory (ProM)—their ability to remember to do things at a later time. Forty-two high checkers and 42 low checkers completed the Prospective Memory Questionnaire and the Prospective and Retrospective Memory Questionnaire—each of which assesses the perceived frequency of a variety of ProM failures. They were also assigned one event-cued ProM task, which required requesting the return of a personal belonging (e.g., a watch) at the end of the session, and one time-cued ProM task, which required reminding the experimenter to make a phone call in exactly 30 min. High checkers reported significantly more ProM failures on the questionnaires and performed significantly worse on the event-cued, but not time-cued, ProM task. We suggest that checking is a compensatory strategy for dealing with impairments in ProM task performance.

• MEMORY PROCESSES •

(4035)

The Role of Basic-Level Convergence in Accounting for the Misinformation Effect. AINAT PANSKY & SARAH K. BAR, *University of Haifa*—Recent findings have shown that information reported from memory tends to converge at an intermediate level of abstractness—the basic level—particularly over time (Pansky & Koriati, 2004). In the present study, these findings were applied to the rich body of research investigating the misinformation effect. Assuming gradual basic-level convergence, a misinformation effect was expected when the misleading information was delayed and consistent with the basic level of the original information, but not when it was inconsistent. The findings from three experiments confirmed the hypotheses. Memory for the original information was impaired when the misleading information belonged to the same basic-level category, but not when it belonged to a different basic-level category, although similarity to the original information was equated for the two types of misleading information. The findings support the view of the misinformation effect as a by-product of spontaneous memory processes that occur over time.

(4036)

Source Monitoring and Interrogative Suggestibility. SERENA MASTROBERARDINO & FRANCESCO S. MARUCCI, *University of Rome La Sapienza*, & DAVID C. RICCIO & MARIA S. ZARAGOZA, *Kent State University*—The Gudjonsson Suggestibility Scale 2 (GSS2; Gudjonsson, 1984) is a well-studied and widely used measure of individual differences in interrogative suggestibility. Most previous research with the GSS2 has focused on the role of personality and social variables in interrogative suggestibility. The goal of the present study was to investigate whether individual differences in cognitive/memorial variables might also play a role in suggestibility, as measured by the GSS2. Specifically, this study assessed whether high-suggestible participants (as measured by the GSS2) would perform more poorly on an unrelated source-monitoring task involving perceptual overlap between

sources. In two experiments, participants who were identified as high suggestible on the GSS2 also made more source-monitoring errors than low-suggestible participants on a later source-monitoring task.

(4037)

A Continuous Retrieval Process Explains the Use of Exclusionary Source Information. JEFFREY J. STARNES & JASON L. HICKS, *Louisiana State University*—We explored participants' ability to attribute items to target contexts when memory for an alternative context could exclude the possibility that items were presented in the target context (exclusive sources) versus when alternative contexts could not disqualify the target source (overlapping sources). We tested a threshold retrieval model and a continuous-dimension retrieval model capable of making predictions regarding the role of exclusionary evidence in source monitoring. We contrasted the models by fitting them to source receiver operating characteristics (ROCs) and by testing their predictions of how source ROCs change based on the availability of exclusionary evidence. Across three experiments, the results of both evaluation procedures suggest that people make source decisions by evaluating a continuous dimension of evidence. When exclusionary information is available, participants make decisions by comparing the amount of evidence for the target source to the amount of evidence for the alternative source.

(4038)

Evidence Against the Semantic Priming Account of Spacing Effects in Cued-Memory Tasks. PETER P. J. L. VERKOEIJEN, REMY M. J. P. RIKERS, DIANE PECHER, RENÉ ZEELENBERG, & HENK G. SCHMIDT, *Erasmus University Rotterdam*—The spacing effect refers to the finding that memory for repeated items improves when repetitions are spaced during study. To date, the spacing effect in cued-memory tasks for semantically processed stimulus materials has been explained with a semantic priming mechanism. According to this account, greater levels of semantic priming generate lower memory performance. The present study was conducted to test the semantic priming account. In Experiment 1, participants studied either repetitions or associated pairs. For repetitions, greater priming coincided with lower memory performance, whereas for associated pairs, the reverse pattern was found. In Experiment 2, participants made either the same semantic decision or different decisions about massed and spaced repetitions. In the same-decision condition, greater priming coincided with lower memory performance. However, in the different-decision condition, a spacing effect emerged, although priming did not differ between massed and spaced repetitions. The results of both experiments argue against the semantic priming account.

(4039)

Spacing and List Strength Effects Following Instructions to Rehearse. PETER F. DELANEY, *University of North Carolina, Greensboro*, & MARTIN E. KNOWLES, *University of Florida*—List strength effects usually involve comparing mixed and pure lists containing “strong” (i.e., spaced) and “weak” (i.e., massed) items. Under intentional learning conditions, the magnitude of spacing effects in pure lists depends on encoding strategy and tends to grow over successive study lists as people change to deeper encoding strategies (Delaney & Knowles, 2005). The present work reports free recall and recognition studies comparing mixed and pure lists when participants were instructed to rote rehearse the items. Rehearsal instructions produced spacing effects on mixed lists, but not on pure lists, for free recall. The same pattern held for recognition, consistent with a rehearsal account of the observed spacing effects and inconsistent with accounts purely in terms of list strength. Rehearse-aloud protocols and recall protocols were employed to understand how intentional rehearsal affects the basis of spacing and list strength effects.

(4040)

What Gets Trained in the Repetition Lag Memory Training Paradigm? HEATHER R. ROTH, DALE DAGENBACH, & JANINE M.

JENNINGS, *Wake Forest University*—The repetition lag memory training procedure developed by Jennings and Jacoby (2003) significantly improves recollection memory performance in older adults and produces gains in measures of working memory and attention (Jennings et al., in press). Previous research by the authors attempted to isolate the basis of these gains by selectively interfering with the study and test phases, using a concurrent variant of an *n*-back task. For the study phase, this diminished, but did not eliminate, improvement in recollection performance and, paradoxically, resulted in even stronger transfer effects. The present research used concurrent random number generation to more successfully eliminate improvement in the study phase, along with reducing transfer effects. The implications of these findings for the understanding of what is being trained will be considered.

(4041)

Context Effects on Remember-Know Judgments: The Influence of Relative Word Frequency. DAVID P. McCABE & DAVID A. BALOTA, *Washington University*—Remember-know judgments have been viewed as reflecting the direct output of different memory systems or processes. We report two experiments suggesting, instead, that remember-know judgments are sensitive to the context in which they are made. In Experiment 1, subjects studied medium-frequency words intermixed with either high-frequency or low-frequency “context” words. Studying medium-frequency words in the high-frequency context led to more remember responses than did studying in the low-frequency context. In Experiment 2, subjects studied a homogenous list of medium-frequency words, which were then tested in the context of high-frequency or low-frequency distractors. Testing medium-frequency words in the high-frequency context led to more remember judgments than did testing in the low-frequency context. Together, these results indicate that remember-know judgments are context dependent, rather than reflecting the direct output of memory systems or processes. We argue that subjects make remember judgments on the basis of a relative, rather than an absolute, perception of distinctiveness.

(4042)

The Role of Attention in Emotional Memory Enhancement. DEBORAH TALMI, ULRICH SCHIMMACK, THEONE PATERSON, LILY RIGGS, & MORRIS MOSCOVITCH, *University of Toronto*—Emotionally enhanced memory (EEM) may stem from enhanced attentional allocation to emotional items or from their higher semantic relatedness. To examine these alternatives, we manipulated attention by having participants encode emotional, random neutral, and related neutral scenes under full or divided attention. Immediate memory was tested with free recall. Memory for emotional scenes was better than memory for neutral scenes under both attention conditions. EEM was larger under divided attention. Emotional scenes garnered more attention than did neutral scenes, but this did not fully account for their mnemonic advantage. EEM was found even when attention was manipulated so that equivalent attention was allocated to neutral and emotional scenes. Neither the attentional nor the semantic relatedness explanations of EEM was supported in full, although they can account for some of the observed effects. The results show that emotion has a direct effect on memory, possibly by enhancing mechanisms implicated in reexperiencing emotional events.

(4043)

The Influence of Emotional Valence on Contextual Novelty. BRETT FROELIGER & REZA HABIB, *Southern Illinois University, Carbondale* (sponsored by Lars Nyberg)—There are several forms of novelty. One form, contextual novelty, arises when a stimulus occurs within an unexpected context. Contextual novelty produces an orienting response where increased attention is automatically diverted to the unexpected stimulus and memory for it is enhanced. Here, we examined the effect of emotional valence on contextual novelty. Reaction times were measured while male participants ($N = 20$) rated the emotional valence of positive and negative target pictures that followed either three positive or three negative context pictures. The results indicated that subjects re-

sponded more slowly to positive targets following negative contexts (RT = 1,139 msec) than to positive targets following positive contexts (RT = 1,002 msec). In contrast, subjects responded more quickly to negative targets following positive contexts (RT = 939 msec) than to negative targets following negative contexts (RT = 989 msec). These results indicate that contextual novelty is affected by the interaction between the emotional valences of the context and the unexpected event.

(4044)

Individual Differences in Memory for Bizarre and Common Verbal Information. JAMES B. WORTHEN, BRETT J. MOSS, LESLIE A. HAYDEL, BLAITHIN D. MACMAHON, & SARAH C. SAVOY, *South-eastern Louisiana University*—Relationships between six personality variables and each of three different measures of recall for bizarre and common sentences were examined. The personality variables investigated included measures of sensation seeking, novelty experiencing, desire for novelty, arousal-seeking tendency, social potency, and conservatism. Recall was measured in terms of sentences accessed, target words recovered per accessed sentence, and misplaced target words. Results from 180 undergraduate students indicated that both arousal seeking and conservatism were positively related to a bizarreness advantage in sentences accessed. In addition, high social potency was related to the recovery of more details from common than from bizarre sentences, and high desire for novelty was related to an increased bizarre misplacement effect. The results are discussed in terms of current explanations of the effects of bizarreness on memory.

(4045)

Blowing Up T–N–T: Interference Instructions Lead to “Suppression.” BRIAN CRABB, CARLI JENSEN, MERYL MARTIN, & MEGAN JENSEN, *Western Washington University*—Anderson and Green’s (2001) “think–no–think” paradigm claims that blocking the entry into conscious awareness of targets from previously learned word pairs leads to lower later recall of the targets. However, because no behavioral response is measured during these “no–think” trials, it is not clear what participants are actually doing. We have found evidence that many participants in this task use an interference strategy (thinking of things other than the target) to not think of the target, rather than use the suppression strategy that Anderson and Green assume they are using. Furthermore, we find that giving participants interference instructions for the “no–think” trials leads to reduced memory for those words. Together, these findings suggest that Anderson and Green’s findings are best explained by interference rather than by suppression.

(4046)

Sleep Benefits Declarative Memory Consolidation: Sleep-Dependent Resistance to Interference (SDRI). JEFFREY M. ELLENBOGEN, *Harvard Medical School*, & JUSTIN C. HULBERT, DAVID F. DINGES, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—There is considerable evidence that sleep improves implicit memory consolidation in humans. However, the role of sleep in declarative (hippocampally mediated) memory remains controversial. The purpose of this study is to clarify whether, and in what manner, sleep affects declarative memory. In two experiments, participants learned word pairs, then were tested after a 12-h retention period that either included sleep or consisted entirely of wakefulness. Experiment 1 assessed cued recall after the delay; Experiment 2 assessed the resilience of such memories to retroactive interference after the delay. Results demonstrate two significant findings: a benefit of sleep, when compared with wakefulness, for cued recall of word pairs and a robust benefit of sleep in preventing interference. We conclude that sleep benefits declarative memory consolidation, rendering memories resistant to subsequent interference. These findings have broad implications for understanding the processes of memory, the purpose of sleep, and their relationship.

(4047)

Expanding Retrieval Does Not Improve Long-Term Retention. JEFFREY D. KARPICKE & HENRY L. ROEDIGER III, *Washington Uni-*

versity (sponsored by Henry L. Roediger III)—Expanding retrieval practice (Landauer & Bjork, 1978) is widely believed to be a superior technique for promoting long-term retention (relative to equally spaced retrieval and other types of practice). In two experiments using GRE vocabulary word pairs, we found that expanding retrieval produced modest short-term benefits (10 min after learning), conceptually replicating Landauer and Bjork. However, equally spaced retrieval produced superior long-term retention (2 days later). This pattern was observed under conditions with or without feedback during the learning phase. We argue that the key factor for promoting retention is having an initial retrieval attempt after a brief delay (thereby making it more effortful and difficult), not expanding the interval between repeated tests. Expanding retrieval is not the most effective spaced retrieval technique for enhancing long-term retention.

(4048)

Determinants of Individual Differences in Current Events Knowledge: A Longitudinal Study. DAVID Z. HAMBRICK, *Michigan State University*, & ELIZABETH J. MEINZ & JONATHAN C. PETTIBONE, *Southern Illinois University, Edwardsville*—Research has established that acquired knowledge is a major source of individual differences in cognitive performance. What, then, contributes to individual differences in knowledge? This study investigated determinants of individual differences in knowledge of politics. The study occurred in two sessions separated by 2.5 months. In Session 1, participants performed tests to assess (1) cognitive ability factors, (2) knowledge of politics, and (3) personality and interest factors. In Session 2, which occurred immediately following the 2004 U.S. general election, participants completed tests to assess knowledge of politics acquired since Session 1. Structural equation modeling revealed strong effects of cognitive ability on acquisition of political knowledge. However, there were independent effects of nonability factors. Specifically, a personality factor reflecting intellectual openness predicted interest in politics, which in turn predicted exposure to and acquisition of political information. Thus, there was evidence for two predictive pathways—an ability pathway and a nonability pathway.

(4049)

Locus of Talker Variability Effects in Primary and Secondary Memory Search for Spoken Words. WINSTON D. GOH, *National University of Singapore* (sponsored by David B. Pisoni)—Previous work on talker variability effects in memory for spoken words suggests that having words spoken by multiple rather than single talkers was detrimental in short-term memory (STM) tasks but facilitative in long-term memory (LTM) tasks. It has been suggested that variability disrupts processing fluency in STM tasks but that, in LTM tasks, multiple talkers provide unique voice cues that aid retrieval. Interpreting the locus of these effects is complicated by variations across tasks. The present study investigated variability effects in auditory memory search, using a single task that had a primary and secondary memory version—the two-memory paradigm (Wickens, Moody, & Dow, 1981) variant of Sternberg’s (1966) memory search task. The magnitude of variability effects was larger for secondary than for primary memory. Memory set size did not interact with variability, suggesting that the locus of variability effects is at the retrieval stage and not at the processing stage.

(4050)

Generating Study Items Increases Older Children’s Reliance on Gist and Younger Children’s Reliance on Verbatim Memories. TIMOTHY N. ODEGARD, *University of Texas, Arlington*, ROBYN E. HOLLIDAY, *University of Kent, Canterbury*, & CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University* (sponsored by Charles J. Brainerd)—The Battig and Montague norms were used to investigate the effects of an encoding manipulation (read versus generate) and an instructional manipulation (accept targets, accept related lures, accept targets and related lures) on 7- to 8-year-old and 10- to 11-year-old children’s true and false recognition. Children studied two blocks of four categorical

lists of words, one “read” (i.e., whole words) and the other “self-generated” (word fragment completion). Each block was followed by a recognition test. Generating studied items increased the tendency for 7- to 8-year-old children to recollect those items, as compared with having read them. In contrast, 10- to 11-year-old children relied more heavily on graded similarity judgments when accepting studied items that had been generated, in comparison with studied items that were read. These findings are consistent with a fuzzy-trace theory account of memory development.

(4051)

Role of Experimental Design and Age on the Generation Effect. LAURENCE TACONNAT, MATHILDE SACHER, DAVID CLARYS, SANDRINE VANNESTE, & MICHEL ISINGRINI, *Université de Tours* (sponsored by Naftali Raz)—The generation effect (e.g., generated words are better recalled than read words: wall-hou__ (vs.) wall-house) was investigated in between-list and mixed-list designs in young and elderly participants. The generation difficulty was also manipulated by varying the strength of association between cues and targets. The results showed different patterns of generation effect according to the design, difficulty, and age, with a robust generation effect in the mixed-list design whatever the participants’ age, corroborating previous researches. In the between-list design, elderly participants did never benefit from the generation effect, and in young participants, the effect was elicited only when they generated strong associates. Findings showed that the type of design did not allow implementation of the same cognitive operations according to age. Contrary to the generation effect in a mixed-list design, the generation effect in a between-list design might be the consequence of effortful processes, difficult to implement in elderly adults, whereas the generation effect in a mixed-list design might be more automatic.

• WORKING MEMORY •

(4052)

Effects of Complexity on the Recall of Spatial Configurations. AYSECAN BODUROĞLU & PRITI SHAH, *University of Michigan*—Recent research has demonstrated that spatial working memory representations preserve the overall configuration formed by a number of attended locations. In a series of studies using the serial spatial recall task, we investigated how configural complexity influences (1) the independent recall of locations in a sequence and (2) the recall of the overall configurations formed by a sequence. Configural complexity was manipulated by varying the number of path crossings in a spatial sequence (zero, one, or three). For highly complex sequences, although complexity did not impact recall of independent locations, it did impair how well the configurations were preserved, as compared with simpler sequences. Results indicate that localization errors in spatial recall tasks are influenced more by length of and serial position in sequences, whereas orientations of errors are more influenced by complexity of configurations. These findings highlight the dissociation between distance and orientation errors for characterizing spatial recall accuracy.

(4053)

Location-Based Versus Configurational Representations of Visuospatial Information in Working Memory. LEON GMEINDL & JAMES K. NELSON, *University of Michigan*, TIMOTHY D. WIGGIN, *Eastern Michigan University*, & JENNIFER C. HSU & PATRICIA A. REUTER-LORENZ, *University of Michigan*—Do people represent multiple spatial targets in working memory (WM) as independent locations or as configurations? In three delayed location matching-to-sample experiments, participants viewed three dots presented simultaneously for 1,500 msec, followed 3 sec later by a three-dot probe. For nonmatch probes, preserved configurations led to false alarms more frequently than did distorted configurations, despite equivalent stimulus displacements. Furthermore, a higher false alarm rate for pre-

served configurations persisted when only a single probe stimulus was designated as relevant by its unique color. In contrast, an arrow cue presented prior to target presentation eliminated the increased false alarm rate for probes with preserved configurations. We conclude that (1) people utilize configurational information in WM representations of multiple locations and (2) attentional processes can reduce the influence of configurational information on WM representations.

(4054)

Is the Binding of Visual Features in Working Memory Resource-Demanding? RICHARD J. ALLEN, ALAN D. BADDELEY, & GRAHAM J. HITCH, *University of York* (sponsored by Alan D. Baddeley)—A series of experiments examined the processes underlying the encoding and retention of visual feature bindings in working memory. Memory for shapes or colors was compared with memory for combinations of these features. When demanding concurrent verbal tasks were used, with the intention of disrupting executive resources, visual memory performance was significantly impaired. However, the effects were no greater for memory for feature combinations than for the features themselves. A comparison of simultaneous and sequential item presentations revealed the combination condition to be significantly worse in the latter, especially for items earlier in the sequence. The findings are interpreted as evidence for a relatively fragile but automatic visual feature binding mechanism in working memory, capable of functioning without placing additional demands on the central executive. This form of ‘unitized’ binding is then compared with the binding of spatially separated features.

(4055)

Feature Binding in Visual Working Memory Without Continued Attention. DANIEL A. GAJEWSKI & JAMES R. BROCKMOLE, *Michigan State University* (sponsored by James R. Brockmole)—Are integrated objects the unit of capacity of visual working memory, or is continued attention needed to maintain bindings between independently stored features? In a delayed recall task, participants reported the color and shape of a probed item from a memory array. During the delay, attention was manipulated with an exogenous cue. Recall was elevated at validly cued positions, indicating that the cue affected item memory. On invalid trials, participants most frequently recalled either both features (perfect object memory) or neither of the two features (no object memory); the frequency with which only one feature was recalled was significantly lower than predicted by feature independence as determined in a single-feature recall task. These data do not support the view that features are remembered independently when attention is withdrawn. Instead, integrated objects are stored in visual working memory without need for continued attention.

(4056)

Eye Movements Reveal Strategic Interactions Between Perceptual Attention and Visual Working Memory During Visual Search. LEANNE BOUCHER & GEOFFREY F. WOODMAN, *Vanderbilt University*—Theories of attention propose that maintaining a representation in visual working memory guides perceptual attention to similar items. However, a recent study showed that when participants maintained a visual working memory representation and performed visual search, the presence of a memory-matching distractor that was never the target did not slow search. Here, we sought to more directly measure selection by tracking observers’ eye movements. Eye movement data revealed that search was faster when the memory-matching distractor was in the array, because observers generally avoided fixating this nontarget until search was completed. However, after the search target was fixated and discriminated, subjects directed gaze to the memory-matching item, consistent with a working memory maintenance strategy of perceptual resampling. Thus, attention can be biased toward or away from items that match the contents of visual working memory, and these biases can dynamically change in the service of different search and memory maintenance strategies.

(4057)

Feature Binding Within Visuospatial Short-Term Memory: Asymmetry Between Shape and Location Encoding. JANE ELSLEY & FABRICE B. PARMENTIER, *University of Plymouth* (sponsored by Fabrice B. Parmentier)—Binding processes play an important role in memory. Using a probe recognition task (Prabhakaran et al., 2000), we investigated visual-to-spatial binding by presenting three irregular shapes simultaneously in irregularly distributed locations, followed by a single probe. Participants had to judge the probe in terms of both the visual and the spatial features. In Experiment 1, robust binding effects were observed. Two further experiments investigated whether binding processes operate automatically. Results indicated that when participants focused only on shapes (Experiment 2A), binding occurred automatically. However, when participants focused on locations (Experiment 2B), no binding effect was observed. Therefore, shape processing was not independent of the processing of location, whereas location could be attended to in isolation. This asymmetry in association is discussed with regard to recent perceptual and attentional accounts of binding.

(4058)

Training on Relations Eliminates Interference of Elements on Relational Processing. AARON S. YARLAS, *Grand Valley State University*, & VLADIMIR M. SLOUTSKY, *Ohio State University*—Previous studies (Yarlas & Sloutsky, 2004) incorporating a Garner interference task with undergraduates showed clear evidence for asymmetry of interference when elements and relations were processed: Status of elements (i.e., objects in an arrangement) could not be ignored during relational processing, whereas status of relations (i.e., patterns of arrangements among objects) had no impact on the processing of elements. The present study, in which the same interference task was preceded by either training focusing on relations (e.g., labeling relations, sorting by relations) or control training, yielded a much different outcome, such that after relational training (although not after control training), the interference of elements with relations disappeared, and there was, in fact, an emergence of interference of relations with elements. These findings provide strong evidence that distinctions between element and relational processing are not fixed a priori but, rather, are flexible and are likely a product of learning and/or directed attention.

(4059)

Architecture and Retrieval Dynamics of Working Memory: Exploring the Role of Pointer Predictability in Redirecting Attention. CHANDRAMALLIKA BASAK & PAUL VERHAEGHEN, *Syracuse University*—Working memory consists of a focus of attention and an active outer store (Cowan, 1995). We conducted a series of four experiments to explore the differential capacity and retrieval dynamics of these two subsystems of working memory and whether a passive memory load affects the retrieval speed or activation of these subsystems. We found that when the retrieval sequence is predictable, the focus switch cost was additive over increasing set size, but when it is unpredictable, a controlled search slope of about 230 msec/set-size emerges. Moreover, with extended practice, the focus can be expanded from one to four in a predictable-sequence task, but not in an unpredictable-sequence task. We propose that a pointer is needed to redirect attention to the correct cell in the memory array; resource demands on a task may depend upon whether the pointer moves predictably or not.

(4060)

The Role of Attention During Retrieval in Working Memory Span: A Dual-Task Study. M. KARL HEALEY, *University of Toronto*, & AKIRA MIYAKE, *University of Colorado, Boulder*—We tested the hypothesis that operation span (OS) performance involves attention-demanding retrieval of target words from long-term memory (LTM), rather than active maintenance of all target words. Participants completed the standard OS task and a modified, word-span-like version

in which all equations preceded all target words. Recall took place under either full attention or divided attention conditions (easy vs. difficult). Secondary-task performance was worse for the standard OS task than for the modified version, with the difficult secondary task showing the larger decrement. Recall also suffered under divided attention, with the recall decrement greater for the more difficult secondary task. Moreover, the time taken to start recalling the first word was considerably longer for the standard version than for the modified version. These results are consistent with the proposal that successful OS performance involves, in part, the attention-demanding use of retrieval cues to recover target items from LTM.

(4061)

Comparison of Standardized Measures of Working Memory Across the Life Span. SANDRA HALE, LISA J. EMERY, JOEL MYERSON, DESIREE A. WHITE, & DUNEESHA RANATUNGA, *Washington University*—Analyses of children's normative working memory data from the WISC III revealed parallel developmental changes in forward and backward digit span, extending our previous analyses of the WAIS III. Notably, the difference between forward and backward span remains approximately constant across the life span. Comparison of performance on the Digit Span and Letter–Number Sequencing subtests revealed a different pattern. Performance on the two subtests develops in tandem from the age of 8 years through young adulthood; scores diverge from middle-age on, however, with performance on digit span tasks showing a much slower decline than that on letter–number sequencing tasks. Taken together, the present findings suggest that at least two mechanisms are involved in age-related differences in working memory. Our findings pose problems, however, for the view that one of these mechanisms, distinct from short-term memory and associated with the frontal lobes, develops more slowly in childhood and declines more rapidly in later adulthood.

(4062)

Do Phonological Processes Contribute to Aging Effects on Verbal STM? DANIEL KLEINMAN & DEBORAH M. BURKE, *Pomona College* (sponsored by Deborah M. Burke)—Age deficits in phonological activation processes have been implicated in word production failures in old age. We tested this phonological deficit hypothesis by examining the effect of phonological neighborhood density of words on short-term memory (STM) in young and older adults. Words with dense neighborhoods share phonemes with many other words; this benefits STM because interactive excitatory processes among phonologically similar words maintain activation of words in STM (e.g., Roodenrys, Hulme, Lethbridge, Hinton, & Nimmo, 2002). Young and older adults recalled word lists varying in word frequency of occurrence and neighborhood density, in a memory span procedure. Frequency effects were the same across age, but high neighborhood density improved STM more for young than for older adults. Implications for the processes underlying frequency, neighborhood, and aging effects in STM are discussed.

• ATTENTION •

(4063)

Attentional Modulation of the Amygdala Varies With Personality. STEVEN B. MOST & MARVIN M. CHUN, *Yale University*, & MATTHEW R. JOHNSON & KENT A. KIEHL, *Institute of Living, Hartford Hospital*—Prominent theories suggest that the amygdala responds to emotional stimuli independently of attention. In contrast, we found evidence for attentional modulation of the amygdala, but this varied as a function of personality. We employed an attentional task where participants always had to ignore emotional and neutral distractors while searching for a target. The ease of ignoring distractors was manipulated through the degree of specificity with which targets were described to participants; more specific information about targets generally leads to better ignoring of distractors (Most et al., in

press). fMRI revealed that when participants did not have specific target-information to aid ignoring, amygdala response to the emotional distractors increased, relative to neutral distractors, but that such modulation was evident especially among participants scoring high on the personality measure “harm avoidance.” Thus, amygdala responsiveness seems sensitive to the filtering out of emotional information, but more in some people than in others.

(4064)

Emotional Blinking With No Sensory Cuing or Semantic Searching. CYNTHIA KASCHUB & IRA S. FISCHLER, *University of Florida*—Recent studies have shown that the attentional blink effect during RSVP presentation can be enhanced by emotionality of the first (distractor or T1) word and reduced by emotionality of the second. However, these studies either superimposed word emotionality on an attention-capturing sensory cue (e.g., a unique color) or required some semantic analysis of each word to identify the target (e.g., categorical exemplars). In the present study, targets were specific words given at the start of each trial, and all words in the 15 wps sequence had the same visual attributes. Nonetheless, presentation of an emotional word one or two words prior to a neutral target reduced target detection by about 5%, suggesting that the emotional connotation of words could capture attention rapidly and automatically. With emotional target words, these blink effects were eliminated. There was no effect of the emotional congruence between distractor and target on target detection.

(4065)

Gender Differences in Selective Attention: Evidence From a Spatial-Orienting Task. PAUL MERRITT, *Texas A&M University, Corpus Christi*, & ELLIOT HIRSHMAN, WHITNEY WHARTON, & BETHANY STANGL, *George Washington University*—Selective attention is considered a central component of cognitive functioning. Although a number of studies have demonstrated gender differences in cognitive tasks, there has been little research conducted on gender differences in selective attention. To test for gender differences in selective attention, we tested 44 undergraduates, using a spatial-orienting task with an endogenous (centrally located arrow) cue. Our primary finding was that females showed larger validity effects at 500-msec stimulus onset asynchrony (SOA). Although males and females showed similar benefits from a valid cue across four cue–target intervals, females showed greater costs from an invalid cue at 500-msec SOA. The potential role of an inhibitory deficit in males is proposed as a possible explanation for these results.

(4066)

Gaze Cues and Emotion: Affective Responses to Cue Faces and Target Objects. ANDREW P. BAYLISS & STEVEN P. TIPPER, *University of Wales, Bangor*—When we see someone look somewhere, our attention is automatically oriented to the same location. *Joint attention* helps us work out which stimulus is being looked at, and infer the mental state of the other person. In studies measuring the effects of gaze cues on attention, responses are quicker to targets that appear where the cue face looks, as compared with targets that appear in *uncued* locations. Here, we investigated the affective consequences of such cuing effects in two separate studies. In Experiment 1, we showed that faces that consistently cued the target location were chosen as more *trustworthy* than faces that always looked away from target location. In Experiment 2, household objects that were consistently cued were *liked* more than objects that consistently appeared in uncued locations. These studies demonstrate that the direction of another’s gaze can modulate personality evaluations and our feelings about the objects that receive the other’s attention.

(4067)

Human Action Directs Attention. WILL GERVAIS, CATHERINE L. REED, PAULA M. BEALL, RALPH J. ROBERTS, MARTIN HO, & KENDALL MCCARLEY, *University of Denver*—People’s actions tell us about their intentions and important environmental events. This

study investigated whether human actions could direct attention. A covert-orienting task with nonpredictive central cues was used. Cues were images of right-/left-facing static human figures in action (running, throwing) or neutral (standing) poses. Results demonstrated that only action poses (not neutral) produced validity effects, suggesting that attention was shifted in the direction of the action. Also, throwing poses produced the fastest responses overall, followed by the running and neutral poses, suggesting that static action poses may have primed motor responses. Experiment 2 disentangled the relative effects of motor effort and directional action on spatial attention. When validity effects were compared for jump, throw, and neutral cues, motor effort (i.e., jumping and throwing) influenced only the speed of the response. Action directed toward a target location (i.e., throwing) was required to influence the direction of shifts in spatial attention.

(4068)

The Regulation of Stroop Interference by Social Context. DINKAR SHARMA & ROBERT W. BOOTH, *University of Kent*, RUPERT J. BROWN, *University of Sussex*, & PASCAL HUGUET, *Université Aix-Marseille 1* (sponsored by Toby J. Lloyd-Jones)—Recently, it has been suggested that social context (mere presence and an upward social comparison) can reduce interference in the Stroop task (Huguet, Galvaing, Monteil, & Dumas, 1999). We assess the extent to which social context can be described within a cognitive framework developed by Lavie (e.g., Lavie et al., 2004) that highlights the role of perceptual load and working memory load in the control of selective attention. In a series of experiments on social presence and social comparison, we extend the findings by Huguet et al. (1999) to show when and how social context affects selective attention. Our data are consistent with the approach taken by Lavie, and thus the discussion will focus on how social context impinges on perceptual load and working memory load in the control of selective attention.

(4069)

Directing One’s Attention by Picking Up Others’ Intentions. PINES NUKU, OLIVER LINDEMANN, & HAROLD BEKKERING, *Radboud University Nijmegen* (sponsored by Martin H. Fischer)—Joint attention refers to the ability to use eye and pointing information from others to direct one’s own action potential. Evidence that grasping and pointing postures convey others’ intentions has prompted us to assess exactly how observed hand postures prime our attentional system. In a first series of experiments, we tested whether hand postures alone influence observers’ attention, whereas in a second series, we tested whether a perceived sensory consequence of a posture–object relation (i.e., a hand moving an object or a hand aperture fitting an object), conveys action intentions and influences action potentials. We found that posture–object compatibility prompts observers’ attention more than does posture alone. This study shows that perceived sensory consequences of postures and objects, representing others’ intentions, lead to changes in observers’ attention potentials. We conclude that inferential processes, such as posture–object vicinity and posture–object compatibility, are central in perceiving others’ intentions and influencing others’ attention.

(4070)

Invariant Effects of Perceptual and Memory Loads on Implicit Priming. EWALD NEUMANN, STEPHEN J. GAUKRODGER, & PAUL N. RUSSELL, *University of Canterbury*—We present findings from several selective attention experiments that question the conclusions from two recent *Science* articles. By adding an ignored repetition (negative priming) manipulation to the perceptual load paradigm used by Rees et al. (1999) and the working memory load paradigm used by de Fockert et al. (2001), we show that nontarget distractors are not filtered out; instead, they are implicitly processed to the level of semantic identification. Contrary to the predictions derived from the work of Rees et al., if a nontarget word matched a target picture on the subsequent trial, a small but significant negative priming effect was obtained. Contrary to the predictions derived from the work

of de Fockert et al., if a nontarget famous face matched the target name of that celebrity on the subsequent trial, a significant negative priming effect was obtained, irrespective of whether the concurrent memory load was low or high.

(4071)

Strategy Effects Counteract Distractor Inhibition: Negative Priming With Constantly Absent Probe Distractors. CHRISTIAN FRINGS, DIRK WENTURA, & HUBERT D. ZIMMER, *Saarland University*—It is an accepted, albeit puzzling, finding that negative priming (NP) hinges on the presence of distractors in probe displays. In three experiments without probe distractors, we found evidence that response-biasing processes based on the contingency between prime and probe displays may have caused this finding. It is argued that it is of help, in standard NP experiments, to process the prime distractor for preparing the response to the probe target. If this contingency was removed (Experiments 2 and 3), NP without probe distractors was reliably observed, whereas no NP emerged if the design comprised the typical contingency (Experiment 1). Hence, the data suggest that the absence of NP, which is usually observed under these conditions, may have been due to a contingency-based component.

(4072)

The Time Course of Visual Attention Triggered by Temporal Expectation. KEN KIHARA & NAOYUKI OSAKA, *Kyoto University*—The purpose of this study was to test the hypothesis that an expectation of a target onset triggers visual attention before its appearance. Using an attentional blink paradigm, we investigated whether processing of a following target (T2) interferes with that of a preceding target (T1) when the time of T2 onset can be expected. Experiment 1, in which T1 and T2 tasks were different, did not show the interference. Experiment 2, however, in which both tasks were the same, showed the interference within 280 msec before T2 onset. Experiment 3 indicated that even if subjects learned the timing of T2 onset only implicitly, the interference occurred. In Experiment 4, the processing of an auditory T1 was not interfered with by a visual T2. These results suggest that the expectation of target onset triggers attentional processing in a task- and modality-specific manner about 300 msec prior to target onset.

(4073)

Age Effects on Task-Switching Over the Telephone. PATRICIA A. TUN & MARGIE E. LACHMAN, *Brandeis University*—We have developed a version of a task-switching test that can be administered over the telephone, allowing for testing of a wide range of participants, including those who are unable or unwilling to come into the laboratory. Data are presented from a large sample of over 900 adults ranging in age from 30 to 85 years. In accord with testing by computer in the lab, response latencies reveal significant age-related increases in reaction time for task-homogeneous blocks of baseline trials, for task-heterogeneous blocks that require task-switching, and for task-switching costs.

(4074)

Spatial Attention Can Enhance or Impair Visual Temporal Resolution. JONGSOO BAEK, KEETAEK KHAM, & MIN-SHIK KIM, *Yonsei University*—Transient attention impairs observers' temporal resolution at a cued location. This detrimental effect of attention was ascribed to inhibitory connections from parvocellular to magnocellular neurons (Yeshurun & Levy, 2003). Alternatively, the difficulty might arise because attention facilitates the temporal summation of two successive stimuli. The present study examined this hypothesis by manipulating the luminance polarity of the stimuli against a background. Attention should not modulate temporal summation of two antipolar stimuli, because these are processed in separate channels. Indeed, observers judged the temporal order of two successive stimuli better for the cued location than for the uncued location when the stimuli were opposite in polarity, but temporal resolution was worse

for the cued location when the stimuli had the same polarity. Thus, attentional effects on temporal resolution may be attributed to temporal summation, rather than to parvocellular inhibition of magnocellular activity.

(4075)

Perceptual Load Effects Inside and Outside the Focus of Attention. DONALD J. TELLINGHUISEN, *Calvin College*—Studies (e.g., Lavie & Cox, 1997) have shown that one irrelevant peripheral distractor presented in a response competition paradigm could be ignored if a letter-circle search array contained perceptually similar nontargets (high perceptual load), but not if it contained dissimilar nontargets (low perceptual load). I investigated the effects of two distractors, either response compatible or response incompatible, presented either outside the search array (one each to the left and right of the array) or inside the search array (one each to the left and right of a central fixation). Reaction time data indicated minimal effects of response-incompatible distractors presented outside, regardless of perceptual load. Response-incompatible distractors presented inside, however, yielded large interference effects for low load searches, but not for high load searches. Thus, two peripheral distractors were more readily ignored than one, regardless of perceptual load. In addition, perceptual load modulated the ability to ignore information, even within the focus of attention.

(4076)

Bottom-Up Priming of Top-Down Attentional Control Settings. CHARLES L. FOLK, *Villanova University*, & ROGER W. REMINGTON, *Johns Hopkins University*—According to the contingent attentional capture hypothesis, the degree to which a stimulus produces involuntary shifts of spatial attention depends on whether the defining properties of the stimulus match top-down attentional control settings. It has been assumed that these control settings reflect the voluntary establishment and maintenance of a target "template" based on task instructions. Here, we show that attentional control settings can be influenced by stimulus-driven trial-to-trial priming. Subjects searched for red or green color-singleton targets preceded by uninformative red or green color-singleton cues. Although all cues produced evidence of attentional capture (i.e., cuing effects), the magnitude of capture was significantly greater when the color of the cue on trial n matched the color of the target on trial $n-1$. These intertrial priming effects suggest a stimulus-driven component to the establishment of top-down attentional control settings.

(4077)

To See or Not to See: Attention Leads to Selection. ZHE CHEN, *University of Canterbury*, & KYLE R. CAVE, *University of Massachusetts, Amherst*—Object-based attention assumes that attending to an object results in its selection, such that all its feature dimensions are processed regardless of whether they are relevant or not. This view was recently challenged by the finding that the extent of processing of an irrelevant dimension depends on the status of the attended object. When it is a target, the irrelevant dimensions are encoded. However, when it is a distractor, only the relevant dimension is processed. In several experiments, we employed a singleton paradigm to investigate the relationship between attention and selection. Our results show that attention and selection cannot be dissociated. The irrelevant dimension of the singleton distractor was processed even when the location of the target was invariant. We suggest that the discrepancies between our results and those of prior research can be resolved by the nature of the specific feature dimension that receives attention.

(4078)

Letter Processing in the Absence of Attention. JOEL LACHTER, *NASA Ames Research Center*, & ERIC RUTHRUFF, *University of New Mexico*—One of the most central, and most hotly debated, issues in attention research concerns the depth to which unattended objects are processed. Numerous studies have shown that irrelevant flanking stimuli speed responses to compatible targets and slow responses to

incompatible targets. Given these ubiquitous flanker effects, many have concluded that unattended visual objects are routinely identified without attention. Lachter, Forster, and Ruthruff (2004), however, recently demonstrated that the effects of flanking words vanish when care is taken to prevent those words from capturing attention. Here, we examine whether the same holds true with much simpler stimuli—individual letters. With flanker and target letters in different cases (e.g., A vs. a), unattended flankers had no effect. With flanker and target letters in the same case (A vs. A), however, small flanker effects emerged. Taken together, these findings suggest that features, but not letters, are identified without attention.

• COGNITIVE CONTROL •

(4079)

Conflict-Related Processing Adjustment at Short RSIs: The ABI Effect and Posterror Slowing. INES JENTZSCH, *University of St. Andrews*, & HARTMUT LEUTHOLD, *University of Glasgow*—In short-RSI situations, participants are usually slower in trial n when the response alternates in trial $n-1$. We recently suggested that this alternation-based interference (ABI) effect results from adjustments following response conflict in the preceding trial (Jentzsch & Leuthold, 2005). Here, we investigate whether the ABI effect is modulated by an error response on trial $n-1$. We hypothesized that response alternations, as well as an error on trial $n-1$, should produce processing conflicts leading to changes in subsequent performance. Twelve participants were tested, using the information reduction paradigm, with four stimuli assigned to two responses. To control for influences of error corrections, single- or double-keypress responses with either the same hand or different hands were required. The ABI effect was reversed in posterror trials, independently of response condition. We therefore suggest that sequence-related response conflicts at short RSIs can modify processes underlying top-down adjustments after errors.

(4080)

The Impact of Combined Temporal and Nontemporal Constraints on the Control of a Dynamic Task. MARIE-EVE JOBIDON & ROBERT ROUSSEAU, *Université Laval*, & RICHARD BRETON, *Defence R&D Canada*—This study aims to understand the role of temporal and nontemporal contextual constraints in the control of a dynamic task. From the contextual control model (Hollnagel, 1993), two temporal parameters are identified: TA and TR, the time available and required to achieve control. The objective is to evaluate how variations in the objective value of TA and TR (through time pressure and workload, respectively) influence control and the subjective estimation of both temporal parameters. A dynamic situation including two subtasks, the pursuit of a target and the avoidance of hostile contacts, was used. Results suggest that performance and time estimation be affected by the combination of the two variables: In some cases, the impact of time pressure and workload are additive; in others, it is not. Findings demonstrate that changes in the value of TA and TR can impair the operator's ability to control the system and can affect time estimation.

(4081)

Repetition Priming and Cognitive Control in Stroop-Like Tasks. DIEGO FERNANDEZ-DUQUE & MARYBETH KNIGHT, *Villanova University*—In Stroop-like tasks, distraction is often reduced by factors that warn participants about incoming conflict. There is a heated debate regarding whether this modulation is due to repetition priming or enhanced cognitive control. We explored this question in a paradigm in which color and number Stroop tasks alternated every trial. Dynamic trial-to-trial changes were fully explained by repetition priming. In contrast, conflict resolution was truly enhanced in blocks with disproportionate number of incongruent trials. This modulation was task specific. Finally, we assessed voluntary modulation of cognitive control: A cue predicted the congruency of the color Stroop, allowing subjects to establish the correct mindset. Getting prepared for an incongruent color enhanced conflict resolution in the number task,

an example of across-task modulation. These experiments reveal the multifaceted aspects of conflict resolution: Trial-to-trial changes are due to repetition priming, tonic modulations brought about by task demands are task specific, and voluntary modulations are task general.

(4082)

Sequential Modulations in the Simon Effect Depend on Task Structure. CAGLAR AKCAY & ELIOT HAZELTINE, *University of Iowa* (sponsored by Eliot Hazeltine)—Spatially defined responses to a non-spatial attribute of a stimulus are faster when the location of the stimulus is congruent with the response. This effect, called the *Simon effect*, depends on contingencies in trial sequence, since after incongruent trials the effect of congruency diminishes. One account of these sequential effects presumes a conflict-monitoring mechanism that adjusts the use of information on the basis of response conflict on the previous trial. An alternative hypothesis of feature integration draws upon the effects of repetition and alternation of stimulus–response episodes. Using a four-choice Simon-type task, we sought to distinguish between these two accounts. The results showed that sequential effects depend on the task structure, operating presumably within a task representation. The carryover of sequential effects was examined in further experiments using common stimulus attributes for pairs of responses or common responses for pairs of stimuli. The results are discussed in terms of the two competing accounts.

(4083)

Stimulus and Response Conflict Induced Cognitive Control in the Flanker Task. FREDERICK VERBRUGGEN, WIM NOTEBAERT, BAPTIST LIEFOOGHE, ANDRÉ VANDIERENDONCK, & TOM VERGUTS, *Ghent University*—Recently, several studies investigated the top-down adjustments made after incongruent trials during conflict tasks. The present study investigated conflict monitoring with different types of conflict. In a modified version of the flanker task, a distinction was made between stimulus–stimulus conflict and stimulus–response conflict. Six colors were mapped onto three responses in order to exclude all sequences where a relevant or irrelevant feature was repeated from trial $n-1$ to trial n . Analyses as a function of the congruency of the previous trial demonstrated that conflict adaptation was present. The stimulus congruency effect was reduced both after a stimulus-incongruent trial and after a response-incongruent trial. The mere response congruency effect did not vary as a function of previous congruency. These findings are discussed in relation to the distinction between conflict detection and conflict regulation.

(4084)

Influence of Complex Distractors in the Remote Distractor Paradigm. VALERIE BROWN, JOHN M. FINDLAY, & SIMON P. LIVERSEDGE, *University of Durham* (sponsored by Simon P. Liversedge)—Three experiments examined the influence of complex distractors in the remote distractor effect (RDE) paradigm (Walker, Deubel, Schneider, & Findlay, 1997). Experiment 1 examined whether different types of distractors modulated the RDE in any systematic way. Linguistic distractors produced prolonged SOLs for central versus peripheral presentation. Nonlinguistic distractors produced equivalent SOLs for central and peripheral presentation. This unexpected finding was investigated in Experiment 2, which showed that repeated presentation of a distractor results in reduced saccade latencies for centrally presented distractors, regardless of distractor status (i.e., linguistic or nonlinguistic). In Experiment 3, this was reproduced for same-category repeated and changing distractors, and a difference in SOLs was obtained between two types of linguistic distractors at a parafoveal presentation location. Latencies for single target trials were influenced by the type of distractor they were presented with. Although SOLs are modulated by distractor complexity, RDE magnitudes are not.

(4085)

Age-Related Increase in Intraindividual Variability Points to Decline in Attentional Control. TARA MCAULEY & DESIREE A. WHITE,

Washington University (sponsored by Jay Pratt)—Intraindividual variability refers to changes within an individual and is reflected in the spread of performance around an individual's mean. The aim of this study was threefold: (1) to determine whether intraindividual variability increases with age; (2) to determine the pervasiveness of obtained age-related increases in intraindividual variability; and (3) to determine whether intraindividual variability is related to quality of performance. To address these aims, we compared the coefficient of variability of younger and older adults on three tasks that varied demands on task difficulty and executive control. In accord with previous studies, older adults demonstrated larger degrees of intraindividual variability than did younger adults. Surprisingly, group differences were exacerbated in easy task conditions and were attenuated in difficult task conditions. Our findings suggest that older adults are more susceptible to lapses of attention when task demands are minimal. These results are interpreted in terms of age-related change in attentional control.

(4086)

Switch Costs in Humans Persist Even After Extensive Training. GIJSBERT STOET & LAWRENCE H. SNYDER, *Washington University*—Switch costs are a reduction in response speed and accuracy observed when humans switch between tasks. Theories of executive control suggest that switch costs reflect difficulty in managing stimulus–response associations. Furthermore, it is assumed that automated tasks require less control and should, therefore, be less prone to difficulties in executive control. We tested the hypothesis that extensive training would eliminate switch costs. Indeed, switch costs are commonly observed in humans, but not in extensively trained animals (Stoet & Snyder, *Neuropsychologia*, Vol. 41, 2003). Three human subjects were trained for ~26,000 trials on different days ($n = 20$ –47 days). Response speed and accuracy decreased with training, but switch costs were never eliminated. We conclude that the improved performance suggests a trend toward the automatization of S–R associations, whereas the persistence of switch costs indicates a continued involvement of executive control in scheduling tasks.

(4087)

Separating Cue Encoding From Task Performance in Task Switching. CATHERINE M. ARRINGTON, GORDON D. LOGAN, & DARRYL W. SCHNEIDER, *Vanderbilt University*—Previously, we argued that switch costs in explicit task-cuing procedures reflect cue-encoding benefits. We explored this account in a series of experiments in which subjects responded separately to the cues and targets in a four-cue/two-task paradigm. Cue responses involving simple vocalization of the cue resulted in patterns in the target RT data similar to that seen when no cue response is made, which can be accounted for with a compound retrieval cue strategy. When the cue response required recoding the verbal cue to a manual response or a different vocal response, the pattern of data changed such that cue RTs showed costs for cue alternations and target RTs showed costs for task alternations. This pattern of data can be accounted for by a model in which the cue response becomes a mediator that is used in combination with the target to retrieve the response from memory.

(4088)

Active Preparation in Task Switching: Differential Effects of Switch-To and Switch-Away Cues. FRINI KARAYANIDIS, REBECCA A. HANNAN, PATRICIA T. MICHIE, & ANNA DAVIES, *University of Newcastle*—Preparation for an impending switch in task set was manipulated using two types of switch cues: *switch away* from the previous task set or *switch to* a different task set. Participants ($N = 24$) switched randomly between letter, digit, and color task sets defined for the same stimulus set. RT switch cost (switch repeat) was larger for switch-away than for switch-to trials. Increasing cue–stimulus interval (CSI: 200 vs. 1,000 msec) facilitated switch-to trials only. At long CSI, event-related potential (ERP) waveforms showed a large, broad differential positivity peaking within the CSI for switch-to, relative to repeat, trials. Switch-away ERP waveforms showed two positiv-

ities, relative to repeat trials: one peaking within the CSI and another, smaller positivity that occurred after stimulus onset. Stimulus-locked ERP waveforms showed a differential switch-related negativity for both switch types. Results demonstrate dissociable effects of switching to an upcoming task set and switching away from the previously active task set, supporting multiple component models of task set reconfiguration.

(4089)

Is Task Set Switching Accomplished Through Task Set Inhibition? DAVID KUHN & MEI-CHING LIEN, *Oregon State University*, & ERIC RUTHRUFF, *University of New Mexico*—Task switching can be accomplished by activating the new task, inhibiting the old task, or both. To look for direct evidence of an inhibitory component, we utilized a variant of a paradigm developed by Hübner, Dreisbach, Haider, and Kluge (2003). Participants switched between three tasks in a predictable, repeating sequence (e.g., digit, letter, and symbol). Adjacent to the target was an irrelevant flanker stimulus belonging to another task—either the more recently performed task or the less recently performed task. If task set inhibition occurs but decays over time, flankers associated with the more recent task should have the smallest effect. But if there is no task inhibition, just task activation, flankers associated with the more recent task should have the largest effect. We found the latter result in several cases, calling into question whether irrelevant tasks were successfully inhibited.

(4090)

Switch Cost Asymmetry Without Switching. RICHARD L. BRYCK & ULRICH MAYR, *University of Oregon* (sponsored by Ulrich Mayr)—The “switch-cost asymmetry” effect (switching takes longer into dominant than into nondominant tasks) has been explained as activation pattern carryover across switch transitions (e.g., Gilbert & Shallice, 2002). We show that asymmetric costs can also be obtained in the absence of a task switch. In an AAAABBBBB alternate-runs task-switching design, the first and second trial pairs within each same-task run were separated by either short or long intertrial intervals (ITIs), whereas within-pair trials were always short. Across two experiments, task selection costs, defined as Trial 1 versus Trial 2 within a pair, showed typical asymmetric costs after task changes for both ITIs, but also following task repetitions for the long ITI. Asymmetric costs without switching cannot result from carryover of activation patterns but are consistent with a long-term memory view of task selection (e.g., Mayr & Kliegl, 2000).

(4091)

Task Switching and Task Interruptions: Two Sides of the Same Coin? EDITA POLJAC, GERARD P. VAN GALEN, & HAROLD BEKKERING, *Radboud University Nijmegen* (sponsored by Gezinus Wolters)—Recently, task-switching paradigms became a tool for exploring cognitive control processes. Two series of behavioral studies with a multiple-trial paradigm investigated the relationship between task-switching and task-restarting performance. Response times and error rates were measured for switching and nonswitching conditions in a color and shape matching task. The first study showed that both explicitly (by visual cues) and implicitly (by temporal separations of task elements) induced task interruptions produced restart costs. Furthermore, the restart costs were present only if, besides restart, switching also was required in the same paradigm, implying a similar nature of the two transition types. The second study illustrated that the cost of task interruption and task switching profited in a similar way from beforehand preparation. Altogether, our data suggest common preparatory mechanisms behind task switching and task interruption. Moreover, the data imply that cognitive control processes are involved in both transition types.

• LANGUAGE PRODUCTION •

(4092)

Asymmetrical Language-Switching Costs: Is This Really Evidence for Language Suppression? MATTHEW S. FINKBEINER & ALFON-

SO CARAMAZZA, *Harvard University*—The asymmetrical language-switching cost (Meuter & Allport, 1999) is often cited as a signature effect of language suppression and has provided the bulk of empirical support for the language suppression hypothesis (Green, 1998). In this study, we found that unbalanced bilinguals exhibited an asymmetrical language-switching cost in a digit-naming task, but not when switching from digit naming to picture naming in the same experiment. Participants named pictures (in their L1) equally quickly regardless of whether the previous digit-naming trial had been named in L1 or L2. This was true even when the pictures and the digits elicited the same verbal responses (Experiment 2). We suggest that this finding constitutes a serious challenge to the language suppression hypothesis. In contrast to the suppression hypothesis, we suggest that bilingual lexical selection may proceed on the basis of differential activation.

(4093)

Word Spelling Performance Is Impaired by the Presentation of Errors During Feedback Intervention. EVE GRIVOT & ARNAUD REY, *LEAD-CNRS, Université de Bourgogne, Dijon*, SÉBASTIEN PACTON, *Université René Descartes, Paris*, & PIERRE PERRUCHET, *LEAD-CNRS, Université de Bourgogne, Dijon*—Several studies have shown that paying attention to misspellings has a negative impact on spelling performance (e.g., Brown, 1988). This observation suggests that when a teacher provides feedback after a spelling test, exposition to errors should be avoided. This hypothesis was tested in an experiment in which adult participants had to learn the spelling of 16 pseudowords. After a familiarization phase with all the pseudowords, participants performed two spelling tests successively. Between the two tests, one group did not receive any feedback on its spelling performance at Test 1. A second group received feedback and was exposed to its own errors. A third group received feedback but did not see its errors again. As was predicted, the results showed that performance at Test 2 was weaker for the second group. It therefore clearly indicates that exposing participants to their own errors during feedback intervention has a negative impact on spelling performance.

(4094)

Semantic Decomposability and the Acoustic Correlates of Idiom Production. DEBRA TITONE & SHARI BAUM, *McGill University*—Many studies have examined idiom comprehension; however, far fewer studies have examined spoken idiom production. In the present study, “verb the noun” idioms (e.g., *chew the fat*) were selected that varied in semantic decomposability of the verb and noun but were controlled in terms of familiarity and predictability of the idiom-final word. These idioms were embedded in idiomatic and literal contexts and were presented to 10 speakers in a manner that highlighted their interpretive contrast. Participants read the context sentence silently and then produced the idiomatic or literal target sentence for recording on digital media and, later, acoustic analysis. For all idioms, nouns were produced with longer durations in idiomatic, relative to literal, contexts. For idioms where noun decomposability was high, verbs were produced with shorter durations in idiomatic, relative to literal, contexts. These results suggest that speakers prosodically mark figurative productions of idiomatic expressions as a function of their semantic decomposability.

(4095)

Recency of Production Influences Semantic Substitutions in Blocked-Cyclic Naming. ESTHER Y. LEE, *Moss Rehabilitation Research Institute*, TATIANA T. SCHNUR, *Moss Rehabilitation Research Institute & University of Pennsylvania*, & MYRNA F. SCHWARTZ, *Moss Rehabilitation Research Institute*—When repeatedly naming sets of pictures from the same semantic category, aphasic speakers often produce substitutions from the set of pictures presented. These substitution errors could be due to random selection from the set or could depend on the recency of each name’s production (i.e., number of intervening trials, or “lag”). To assess whether recency played a role, we analyzed sub-

stitutions produced when aphasic participants named 12 sets of six related pictures in four-cycle blocks. To estimate the chance of producing substitutions by random selection, we shuffled target–response pairs within blocks, preserving each block’s cyclic structure. For both observed and random distributions, we calculated substitution frequency and the probability of a match for a given substitution, at each of the first six lags. After accounting for chance, both measures were found to change over lags. In accord with the competitor priming account, substitutions are dependent on the recency of previous production.

(4096)

Conditional Picture Naming: When It Costs and When It Doesn’t. CLAUDIO MULATTI, *University of Trento*, FRANCESCA PERES-SOTTI, *University of Padua*, & REMO JOB, *University of Trento*—Job and Tenconi (2002) proposed that to categorize-then-name pictures (conditional naming) does not take longer than just naming them (free naming), because the semantic information required for picture naming includes all the information required by categorization. An alternative explanation would be that the absence of cost in conditional naming, as compared with free naming, is due to the slow rate of activation of picture name representations, which allows other tasks, such as semantic categorization, to be covertly carried out. Empirical evidence disentangling the two explanations is provided.

(4097)

No Morphological Encoding in Chinese Word Production: Further Evidence. JENN-YEU CHEN, *National Cheng Kung University*, & GUAN-HUNG LIU & TRAIN-MIN CHEN, *National Chung Cheng University*—Employing the implicit priming paradigm, we had shown previously that word production in Chinese does not involve morphological encoding (Chen & Chen, in press). We sought further evidence from three experiments, employing the same paradigm. In Experiment 1, the disyllabic target words shared the initial characters or did not. The preparation effect was similar whether the shared characters corresponded to different morphemes or to the same morpheme. In Experiment 2, the disyllabic target words were monomorphemic or bimorphemic. They shared the initial syllables or did not. In the bimorphemic condition, the shared syllables were of the same character and of the same morpheme. The preparation effects were similar in the two conditions. In Experiment 3, associative word naming was contrasted with direct word naming. The preparation effect did not differ between the two versions of the implicit priming task. The results strengthened our previous conclusion.

(4098)

Errors in Deep Dyslexia Are Correlated With Words’ Production Complexity. ARPITA BOSE, ANNETTE COLANGELO, & LORI BUCHANAN, *University of Windsor*, & GUY VAN ORDEN, *Arizona State University*—Deep dyslexia is characterized by marked production of semantic errors and nonword reading difficulty. Various explanations have been proposed, particularly pertaining to the semantic and/or phonological systems. However, these explanations did not consider whether the output production difficulty of words could impact word reading. We tested for an effect of output production difficulty in a post hoc analysis of the reading errors of a deep dyslexic subject. Phonetic complexity of words estimated output production difficulty, and as words increased in phonetic complexity, so too did the likelihood of reading errors. In addition, the positive association of phonetic complexity with reading errors is modulated by semantic blocking. That is, the association was most pronounced when words were presented in blocks of semantically related words, as opposed to randomized lists. The findings will be discussed in the context of word production models including both lexical and production processes.

(4099)

Speech Errors: You Don’t Learn From Your Mistakes, You Simply Learn Your Mistakes. KARIN R. HUMPHREYS & HEATHER MENZIES, *McMaster University*—Every act of speaking is also an act of

learning; we become faster and more accurate after practice. This experiment tested whether making a speech error also leads to learning. Does making a mistake give speakers an opportunity to learn from that mistake and make them less likely to make the same error a second time? Alternatively, does making a speech error lead to the “learning” of that error, making it more likely to be made again. This experiment elicited phonological speech errors, using a SLIPs technique. Results show that speakers are much more likely to make a particular speech error in the test phase if they made the same mistake during the study phase. Furthermore, this effect appears not to be simply due to the repetition of the outcome words but, instead, implicates an erroneously learned mapping between the intended utterance and the errorful phonological outcome.

(4100)

Distinguishing Excitatory and Inhibitory Accounts of Semantic Interference: An Analysis of Aphasic Error Types. TATIANA T. SCHNUR, *Moss Rehabilitation Research Institute & University of Pennsylvania*, MYRNA F. SCHWARTZ & ADELYN BRECHER, *Moss Rehabilitation Research Institute*, & CATHERINE HODGSON, *University of Manchester*—Nonaphasic speakers take longer to name a repeated series of pictures from the same semantic category versus mixed categories, presumably due to increased competition for lexical selection from semantically related competitors. However, because latency data are open to multiple interpretations, the effect is equally compatible with an inhibition account: Repeated naming from the same semantic category delays lexical selection due to competitors’ reduced availability. We analyzed 5,755 aphasic errors in blocked-cyclic naming to test whether semantic errors increased (excitation prediction) or decreased (inhibition prediction) in the homogeneous, as compared with mixed, condition. We found that both semantic and omission errors linearly increased across repetitions. This pattern suggests that both result from competitive activation, omissions representing occasions on which competition was not resolvable prior to the response deadline. That the homogeneous manipulation caused semantically related words to become increasingly activated and miss-lected is evidence for competitive intrusions and against competitor suppression.

(4101)

Older Adults’ Tip-of-the-Tongue States Associated With Region-Specific Gray Matter Atrophy. MEREDITH A. SHAFTO, *University of Cambridge*, DEBORAH M. BURKE, *Pomona College*, EMANUEL STAMATAKIS & PHYLLIS TAM, *University of Cambridge*, GABRIELLE OSBORNE, *Claremont Graduate University*, & LORRAINE K. TYLER, *University of Cambridge*—Older adults have more frequent tip-of-the-tongue (TOT) states, in which they are temporarily unable to produce a familiar word. The hypothesis that phonological retrieval deficits cause TOTs is supported by behavioral evidence (Burke & Shafto, 2004) and the finding that TOTs correlate with activation in the insula (Kikyo et al., 2001), an area implicated in phonological production. Participants 19–88 years of age named celebrities cued by pictures, indicating when they had a TOT. Structural MR scans were obtained and voxel-based morphometry (VBM) was used to correlate gray matter concentration with age and TOT frequency. TOT frequency increased with age and correlated negatively with gray matter concentration in the insula. Another cognitive behavioral measure not involving phonological production (Raven’s matrices), correlated with age, but not with insula gray matter concentration. Age-related atrophy in neural regions important for phonological production may contribute to age-related word production failures, such as TOT states.

• CATEGORIZATION •

(4102)

Familiarity Processing in Primates and Avians: Observing Response Requirements. JEFFREY S. KATZ, *Auburn University*, ANTHONY A. WRIGHT, *University of Texas Health Science Center, Houston*,

BRADLEY R. STURZ, *Auburn University*, TAMO NAKAMURA & JACQUELYNE J. RIVERA, *University of Texas Health Science Center, Houston*, & KENT D. BODILY, *Auburn University*—Rhesus monkeys and pigeons learned a simultaneous *same/different* concept by responding to a sample picture 10 (monkeys) or 20 (pigeons) times before responding *same* or *different* to another picture. Familiarity of the sample item was manipulated by decreasing the observing response to zero. Good performance was maintained with the FR0 observing response. Trial-unique transfer tests conducted with the FR0 observing response showed, again, evidence for the abstract *same/different* concept. These results show that familiarity (as the term is commonly conceived) due to responding to the sample item is unlikely to be the major process for the abstract concept learning demonstrated by both species.

(4103)

Uncertainty Monitoring by Humans and Rhesus Macaques (*Macaca mulatta*) in the Categorization of Multidimensional Stimuli. JOSHUA S. REDFORD, MELANIE BOGDAN, & J. DAVID SMITH, *SUNY, Buffalo*—This study examined uncertainty monitoring in humans and macaques (*Macaca mulatta*) in a randomization categorization task drawn from general recognition theory. For both humans and monkeys, accuracy decreased as to-be-categorized stimuli approached the decision boundary that optimally separated the stimulus distribution of the two categories. Humans and 1 monkey also used an uncertainty response selectively to decline trials nearest the decision boundary. The results suggest that both species are similar in their classification of multidimensional stimuli and that both possess a generalized uncertainty-monitoring system that extends to tasks of categorization.

(4104)

Interaction of Stimulus Proximity, Property Overlap, and Aliveness in Similarity Judgments. KATJA WIEMER-HASTINGS & KIMBERLY K. BARNARD, *Northern Illinois University*—One-time observation of two items’ co-occurrence creates associations and may increase the items’ perceived similarity. Two experiments tested the influence of spatial distance on similarity. Stimuli varied in feature overlap, apparent aliveness, and spatial proximity. Proximity accentuated both similarity and distinctness of stimuli: Similarity ratings for adjacent items were increased for high-overlap and decreased for low-overlap items, relative to items separated by an empty space. When distance was conceptualized as a boundary (vertical line) between items, different patterns emerged for living versus nonliving stimuli: As compared with a no-boundaries but equal-proximity condition, nonliving stimuli were rated more similar and similar living stimuli were rated less similar when separated by a line. Finally, if the dividing space was filled by a third stimulus of the same kind, effects of spatial distance on similarity disappeared. Overall, the effect of spatial distance on similarity seems to be mediated by interpretation.

(4105)

Representing Visual Information of Concepts Facilitates Delayed Picture Recognition. DIANE PECHER, KIKI ZANOLIE, & RENÉ ZEELLENBERG, *Erasmus University Rotterdam*—According to the embodied view of cognition (e.g., Barsalou, 1999), sensory–motor simulations underlie the representation of concepts. Support for this view is given by findings of similar phenomena in perception and cognition. We investigated whether recognition of pictures of objects was facilitated by earlier representation of the visual properties of those objects. Object names (e.g., *apple*) were presented in a property verification task with a visual property (e.g., *shiny*) or with a nonvisual property (e.g., *tart*). Picture recognition was better if the concept name had been presented with a visual property than if it had been presented with a nonvisual property. These results indicate that modality-specific information is used for concept representation.

(4106)

Stimulus and Participant Variables Affect Responses in the Triad Classification Task. KAREN A. HUSSEY & JOHN PAUL MINDA,

University of Western Ontario—The triad classification task presents participants with a target concept and two possible associates. These associates are related to the target differently, allowing the researcher to contrast two classification alternatives. Participants choose which alternative to pair with the target concept. This task has been used to demonstrate many conceptual and perceptual preferences, including whether adults might prefer taxonomic groupings, such as *bed* and *crib* (Smiley & Brown, 1979) or thematic groupings, such as *baby* and *crib* (Lin & Murphy, 2001). We explore this issue further by examining the mode of stimulus presentation (words or pictures) and the sex of participants. Several experiments showed an overall preference for thematic classifications, but this was attenuated when the stimuli were presented as pictures. In particular, male participants tended to make taxonomic classifications when presented with pictures and thematic classifications when presented with words. We argue that classification preferences are dynamic and are influenced by various stimulus properties.

(4107)

Modeling Categorization Response Times Using Decision Trees: A Goodness-of-Fit Comparison of Rule-Based and Exemplar Models. DANIEL LAFOND & YVES LACOUTURE, *Université Laval* (sponsored by A. A. J. Marley)—Lamberts (2000) has modeled individual categorization response data from 10 participants, using the extended generalized context model and the exemplar-based random walk model. In the present study, we used three rule-based classification models proposed by Trabasso, Rollins, and Shaughnessy (1971) to fit the same data. A decision tree consistent with the observed response choices was first derived for each participant. The sequence of decisions within each tree provides the basis for response time modeling. Minimizing SSE with a quasi-Newton search algorithm allowed us to estimate individual parameters. Two goodness-of-fit indicators were used, MS_e and R^2 . Results show that one of the rule-based models, which has fewer free parameters than both exemplar models, provides overall best fit. Some implications for modeling categorization processes are discussed.

(4108)

Exemplar Models Seen as a Mixture of Serial Decision Rules. FABIEN MATHY, *Rutgers University, Piscataway* (sponsored by Jacob Feldman)—This poster reports a study of a decision tree model in Boolean concept learning. The model aims to determine the minimal decision tree corresponding to a concept. The time needed to classify a stimulus (i.e., response time) is linked to the number of decisions that must be made in order to know its category. When mixing all equivalent decision trees for a given concept, the mean predicted response times are perfectly correlated with those given by exemplar models. We present an experiment including 84 subjects who learned and applied Shepard's (1961) Type IV concept. The mean response times fit both decision tree and exemplar models. However, when the individual patterns are looked at, the decision tree model explains the results better than does the exemplar model in 69 out of 84 subjects.

(4109)

Knowledge Partitioning in Categorization Without Context. LEE-XIENG YANG, *National Chung Cheng University*, & STEPHAN LEWANDOWSKY, *University of Western Australia* (sponsored by Stephan Lewandowsky)—Knowledge partitioning refers to the notion that knowledge can be held in independent and nonoverlapping parcels. People use a context cue to choose a knowledge parcel for responding, while ignoring information held in other parcels. A number of studies have reported evidence for such context-gated knowledge partitioning in function learning (Lewandowsky, Kalish, & Ngang, 2002) and categorization (Yang & Lewandowsky, 2003, 2004). In addition, knowledge partitioning has been observed in function learning in the absence of context cues (Kalish, Lewandowsky, & Kruschke, 2004). We report a study that examined whether knowledge partitioning can occur without context cues in categorization. Partic-

ipants were trained with separate clusters of stimuli located in different regions of the category space and were found to learn two partial rules for categorization, as is predicted by the knowledge-partitioning framework. We show by simulation that a pure exemplar-based model, such as the GCM, has difficulty accommodating these results.

(4110)

QMQ Shows Male Adolescent Sex Offenders Can Respond to Therapy. R. CHRIS MARTIN, *University of Missouri, Kansas City*, DEBBIE K. MARTIN, *Quality Motivation Corporation*, BONNIE E. POOLE & LEAH K. GENSHEIMER, *University of Missouri, Kansas City*, & SCOTT U. LEGRAND, *Devereaux Florida Network*—Adolescent male sex offenders are recalcitrant therapy subjects for many reasons. A midwestern Boy's Town facility provided a structured environment with many group sessions and several individual sessions weekly, with an emphasis upon behavioral change. The Quality of Motivation Questionnaire (c) is a true/false, computer-scored instrument that provides 38 scales, including amounts of positive and negative motivation, energy level, emotional stability, depression, life styles, and skills. Upon presentation, they were deceitful, depressed, and high in maladaptive skills, such as self-sabotage, self-punishment, and a lack of problem-solving abilities. Success of treatment was shown in statistically significant changes in five areas: emotional stability, depression, decision making, responsibility, and problem solving. Recommendations are made regarding how to further improve adaptive skills and reduction in the maladaptive ones. Depression scores, although reduced, were still high, and specific changes are needed. The attitude that sex offenders are immutable might need to change.

(4111)

Accessibility of Taxonomic and Script Knowledge in the Domain of Food. ANNA Z. VITKIN, JOHN D. COLEY, & KONSTANTIN FEIGIN, *Northeastern University*—Ross and Murphy (1999) showed that priming improved the accessibility of script knowledge about food (apple as snack), but not taxonomic knowledge (apple as fruit), relative to neutral priming, suggesting that taxonomic knowledge is more accessible to reasoning about food. We examined the effects of cross priming, asking whether incongruent priming would differentially interfere with accessibility of script versus taxonomic knowledge. Participants read a sentence about a food that primed either taxonomic or script knowledge. They then verified the food's taxonomic or script category membership (congruent or incongruent with priming). Overall taxonomic decisions were faster and more accurate than script decisions. Incongruent priming had no effect on taxonomic decisions, whereas script decisions were significantly slower and less accurate for incongruent primes. Taken together with Ross and Murphy (1999), this suggests that not only is script knowledge less accessible overall, but also it is actively inhibited by the activation of taxonomic knowledge.

(4112)

Who Do You Look Like? Further Exploration Into the Relationship Between Names and Faces. MELISSA A. LEA, *Union College*, ROBIN D. THOMAS, AARON T. BELL, NATHAN A. LAMKIN, & JEFF H. SHOLL, *Miami University*—Many cognitive researchers support the notion that names and facial features have no relationship with each other (Bruce & Young, 1986; Burton & Bruce, 1992). However, Lea (2002) showed that when participants are given a name and are asked to provide a description of that person by rating second-order relational features, they give similar descriptions of how that face should look. For example, the name "Bob" provoked a description of a wide-faced, round-featured man, and "Tim" a thin-faced, thin-featured man. Conversely, the present study was conducted to determine whether participants would consistently label a set of prototype faces with those names. That is, would participants give the wide-faced, round-featured face the name "Bob"? The results demonstrate that participants are reliable at giving names to prototype faces and support the idea that faces and names can have a direct relationship.

(4113)

Perception of Age in Human Faces. PATRICIA A. COSTELLO, *Gustavus Adolphus College*, & TRACY L. CLEVELAND & SETH M. LANGEVIN, *Bradley University*—Faces convey a substantial amount of information about their owners, including emotional state, gender, and age. Perception of age plays an important role in how we interact socially with others. This study seeks to understand how people's age and gender influence age judgment of an unknown face. The study also examines the effect of exposure time on the judgment about a face's age. Younger subjects (college age) viewed male and female faces ranging from 20 to 80 years old for 100 msec and estimated how old each face was. Older subjects (55–85) viewed faces for 3 sec and also estimated how old each face was. All subjects also categorized the faces as "young" or "old." Both the younger and the older subjects were more accurate for their own age groups, but younger subjects tended to underestimate faces from older age groups and older subjects tended to underestimate younger age groups.

(4114)

Revisiting the Chicago–Rome Effect. CATHERINE MELLO & MICHÈLE ROBERT, *Université de Montréal*—Examination of biases in location estimates has led some authors (Friedman & Brown, 2000; Friedman, Kerkman, & Brown, 2002) to think that North America, Europe, and Africa were organized in distinct subjective units. The present study assesses the biases existing in relative location judgments for pairs of Old and New World cities belonging to different subjective subregions. Sixty undergraduate students from Québec provided 28 location estimates, using a compass. Overall, their answers were biased, as predicted, from previous studies. However, analyzing individual items suggests that the subjective geography of these participants may differ from that of the prior Albertan and American samples. The present participants seem to align the United States with southern Europe and northern Africa and do not appear to conceptualize northern Europe as a whole. Since such distortions in geographical representations cannot be explained by climate considerations, the role of various categorical cues needs to be investigated.

(4115)

Influence of Task Rule on the MARC Effect. YANG SEOK CHO, *Korea University*, & ROBERT W. PROCTOR, *Purdue University*—The MARC effect is that performance is better when an even number is mapped to the right response and an odd number to the left response than when the mapping is opposite. Two experiments examined the effect of task rule on the MARC effect. In Experiment 1, participants made left–right keypresses to Arabic numerals 3, 4, 8, and 9 with the odd–even classification rule or with a multiple-of-3-or-not rule. The MARC effect was evident with the odd–even rule, whereas a reverse MARC effect was obtained with the multiple-of-3-or-not rule. However, the SNARC effect (left response faster for small numbers and right response for large numbers) was not influenced by task rule. In Experiment 2, in which the stimuli were Arabic numbers or number words, the same result pattern was obtained for both stimulus modes. These results suggest that the MARC effect is due to a coding asymmetry determined by task rule.

(4116)

Thematic Relations and Individual Differences in the Noninversion of Similarity and Difference. SABRINA G. SIMMONS & ZACHARY ESTES, *University of Georgia* (sponsored by Zachary Estes)—We investigated the role of thematic relations in the apprehension of similarity and difference, and we identified systematic individual differences in the perception of similarity. Although traditional models construe similarity as a weighted function of common and distinctive features (Tversky, 1977), recent evidence suggests that thematic relations also influence perceived similarity (Wisniewski & Bassok, 1999). That is, related items (milk–coffee) are judged more similar than unrelated items (milk–lemonade). Experiment 1 revealed that thematic relations affect similarity more than difference (the nonin-

version effect). Experiment 2 eliminated this noninversion effect by instructing participants to ignore relations. Experiment 3 used a pre-screening task (Is *dog* more similar to *cat* or *bone*?) to distinguish relation-dominant participants (*bone*) from feature-dominant participants (*cat*). Relation-dominant participants exhibited the noninversion effect, whereas feature-dominant participants did not. Results suggest that the noninversion of similarity and difference is attributable to thematic relations, and is subject to individual differences.

(4117)

Bidirectional Relatedness Norms: Comparisons With Associability and Latency Measures. HARRIETT AMSTER & DAVID S. GORFEIN, *University of Texas, Arlington*, & KIMBERLY K. WEAR, *High Point University*—Rated relatedness ratings were obtained for word pairs that were of three types: (1) members of the same category (e.g., *ruby–emerald*), (2) associatively related as primary (e.g., *black–white*) or secondary (e.g., *black–dark*), and (3) assorted relationships, including homographs paired with related nonhomograph responses to each of two meanings of the homograph (e.g., *bat–baseball*; *bat–rat*). The ratings for relatedness were obtained in both the forward and the backward directions.

• MATHEMATICAL COGNITION AND PROBLEM SOLVING •

(4118)

All Mixed Up: The Effect of Numeral Format on Single-Digit Addition and Multiplication Performance. JO-ANNE LEFEVRE & MARCIE PENNER-WILGER, *Carleton University*—How does numeral format affect calculation? University students ($n = 40$) solved single-digit problems in either addition or multiplication in digit format (e.g., $2 + 3$), word format (e.g., two + three), and mixed format (e.g., $2 +$ three; two + 3). Participants reported their solution methods. For addition, participants took longer to solve mixed than digit problems and longer to solve word than mixed problems. Participants also reported using retrieval less frequently for word than for digit problems. There was a problem size effect for all dependent measures, but no format \times size interaction for addition. For multiplication, participants were slower to solve word than mixed or digit problems. There was a problem size effect for all dependent measures, and there was a format \times size interaction such that the problem size effect was greater for digit than for mixed or word problems. Implications for theories of arithmetic performance are discussed.

(4119)

Effects of Numerical Surface Form on Performance of Simple Arithmetic Rules. JAMIE I. CAMPBELL & ARRON W. METCALFE, *University of Saskatchewan*—Adults performed simple, rule-based arithmetic problems ($N + 0 = N$, $N \times 1 = N$, $N \times 0 = 0$) composed of Arabic digits (5×1 ; $0 + 4$) or written English number words (five \times one; zero + four). With Arabic digits, $N \times 0 = 0$ was relatively slow, compared with the other zero and one problems, and there was a high rate of $N \times 0 = N$ errors. In contrast, with word stimuli, $N \times 0$ items were relatively fast and yielded a low rate of $N \times 0 = N$ errors. These format-related differences imply that Arabic digits generated more inter-rule confusion than did number words. These findings provide additional evidence that numeral-encoding mechanisms and central mechanisms for calculation can be interactive, rather than strictly additive, processes.

(4120)

Assessing Students' Mathematics Learning. PATRICIA BAGGETT, *New Mexico State University*, & ANDRZEJ EHRENFEUCHT, *University of Colorado, Boulder*—In the United States, in conjunction with state and national standards, as well as NCLB evaluations of schools, methods of assessment and their uses are hotly discussed. Most assessment instruments rely heavily on multiple choice questions and short answers and are also cumulative, covering many topics only briefly. We are experimenting with a different paradigm. Students are taught a

specific lesson that requires them to apply a variety of math concepts. Then, after some delay, they are asked to summarize what they have learned and understood by doing a guided recall task. Lesson plans and data from five groups of fifth through eighth graders from a region in the southwestern United States are shown, and methods of their evaluation, together with conclusions, are presented.

(4121)

The Whole or the Sum of the Parts: Strategies for Multidigit Addition. TINA SHANAHAN & JO-ANNE LEFEVRE, *Carleton University* (sponsored by Jo-Anne LeFevre)—Adults and children use a variety of procedures to solve simple mental arithmetic problems (e.g., $2 + 3$, $7 + 9$), and these procedures are differentially effective. For example, in mental addition, direct retrieval of stored number facts is faster and more accurate than counting up. Strategy choice in simple arithmetic varies with characteristics of the individual, such as age and math ability, and with problem characteristics, such as complexity. In the present research, we examined the range of strategies that were reported by young adults ($N = 30$) in mental calculation of multidigit sums (e.g., $37 + 28$) and determined the extent to which these choices were influenced by individual differences (e.g., math ability) and by problem characteristics (e.g., complexity, orientation). The results have impli-

cations for understanding how adults select strategies for complex mental calculations.

(4122)

The Perceptual Constituents of Algebraic Knowledge. DAVID LANDY & ROBERT L. GOLDSTONE, *Indiana University* (sponsored by Robert L. Goldstone)—In addition to being a cognitive activity of great practical significance, algebraic reasoning is a default example of symbolic processing. Unlike purely internal processes, algebraic symbol manipulation requires complicated acts of perception. This poster presents the results of two experiments that demonstrate a significant interaction between the application of the order of precedence laws and nonmathematical grouping effects. In both experiments, subjects judged whether an equation containing both additions and multiplications was valid. In the first, the spacing between terms was manipulated to either support or violate the order of operations. In the second experiment, the symbols were chosen so that letters on the sides of an operation were either nearby or distant in the alphabet. In both experiments, grouping pressures inconsistent with the order or precedence rule impeded correct judgment only when the correct answer depended on the grouping. This indicates that algebraic reasoning interacts with nonmathematical grouping pressures.

POSTER SESSION V
Sheraton Hall, Saturday Evening, 6:00–7:30

• VISUAL PROCESSING •

(5001)

The Poggendorff Illusion: Rectangle Fill Patterns Alter Illusion Magnitude. CLARE K. PORAC, *Pennsylvania State University, Erie*, & ALAN SEARLEMAN, *St. Lawrence University*—Masini et al. (1992) found that illusion magnitude (IM) in the Poggendorff is lowest when the inducing rectangle is filled with lines resembling the figure's oblique line. IM is highest when the rectangle is filled with lines that mimic the straight lines in the inducing rectangle. In Experiment 1, six Poggendorff figures were presented with vertical rectangles that were filled with vertical lines of high and low spatial frequency or horizontal lines of high and low spatial frequency or were solid white or black. In Experiment 2, the same six Poggendorff figures were presented with a horizontal rectangle. IM was highest in Experiment 1 when the rectangle was filled with low spatial frequency vertical lines. In Experiment 2, IM was highest when the rectangle was filled with vertical lines. Vertical line fill causes higher IM regardless of the orientation of the straight lines in the rectangle.

(5002)

ART Theory Accounts for Perceived Changes in Perspective Pictures Due to Eye Height. IGOR JURICEVIC & JOHN M. KENNEDY, *University of Toronto, Scarborough*—A problem that has been with the study of vision since the Renaissance is our reaction to perspective in pictures. Perspective pictures of square tiles can be drawn using a high, low, or intermediate eye height. When the eye height is low—that is, close to the ground—many quadrilaterals that depict squares appear compressed. But increase the eye height and the apparent compression decreases, producing quadrilaterals that appear square or even elongated. A two-factor angles and ratios together (ART) theory explains which quadrilaterals appear compressed, square, or elongated across the different eye heights. The ART theory's two factors are (1) the ratio of the visual angles of the tile's sides and (2) the angle between the normal to the picture plane from the observer and the direction to the tile from the observer. We point out implications for constancy.

(5003)

Asynchronous Priming in the Gamma Band Facilitates Discrimination of Kanizsa-Type Forms. ROBERT G. MORRISON, *Xumesis*, & HONGJING LU, JOHN E. HUMMEL, & KEITH J. HOLYOAK, *UCLA*—We investigated the role of temporally structured priming in discrimination tasks involving perceptual relations between multiple Kanizsa-type figures. Visual information presented as asynchronous flicker in the gamma band can modulate the perception of multiple objects in a subsequent display, decreasing response time to identify and discriminate relations between the objects. Our findings provide support for the JIM model of visual binding.

(5004)

The Flash-Lag Effect Is Modulated by Accumulating Preprobe Excitation and Postprobe Inhibition. MICAH GEER & WILLIAM C. SCHMIDT, *SUNY, Buffalo*—The flash-lag effect occurs when observers perceive a flashed probe to lag spatially behind a moving target even though both were physically aligned at the time of the flash. The present research manipulated properties of the target theorized to modulate the speed at which signals from moving stimuli are neurally processed. The results are at odds with a number of explanations of the effect and are predicted exclusively by an account that relies on accumulating subthreshold excitation and cumulative lateral inhibition induced in cortical maps by the moving stimulus.

(5005)

Eye-Movement-Based Biometric Measures. FRANK M. MARCHAK & TANNER L. KEIL, *Veridical Research and Design*—Kasproski and

Ober (2005) describe a method for characterizing eye movements to a moving point that can capture differences among individuals and uniquely identify a specific individual. In this work, we attempt to produce a similar result by characterizing eye movements to static images of natural scenes. Standard eye movement measures based on fixation and saccade data were examined for subjects repeatedly viewing the same images. A selection of classification techniques were applied to these data to determine a set of parameters that could uniquely identify an individual. We present the results of these efforts, both positive and negative, and discuss the implications of the use of eye movements as a biometric measure.

(5006)

The Development of Sensitivity to a Common Region as a Perceptual Organizational Principle. ANGELA HAYDEN & RAMESH S. BHATT, *University of Kentucky*, & PAUL C. QUINN, *University of Delaware*—We examined whether 3- to 4-month-olds and 6- to 7-month-olds exhibit sensitivity to a common region as an organizing principle. Infants were familiarized to two rectangles, one of which contained two stars. Older infants looked longer at a novel pattern in which one of the stars was now located in the other rectangle than at a pattern in which the star was displaced the same amount but still within the same rectangle. Infants in a control condition in which the organization was not based on a common region failed to discriminate between analogously modified patterns. Thus, 6- to 7-month-olds exhibited evidence of sensitivity to a common region. However, 3- to 4-month-olds failed to exhibit similar sensitivity in this study and in a subsequent study with simpler patterns. These results indicate that the principle of common region is functional in infancy, although not until sometime after 3–4 months of age.

(5007)

Configural Processing of Faces and Objects: An ERP Study of the Thatcher Illusion. LUC BOUTSEN, *Aston University*, & GLYN W. HUMPHREYS, PETER PRAAMSTRA, & TRACY WARBRICK, *University of Birmingham*—In the Thatcher illusion, a face with inverted eyes and mouth looks abnormal when upright, but not when inverted. Behavioral studies have shown that Thatcherization of an upright face disrupts perceptual processing of the local configuration. We studied ERP correlates of the illusion during the perception of faces and non-face objects, to investigate whether inversion and Thatcherization affect similar neural mechanisms. Observers passively viewed faces and houses in four conditions (upright vs. inverted and normal vs. Thatcherized) while detecting an oddball category (chairs). Thatcherization modulated N170 to faces, but not to houses, over the occipito-temporal cortex. This modulation matched the illusion, since it was larger for upright than for inverted faces; it occurred for whole faces and parts. P1 was unaffected by Thatcherization but was modulated by inversion. Face Thatcherization affected P2, whereas inversion affected P2 across categories. These results suggest that inversion and Thatcherization disrupt perceptual encoding of faces and objects differently.

(5008)

Do Affordances Change With Changes in Body Shape? WILLIAM LANGSTON & CHARLOTTE TIDRICK, *Middle Tennessee State University*—Patients undergoing weight loss surgery frequently report a mismatch between their new body shape and their perceived shape (affecting such decisions as which chairs can hold them or whether they can walk down the aisle in an airplane). Preliminary research was conducted to determine what might influence changes in affordances after changes in body shape. For an initial study using a method of limits procedure, participants were asked to judge whether or not they could fit through an aperture when facing forward or sideways or carrying a large backpack. Participants were then asked to pass through the aperture to determine the smallest gap through which they could actually fit. Participants were slightly more accurate for facing forward than for facing sideways or carrying a backpack. Additional studies will investigate improvements to the methodology and how af-

fordances change with changes in body shape (e.g., becoming more accurate while a well-stuffed backpack is worn).

(5009)

Changes in Visual Awareness: Event-Related Brain Potential Correlates. HARTMUT LEUTHOLD, *University of Glasgow*—In a recent event-related brain potential (ERP) study (Koivistu & Revonsuo, 2003), awareness of visual change has been associated with an early negative ERP deflection over posterior electrodes. This study employed rectangular stimuli that varied only in orientation. Thus, to investigate whether the change-related ERP negativity is independent of the object dimension changing, I conducted an experiment that used objects defined by color and shape. In different change detection task blocks, where memory set size (2 vs. 5 items) varied randomly, participants were to indicate change in either color or shape. ERPs from 12 participants were simultaneously recorded during task performance. A negative amplitude shift over parieto-occipital electrodes, about 200 msec after stimulus onset, was triggered by detected changes, as compared with undetected and no changes. In conclusion, the present study strengthens the view that a posterior ERP negativity provides a neural correlate of processes associated with changes in visual awareness.

(5010)

Repetition Blindness for Chinese Characters: Form and Meaning Matter. CAILI WU, ALBRECHT W. INHOFF, & CYNTHIA M. CONNINE, *SUNY, Binghamton* (sponsored by Albrecht W. Inhoff)—Repetition blindness (RB) is the failure to detect the second occurrence of repeated words presented in rapid serial visual presentation. However, absolute repetition of two items is not the prerequisite for RB. RB was found for two English words that were either visually or phonologically similar. Yet there was little evidence for a semantic contribution to RB. By using some unique properties of Chinese characters, two experiments were conducted to investigate whether the form, sound, and meaning of a Chinese character contributes to the RB effect. The results showed form overlap alone was sufficient to produce RB but that sound overlap alone was not adequate for RB to occur. Given some form overlap (i.e., two characters shared the same semantic radical), semantically related character pairs yielded more RB than did semantically unrelated character pairs.

(5011)

Object Substitution Masking Interferes With Semantic Processing: Evidence From ERPs. JASON E. REISS & JAMES E. HOFFMAN, *University of Delaware*—Object substitution masking (OSM) refers to impaired target identification caused by the common onset, but delayed offset, of a surrounding dot mask. This effect is believed to result from reentrant processes that replace the target representation with the mask. However, little is known about the degree of processing associated with masked targets. We investigated this issue by examining the effect of OSM on the N400 ERP component, which reflects the degree of semantic mismatch between a target and its context. Participants read a “context” word followed by a semantically related or unrelated “target” word surrounded by dots. As was expected, delayed dot offset led to significantly reduced target identification accuracy. Importantly, the N400 component was also diminished by OSM. These results indicate that OSM interferes with target processing prior to semantic analysis, demonstrating an important difference between OSM and visual phenomena such as the “attentional blink,” where semantic processing is independent of identification accuracy.

(5012)

Temporal Dynamics of Suppression in the Distractor Previewing Effect. ALEJANDRO LLERAS, *University of Illinois, Urbana-Champaign*, & JUN KAWAHARA, *Hiroshima University*—When a visual search for a color oddball (e.g., a red diamond among green diamonds) is performed, oddball-absent trials (for which no response is required) affect performance on the subsequent oddball-present trial, an effect known as the *distractor previewing effect* (DPE). Specifi-

cally, the color of the distractors in the oddball-absent trial (e.g., green) suppresses responses to a target of that color in the subsequent trial (a green target among red distractors), even though participants report a target attribute uncorrelated with color. We investigated the temporal dynamics of this suppression. On oddball-present trials, we switched the color of the items at different points during the trial. Oddball status and correct response were maintained before and after the switch. Despite this, we found that color-switches occurring as early as 100 msec into the trial reduced the magnitude of the DPE by about 50%. Implications regarding the locus of the DPE are discussed.

(5013)

Speed–Accuracy Tradeoff in Reaction Times During Smooth Pursuit. YASUHIRO SEYA & SHUJI MORI, *Tokyo Metropolitan University*—We examined reaction times (RTs) during smooth pursuit eye movement with different retinal eccentricities and stimulus velocities. In Experiment 1, participants were asked to pursue a row of circular frames moving at a constant velocity and to respond to the target presented within one of the frames. In Experiment 2, the participants were presented with stimuli identical to those used in Experiment 1 while fixating their eyes on stationary central points. The results of Experiments 1 and 2 showed that the RTs during both smooth pursuit and fixation increased with the retinal eccentricity. The RTs during fixation increased with the stimulus velocity, whereas RTs during smooth pursuit did not change systematically with velocity (although there were large individual differences). We propose that the latter finding is due to a tradeoff between response speed (RT) and pursuit accuracy.

• ASSOCIATIVE LEARNING AND SKILL ACQUISITION •

(5014)

Imagine That! Motor Imagery Enhances Repetition Priming of Sequences. ERICA L. WOHLDMANN, ALICE F. HEALY, & LYLE E. BOURNE, *University of Colorado, Boulder*—We examined the efficacy of motor imagery for sequence learning and skill acquisition. Subjects participated in four experimental phases: familiarization, training, testing, and recognition. Familiarization involved typing 32 four-digit numbers. During training, 64 different four-digit numbers were presented five times each. The 80 subjects were assigned to four training groups: The control group merely looked at each number; the physical group typed each number; the imagery-move group imagined typing each number while making finger movements; and the imagery-grip group imagined typing each number while holding a mouse to inhibit finger movements. At testing, which required typing old and new numbers, all but the control group showed repetition priming (i.e., an *old–new* difference). The recognition test indicated that explicit memory was neither necessary nor sufficient for repetition priming. These findings suggest that motor imagery can be used to learn new sequence representations, but not necessarily new motor skills.

(5015)

Observed Individual Differences by Controlling Any Timings of Occurrences of Vast Study Events. TAKAFUMI TERASAWA, *Okayama University*, TETSUYA YOSHIDA, *Tokoha Gakuen University*, KYOKO MAEMOTO, *Okayama Higashi Commercial High School*, ATSUSHI KATSUBE, *Okayama University*, & NOBUO OHTA, *Tokyo University of Social Welfare*—We conducted a 5-week learning study on the second-language (English) acquisition of high school students. At a study phase, students were asked to rate their achievement (i.e., how far they had mastered the Japanese meaning of each English word) for each English–Japanese pair word on a 4-point scale (0 = *no good at all*, 1 = *no good*, 2 = *good*, and 3 = *perfect*). For all the pairs, the number of study repetitions (1, 4) and occurrences of learning events were controlled. For controlling the timing of occurrences of vast study events (over 1 million), a new experimental design had to be developed. The design also enables researchers to measure the ef-

fect of long-term learning (over 1 year). The results showed that the effects of even slight word learning were accumulated unconsciously. Furthermore, individual differences were clearly described by the progress of achievement for each student.

(5016)

Examining the Applicability of a New Method for Measuring the Long-Lasting Effects of Learning. TETSUYA YOSHIDA, *Tokoha Gakuen University*, TAKAFUMI TERASAWA & ATSUSHI KATSUBE, *Okayama University*, & NOBUO OHTA, *Tokyo University of Social Welfare* (sponsored by Nobuo Ohta)—This study shows that a new experimental design, which we call the *micro-step method*, is widely applicable for measuring the effects of learning with various study materials. This experimental design was developed to measure minutely the effects of relatively long-lasting repeated learning, for weeks or months, by controlling various timings in the presentation of study materials. Yoshida et al. (2003) examined the long-lasting effects of learning second-language (English) word acquisition by Japanese senior high school students for 6 months, using the micro-step method. This study examines the same effects of learning for the acquisition of scientific terms (terms in psychological domain) by Japanese undergraduates. The expected result is that the main effects of learning will certainly be accomplished and that individual differences will be large.

(5017)

Training Effects on Implicit Stereotype Bias in the Decision to Shoot. KIMBERLY M. FENN & BERND WITTENBRINK, *University of Chicago* (sponsored by Howard C. Nusbaum)—Stereotypes affect the way we act toward others, and in the extreme, holding negative stereotypes can lead to violent outcomes. In a video game setting, participants were quicker to press one button to “shoot” an African-American target and to press a different button to “not shoot” a Caucasian target (Correll et al., 2002). However, real guns have a single trigger, and choice decisions are different from go/no-go decisions. Does the racial shooter bias occur with a more realistic response? With a go/no-go task, participants are both quicker and more accurate in shooting African-American targets than Caucasian targets. Does the probabilistic association of race and gun change this shooter bias? Stereotypic or counterstereotypic training resulted in a significant change in the size and direction of the shooter bias. Counterstereotypic target distributions reduce shooter bias; stereotypic training increases bias. Training can modify implicit stereotype effects and may ameliorate shooter bias.

(5018)

Causal Learning: Cue Competition With Two- Versus Three-Cue Compounds. LEYRE CASTRO & EDWARD A. WASSERMAN, *University of Iowa*—Pairings of Cue A with an outcome, either before or after pairings of Compound Cue AB with the same outcome, lead to weakened responding to Cue B in testing. Our experiments consider the case in which the compound comprises three cues (i.e., ABC) instead of two, a situation that poses interesting questions: Will judgments to both Elemental Cues B and C decrease when Cue A is paired with the outcome? Will judgments to Compound Cue BC also decrease? What about Compound Cues AB and AC? In general, participants’ judgments reflected the value of the elemental cues. Moreover, low judgments to Elemental Cues B and C were observed when the elemental phase preceded the compound phase, but not when the order was reversed. These results raise difficulties for both associative and statistical accounts of causal learning.

(5019)

Word Associations are Formed Incidentally During Sentential Semantic Integration: A Behavioral and Electrophysiological Study. ANAT PRIOR-UNGER, *Carnegie Mellon University*, & SHLOMO BENTIN, *Hebrew University of Jerusalem*—We explored the manner in which sentential context facilitates the incidental formation of word

associations. In Experiment 1, unrelated word pairs were embedded in either coherent or semantically anomalous sentences, including either local or global anomalies. At study, participants performed a sentence categorization task. The strength of the incidental associations formed between sentence constituents was probed by assessing their associative priming effect in a subsequent unexpected explicit recognition test for single words. Significant priming was found for noun pairs studied in coherent sentences, but not for those appearing in anomalous sentences, regardless of anomaly type. Experiment 2 used the N400 component to further investigate the difference between the types of semantic anomaly. Global anomalies were found to disrupt online word integration more than did local anomalies, but both types of anomalies were equally detrimental to whole-sentence integration. Thus, sentence constituents may be incidentally associated during sentence processing, particularly as a result of whole-sentence integration and mental model consolidation.

(5020)

Memory-Contingent Patterns of Brain Activity During Integrative and Isolated Encoding of Word Pairs. BRIAN G. HOWLAND & IRA S. FISCHLER, *University of Florida* (sponsored by Ira S. Fischler)—College students were shown object–location noun pairs (e.g., *elephant–library*; *apple–beach*) and were asked either to image each pair in a single common event or scene or to image each named object separately. Words in a pair were shown individually for 3 sec each, while EEG was recorded. Associative memory (recognition of intact vs. re-matched pairs), but not item memory, was better following integrative encoding. Slow-wave potentials in the ERPs differentiated the two tasks. Memory-contingent differences in the ERPs were found for both associative and item memory, but the latency and topographic pattern of these memory-contingent ERPs differed across the specific encoding task and type of memory test. Results are discussed in terms of the nature and functional anatomy of Baddeley’s “episodic buffer” and the distinction between item and relational processing.

(5021)

The Associative Memory Basis of Cognitive Skill Learning: Adult Age Differences. WILLIAM J. HOYER, JOHN CERELLA, & SERGE V. ONYPER, *Syracuse University*—It has been established that “item learning” underlies cognitive skill development and that there are substantial age deficits in the rate of item learning. In a between-groups design, we compared learning rates for the same set of items in skill training (ST) and paired-associate training (PAT). We found main effects due to condition (PAT items were acquired earlier) and to age (older adults’ learning was delayed), but no condition \times age interaction. Thus, the age deficit in ST can be accounted for by the age deficit in associative memory; no further explanation is needed. We also analyzed fast and slow retrieves in ST and PAT and found that the frequency of fast retrieves did not differ. The overall advantage of PAT was due to the use of slow retrieves, which were absent in ST. We conjecture that the skill algorithm displaces the recollective process in ST.

(5022)

Item Learning in Skill Training: Strategic or Automatic? BRANDY BESSETTE-SYMONS, WILLIAM J. HOYER, & JOHN CERELLA, *Syracuse University* (sponsored by William J. Hoyer)—Repeated items are learned individually in the course of cognitive skill training, allowing the skill algorithm to be bypassed. There is a question whether this learning occurs automatically or requires a deliberate strategy. We tested one implication of the latter: Repeats from a mixed list of repeated and novel items should be learned less rapidly than repeats from a pure list of all repeated items, because the strategy fit is only partial. In three between-groups experiments, we found no condition difference in learning rate for mixed and pure lists equated on interitem lags. This was true for both short and long lists and for both younger and older adults. We concluded that item learning proceeds autonomously, driven by item repetition independently of list composition or task-level context.

(5023)

Elemental Associability Changes in Complex Discrimination Learning. EVAN J. LIVESEY & IAN P. L. McLAREN, *University of Cambridge*—The present study complements recent evidence, from human learning, of associability changes governed by associative history and the relative predictiveness of stimulus features. Participants completed a complex discrimination task involving categorization of abstract patterns with multiple common features, the frequency of occurrence of each feature being partly predictive of the correct response. Differential performance on a second discrimination task suggested that the stimulus features most predictive of the original correct responses were more associable with new responses, as compared with less predictive stimulus features. Implications for the rules governing associability change are discussed in relation to this and other discrimination learning effects.

(5024)

Complex Skill Learning and Generalization by Gerbils. MORGAN C. RUCH, ESTELLA H.-M. LIU, & EDUARDO MERCADO III, *SUNY, Buffalo*—We shaped gerbils to move a ball from arbitrary locations to a specified goal. After training, we tested each gerbil's ability to perform this task when the ball was placed in various locations; gerbils ($N = 6$) proved to be able to reliably perform the task. Next, we examined how gerbils generalized this skill when performing in novel social contexts. Specifically, we tested transfer when two gerbils were placed together and given the opportunity to perform the task under the following conditions: the gerbils were (1) both required to move the ball to the same location (a cooperative task), (2) each required to move the ball to a different location (a competitive task), (3) cagemates, and (4) not cagemates. Gerbils showed complete transfer in the cooperative situation, independently of their familiarity with the partner gerbil, but failed to generalize in the competitive situation. These data suggest that actions observed in novel contexts disrupt learned behavior less when subjects share a common goal.

(5025)

Social Enhancement of Food Finding in Green Sea Turtles. MARTHA A. MANN, ROGER L. MELLGREN, & ALBERTO L. BONFIGLIO, *University of Texas, Arlington*—Socially mediated learned behaviors were examined in posthatchling green sea turtles (*Chelonia mydas*). A food source was confined to one part of a tank while a mesh barrier sequestered a single observing, food-deprived turtle in another part of the tank. Each turtle (1) watched a trained turtle feed from the source, (2) watched a naive turtle discover food from the source, or (3) spent time in isolation (control). When the barrier was removed, allowing the turtle to feed by itself, those that had watched the naive turtle feed exhibited a shorter latency to feed than did the turtles in the remaining two conditions, suggesting a local enhancement effect. That turtles that had observed the trained subjects did not differ from control subjects may have been due to the fact that the trained demonstrators located and consumed food too rapidly and efficiently to be effective models for foraging.

(5026)

Contextual Control of Consummatory Successive Negative Contrast. ALAN M. DANIEL, MICHAEL WOOD, SANTIAGO PELLEGRINI, JACOB N. NORRIS, & MAURICIO R. PAPINI, *Texas Christian University* (sponsored by Mauricio R. Papini)—Rats exposed to reward downshift show behavioral deterioration. This phenomenon, called *successive negative contrast* (SNC), occurs in instrumental and consummatory responses (iSNC, cSNC). Whereas iSNC is related to the violation of reward expectancies retrieved in anticipation of the goal (cued recall), cSNC involves reward rejection and may require only recognition memory. However, a within-subjects experiment reported here suggests that cued-recall memory is also involved in cSNC. One group of rats received access to 16% sucrose solution in one context and 2% sucrose in another, for a total of 30 daily trials (X16/Y2). Sub-

sequently, rats received X2/Y2 postshift training for an additional 10 daily trials. Rats showed cSNC by displaying less consummatory behavior in the shifted context (X) than in the unshifted context (Y). Groups receiving X16/Y16 and X2/Y2 trials throughout training indicated that simultaneous negative and positive contrasts did not contribute to the cSNC effect observed in the experimental group.

(5027)

Similarity Between Target and Interfering Associations Facilitates Proactive Interference in Rats. JEFFREY C. AMUNDSON, DANIEL S. WHEELER, & RALPH R. MILLER, *SUNY, Binghamton* (sponsored by Ralph R. Miller)—One might expect that similarity would encourage interaction between cues (interference or facilitation). Specifically, if two associations share attributes (e.g., spatial or temporal location or same number of elements), the interaction should be greater than when the two associations share fewer attributes. Two experiments with rats investigated the influence of similarity in proactive interference in first-order Pavlovian conditioning. Experiment 1 examined the influence of spatial similarity in proactive interference by pairing two separate auditory stimuli, originating either in the same location or in different locations, with the same outcome. Greater proactive interference was observed when the interfering cue and the target cue originated from the same location. Experiment 2 investigated whether differing numbers of elements in the target and the interfering associations would attenuate proactive interference. Greater proactive interference was observed when the interfering association and the target association were composed of the same number of elements.

(5028)

Associative Structure of Two-Stage Biconditional Discrimination in the Monkey: Implications From Neural Activities in the Prefrontal Cortex. KOSUKE SAWA, XIAOCHUAN PAN, & MASAMICHI SAKAGAMI, *Tamagawa University*—Two male Japanese monkeys (*Macaca fuscata*) were trained to perform sequential biconditional discrimination by using visual stimuli with asymmetric rewards. In this task, the first cue A1 (or A2) is followed by the second cues (B1 and B2), and the monkey makes a saccadic eye movement to choose B1 (or B2). After the first choice, the third cues (C1 and C2) are displayed, and the monkey selects C1 (or C2). The asymmetric reward rule was introduced block by block: in one block, A1-chain was rewarded, whereas A2-chain was not; in another block, vice versa. Monkeys showed differential reaction time and accuracy on the basis of the reward prediction. And we found neural activities related to the reward prediction and the stimulus-reward relationship from the prefrontal cortex. These results suggest that the prefrontal cortex might encode associative structure of biconditional discrimination.

• FACE PROCESSING •

(5029)

Verbal Overshadowing of Multiple Face Recognition: Effects on Remembering and Knowing Over Time. TOBY J. LLOYD-JONES & CHARITY BROWN, *University of Kent*—*Verbal overshadowing*, the phenomenon whereby the verbal reporting of a visual memory of a face interferes with subsequent recognition of that face, arises for the presentation of multiple faces following a single face description. We examined the time course of verbal overshadowing in the multiple face paradigm and its influence on recollection and familiarity-based recognition judgments. Participants were presented with a series of faces and then described a subsequent face (or not, in the control condition). Study faces were subsequently discriminated from distractors at either a short or long lag after initial presentation, in a yes/no recognition task using the remember/know procedure. Verbal overshadowing was most apparent for the short lag for discrimination and false *know* judgments. We discuss these findings in terms of the nature of verbal interference in this paradigm and similarity-based theories of visual recognition.

(5030)

Evidence for Gender Differences in Memory for Names and Faces.

KIMBERLY D. BATES & SHELIA M. KENNISON, *Oklahoma State University* (sponsored by Shelia M. Kennison)—The research investigated gender differences in memory for names and faces. Prior research has shown that women remember faces better than do men. It has further been shown that both men and women remember names better when they refer to individuals of the same gender than those of the opposite gender. In the present research, participants were shown picture–name combinations. Names were unfamiliar and gender neutral (e.g., *Sharg, Tilk*). Counterbalancing was used to ensure that each name was paired with a male and a female picture. In two experiments, participants studied 40 picture–name combinations. In Experiment 1, participants were later instructed to recall names when presented with the picture. In Experiment 2, participants were asked to match the name with the appropriate picture. The results of both experiments showed that women remembered names of men and women equally well but that men remembered names of men significantly more accurately than names of women.

(5031)

Task and Strategic Influences on the Eye-Movement–Based Memory Effect.

TRAVIS L. SEYMOUR, CHRIS BAKER, & JOSH GAUNT, *University of California, Santa Cruz*—We measured eye movements to faces in an exclude–recognition task where one of two old lists was to be accepted as “old” and the other as “new” along with new filler faces. Previously, Althoff and Cohen (1999) showed that a host of eye-based measures differentiate familiar from unfamiliar faces (e.g., number of fixations, regions sampled, and different looking patterns). We compared eye movements during a familiarity task with those in the exclude–recognition task, where source recollection is required. Results show that whereas the familiarity task replicates previous eye movement patterns (longer, more constrained movements to new faces), exclude tasks lead to the opposite pattern (slower, more constrained looking for old items). Surprisingly, even the looking patterns for new items differ across tasks. We suggest that eye movements in recognition are dependent on task strategy. Also, despite previous reports, we show that unconscious behaviors, such as pupil dilation, but not blinking, can index prior exposure.

(5032)

Viewpoint-Dependent Performance for Faces Rotated About Pitch and Yaw Axes.

SIMONE K. FAVELLE, STEPHEN A. PALMISANO, & RYAN MALONEY, *University of Wollongong*—When investigating the extent to which the processing of faces is dependent on viewpoint, studies typically consider rotation in depth (yaw; rotation around the head’s vertical axis) and compare performance between front-on and profile views. However, another common, although less studied, source of viewpoint variation in faces is rotation in pitch (rotation around the head’s horizontal axis). In the present study, we systematically examined and compared the effect of viewpoint change in both the pitch and the yaw axes on human face recognition. We used a sequential matching task in which stimuli were images of real female Caucasian faces shown at 15° increments around pitch (0°–75°) and yaw (0°–90°). Performance on both axes was dependent on viewpoint; however, participants responded more slowly and with less accuracy when matching faces rotated around pitch as opposed to around yaw.

(5033)

Short-Term Adaptations of Face Configural Representation.

PAMELA M. PALLETT & KANG LEE, *University of California, San Diego* (sponsored by Victor S. Ferreira)—Configural information plays an important role in face processing. Lifelong experience with faces leads one to acquire common configural representations. Are these representations malleable with short-term experiences, despite an arduous acquisition process? To address this, our study capitalized on an illusion demonstrating that perception of an oval containing a face

is influenced by face configuration. Moving the eyes and mouth closer to the nose makes the oval appear rounder. Subjects adapted to 64 similarly shortened faces and provided magnitude estimations for an oval surrounding an unseen shortened face. Subjects perceived a strong shape illusion. Exposure to shortened faces decreased this illusion, whereas normal face exposure failed to produce this shift. These findings suggest that our face configural representations are malleable with short-term experience. The present results add to converging evidence for high-level nonretinotopically organized face adaptation that distinctly differs from adaptation to basic psychophysical properties.

(5034)

The Influence of Familiarity on Sex Decisions to Faces and Names.

ROBERT A. JOHNSTON & RUTH CLUTTERBUCK, *University of Birmingham*—According to the model of face recognition by Bruce and Young (1986), sex analysis occurs independently of identity analysis, and as a consequence, no influence of familiarity should be found on the time taken to perform sex decisions. Results of recent behavioral studies cast doubt upon this claim. Two experiments are reported that explore the influence of familiarity on sex decisions to faces (Experiment 1) and surnames (Experiment 2) of different levels of familiarity. In Experiment 1, participants were able to assign sex more quickly to highly familiar faces than to unfamiliar faces. Therefore, familiarity can influence the speed at which sex is analyzed from faces. Similarly, in Experiment 2, participants were able to assign sex and familiarity more quickly to highly familiar surnames than to moderately familiar surnames. These findings are discussed in relation to the influence of sex information from identity-specific semantics, and an explanation is offered on the basis of Burton et al.’s (1990) IAC model of face recognition.

(5035)

Amygdalae and Affective Facial Expressions.

ROMINA PALERMO, *Macquarie University*, LAURIE MILLER, *Royal Prince Alfred Hospital*, & MAX COLTHEART, *Macquarie University*—The ability to recognize facial expressions of emotion is crucial for successful social interactions. One neural structure that appears to be involved in processing information from facial expressions is the amygdala. We have been investigating how people with temporal lobe epilepsy, who may have amygdala damage, recognize facial expressions of emotion. In one study, we examined whether people who have affective auras prior to their seizures recognize facial expressions differently than do those that do not have auras. Another study examined whether the amygdala is involved in affective priming. In the affective priming task, we manipulated the expression, duration, and spatial frequency information of the face primes. Affective priming was absent when the prime faces contained only low-pass or high-pass information and were shown very briefly. Implications for models of affective processing are discussed.

(5036)

The Role of the Eyes and Mouth in Facial Emotions.

CHRISTOPHER KOCH, *George Fox University*—Facial processing of emotions was examined using an emotional face Stroop task in which a face was presented with an emotion word. The expressed emotions included anger, sadness, happiness, and fear. In addition, the importance of facial features was examined by removing the eyes or mouth on some trials. Thus, there were three face conditions (full face, eyes removed, mouth removed) and three word conditions (no word, congruent emotion, incongruent emotion). Twenty-seven graduate students participated in the study. The results reveal a significant effect of face [$F(2,52) = 4.63, p < .02$] and word conditions [$F(2,52) = 9.57, p < .001$]. Full faces produced significantly shorter RTs than did faces with either the eyes or the mouth removed, but there was no difference between the eyes- and mouth-removed faces. Congruent emotion words did not produce facilitation but incongruent words produced significant interference. These findings suggest the eyes and the mouth are equally important in facial expressions of emotions.

(5037)

Photographic Memory of Unfamiliar Faces Under 30 Seconds. KANG LEE & STEPHEN LINK, *University of California, San Diego*, & LIEZHONG GE & SONGQING WANG, *Zhejiang Sci-Tech University* (sponsored by John T. Wixted)—The present study examined how accurate one's memory is for an unfamiliar face and what is the minimal amount of exposure needed to ensure an adequate face memory. Participants were first shown a face for 10, 20, or 30 sec and then were presented with either the familiarized "old face" or new faces, one at a time. The new faces differed from the old face only in terms of the interocular distance of the old face, ranging from 2 to 20 pixels. In a control condition, participants had to discriminate the old and altered faces presented simultaneously. Accuracy for the 20- and 30-sec conditions was comparable to that for the control condition. Thus, a brief exposure of between 10 and 30 sec is sufficient to create photographic memory of unfamiliar faces, and this memory is perhaps limited only by our visual system's ability to resolve interocular distance differences.

• WORKING MEMORY •

(5038)

Auditory Sequence Processing: Individual Differences in Memory for Serial Order. ELIZABETH I. PIERPONT & MARK S. SEIDENBERG, *University of Wisconsin, Madison*—Impairments in memory for the serial order of auditory events have been implicated in some types of language and memory disorders. However, assessments that rely on spoken responses could be affected by differences in the ability to name the stimuli. We examined variability in memory for serial order in college students. Subjects listened to a series of four sounds presented in a continuous loop and were asked to report their order. Stimuli included nameable animal sounds and nonnameable tone sequences. Stimulus durations varied between 250 and 1,000 msec. Subjects responded either vocally or by manipulating objects corresponding to the sounds. Latencies to name the animal sounds were independently assessed. The results showed individual differences among subjects in memory for serial order that were not due to differences in naming ability but were related to performance on tests of grammar and working memory.

(5039)

A Phonological Similarity Advantage in Serial Recall. DANIEL J. ACHESON & MARYELLEN C. MACDONALD, *University of Wisconsin, Madison*—Phonological similarity among items in word lists reduces serial recall rate. This effect persists with concurrent articulation of a nonsense syllable during encoding of auditorily presented items but disappears when the list is presented visually. In the present study, an additional dimension of phonological similarity was investigated in immediate serial recall—similarity between list items and a concurrently articulated syllable. This manipulation was crossed with list presentation modality (visual vs. auditory). Results ($N = 32$) replicated previous phonological similarity effects with one notable exception: Whereas memory was better for nonoverlapping lists than for overlapping lists presented auditorily, superior recall was achieved for phonologically similar lists when the articulated syllable overlapped with list items, relative to when it did not. The implications of this facilitation effect for phonological similarity are discussed, with particular emphasis on the role of language production mechanisms in verbal short-term memory.

(5040)

Timing and Short-Term Memory for Order Information. SIMON FARRELL, *University of Bristol*—Several theories of short-term order memory assume that people remember the order of sequences in short-term memory by associating each item or event with a time code (e.g., Brown, Preece, & Hulme, 2000). Alternatively, some models assume that order representation is not time based but is, instead, event driven (Farrell & Lewandowsky, 2002). Recent evidence supports the latter view by showing that the spacing of items in time has little effect

on their serial recall (Lewandowsky & Brown, 2005). The present experiment investigated this issue by presenting lists of digits with irregular timing and postcuing participants for their memory of the order of the digits or the timing of the digits. The results showed that the timing of recall of order tended to match the input timing and that grouping instructions had similar effects on timing in the serial recall and the timing tasks. Implications for models of serial recall are considered.

(5041)

Memory for Empty and Filled Intervals: Evidence for the Instructional Ambiguity Hypothesis. ANGELO SANTI & STEPHEN GAGNE, *Wilfrid Laurier University*—Pigeons were trained in a within-subjects design to discriminate durations of an empty interval (2 sec and 8 sec bound by two 1-sec light markers) and durations of a filled interval (2 sec and 8 sec of continuous light). The background illumination displayed on the video monitor was varied in order to differentiate the intertrial interval (ITI), the sample presentation phase, and the delay interval (DI). Differentiating all three trial phases resulted in parallel retention functions for both empty and filled intervals. When the DI and the sample phase were undifferentiated, there was a choose-long bias for empty intervals, but no bias for filled intervals. When the DI was differentiated from both the ITI and the sample phase, the retention functions were parallel for both empty and filled intervals. When all three trial phases were undifferentiated, there was a choose-long bias for empty intervals. These results support the ambiguity explanation of biased-forgetting effects.

(5042)

Effect of Training Delay on the Choose-Short Effect in Pigeons. DOUGLAS S. GRANT, *University of Alberta*—Pigeons were trained on a matching-to-duration task in which the samples were 2- and 8-sec presentations of keylight. Three groups of pigeons received one of three delay conditions during training: a 0-sec fixed delay (Group 0sF), a fixed 2-sec delay (Group 2sF), and a variable 2-sec delay (range, 1–3 sec; Group 2sV). Acquisition was more rapid in Group 0sF than in the other two groups which did not differ from each other. During retention testing, only Group 0sF demonstrated a statistically reliable choose-short effect (CSE). It was concluded that use of a nonzero delay during training reduces the likelihood of analogical sample coding and, hence, results in a less robust CSE.

(5043)

A Time–Accuracy Study of Age Differences in Perception and Working Memory. JULIE A. DUMAS, *University of Vermont*, & MARILYN HARTMAN & BREA STRATTON, *University of North Carolina, Chapel Hill*—The locus of reduced working memory in older adults and its relationship to slowed perception was examined using a delayed-matching-to-sample (DMTS) task. Older and younger participants performed six blocks of a DMTS task and a perception task across a range of study times. Time–accuracy curves were fitted for each participant to estimate parameters measuring the encoding time necessary for performance to rise above chance, asymptotic accuracy, and the rate of approach to the asymptote. Results showed age differences in the rate of approach parameter on the working memory test and in the asymptote and rate of approach parameters on the perception test. When speed of perception was controlled statistically, age differences in working memory were no longer present. These results are discussed with respect to the effects of age on speed and accuracy in working memory and to the role that lower level perceptual processes play in these effects.

(5044)

The Role of Working Memory Functions in Metaphor Production. DAN L. CHIAPPE, VANESSA E. CHAMBERS, CANDACE J. STUTE, KELLY M. McCULLOCH, DEBORAH L. NELSON, & JESSE MELENDEZ, *California State University, Long Beach*—Although mechanisms of metaphor comprehension have received much attention, those involved in metaphor production have not. We remedy this by

examining working memory functions in the production of metaphors. We administered 281 participants the retrieval fluency task, the pair cancellation task, and the listening span task as measures of working memory executive function. In addition we administered the PPVT, a verbal IQ test. For the metaphor production task, participants were given topics (e.g., “billboards ____”) plus a property that had to be attributed (e.g., “billboards are something noticeable and unattractive”). For each item, they had to provide a vehicle term (e.g., “warts”) that can be used to attribute the property to the topic. The resulting metaphors were rated on a five-point scale. We found that while verbal IQ predicted the quality of metaphors produced, measures of working memory executive function predicted additional variance in metaphor quality, independently of verbal IQ.

(5045)

Stereotype Threat and Working Memory: What Is Threatened, and Can It Be Alleviated? SIAN L. BEILOCK, *University of Chicago*, ROBERT J. RYDELL, *University of California, Santa Barbara*, & ALLEN R. MCCONNELL, *Miami University*—Highlighting a negative social group stereotype produces less-than-optimal performance by members of that group (i.e., a stereotype threat [ST]). But why? Three experiments demonstrated that an ST induces performance-related worries that co-opt the verbal working memory resources required for successful math performance. Experiment 1 demonstrated that horizontally oriented (but not vertically oriented) mental arithmetic problems rely heavily on verbal working memory resources. Experiment 2 examined the impact of ST (induced by highlighting gender differences in math) on women’s performance of vertical and horizontal math problems. All women reported performance-related worries under ST yet performance decrements were revealed only on difficult horizontal problems (i.e., problems requiring considerable verbal resources). Experiment 3 implemented a training regimen to alleviate ST’s impact. Women repeatedly practiced some horizontal math problems until their answers were retrieved directly from long-term memory. ST did not harm practiced problems, whereas performance on new problems (which relied heavily on working memory) was impaired.

(5046)

Forcing Attention to Printed Words by Altering Case and Concept Familiarity. PAULA GOOLKASIAN & PAUL W. FOOS, *University of North Carolina, Charlotte*—Three experiments investigated whether concept familiarity and alternating the upper- and lowercase of printed words would reduce the recall advantage of picture and spoken words over printed words. A working memory task was used, and participants were required to remember three or six concrete nouns presented in varied presentation formats while verifying the accuracy of a visual/spatial reasoning task. Presenting words in alternating case was found to be an effective way of improving recall, and it worked for both short and long lists of to-be-remembered items. Items with high concept familiarity were recalled better when presented in long lists of spoken words, but this advantage was absent for printed words. These findings extend our previous work with the allocation of attention hypothesis by demonstrating that the recall advantage typically found with spoken words and pictures over printed words can be reduced by requiring participants to actively process the printed words.

• RECOGNITION MEMORY •

(5047)

Two-Process Theory in Recognition Memory: Evidence From zROC Curves and Temporally Defined Associations. MARC W. HOWARD, *Syracuse University*—Recognition memory has been hypothesized by some to reflect two processes, typically referred to as *recollection* and *familiarity*. Others have argued that recognition is supported by a single, variable memory process. We review three studies of recognition memory for travel scenes that provide strong support for a two-process account. All three studies showed nonlinear zROC curves.

One study (Schwartz et al., in press) shows evidence that temporally defined associations result from recollection, but not from familiarity. Another study (Sherman et al., 2003) showed strong evidence for a bimodal strength distribution for old items when subjects were administered scopolamine. A third study (Howard et al., 2005) showed different levels of recollection across younger and older adults. These studies, taken as a whole, suggest that two processes contribute to recognition memory, that recollection is variable rather than all or none, and that successful recollection is accompanied by recovery of temporal context.

(5048)

Exploring the Nature of the Recognition Memory Impairment in Parkinson’s Disease. PATRICK S. DAVIDSON & DAVID ANAKI, *Rotman Research Institute*, JEAN A. SAINT-CYR, *Toronto Western Research Institute*, & MORRIS MOSCOVITCH, *University of Toronto* (sponsored by Morris Moscovitch)—Dual-process theories suggest that recognition memory can be based on either recollection or familiarity (Jacoby, 1991; Mandler, 1980), but the relation between these two processes remains unclear. For example, it is rare to find people who are impaired in familiarity and not in recollection. We sought to determine whether recollection and familiarity are differentially impaired in Parkinson’s disease (PD), using a list discrimination version of the process dissociation procedure (Jacoby, 1991). We tested PD patients (free of dementia and depression) and a group of age- and education-matched controls. Overall, the PD group showed impaired recognition memory (hits minus false alarms). However, the process dissociation estimates suggested that this was due more to a decline in familiarity than to a decline in recollection. We discuss how these data conform with another recent study conducted on the word frequency mirror effect and how they may help us evaluate models of recollection and familiarity in recognition memory.

(5049)

Memory Strength and the Decision Process in Recognition. MICHAEL F. VERDE, *University of Plymouth*, & CAREN M. ROTELLO, *University of Massachusetts, Amherst*—Which stimulus cues affect the placement and maintenance of the decision criterion in recognition? At study, strong items were repeated four times and weak items were repeated one time. Previous studies suggest that strong items are associated with more conservative criteria. In Experiment 1, strong items were tested in Block 1, and weak items in Block 2. There was no evidence of criterion change following the change in item type. In Experiment 2, weak items were tested in Block 1, and strong items in Block 2. Again, there was no evidence of criterion change following the change in item type. However, initial criterion placement was less conservative than in Experiment 2. Experiment 3 replicated Experiment 1 with the addition of accuracy feedback, which produced dynamic criterion change. In sum, subjects initially choose their criterion on the basis of test item strength but do not shift this criterion in response to changes in strength.

(5050)

Hierarchical Multinomial Processing Tree Models. JARED B. SMITH & WILLIAM H. BATCHELDER, *University of California, Irvine*—Analysis of traditional multinomial processing tree (MPT) models has often assumed identical parameters across subjects. This assumption can be quite suspect in ordinary psychological experiments. One method for dealing with parameter variability is to consider the parameters as coming from their own distributions through the use of *hierarchical modeling*. In this paper, we examine the construction and analysis of a hierarchical MPT model for the learning of word pairs. We show that a simple version of this hierarchical MPT pair-clustering model can capture the presence of subject parameter variability but is unable to capture underlying group structure or parameter correlation. We will present a number of more complex candidate hierarchical distributions to overcome these limitations. Also, we will present some tips on how to construct a distribution for the hierarchical level depend-

ing on the particular MPT model of interest and the type of parameter variability and correlation expected.

(5051)

The Role of Monetary Incentives for Recognition Memory. JESSICA R. CHAMBERLAND & RICHARD A. CHECHILE, *Tufts University*—Multinomial-processing trees (MPTs) have been used to examine a number of processes associated with memory, including storage, retrieval, fractional storage, and guessing. Recently, Chechile (2004) proposed several new MPT models that can represent recognition memory. Some validation evidence for these models was also provided in that study. In the present study, an additional validation assessment was performed. In two experiments, the role of monetary incentives was examined with an MPT model from Chechile (2004). In both experiments, incentives influenced memory performance by means of changes in guessing measures. The manipulation of incentives did not change storage, which is additional validation support.

(5052)

Conjunction Memory Errors: The Contribution of Recollection. HEEKYEONG PARK & LYNNE M. REDER, *Carnegie Mellon University*—Conjunction memory errors refer to false recognition of recombined compound words (e.g., false alarming to *blackbird* after studying *blackmail* and *jailbird*). Dual-process models of recognition have been used to account for these conjunction errors; however, it is unclear whether recollection is involved in avoiding conjunction errors or exacerbating these errors. Previous studies showed that the manipulations known to affect recollection (e.g., divided attention, LOP, and deadline) did not have an effect in the conjunction error rate. We presented compound words either in a rare font or in a common font and tested the compound words with conjunction lures in a matched font or a swapped font. Participants produced more hits to studied items that were re-presented in studied rare fonts, but they also made more conjunction errors when conjunction lures were presented in the font that was used with rearranged parent words during study. These results raise issues about the role of recollection in spurious recognition of conjunction lures.

(5053)

Reducing Conjunction Errors in Recognition Memory. MARIANNE E. LLOYD, *SUNY, Binghamton*—Three experiments examine the role of encoding and testing conditions on the rate of conjunction errors in recognition memory (e.g., endorsing the test item “firefly” as presented when “fireplace” and “housefly,” but not “firefly,” were presented). Presenting distinctive information (e.g., a picture) with each study item was found to reduce conjunction errors during standard, but not speeded, recognition tests. Furthermore, these results were obtained even when participants made both a speeded and an unspeeded response to each test item. Results are discussed in terms of dual-process theories of memory and metamemorial influences in recognition memory.

(5054)

Manipulating Word Frequency Effects by Varying Processing Demands: Low-Frequency Words are More Difficult to Encode. RACHEL A. DIANA & LYNNE M. REDER, *Carnegie Mellon University* (sponsored by Lynne M. Reder)—Low-frequency words produce more hits and fewer false alarms than do high-frequency words. However, a number of experiments using tasks other than recognition show effects that seem to contradict the low-frequency advantage in memory. The present research shows that in addition to the advantage of low-frequency words in recognition tasks, there is a low-frequency disadvantage during encoding. That is, low-frequency words require more processing resources at encoding than do high-frequency words. Under conditions where processing resources are limited, low-frequency words show a larger decrement in recognition than do high-frequency words. We used a divided attention task, a picture–word interference task, and examined individual differences in working

memory to demonstrate this effect. Thus, the advantage for low-frequency words in recognition occurs despite an encoding disadvantage. We also investigated the mechanisms behind this disadvantage and the implications for encoding in general.

(5055)

Orienting Task, Letter Distinctiveness, and the Word Frequency Effect in Recognition Memory. AMY H. CRISS, *Carnegie Mellon University*—In studies of recognition memory, low-frequency (LF) words have higher hit rates (HRs) and lower false alarm rates than do high-frequency words, called a *mirror pattern*. In five experiments, varying study time and orienting task, the full mirror pattern was found only in two cases: the standard condition requiring study for a later memory test and a condition requiring a judgment about unusual letters. A variety of other orienting tasks, both perceptual and semantic in nature and covering a wide range of different performance levels, resulted in no benefit for LF targets. We hypothesized that the HR portion of the word frequency effect is driven by letter distinctiveness and tested this in a final experiment where letter distinctiveness and word frequency were orthogonally manipulated. As was expected, we found an advantage for targets composed of distinct letters, regardless of study task, and we found no effect of word frequency.

(5056)

Encoding Duration, Task Performance, and Task Dissociation. MARCI A. FLANERY & CRAIG E. L. STARK, *Johns Hopkins University*—Conventional wisdom suggests that memory for an item will be better if subjects are allowed more time to encode the stimulus. However, Mulligan (1997, 1999) has demonstrated that in the case of very short, masked encoding conditions (100 msec), single-item, but not relational, memory is enhanced relative to longer durations. We further investigated this phenomenon by varying encoding duration by 20-msec intervals. We found that old–new recognition accuracy peaked for items encoded for 110 and 190 msec, whereas relational memory accuracy followed a monotonic function. We further examined whether these patterns were affected by the existence of prior representation (by testing with pseudowords), by familiarity (by testing with and without recent exposure), or by task (by testing with declarative and nondeclarative tasks) and found that these additional factors were able to eliminate or alter the nonmonotonic pattern in the single-item memory task.

(5057)

Attention and Memory Retrieval: Effects of Semantic Encoding and Divided Attention. JEFFREY P. LOZITO & NEIL W. MULLIGAN, *University of North Carolina, Chapel Hill*—Research on attention and memory suggests that semantic encoding leads to retrieval that is highly susceptible to the dividing of attention. Three experiments tested this proposition and showed that dividing attention did not selectively affect semantically encoded items. Participants encoded a list of words in one of two ways: semantically or phonetically. Later, memory was assessed using either a standard recognition test (Experiment 1) or a rhyme recognition test (Experiments 2 and 3). Participants took the memory test either alone (full attention) or while simultaneously performing a secondary task (divided attention). Recognition accuracy was reduced by divided attention on both recognition tests, and semantically and phonetically encoded words were equally affected.

(5058)

Concurrent Task Effects on Memory Encoding and Retrieval: Further Support for an Asymmetry. MOSHE NAVEH-BENJAMIN & ANGELA KILB, *University of Missouri, Columbia*, JONATHAN GUEZ, *Achva College, Israel*, & SUSAN OLD, *University of Missouri, Columbia*—Several studies have demonstrated that divided attention at encoding significantly reduces memory performance. However, divided attention at retrieval has been shown to affect memory performance to a lesser degree, although this relative protection of retrieval

processes requires substantial resources. Our present research assesses both methodological and theoretical issues related to the relative immunity of retrieval processes to the detrimental effects of divided attention. With respect to methodological issues, we evaluated the possibility that retrieval processes show this resilience because the concurrent tasks used are often not very demanding. Theoretically, we evaluated the degree to which retrieval, despite not being much affected by the difficulty of the concurrent task, is vulnerable to competition when the type of processing required by the concurrent task is the same as in the retrieval task.

(5059)

Enhancing Recollection Without Enhancing Recognition Probability: The Effects of Testing on Recollection and Familiarity. JASON C. K. CHAN & KATHLEEN B. McDERMOTT, *Washington University* (sponsored by Janet Duchek)—We examined the effects of taking an initial test on later memory retrieval, using a modified process dissociation procedure. Subjects studied unrelated word lists and performed immediate free recall on half the lists; for the remaining lists, subjects performed an unrelated filler task. Subjects then performed delayed recognition tests in which the relative contribution of recollection and familiarity can be estimated. Similar to previous findings, overall recognition performance (hits and correct rejections) showed no testing effect. However, when recollection and familiarity estimates were computed via source judgments, taking an initial free recall test was shown to enhance recollection (or source memory) without affecting familiarity. A separate analysis comparing recalled and unrecalled items showed that this enhanced recollection was seen only for words recalled initially, suggesting that the origin of the testing effect may lie in subjects' remembering the previous recall episode, rather than the study episode.

(5060)

Sensory Modality Moderates Illusions of Recognition Based on Perceptual Fluency but Not Conceptual Fluency. DEANNE L. WESTERMAN, *SUNY, Binghamton*, JEREMY K. MILLER, *Willamette University*, & MARIANNE E. LLOYD, *SUNY, Binghamton*—Illusions of recognition memory based on enhanced perceptual fluency are sensitive to the perceptual match between the study and the test phases of an experiment. Enhanced visual fluency of test stimuli leads to an illusion of recognition only when the study list is also visual. Five experiments demonstrate that participants are very reluctant to interpret enhanced perceptual fluency as a sign of recognition when there has been a change in sensory modality across the study and test phases of the experiment. The present results show that the interaction between modality and perceptual fluency manipulations persisted under speeded recognition conditions, with a long delay between study and test, and also when participants visualized each study word as it was presented on an auditory list. Results also show that illusions of recognition based on a more conceptually driven manipulation of processing fluency are not sensitive to modality changes between study and test.

(5061)

The Contribution of Familiarity and Recollection to Immediate and Continuous-Distractor Recognition. YONATAN GOSHEN-GOTTSTEIN & AMIT G. STEINBERG, *Tel-Aviv University*—Using single-probe recognition, an earlier study (Goshen-Gottstein & Talmi, 2005) reported a recency effect not only when study items were presented sequentially and testing was immediate (i.e., immediate recognition), but also when distractor activity was interspersed between study items and also followed the last study item (i.e., continuous-distractor recognition). In this study, we examined the contributions of recollection and familiarity to performance in these two recognition tasks. Following each study list, participants' memory was probed for a single position. For every participant, each list position was probed an equal number of times across lists. For positive responses, participants made know/remember/guess judgments. Results

replicated the recency effect in both tasks. Critically, the contribution of familiarity was similar in both tasks, with differences in performance being mediated only by recollection.

• IMPLICIT MEMORY •

(5062)

An Interaction Between Priming and Location of Target Information in Reading. SUSAN T. DAVIS, CHRISTINA G. RUTHERFORD, & DEBORAH L. BAKOWSKI, *University of Dayton*—In accord with extant research (e.g., Rastle & Coltheart, 1999), phonological priming produced greater accuracy and shorter reaction times overall than semantic priming in a task that required scanning text for information. However, this advantage was weakest for information embedded at the end of a text passage. Perceptual selectivity (cf. Masson, 1982) provides a reasonable explanation for the advantage of phonological priming when information that can answer a specific question is scanned for. However, we propose that the reader's initial goal may be affected by the text itself. Longer texts appear to engage the reader in the textual story line and produce a switch to conceptually selective processing. Consequently, as reading of the text progresses, semantic priming becomes more advantageous for speeded identification of information found in the latter portion of the text. This is a reasonable strategy that appears to operate as much on an implicit level as the priming itself.

(5063)

Evoking Familiarity Without Recollection: Modeling the Déjà Vu Experience. ALAN S. BROWN, *Southern Methodist University*, & ELIZABETH J. MARSH, *Duke University*—We attempted to model a feeling of false positive familiarity similar to the déjà vu experience. After shallow exposure to pictures of naturalistic scenes (searching for an embedded cross), participants returned 1 (Experiment 1) or 3 (Experiment 2) weeks later to evaluate whether they felt that they had actually visited each pictured setting (new plus old scenes). Mundane and unique campus scenes from an unfamiliar campus (Duke or SMU) were shown zero, one, or two times in the first session. The mean visit rating increased with prior exposure, but one versus two exposures did not differ. Participants gave higher visit ratings to mundane than to unique scenes, and this did not vary as a function of exposure frequency or delay. About half of each sample reported “yes” to the question “did you have a déjà vu response to any of the photos?”

(5064)

Implicit Preference in the Absence of Conscious Memory for Advertisements Appearing in Basketball Games. KRISTEN A. DILIBERTO-MACALUSO, *Berry College*, TODD A. KAHAN, *Bates College*, & ROSANNA PRATO, *Berry College*—We examined unconscious (implicit) perception and memory of advertisements that appeared in the background of basketball games. Participants were instructed to attend either to the ads (deliberate group) or to a salient aspect of the video clip itself (incidental group). Once all 18 clips had been shown, we presented participants with 36 advertisements, which they rated on four dimensions (eye-catching, appealing, memorable, distinctive), using a 7-point Likert-type scale (1 = *very much less than average*; 7 = *very much more than average*). In addition, participants indicated whether or not they remembered each ad from the original video clip. We found that participants in the incidental group rated “old” logos as more appealing and distinctive than “new” logos; however, recognition memory did not differ for old and new logos. The data suggest that participants unconsciously showed a preference for the original advertisements but showed inattention blindness for recognition memory of those same ads.

(5065)

Differential Effects of Time of Day on Explicit and Implicit Memory. GILLIAN ROWE & STEVEN VALDERRAMA, *University of Toronto*, LYNN HASHER, *University of Toronto and Rotman Research Institute*,

& AGATHA LENARTOWICZ, *Princeton University* (sponsored by Lynn Hasher)—Participants were given two tasks at either their peak or off-peak time of day: a spatial working memory task and an implicit test for distraction presented in the context of a target task. The participants' peak times were either in the morning or in the afternoon, and they were tested either early in the day (8 a.m.–9 a.m.) or late in the afternoon (4 p.m.–5 p.m.). In accord with results reported by May, Hasher, and Foong (2005), we found that performance on our intentional task, spatial working memory, was better at peak times of day (morning for the morning types and afternoon for the evening types). The data from the implicit task showed a dramatically different pattern, with greater tacit knowledge at off-peak times of day.

(5066)

Memory for Unattended Stimuli in a Flanker Task. MARTIN L. BINK & JOHN L. JONES, *Western Kentucky University*—The flanker paradigm is used to explore the distinctions between early and late attention selection. The flanker effect occurs when unattended stimuli in a display affect the processing of target stimuli. The flanker effect suggests that the unattended stimuli are being processed in real time, but there is no suggestion about the degree to which these unattended stimuli are available to subsequent memory processes. The goal of the present study was to explore the degree to which unattended stimuli could be “remembered” in subsequent tests of implicit memory and recognition. Stimuli were first presented in a flanker task. Across three experiments, memory for the distractor items was tested using a lexical decision task (implicit test), recognition, modified recognition (explicit tests), and the process dissociation procedure. The results indicated that the to-be-ignored stimuli were nonetheless available to implicit memory processes in the subsequent memory tests.

(5067)

Interference as a Source of Dissociation Between Implicit and Explicit Knowledge. RICARDO TAMAYO & PETER A. FRENCH, *Humboldt University, Berlin*—Two experiments tested the assumption that implicit and explicit knowledge decay at different rates due to interference. In a training phase, participants responded to letters that followed a repetitive pattern according to a finite state grammar. In the first experiment, participants were tested immediately following training and after 7 days. During each test, participants responded to old and new sequences and performed a concurrent recognition test. Priming was measured by the difference in reaction time to learned versus new items. The results of this experiment partially replicated those of Tunney (2003). In a second experiment, an interference task, in which participants were required to respond to randomly formed sequences of letters, produced results equivalent to those observed by delay. Results are discussed in terms of their implications for unitary explanations of learning.

(5068)

The Modulation of Consolidation by D-Amphetamine in Implicit and Explicit Sequence Learning. INGE ZEEUWS, NATACHA DEROST, & ERIC L. L. SOETENS, *Vrije Universiteit Brussel* (sponsored by Eric L. L. Soetens)—D-amphetamine enhances the retention of explicitly learned verbal material (Soetens et al., 1995). Presently, we examined whether this finding can be generalized to the consolidation of implicit sequence learning. To this end, participants performed a serial reaction time (SRT) task in which they were not informed that the stimuli followed a structured sequence. The next day, participants were transferred to the initial sequence, a mirrored sequence, or a different sequence, to determine the extent to which knowledge consolidation involves abstraction of the learned material. Knowledge consolidation and abstraction were observed in implicit sequence learning, but the effect was independent of drug influence. In a second experiment, the explicitness of sequence knowledge in the SRT task was manipulated by instructions. Again, no influence of d-amphetamine was observed. Accordingly, the present results suggest that the consolidation of verbal and nonverbal material occurs differently.

(5069)

Explicit Contamination in Word Stem Completion Task: A Response Time Approach. MICHEL ISINGRINI, SÉVERINE FAY, LAURENCE TACONNAT, DAVID CLARYS, & BADIÂA BOUAZZAOU, *University of Tours*, & VIVIANE POUTHAS, *CNRS, Paris* (sponsored by Patrick Lemaire)—This experiment investigated the involvement of awareness in functional dissociations between explicit and implicit memory tests using word stems. The words were lexically or semantically studied. In the implicit condition, subjective awareness was subsequently measured on an item-by-item basis. The time taken to complete each stem was recorded. In the explicit task, semantically studied words were associated with higher levels of recall and shorter response times than were lexically studied words. In the implicit task, these effects failed to reach significance, although deep encoding made the contents of memory more accessible to awareness. Performance was slower in the explicit than in the implicit task, but in the latter condition, times to produce old words with and without awareness were comparable, and both of these responses were produced more quickly than with control words. This finding suggests that although participants may become aware in implicit paradigms, they do not adopt voluntary retrieval strategies.

(5070)

Impact of Positive and Anxious Moods on Alcohol-Related Cognitions in Internally Motivated Drinkers. VALERIE V. GRANT & SHERRY H. STEWART, *Dalhousie University* (sponsored by Raymond Klein)—We investigated the impact of musically induced positive and anxious moods on the alcohol-related cognitions of undergraduates who drink either to enhance positive mood states (EM) or to cope with anxiety (CM anxiety). Participants completed a postmood induction Stroop task that taps implicit alcohol-related cognitions. As was expected, CM-anxiety participants in the anxious mood condition maintained the tendency to show longer color-naming latencies for alcohol (vs. nonalcohol) targets following mood induction. However, contrary to our expectation, EM participants in the positive mood condition did not maintain the alcohol interference effect following mood induction. Also in accord with our hypothesis, CM-anxiety drinkers in the anxious mood condition showed increases in the strength of explicit emotional relief alcohol expectancies after the mood induction. Surprisingly, EM drinkers in the anxious condition also exhibited significant increases in the strength of explicit emotional relief (but not emotional reward) alcohol expectancies. Theoretical and clinical implications of the findings will be discussed.

(5071)

A Benefit of Heightened Susceptibility to Distraction: An Aging Study. SUNGHAN KIM, *University of Toronto*, LYNN HASHER, *University of Toronto and Rotman Research Institute*, & ROBERT S. LOCKHART, *University of Toronto*—Under instructions to ignore distraction, younger and older adults read passages with interspersed distracting words. The distraction was manipulated such that some of the words could then serve as solutions to a subsequent set of verbal problems in which three weakly related words can be related by retrieving a missing fourth word (i.e., the Remote Associates Test; Mednick, 1962). If older adults are less able than younger adults to regulate attention during the reading task, they might show a benefit of that distraction on the subsequent problem-solving task. And the findings are quite clear: They are better than younger adults when the problems can be solved by distractors from the original reading task. This study shows a case in which the lack of attentional control can actually lead to superior performance.

(5072)

The Role of Response Competition in Age Reductions in Implicit Memory Performance. LISA GERACI, *Texas A&M University*, & MARYELLEN HAMILTON, *Saint Peter's College*—Implicit memory performance is sometimes reduced in older adults, as compared with younger adults. These age reductions in performance have been ex-

plained in terms of differing test demands. According to one hypothesis, older adults show reduced performance on implicit tests that allow for multiple responses that compete with the production of the studied target response. The following experiments directly tested this response competition theory. Older adults studied a list of words and were then given two different implicit memory tests: word stem completion and general knowledge. To examine the role of response competition, each test contained items with unique solutions and items with multiple solutions. Results showed significant priming for older adults on both tests but no effect of response competition on priming. Thus, results fail to support the response competition hypothesis of age effects in implicit memory. Alternate explanations of previously reported age reductions in implicit memory are offered.

(5073)

Experimenter Context and Perceptual Subsystems Predict Stereotyping and Individuating. SUSAN J. PARK, ALEXANDER J. ROTHMAN, & CHAD J. MARSOLEK, *University of Minnesota*—Gender stereotyping of an unfamiliar person can be enabled or inhibited in unintentional manners as a function of the perceptual subsystems engaged. In our paradigm, female and male faces are presented directly to the left or right hemisphere, followed by centrally presented words (some of which reflect female or male stereotypes) to which participants make lexical decisions. Gender stereotype activation (faster processing of stereotype words preceded by same-gender faces, rather than by opposite-gender faces) is observed when faces are presented directly to the left hemisphere, enabling abstract categorical face processing, whereas gender stereotype inhibition (slower processing of stereotype words preceded by same-gender faces, rather than by opposite-gender faces) is observed when faces are presented directly to the right hemisphere, enabling specific exemplar face processing. These results are observed when the gender of the experimenter mismatches the gender of the face cue, but not when they match, in an intriguing interaction between perceptual processing and social context.

(5074)

Trust in Team Training. ADRIENNE Y. LEE, GARY D. BOND, & PAMELA SCARBROUGH, *New Mexico State University*—This study examined team training and transfer in a complex peacekeeping task and the degree to which dispositional, task-based, and emergent trust relates to performance. Teams of 3 participants completed eight simulated missions over 2 days in an 8-h-long experiment. Task-based trust questions were embedded in postmission questionnaires. Also, emergent trust was obtained from each team member's ratings of the other 2 team members as to the extent to which the person knew and trusted the other team members. For individuals' dispositional comparisons with team results, each team member completed the Rotter Interpersonal Trust Scale at the beginning of the experiment. Results indicated that task-based and emergent trust increases over time and that dispositional trust is related to performance under the most difficult task conditions.

• CONCEPTUAL IMPLICIT MEMORY •

(5075)

Testing the Longevity of Rapidly Formed New Conceptual Associations. SUPARNA RAJARAM & HELENA BLUMEN, *SUNY, Stony Brook*, & KAVITHA SRINIVAS, *IBM T. J. Watson Research Center*—This research is aimed at understanding the process by which new information is integrated into existing conceptual knowledge. In our recent work (Srinivas, Culp, & Rajaram, 2000), we addressed this issue by investigating implicit memory for rapidly formed new conceptual associations. We developed a novel paradigm that eliminates the assistance of perceptual cues and minimizes the use of explicit retrieval strategies. As such, this paradigm is particularly suited for studying this issue in memory-intact, as well as memory-impaired, populations. Participants received single study exposures to scenes and dialogues that paired incongruous objects (*flashlight*) with ad hoc categories

(*mailbox*). Implicit memory was observed in the form of slower rejection of studied incongruous targets than of nonstudied incongruous targets. In the present study, we assessed the longevity of this phenomenon by comparing implicit memory at three delays—10 min, 2 h, and 48 h—and found that this effect dissipated at longer intervals.

(5076)

Measuring Automatic Retrieval in a Conceptual Priming Task. JENNIFER C. MAJOR & KEITH D. HORTON, *Wilfrid Laurier University*—The speeded response technique has provided pure estimates of automatic retrieval in perceptual memory tasks. The present research was designed to investigate whether pure automatic retrieval could also be evidenced in a conceptual task. In two experiments, subjects were encouraged to generate category exemplars, using strictly automatic retrieval, by presenting practice trials that did not allow responding with previously studied items and by encouraging speed of responding. The studies differed only in terms of the frequency of the exemplars. To assess use of automatic retrieval in the speeded group, RTs were compared with those in a baseline condition in which conscious retrieval was not possible and an explicit condition in which conscious retrieval was required. Target completion rates in the speeded condition were compared with those in an implicit and a PDP condition to measure automatic retrieval. Results are discussed in terms of automatic retrieval of conceptual information.

(5077)

Subliminal Word Presentations Yield Conceptual Priming in the Absence of Recognition. CHAO-WEN CHEN, *Northwestern University and National Yang Ming University*, & WEN LI & KEN A. PALLER, *Northwestern University*—Preserved conceptual priming among amnesic patients with severely impaired declarative memory implies a high degree of independence between the two memory phenomena. Nonetheless, recognition in healthy individuals may still be driven by processing associated with conceptual priming. We attempted to produce conceptual priming via subliminal visual presentation of 120 words from 30 categories. Each word presentation was followed by a subjective report on word awareness and a category selection task. After approximately 2 min, words were presented auditorily, with visual category labels for category verification. Higher accuracy was observed for studied words than for new words, even though the studied words were not remembered. Using the same paradigm, brain potentials were recorded in another group of participants to examine neural events associated with conceptual priming for words, as demonstrated in these circumstances in the absence of declarative memory for the same words.

(5078)

Semantic Flexibility Effects in a Speeded Conceptual Implicit Memory Task. RENÉ ZEELLENBERG, *Erasmus University Rotterdam*—The present study investigated priming in speeded relatedness decision. In Experiment 1, participants studied single words (*dog*) in either a shallow-processing task or a deep-processing task. In the test phase, word pairs (*cat–dog*) were presented in the relatedness decision task. More priming was obtained in the deep condition than in the shallow condition, confirming that priming relied on conceptual processes. In Experiment 2, participants studied target words embedded in a sentence context that emphasized meaning aspects that were more or less congruent with the context word with which the target was subsequently presented in the relatedness decision task. In accord with the idea that semantic representations are flexible, faster responses were obtained in the more congruent condition than in the less congruent condition. Because speeded responses are required in the relatedness decision task, it may be less prone to explicit contamination than are other conceptual implicit tasks.

(5079)

Decomposition of Repetition Priming Processes in Bilingual Word Translation. WENDY S. FRANCIS & GABRIELA DURÁN, *Univer-*

sity of Texas, El Paso—Two experiments with 120 fluent Spanish–English bilinguals evaluated the contributions of word comprehension, word retrieval, and articulation to repetition priming in translation. Experiment 1 combined picture drawing (based on word stimuli) and picture naming as encoding tasks meant to facilitate word comprehension and word retrieval/articulation processes, respectively. These tasks facilitated spoken translation additively, but their combination fell short of the identical repetition effect, indicating that drawing does not trigger exactly the same comprehension processes as translation. In Experiment 2, written translation did not fully prime spoken translation, indicating a small contribution of articulation. Facilitation effects from written translation and picture naming interacted subadditively, as was expected, presumably due to overlapping word retrieval processes. The second word retrieval repetition increased facilitation, but by a smaller increment than the first repetition. Overall, practice of word comprehension, word retrieval, and articulation processes facilitated spoken word translation.

(5080)

A Test of Functional Equivalence of Automatic Memory Processes in Recognition, Conceptual Implicit, and Perceptual Implicit Memory. CHRISTOPHER N. WAHLHEIM & DAWN M. McBRIDE, *Illinois State University*—Dual-process models of recognition posit that recollection is mediated by conceptual processes; however, there is controversy as to which processes mediate familiarity. The present study was designed to provide a direct test of the effects of conceptual processing on familiarity, conceptual automatic memory, and perceptual automatic memory, using a levels-of-processing (LoP) manipulation. LoP effects were predicted for recognition familiarity and conceptual automatic memory, but not for perceptual automatic memory. The process dissociation procedure (Jacoby, 1991) was used to estimate automatic memory in a recognition task (i.e., familiarity), a word association task (conceptual), and a word stem completion task (perceptual). LoP effects were found for recognition familiarity and conceptual automatic memory; however, LoP effects were not found for perceptual automatic memory. These findings suggest that recognition familiarity may be mediated by conceptual processes.

• COGNITIVE CONTROL •

(5081)

Stimulus-Driven Cognitive Control: Abstract Task Set Selection or Episodic Retrieval? MATTHEW J. CRUMP, SANDRA J. THOMPSON, & BRUCE MILLIKEN, *McMaster University*—Cognitive control is often described as involving high-level voluntary shifts of set that shape lower level perceptual processing. However, recent studies of task-switching costs (Allport & Wylie, 2000; Waszak, Hommel, & Allport, 2003) demonstrate that cognitive control is also imparted by the involuntary retrieval of similar prior processing episodes, which can either facilitate or interfere with performance. We examined this conceptual issue further using a different cognitive control tool, the item-specific proportion congruency (ISPC) effect. Jacoby, Lindsay, and Hessels (2003) demonstrated that Stroop interference is sensitive to proportion congruency even when proportion congruency is tied to item type, varying from trial to trial. Yet it is not clear whether this effect tells us that abstract cognitive control sets can be adapted remarkably quickly or that cognitive control is inherent to memory episodes that are retrieved, of course, quickly. We examine this issue further in the context of both Stroop and attention capture studies.

(5082)

The Cognitive Representation and Integration of Task Set Components. ANDREA M. PHILIPP & IRING KOCH, *Max Planck Institute for Human Cognitive and Brain Sciences*—The present study examined the cognitive representation of tasks (*task sets*), using the task-switching paradigm. Generally, task sets are thought to contain several components. In two experiments, we explored different task set components

in order to identify those components that can distinguish one task from another. The experiments showed that task set components, such as stimulus categories and response modalities, play the same crucial role in cognitive task representations. In further task-switching experiments, we manipulated two task set components (stimulus categories and response modalities) orthogonally. We found that both components were not represented independently but were integrated into a single task representation. On the basis of these results, we developed a new model, the task integration model. The model proposes that all task set components are equally important for the cognitive representation of tasks and that different task set components have to be integrated into one single task representation before subjects can perform a task (i.e., select a response).

(5083)

Neural Correlates of Cue Encoding and of Task Set Reconfiguration. STEPHANIE V. TRAVERS & ROBERT WEST, *University of Notre Dame*—We used event-related potentials (ERPs) and Stroop stimuli to examine the processes engaged during a task-switching paradigm in which the task switched, the cue switched but the task remained the same, or no switch occurred (cf. Mayr & Kliegl, 2003). Analyses of activity during the cue-to-target interval revealed differential processing for pure and mixed blocks and for task switches, relative to other types of trials. Analyses of posttarget processing distinguished between pure and mixed blocks and, again, differentiated task switch trials from cue switch and no-switch trials. These data provide evidence that task-switching costs arise from an active reconfiguration of the task set in response to the cue and, possibly, from processes that serve to regulate proactive interference from previous trials.

(5084)

Instruction-Induced Feature Binding. DORIT WENKE, PETER A. FRENDSCH, DIETER NATTKEMPER, & ROBERT GASCHLER, *Humboldt University, Berlin* (sponsored by Peter A. Frensch)—In order to test whether or not instructions specifying the stimulus–response (S–R) mappings for a new task suffice to create bindings between specified S- and R-features, we developed a dual-task paradigm of the ABBA type, in which participants saw new S–R instructions for the A-task in the beginning of each trial. Immediately after the A-task instructions, participants had to perform a logically independent B-task. The imperative stimulus for the A-task was presented after the B-task had been executed. The present data show that the instructed mappings influence performance on the embedded B-task, even when they (1) have never been practiced and (2) are irrelevant with respect to the B-task, at least when (3) overlapping features are relevant for both tasks. These results imply that instructions can induce bindings between S- and R-features without prior execution of the task at hand.

(5085)

Action Effects in the PRP Paradigm: Which Codes Require Central Resources? MARKO PAELOCKE & WILFRIED KUNDE, *Martin Luther University, Halle-Wittenberg*—Ideomotor theories of action control assume that actions are represented and accessed by codes of their sensorial effects. In three experiments, we investigated whether the activation of effect codes is subject to central capacity-limited mechanisms. Participants made two choice reactions in response to stimuli presented in rapid succession at variable stimulus onset asynchronies (SOAs). In Task 2, we varied the compatibility between responses and forthcoming sensorial effects (Experiments 1 and 2) or between responses and stimuli partly resembling those effects (Experiment 3). With forthcoming effects, the influence of compatibility was additive with influence of SOA, whereas with perceptual stimulation of effect codes, an underadditive interaction with SOA was found. These results suggest that an endogenous, but not an exogenous, activation of effect codes occurs during the capacity-limited response selection stage. The results are discussed with respect to current models of action control.

(5086)

Action Corepresentation With Numerical Stimuli: The Joint SNARC Effect. SILKE ATMACA, NATALIE SEBANZ, & GÜNTHER KNOBLICH, *Rutgers University, Newark*—Social context profoundly affects thinking and reasoning. Does it also affect action planning? Using pointing stimuli, we have demonstrated that when a task is distributed between two persons, each person represents the other's actions, resulting in a joint spatial compatibility effect. In the present study, we investigated whether action corepresentation emerges for more abstract stimuli. Participants classified numbers as odd or even. When one actor performed a two-choice task, small numbers were responded to more quickly with the left key, and large numbers were responded to more quickly with the right key, replicating the original SNARC effect. The same effect occurred when the two responses were distributed between two persons, each of them performing a go/no-go task. However, no SNARC effect was observed when one person performed the same go/no-go task alone. These results suggest that action corepresentation is a general phenomenon that is not bound to a specific task.

(5087)

Does Tool Use Eliminate the Spatial Compatibility Effect? JOCHEN MÜSSELER, *RWTH Aachen*—Subjects tend to respond more quickly and less erroneously to stimuli presented in the visual hemifield that spatially corresponds to the responding hand. In the present experiments, we examined whether this spatial compatibility effect is modified or even eliminated by using a tool. Subjects aimed at a left or a right stimulus by moving a tool to the left or the right. Different hypotheses emerged from considering the direction of the movement or the direction in which the tool was aiming (the direction of the action effect). If the direction of movement is important, tool use should not affect the spatial compatibility effect. If the direction in which the tool is aiming, is important, tool use should eliminate or even reverse the spatial compatibility effect. So far, results have shown that the spatial compatibility effect is not affected by tool use.

(5088)

Between-Task Interference and the Occurrence of Task Inhibition. MIRIAM GADE, WOLFGANG PRINZ, & IRING KOCH, *Max Planck Institute for Human Cognitive and Brain Sciences*—In addition to activation of the currently relevant task, inhibition of competing tasks occurs when task sequences are performed. We argue that inhibition arises to resolve between-task interference. We assessed task inhibition as $n-2$ repetition cost (ABA sequences, as compared with CBA sequences). In Experiments 1A and 1B, we manipulated the temporal interval between tasks (i.e., we manipulated decay of task activation). We showed that the amount of inhibition in task sequences is dependent on the residual activation of the competing task. In Experiments 2A and 2B, we showed that feature overlap between tasks (i.e., overlap in response categories) leads to between-task interference, determining the occurrence of task inhibition. We conclude that inhibition in the control of task sequences mainly serves the resolution of interference, either because of residual activation of competing tasks or because of feature overlap between tasks.

(5089)

The Effects of Attention Process Training in Older Adults. VALERIE D. WEISSER & JANINE M. JENNINGS, *Wake Forest University*, PAUL J. LAURIENTI, *Wake Forest University School of Medicine*, & DALE DAGENBACH, *Wake Forest University*—Self-reports from older adults in a recollection memory training study attribute performance gains to improvements in attention and concentration (Jennings & Jacoby, 2003; Jennings et al., in press). In addition, age differences in the integration of information from multiple senses have been found (Laurienti et al., in press) and can be linked to attentional processing. The present study was thus designed to investigate the effects of attention training on both memory and sensory processing in older adults, using a modified version of the Attention Process Training (APT-II) program (Sohlberg & Mateer, 1987; Sohlberg et al., 2001). Training consisted

of auditory and visual tasks devoted to selective, alternating, and divided attention. Transfer performance was assessed on these aspects of attention, as well as on measures of recollection, working memory, processing speed, and multisensory integration. Training-related changes on these tasks and their implications will be discussed.

(5090)

Attentional Processes Can Be Reverted by Different Manipulations on Memory Load in an RSVP Stroop-Like Task. BEATRIZ GIL-GÓMEZ DE LIAÑO & JUAN BOTELLA, *Autónoma University of Madrid* (sponsored by Juan Botella)—We have recently studied the relationship between working memory and attention (Gil-Gómez de Liaño & Botella, 2004), using an RSVP paradigm within the framework of the formation of illusory conjunctions in the time domain (Botella, Barriopedro, & Suero, 2001). Our results showed better performance in a Stroop-like task for the incongruent condition when memory was loaded. The present study is an attempt to explain those results in more detail. The last experiment used a dual-task paradigm in which participants had to maintain and recall a set of numbers presented at the beginning of the task while performing an RSVP Stroop-like task. The present study uses a simple task paradigm where memory load is manipulated by using stimuli associated with the RSVP Stroop-like task. The results show an inversion on the effect found in the first study: Now, performance is worse for the incongruent condition when memory is loaded.

(5091)

Fatiguing Executive Function. MARC G. BERMAN, DEREK E. NEE, & JOHN JONIDES, *University of Michigan*—Resolving interference in working memory is a component crucial to successful cognitive functioning. However, little research has investigated whether interference resolution processes can be facilitated or fatigued. Here, we propose a paradigm with which to explore this question. We utilized two tasks that require the resolution of proactive interference in working memory: a directed forgetting task and an item recognition task. The resolution of interference in both of these tasks has been shown to activate the left inferior frontal gyrus. We found that subjects who performed the item recognition task that included proactive interference showed increased interference effects on the directed forgetting task relative to subjects who performed an identical item recognition task without an interference component. The results suggest that mechanisms involved in the resolution of proactive interference (perhaps localized to the left inferior frontal gyrus) fatigue, resulting in increased interference on subsequent tasks using the same mechanisms.

(5092)

Executive Control Over Interference Effects. BIRGIT STÜRMER, *Humboldt University, Berlin*—Cuing the correspondence condition on a trial-by-trial basis in a stimulus–response correspondence task affects the interference effect. Especially, responses to corresponding events are faster with a valid correspondence condition cue. Manipulating cue validity, as well as cue type, showed that the advantage of the correspondence condition cue holds true only with 100% cue validity. Moreover, modulations of the interference effect depending on the correspondence condition of the previous trial were analyzed. With a correspondence cue, the interference effect was enlarged after a preceding corresponding event, as compared with other cue types. In addition, cuing effects were tested in a Simon task. The cue type did not affect the sequence-dependent modulation of the Simon effect. Therefore, cuing the correspondence condition influenced the sequence dependency in both tasks differentially. This finding is discussed against the background of intentional and nonintentional control mechanisms operating in the stimulus–response correspondence task and the Simon task, respectively.

(5093)

Taboo: A Naturalistic Study of Mental Control. WHITNEY A. HANSEN & STEPHEN D. GOLDINGER, *Arizona State University*—

In recent years, many studies have compared perceptual or cognitive abilities between people with greater or lesser working memory capacity (span). In laboratory tests, it appears that lower span people are less efficient at suppressing irrelevant information, keeping task-specific goals in mind, and maintaining vigilance. When both groups are placed under cognitive load, these differences tend to disappear. We conducted a naturalistic experiment, with high- and low-span participants playing the game Taboo for prizes. In Taboo, a clue-giver must elicit a target word from teammates, without using the best associates as clues (“taboo” words). Using multiple indices of performance, we found that higher span people played more efficiently than lower span players. They committed fewer Taboo errors, perseverated less often, and guessed correctly more often. This was true even in a control condition with Taboo words eliminated. The results reinforce findings from many laboratory procedures (e.g., Stroop interference, cocktail party effect, and antisaccade task).

(5094)

Attentional Control in Novice and Expert Baseball Batters. BROOKE CASTANEDA & ROB GRAY, *Arizona State University* (sponsored by Rob Gray)—This study investigated the attentional control structures involved in baseball batting. Novice and expert baseball players participated in four dual-task conditions: two that directed attention to skill execution (skill/internal [hand movement] and skill/external [bat movement]) and two that directed attention to the environment (environmental/irrelevant [tones] and environmental/relevant [ball rotation]). Temporal swing errors for experts were (1) lower for skill/external than for skill/internal and (2) lower for environmental/relevant than for environmental/irrelevant. For experts, the best batting performance was in the environmental/relevant condition. For novices, there were no significant differences in batting performance across conditions. Secondary task judgments were accurate for all conditions, suggesting that participants directed their attention to the instructed location. We conclude that experts should attend to ball rotation to achieve optimal hitting performance because it (1) does not disrupt proceduralized knowledge, (2) allows batters to effectively process the swing outcome, and (3) allows batters to utilize rotation to judge pitch speed.

• MOTOR CONTROL •

(5095)

Tapping the Mind for Movement. ROBRECHT P. R. D. VAN DER WEL & DAVID A. ROSENBAUM, *Pennsylvania State University* (sponsored by David A. Rosenbaum)—Psychologists can make special contributions to the study of movement by identifying psychological determinants of movement forms. Similarly, kinesiologists can make special contributions to the study of psychology by identifying biomechanical determinants of psychological control. With this interaction in mind, we asked university students to tap targets in time with a metronome. Aspects of their performance reflected a blend of biomechanical and psychological factors. Because the psychologically driven features of their movements were similar to aspects of performance that emerge in more intellectual tasks, one may speculate that demands of movement control establish the basis for other psychological phenomena.

(5096)

Multiresolution Model of Human Motor Control. OH-SANG KWON, ZYGMUNT PIZLO, HOWARD N. ZELAZNIK, & GEORGE T.-C. CHIU, *Purdue University* (sponsored by Zygmunt Pizlo)—Multiresolution architecture is a well-established model of the human visual system. According to this model, the time it takes to judge the line of length D with accuracy d is proportional to $\log(D/d)$. Interestingly, the same function, called *Fitts's law*, is used to characterize skilled motor performance, suggesting that the visual and motor systems may share the same multiresolution architecture. To verify this claim, we tested human subjects in a transfer of motor skill. In the experiment, a

trained motor skill was transferred to the task (1) where the sizes of movements remained the same but more accurate movements were required or (2) where the sizes of movements were scaled by the same factor as the required accuracy. Results showed that the degree of transfer in (2) was substantially higher than in (1), supporting the multiresolution model.

(5097)

Cooperative and Competitive Ideomotor Movements. ANNE HÄBERLE, GISA ASCHERSLEBEN, RAFAEL LABOISSIÈRE, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Ideomotor movements occur involuntarily when we observe another person's action. They reflect two aspects of the observed action. Perceptually induced ideomotor movements correspond to an actually observed movement. Intentionally induced ideomotor movements relate to the action goal of the observed action. The present experiment investigated both aspects: Subjects' finger movements were recorded while they watched on a computer screen how another person attempted to steer a ball toward its target in order to achieve a hit. Perceptually induced ideomotor movements were found to relate to the ball's movements on the screen. Intentionally induced movements were shown to relate to the attempts to achieve a hit. When subjects had a personal interest in the observed action, their ideomotor movements were modulated by that interest. When subjects benefited from an observed hit, their ideomotor movements reflected cooperative intentions. When subjects experienced a monetary loss for an observed hit, their ideomotor movements reflected competitive intentions.

(5098)

Temporal Coordination of Actions and Auditory Feedback in Sequence Production. PETER Q. PFORDRESHER & BRIAN BENITEZ, *University of Texas, San Antonio*—Delayed auditory feedback (DAF) causes asynchronies between perception and action that disrupt production (Lee, 1950), relative to normal feedback. Varying amounts of disruption have been found for different delays. These differences may reflect the phase location of feedback onsets, relative to produced interresponse intervals (e.g., Finney & Warren, 2003), or the absolute temporal separation between actions and sounds (e.g., MacKay, 1987). Three experiments addressed this issue by observing production with traditional DAF, which uses a constant temporal separation or delays that adjust temporal separation to maintain the phase location of feedback onsets. Participants (trained pianists and nonmusicians) played simple isochronous melodies on a keyboard or tapped an isochronous beat at three production rates. Disruption was best predicted by the phase location of feedback onsets and was diminished when feedback onsets formed harmonic phase ratios (e.g., phase synchrony). These results support the view that perception and action are coordinated in relative time.

(5099)

Two Modes of Sensorimotor Integration in Intention-Based and Stimulus-Based Actions. FLORIAN WASZAK, *CNRS, Paris and Max Planck Institute for Human Cognitive and Brain Sciences, Munich*, & ARVID HERWIG & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Human actions may be driven endogenously (to produce desired environmental effects) or exogenously (to accommodate to environmental demands). There is a large body of evidence indicating that these two kinds of actions are controlled by different neural substrates. However, little is known about what happens—in functional terms—on these different “routes to action.” Ideomotor approaches claim that actions are selected with respect to their perceptual consequences. We report experiments that support the validity of the ideomotor principle and that, at the same time, show that it is subject to a far-reaching constraint: It holds for endogenously driven actions only. Our results suggest that the activity of the two “routes to action” is based on different types of learning: The activity of the system guiding stimulus-based actions is accompanied by stimulus–response (sensorimotor) learning, whereas

the activity of the system controlling intention-based actions results in action–effect (ideomotor) learning.

(5100)

Planning Tool Actions. CRISTINA MASSEN & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—In our experiments, we investigated the planning and representation of tool actions. Results from previous work suggest a subordinate role of the movement itself in the representation of tool actions, and in this study, we focus on the relative roles of the transformation and the intended effect of the movement. Subjects were required to plan lever actions displayed on a computer screen and indicated by buttonpresses how (in terms of direction and amplitude) to move the end of a lever to produce an intended effect, given a specific center of rotation of the lever (transformation). In a tool-switching paradigm, subjects either switched between two transformations (A and B; Condition 1) in successive tool actions or switched between two effects (A and B; Condition 2). Results point toward a dominant role of the transformation in planning tool actions and are discussed with respect to the ideomotor theory of action.

(5101)

Tool Transformation and Fitts's Law: The Influence of Extracorporeal Space. MARTINA RIEGER & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Does Fitts's law hold when different transformations between movement space and visual space are introduced? In Experiment 1, participants carried out continuous vertical reversal movements. Movement amplitude (12 cm) and target width (0.4 cm) and, therefore, index of difficulty (5.91) were equal for all conditions. Nine different gain conditions were conducted in different blocks (1.8, 1.6, 1.4, 1.2, 1.0, 0.8, 0.6, 0.4, 0.2). Movements with higher gain were slower and had lower peak velocity than did movements with lower gain. According to Fitts's law, movement times should be equal in all conditions. The results therefore indicate that extracorporeal space has an effect on movement kinematics and that Fitts's law does not hold across different transformations between movement space and visual space. Experiment 2 showed that the effects of external space are more pronounced with high indexes of difficulty and large gains.

(5102)

Does Compatibility Interference Require Similar Response Actions? MATTHEW WIEDIGER & LISA R. FOURNIER, *Washington State University*—Previous research shows that planning and withholding an action to a stimulus (X1) can delay the response to a second stimulus (X2), if X2 is response compatible (requires the same response hand) with X1 (compatibility interference, CI). According to Stoet and Hommel (1999), CI occurs because of an overlap in response codes (e.g., same hand) between X1 and X2. However, we found that CI did not occur when X1 required an identity-based response and X2 required an ego-location–based response. In this case, perhaps the motor actions required for X1 and X2 were too dissimilar or response execution to X2 was too long to detect CI. The present study investigated whether the failure to find CI for ego-location–based responses was due to either of these factors. Results will be discussed in terms of their implications for the code occupation hypothesis originally proposed by Stoet and Hommel (1999) to account for CI.

(5103)

Human Rotational Preference and Behavioral Activation System Sensitivity. DAVID A. ABWENDER & MIKE J. PUSATERI, *SUNY Brockport* (sponsored by Stuart Appelle)—Freely ambulating animals, including humans, preferentially turn in the direction contralateral to the brain hemisphere with greater tonic dopamine activity. Using 64 female and 25 male undergraduate participants, we investigated whether rotational preference (RP) predicts behavioral activation system (BAS) sensitivity, a behavioral disposition thought to be partly mediated by left-hemisphere dopamine pathways. RP was assessed by having participants move about a room in response to tones emanat-

ing from speakers placed against the four walls. BAS sensitivity was significantly higher among males with left RP and lower among males with right RP but was unrelated to RP among women, presumably because ovarian hormone fluctuation lowers RP assessment reliability. Conclusion: Lower left- than right-hemisphere tonic dopamine release, producing left RP, permits higher amplitude left-hemisphere phasic firing bursts that yield high BAS sensitivity; higher left tonic dopamine release, producing right RP, precludes high amplitude phasic bursts, thus diminishing BAS sensitivity.

(5104)

Unintentional Movements During Action Observation: Copying or Compensating? NATALIE SEBANZ & MAGGIE SHIFFRAR, *Rutgers University, Newark*—People often unintentionally mimic others' actions. However, compensatory movements have been reported for situations where actions that are inconsistent with the actor's goal are observed. The aim of the present study was to investigate systematically when unintentional imitational and compensatory movements are made. Participants were shown movies of a person balancing on a foam roller. Their task was to indicate how likely they thought it was that the actor would reach the end of the foam roller. The movies showed the actor from the front and back. Using a motion capture system, we measured unintentional movements during action observation. Participants had a strong tendency to imitate the observed movements when the actor was seen from the front. Compensatory movements occurred when the actor was seen from the back. These findings suggest that motor responses are mediated by the spatial relationship between the observer and the actor.

(5105)

Dyslexic Adults' Eye Movement Control During Reading and Visual Tracking. ROBERT A. KACHELSKI, SINEEPORN CHATTRAKULPONG, TERRI L. ENTRICHT, KRISTEN B. GAYNOR, MARGARET R. JUDIN, & ROSEMARY LOKKO, *Agnes Scott College*—Currently, most theoretical accounts of developmental dyslexia emphasize a phonological processing deficit that makes decoding written words into their constituent sounds difficult for dyslexics. However, some researchers have found evidence of poor eye movement control that may be an additional problem for at least a subset of those with dyslexia. Because these findings have been controversial, the purpose of our research was to determine whether dyslexics do, in fact, exhibit poor eye movement control when compared with normal readers. We used an eyetracking system to record dyslexic and control participants' eye movements as they completed both reading and visual-tracking tasks. Results are presented comparing the two groups on variables relevant to the control of eye movements, such as fixation accuracy and the percentage of regressive eye movements, as well as variables relevant to reading performance and phonological processing.

(5106)

The Effect of a Concurrent Task on Gait Performance in Children With Developmental Coordination Disorder. RONG-JU CHERNG, LING-ING LIANG, & JENN-YEU CHEN, *National Cheng Kung University*, & CATHERINE L. PURDOM & LAURA M. TUTTLE, *Agnes Scott College* (sponsored by Jenn-Yeu Chen)—Thirteen children (10 boys, 3 girls; ages 4–6 years) with developmental coordination disorder (DCD) and 26 age- and gender-matched normal children were recruited to examine the effect of a concurrent task on walking performance under different task types (cognitive vs. motoric) and different difficulty levels (easy vs. hard). Each child performed (1) free walking, (2) walking while carrying an empty tray, (3) walking while carrying a tray with seven marbles in it, (4) walking while repeating a group of digits forward, and (5) walking while repeating the digits backward. Walking performance was affected by the concurrent task in DCD more than in normal children. Greater task difficulty increased the dual-task cost in DCD children more than in normal ones. However, the above patterns held true only when the concurrent task was motoric. The cognitive task also affected the walking perfor-

mance, and greater task difficulty increased the cost, but these patterns did not vary between the groups.

(5107)

Alcohol-Induced Impairment of Behavioral Control: The Motor Program and Impulsivity. CECILE A. MARCZINSKI & BEN D. ABROMS, *University of Kentucky*, MARK G. VAN SELST, *San Jose State University*, & MARK T. FILLMORE, *University of Kentucky*—Model-based assessments of behavioral control have been used to study the ability to execute and inhibit behavioral responses. Response inhibition appears to be more vulnerable to the impairing effects of alcohol than does response execution. Current information-processing models have not accounted for this observation. The present study examined whether the particular vulnerability of response inhibition to the effects of alcohol occurs at the level of the action (motor program). Participants performed a cued go/no-go task that required quick responses to go targets and suppression of responses to no-go targets. Response requirements were manipulated by varying the nature of the action required (pressing or releasing a key). Dose-dependent increases in commission errors were observed only with response engagement (keypress) and not with response disengagement (releasing a key). Therefore, not all aspects of motor processing requiring inhibition are equally impaired by alcohol, and the duration of the motor program appears to be fundamental to observing alcohol-induced impulsivity.

(5108)

Incidental Learning and Subliminal Motor Priming. FRIEDERIKE SCHLAGHECKEN, ELISABETH BLAGROVE, & ELIZABETH A. MAYLOR, *University of Warwick*—Subliminal priming effects in the masked-prime paradigm can be obtained only when primes are part of the task set (e.g., arrow primes elicit priming effects only when arrows also appear as targets). We investigated whether the relevant feature of the task set needs to be explicitly instructed (e.g., “left-hand response to a left-pointing arrow”), or whether participants would extract it automatically in an incidental learning paradigm. Primes and targets were symmetrical arrows (<> and ><), with target color, not shape, the response-relevant feature. Whereas shape and color covaried for targets (e.g., <> always blue, >< always green), primes were always black. Over time, a negative compatibility effect (NCE; response benefits for prime–target pairs with different shapes) developed, indicating that primes began to affect the motor system. When target shape and color varied independently (control condition), no NCE occurred, confirming that the NCE reflects motor processes, not perceptual interactions.

(5109)

Contribution of Ipsilateral Motor Areas to Response Initiation: Test of the Hemispheric Coactivation Hypothesis. JEFF O. MILLER, *University of Otago*—Miller (2004) proposed a “hemispheric coactivation” hypothesis to explain the surprising finding that redundancy gain is larger when redundant visual stimuli are presented to different hemispheres of individuals without a functioning corpus callosum than when such stimuli are presented to normals. According to this hypothesis (and contrary to the standard assumption of contralateral hand control), unimanual responses are actually bilaterally controlled, with ipsilateral, as well as contralateral, motor areas making a substantial contribution to response initiation. An EEG experiment was conducted to test for the hypothesized contribution of ipsilateral motor areas to response initiation. The results suggest that ipsilateral motor areas do contribute to response initiation in a unimanual simple RT task, but not in a between-hands choice RT task.

• PSYCHOLINGUISTICS •

(5110)

Is There a Verb/Noun Access Dissociation by Modality in Normals? CHRIS WESTBURY, *University of Alberta*, & SIGNY SHELDON, *University of Toronto*—Studies of aphasics suggest that word class (e.g., noun and verb) processing can be dissociated by sensory modality via

brain injury. Does modality also interact with word class in normal language processing? We hypothesized that the aphasic production deficits might reflect an underlying dissociation in representation, which could be studied in normal subjects by using a comprehension task that facilitates experimental control. We use a syntactic priming task, in which nouns and verbs words were preceded by either the word *to* or *the*. Subjects were asked to make lexical decisions. Syntactic priming effects were seen in both the visual and the auditory modalities, but they were much larger in the auditory than in the visual modality. RTs were much longer to primed than to unprimed words in the visual modality only. The results constitute evidence of modality-specific grammatical class access differences in normal subjects.

(5111)

Coercion Without Type Shifting: The Role of the Subject in Enriched Interpretations. STEVEN FRISSON, BRIAN D. McELREE, & PREETI THYPARAMPIL, *New York University* (sponsored by Brian D. McElree)—Interpreting expressions like “began the book,” in which an event-selecting verb is paired with a complement of a different semantic type (an entity), requires more processing than do expressions with no mismatch in semantic type (e.g., McElree et al., 2000). Recent data suggest that it is the time required to generate additional semantic content (e.g., “began TO READ the book”) that is costly. Two eyetracking experiments further investigated this hypothesis with sentences like “{The honest witness}/ {The court reporter} completed the testimony about . . .” Neither of these sentences requires type shifting, since the verb is event selecting and the complement expresses an event. In (1), the agent can plausibly control the actual event. In (2), the agent controls another unspecified event associated with the complement (e.g., recording the testimony). We observed increased reading times for (2), as compared with (1), and to different controls, indicating coercion effects for sentences that do not require type shifting.

(5112)

Evaluation of Unsupervised Semantic Mapping of Natural Language With Leximancer. ANDREW E. SMITH & MICHAEL S. HUMPHREYS, *University of Queensland* (sponsored by Andrew J. Heathcote)—The Leximancer system is a new method for unsupervised transformation of natural language into semantic patterns in an unsupervised manner. The technique employs two stages of lexical co-occurrence information extraction that are performed in sequence, using a different algorithm for each stage. These can be characterized as semantic extraction followed by relational extraction. In each stage, the data consists of actual episodic co-occurrence records. The algorithms used are statistical but employ nonlinear dynamics and machine learning. This paper seeks to validate Leximancer output, using a set of evaluation criteria taken from content analysis that are appropriate for knowledge discovery tasks. There are several reasons why one would want an automated system for content analysis of text. Human decision makers are potentially subject to influences that they are unable to report (Nisbett & Wilson, 1977). Furthermore, mitigation of subjectivity in human analysis currently requires extensive investment in the analysis process.

(5113)

The Effect of Manipulation Features on Lexical-Semantic Processing: An Eyetracking Study on Normal and Brain-Damaged Populations. JONG-YOON MYUNG, SHEILA E. BLUMSTEIN, & JULIE C. SEDIVY, *Brown University* (sponsored by Steven Sloman)—An eyetracking method was used in both normal and brain-damaged populations to investigate whether manipulation features are a part of the lexical-semantic representation of objects and whether they are related to physical manipulations of objects. Participants viewed a visual display on a computer screen and were asked to touch the corresponding object on the display in response to an auditory input. Normals fixated on an object picture (e.g., “typewriter”) that was manipulation-related to a target word (e.g., “piano”) significantly more often than an unrelated object picture (e.g., “bucket”), as well as a visual control

(e.g., “couch”). These effects indicate that manipulation features are an intrinsic part of the lexical-semantic representation of objects. These results are compared with fixation patterns of apraxic patients who have deficits in producing and comprehending voluntary movements, in order to determine whether such deficits result in a concomitant impairment in the lexical-semantic representation of manipulable objects.

(5114)

Priming Effects Without Semantic or Associative Links Through Collocation. WILLIAM J. BONK & ALICE F. HEALY, *University of Colorado, Boulder* (sponsored by L. E. Bourne, Jr.)—This study investigates priming effects for verb–object collocate pairs (e.g., “pay attention”); such words tend to co-occur by linguistic convention, rather than by meaning. The words in collocate pairs do not share semantic features, and do not cue each other in association norm tasks. In this experiment, naming times for targets preceded by established collocates are compared with those for unrelated words and for neutral primes (the word “blank”) in both forward (verb–noun) and backward (noun–verb) conditions. Collocationally related words provided automatic priming effects, as compared with both the neutral and the unrelated prime words as baselines. This finding supports the hypothesis that words automatically make their conventional partners active in memory, potentially facilitating both language comprehension and production. It appears that this activation is not semantically based but is, rather, the result of experience-based direct connections between lexical entries in memory.

(5115)

Two Stages of Sentence Comprehension in Patients with Alzheimer’s Disease. GLORIA S. WATERS, *Boston University*, & DAVID N. CAPLAN, *Massachusetts General Hospital*—The sentence comprehension abilities of patients with dementia of the Alzheimer’s type (DAT) and age- and education-matched controls were assessed using a sentence acceptability and a sentence plausibility judgment task. The stimulus materials were created so that the acceptability judgments could be made simply on the basis of syntactic acceptability, whereas a search of real-world knowledge was required for plausibility judgments. Syntactic complexity of the stimulus materials was also manipulated in both tasks. Performance of the patients was poorer than that of the control subjects. All subjects performed more poorly on the plausibility task than on the acceptability task. However, differences between the tasks were much greater for DAT patients than for control subjects. The results are interpreted as showing evidence that DAT patients are much more sensitive to increases in processing load at two stages of sentence comprehension.

(5116)

When Good Enough Parsing Is Not Good Enough: Error Signals and Reanalysis. KIEL CHRISTIANSON, *University of Illinois, Urbana-Champaign*, & TIMOTHY J. SLATTERY, *University of Massachusetts, Amherst*—In experiments exploring garden path sentences (GPs), such as “While the man hunted the deer ran into the woods,” Christianson et al. (2001) discovered that interpretations derived from GPs are often not faithful to the input. Instead, interpretations reflect lingering effects of the initial GP parse. In this study, eye movements were recorded as participants read GPs and non-GPs containing commas, followed by, for example, “The man was hunting a deer (bear) in the woods.” The results showed classic GP effects of longer reading times (RTs) and more regressions in the GPs. When the noun in the subsequent sentence did not match the previous one, RTs and regressions increased, suggesting lingering effects of the GP, in addition to large effects of the noun mismatch. RTs on the mismatched noun did not differ as a function of the GP, however. We discuss the results in terms of “good enough” syntactic and semantic representations.

(5117)

Arriving and Struggling the Veterinarian: Lexical Guidance in Parsing, Revisited. ADRIAN STAUB & CHARLES E. CLIFTON, *Uni-*

versity of Massachusetts, Amherst—Several previous studies (Adams, Clifton, & Mitchell, 1998; Mitchell, 1987; van Gompel and Pickering, 2001) have examined whether readers experience processing difficulty on a noun phrase immediately following an intransitive verb, with inconclusive results. In an eyetracking experiment, we explored the hypothesis that a relevant factor is whether the intransitive verb is an unaccusative (e.g., *arrive*) or an unergative (e.g., *struggle*). We suspected that readers might experience more difficulty with unergatives than with unaccusatives, since the underlying syntax of unaccusatives categorically prohibits a direct object. In fact, we found that readers experienced significant difficulty on a postverbal noun phrase with each type of intransitive, as compared with transitive verbs, as reflected in both first-pass and go-past reading times. Furthermore, the two verb types did not differ significantly from each other. These results support parsing theories holding that the parser does not initially make use of verb argument structure information.

(5118)

Unrepairable Garden Paths Reveal Reanalysis Processing. FERNANDA FERREIRA & EDWARD M. HUSBAND, *Michigan State University* (sponsored by Fernanda Ferreira)—The time course of reanalysis processes in sentence comprehension was examined in two experiments using a modified version of the speed–accuracy tradeoff design. The first experiment used experimenter-paced phrase-by-phrase visual presentation, and the second used a saccade-contingent self-paced visual presentation. Subjects made rapid acceptability judgments when prompted by a beep at one of four delays after reading the disambiguating phrase. A second judgment, without time pressure, followed the speeded response. The results from both acceptability judgments and eye movement behavior suggest that reanalysis includes a lexical reaccess step for garden paths involving alternative verb argument structures, but not for those that require just structural revisions. The results are consistent with reprocessing views of reanalysis and provide indirect support for serial models of initial parsing.

(5119)

Relative Clause Comprehension in Mandarin. YOWYU LIN & SUSAN M. GARNSEY, *University of Illinois, Urbana-Champaign*—Speakers of both English and Japanese find object-relative clauses harder to understand than subject relatives. Although these languages differ in many ways (default word order, whether relative clauses follow or precede the head nouns they modify, etc.), they have in common that subject relatives follow the default word order pattern, whereas object relatives do not. In contrast, in Mandarin, it is object relatives that have the default word order, leading Hsiao and Gibson (2003) to predict that they should be easier in Mandarin; they collected reading time data that provided weak support for their prediction. In two Mandarin reading time studies, we found and replicated robust support for this prediction, but we also found that differences between subject and object relatives disappeared when head nouns were less confusable with other nouns in the sentences, consistent with Lewis’s (1999) claims about the role of similarity-based interference during sentence comprehension.

(5120)

Effects of Event Possibility and Likelihood on Eye Movements in Reading. TESSA C. WARREN & KERRY A. MCCONNELL, *University of Pittsburgh*—Eye movement reactions to semantic anomalies provide information about the time course over which different sources of information become available to the language comprehension system during reading (Rayner, Warren, Juhasz, & Liversedge, 2004). Although many studies have investigated the impact of anomaly severity on eye-movement latencies (e.g., Murray & Rowan, 1998; Rayner et al., 2004), little work has investigated effects of sources of information, such as event likelihood or possibility, that contribute to anomalies (cf. Hagoort, Hald, Bastiaansen, & Petersson, 2004). This experiment recorded eye movements over sentences with a possible and likely event, sentences with a possible but extremely unlikely

event, and sentences with an impossible and unlikely event. Sentences had the same words in critical regions and were normed for both possibility and likelihood. Results suggested that event likelihood and possibility had differential effects in the eye movement record. Results will be discussed in relation to Hagoort et al.'s (2004) ERP results.

(5121)

The Relative Importance of Language Factors in Word Skipping During Reading. DENIS DRIEGHE & TIMOTHY DESMET, *Ghent University*, & MARC BRYLSBAERT, *University of London* (sponsored by Robert Hartsuiker)—The skipping probability of a word is influenced by its processing ease (e.g., predictability). Meta-analyses examining these influences report effect sizes across studies ranging from 0% to 13%, with an average of 8%. One study does not fit this picture: Vonk (1984) reported 23% more skipping of the pronoun (she) in Sentence 1 (*Mary was envious of Helen because she never looked so good*), in which the pronoun had no disambiguating value, than in Sentence 2 (*Mary was envious of Albert because she never looked so good*), where it did. We reexamined this ambiguity in Dutch and observed only an 8% skipping difference. Our results also show that when the pronoun was masculine (*hij [he]*), it was skipped 10% more often than the feminine pronoun (*zij [she]*), probably due to the

fact that in Dutch, the feminine pronoun can also be plural (*they*), making it potentially ambiguous.

(5122)

Interaction in Models of Spoken Word Recognition. JAMES S. MAGNUSON, TED STRAUSS, & HARLAND D. HARRIS, *University of Connecticut*—A long-standing debate in spoken word recognition concerns information flow: Is there feedback from lexical to sublexical representations, or does information only flow forward? Proponents of feedforward models cite Frauenfelder and Peeters (1998; FP98) as evidence that even in TRACE, an interactive model, feedback serves no functional role (aside from accounting for lexical influences on sublexical decisions). FP98 tested recognition time in TRACE for 21 words with lexical feedback on and off. About half were recognized more quickly without feedback. We revisited this result to see whether it generalizes to all words and whether feedback protects the model against noise. We tested all words in a 901-word lexicon under multiple levels of noise. Without noise, 73% of the words were recognized faster with feedback (we will discuss neighborhood characteristics of items recognized faster without feedback). With noise, both accuracy and response times were significantly better with feedback. In short, feedback helps.