

Implicit Memory

Regency ABC, Friday Morning, 8:00–9:20

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

8:00–8:15 (1)

Attention and Auditory Implicit Memory. NEIL W. MULLIGAN, *University of North Carolina, Chapel Hill*—Traditional theorizing stresses the importance of attentional state during encoding for later memory, based primarily on research with explicit memory. Recent research has investigated the role of attention in implicit memory in the visual modality. The present experiments examined the effect of divided attention on auditory implicit memory, using auditory perceptual identification, word-stem completion, and word-fragment completion. Participants heard study words under full attention conditions or while simultaneously carrying out a distractor task. In Experiment 1, a distractor task with low response frequency failed to disrupt later auditory priming (but diminished explicit memory as assessed with auditory recognition). In Experiment 2, a distractor task with greater response frequency disrupted priming on all three of the auditory priming tasks as well as the explicit test. These results imply that although auditory priming is less reliant on attention than on explicit memory, it is still greatly affected by at least some divided-attention manipulations.

8:20–8:35 (2)

The Hebb Repetition Effect in Auditory Space. FABRICE B. PARMENTIER, *University of Plymouth*, MURRAY T. MAYBERY & MATTHEW HUITSON, *University of Western Australia*, & DYLAN M. JONES, *Cardiff University*—We examined the Hebb repetition effect for auditory spatial stimuli. Consistent with the proposition that the spatial scattering of auditory to-be-remembered stimuli hinders the preattentive processing of order information by preventing the perceptual organization of the stimuli into a coherent stream, two experiments using bursts of white noise showed no repetition learning for such stimuli. Further experiments produced a Hebb effect for non-words scattered across space, and for spatial locations when the stimuli were nonwords. This effect could not be explained on the basis of a binding account or a distinctiveness account. Rather, the data suggest that the presentation of stimuli spoken in a human voice offers a common carrier on the basis of which the locations are perceived as part of a coherent stream, thereby affording the preattentive processing of order information and repetition learning.

8:40–8:55 (3)

Implicit Motor Learning Depends on Task Structure: Evidence From the Chord Task. ELIOT HAZELTINE, TANA TRUELOVE, & KARL FRIEDRICHSEN, *University of Iowa*—Implicit learning of response contingencies is a robust phenomenon that has been demonstrated even when attentional resources are diverted by a secondary task. In the present set of studies, we examined the effects of task structure on implicit learning using the chord task. In the chord task, individuals make two responses simultaneously, and learning is measured as the performance cost associated with production of unpracticed combinations compared to the production of practiced combinations. In Experiments 1–4, chord learning occurred only when the stimuli for both tasks were visual and the responses for both tasks were manual. However, subsequent experiments showed that the overlap in the stimulus and response modalities was not critical for learning, but the two tasks had to be conceptualized as related for practiced response combinations to be performed better than unpracticed combinations. This finding suggests that conceptual task boundaries play an important role in implicit learning.

9:00–9:15 (4)

Problems With Modeling Processes Underlying the Process-Dissociation Task. RICHARD A. CHECHILE & JESSICA R. CHAMBERLAND, *Tufts University*—The process-dissociation task

is a widely used experimental procedure that has been modeled in order to obtain ostensibly separate measures for explicit memory and implicit memory. Existing models are critiqued here and a new confidence process-dissociation (CPD) model is developed for a modified process-dissociation task that uses confidence ratings in conjunction with the usual old/new recognition response. With the new model there are several direct tests for the key assumptions of the standard models for this task. Experimental results are reported here that are contrary to the critical assumptions of the earlier models for the process-dissociation task. These results cast doubt on the suitability of the process-dissociation procedure itself for obtaining separate measures for implicit and explicit memory.

Attentional Selection and Priming
Regency DEFH, Friday Morning, 8:00–10:00

Chaired by Veronica J. Dark, Iowa State University

8:00–8:15 (5)

Semantic Selectivity Reflects Attention and Not “Just” Semantic Priming. VERONICA J. DARK & CHRISTOPHER M. MASCIOCCHI, *Iowa State University*—Selective attention is shown when some stimuli undergo processing allowing identification, whereas other stimuli do not. Spatially precued items are selectively processed, as are items semantically (associatively) related to a prior context. Some have suggested that semantic selectivity just reflects benefit from semantic priming, arguing that if attention (i.e., limited capacity resources) were involved, there also would be cost. We asked whether semantic selectivity would interfere with spatial selectivity and vice versa. Subjects reported either the spatially precued or the related word in masked word pairs. In the spatial precue baseline, no related words appeared. The addition of related words interfered with spatial selectivity by inhibiting report of cued unrelated words and enhancing report of uncued related words. In the report-related baseline, no precues appeared. The addition of precues interfered with semantic selectivity primarily by inhibiting report of uncued related words. Selective attention has both spatial and semantic components.

8:20–8:35 (6)

Spatial Attention and Masked Priming: Biological Relevance Matters. MATTHEW FINKBEINER & ROMINA PALERMO, *Macquarie Centre for Cognitive Science*—Theories of human cognition have long held that nonconscious processes are “automatic” insofar as they appear to be elicited independently of higher level cognitive mechanisms, such as attention. Recent findings have called this view into question by demonstrating that a masked visual word or number does not produce priming unless it is attended. From these findings, it has been suggested that nonconscious cognitive processes are not automatic because they are not elicited autonomously. Here, we show that the autonomy of non-conscious cognitive processes varies as a function of the masked prime’s biological relevance. Masked pictures of animals, tools, and vegetables produced priming, but, like words and numbers, only when attended. In contrast, masked pictures of faces produced priming both when attended and not. Our results demonstrate that nonconscious processes may be elicited autonomously, but only when the to-be-processed information has a high degree of biological and/or social relevance.

8:40–8:55 (7)

Feature Detection Requires Spatial Attention. JAN THEEUWES, ERIK VAN DER BURG, & ARTEM V. BELOPOLSKY, *Vrije Universiteit*—It has been claimed that the detection of a feature singleton can be based on activity in a feature map containing a coarse coding that something unique is present in the visual field. In the present experiment, participants detected the presence or absence of a color singleton. Although it was irrelevant for the task, the color singleton was a letter that could be repeated on the next trial. We showed that the identity of the singleton resulted in repetition priming on the next trial, suggesting that even in the simplest present-absent feature detection task,

focal attention is allocated to the feature singleton. These results are inconsistent with theories that claim that it is possible to detect a feature singleton without directing attention to the location of the singleton.

9:00–9:15 (8)

Numerical Format Effects in the Eriksen Task. PHILIP T. QUINLAN, *University of York*—Although this is not the only study to have examined numerical versions of the Eriksen flanker task, it is (probably) the only study with displays containing both Arabic and Chinese characters. Twenty-eight Chinese/English bilingual undergraduates were tested in two numerical versions of the task. On every trial, subjects were timed to classify a central target—either four/six or five/seven—in a row of three characters. Across the versions the target was either always Arabic or Chinese. Flankers were either both Arabic, or both Chinese. On Same trials all the characters represented the same number, on Congruent trials the target and flankers differed but each was assigned to the same response, on Incongruent trials the targets and flankers demanded different responses. Robust slowing on incongruous trials was found throughout. The effect was enhanced when the targets were Chinese. Both notions of unattended processing and theories of numerical cognition are considered.

9:20–9:35 (9)

A General Computational Theory of the Distribution of Visual Spatial Attention. GEORGE SPERLING, IAN J. SCOFIELD, & ARVIN T. HSU, *University of California, Irvine*—We derive a computational theory of the distribution of visual attention using a linear systems approach. First, we measure an observer's ability to distribute attention sinusoidally along rows or columns in a 12×12 array that contains 1 target (a large disk) on 1 of 72 attended locations, 10 false targets among 72 unattended locations (to force the observer to ignore unattended locations), and distractors (small disks) elsewhere (Gobell, Tseng, & Sperling, 2004). These data then enable the theory to make accurate, completely parameter-free predictions of the same observer's ability to distribute spatial attention in response to arbitrarily complex 72-square requested patterns of attentional distribution. The theory contains (1) a spatial acuity function, (2) an attention modulation-transfer function that describes the decline of attentional conformability with increasing spatial frequency, (3) multiplicative combination of (1) and (2), (4) random decision noise, and (5) a decision process that selects the most likely target location.

9:40–9:55 (10)

Using Foils to Measure Spatial Tuning Functions for Visual Attention. JOHN PALMER, *University of Washington*, & CATHLEEN M. MOORE, *University of Iowa*—Our goal is to measure the spatial extent of visual attention. To do so, observers are required to detect a visual target while ignoring a nearby foil that is identical to the target except for location. The experiment includes a manipulation of both the contrast of the foil and the separation between the foil and the relevant location. The appropriate measure of selectivity depends on how attention modulates the effect of contrast. Two common hypotheses for attentional modulation are contrast gain versus an all-or-none mixture. The results disconfirm the contrast gain hypothesis and are instead consistent with the all-or-none hypothesis. Moreover, the effect of the separation between the foil and the relevant location is very large: Performance ranges from chance to perfect. We are now using the foil task to measure spatial tuning functions for visual attention.

**Models of Choice and Decision Making
Beacon A, Friday Morning, 8:00–10:00**

Chaired by Jerome R. Busemeyer, Indiana University

8:00–8:15 (11)

A Quantum Information Processing Explanation of Disjunction Effects. JEROME R. BUSEMEYER, *Indiana University*, ZHENG WANG, *Ohio State University*, & MERV MATTHEW, *Indiana Uni-*

versity—A new approach to decision theory based on quantum information processing principles is used to explain some paradoxical phenomena of human choice behavior. Quantum strategies were originally used to explain the fact that humans prefer to cooperate rather than defect in a Prisoner Dilemma game. Here, we develop a quantum model for the disjunction effect. This refers to a paradox in which (1) a player prefers to defect when the player knows that an opponent will defect, and (2) the player also prefers to defect when the player knows that an opponent will cooperate, but (3) the player reverses preference and cooperates when the opponent's action is unknown. New experimental findings on the disjunction effect are reported, and a quantum explanation for the findings is presented. The quantum model is also compared to traditional information processing models.

8:20–8:35 (12)

The Simplest Model of Choice and Reaction Time. SCOTT D. BROWN & ANDREW J. HEATHCOTE, *University of Newcastle*—Over the past 50 years, accumulator models of response time and accuracy have become increasingly sophisticated, to accommodate an increasing range of empirical phenomena. In the last 2–3 years, an effort has been made to identify models that either (1) are just as powerful as their more complex competitors, but a little simpler or (2) have less explanatory power, but are much simpler. Brown and Heathcote (2005, *Psychological Review*) developed a ballistic accumulator model, of Type A. We now proceed one step further, and demonstrate that an even simpler model can accommodate almost all the major benchmark phenomena, and provides a very good fit to real data. This linear BA model has the unique advantage among its competitors of completely analytic solutions for its predicted RT distributions, even for choices between many alternatives (2+).

8:40–8:55 (13)

Gaining Insights From Reaction Time Data Using Bayesian Wiener Diffusion. JOACHIM VANDEKERCKHOVE & FRANCIS TUERLINCKX, *University of Leuven*, MICHAEL D. LEE, *University of California*, & ERIC-JAN WAGENMAKERS & GILLES DUTILH, *University of Amsterdam* (read by Francis Tuerlinckx)—The Wiener diffusion process is a convenient model for the analysis of two-choice response time data. We use Bayesian methods to extend the applicability of the diffusion model. The extended methods are easy to apply, show no serious numerical problems, and yield output that can be interpreted in a direct and intuitive way. The Bayesian context also allows for the easy evaluation of hypotheses that would otherwise be very complex to test. Combined with the straightforward interpretation of the diffusion model's parameters, this type of analysis will enable researchers to investigate cognitive processes in ways that were not previously practicable. Fitting functional forms to parameters, modeling changes in parameters over time, and capturing random effects across individuals are just some examples. We have successfully implemented the Wiener diffusion model in WinBUGS, and will illustrate the potential of the method with an experiment investigating practice effects in a lexical decision task.

9:00–9:15 (14)

Dual Processes and Development: Explaining Contradictory Relations Between Risk Perception and Risk Taking. VALERIE F. REYNA, BRITAIN MILLS, STEVEN ESTRADA, & CHARLES J. BRAINERD, *Cornell University*—Dual processes in fuzzy-trace theory predict opposite relations between risk perception and risk taking: Both positive and negative correlations were obtained within the same individuals, depending on verbatim versus gist cues in questions. These results might mask developmental changes in such effects, however. We tested this hypothesis by assessing relations between risk perception and risk taking separately for different ages in a large sample ($N = 596$) of 14- to 17-year-olds. Measures of risk perception differed in cue specificity and response format. Measures that emphasized verbatim retrieval and quantitative processing produced positive correlations, but these relations did not change monotonically with

age. Measures that assessed global gist-based processing produced negative correlations (higher risk perceptions associated with less risk taking), and increased with age. Endorsement of simple, categorical principles correlated most strongly with risk avoidance. The results support a dual-processes interpretation in which relations depend on developmental shifts in verbatim versus gist processing.

9:20–9:35 (15)

Decision Processes in Eyewitness Identification. STEVEN E. CLARK & RYAN RUSH, *University of California, Riverside*—Eyewitness identification accuracy depends not only on the accuracy of the witness's memory, but also on the kinds of decision processes that witnesses utilize. We varied the composition of target-absent lineups to evaluate Wells's (1984) distinction between absolute versus relative judgments. Specifically, our experiments were designed to make contrasting predictions for a best above criterion (BAC) model versus a difference model. A BAC model makes an identification if the best-matching lineup member is above a set criterion, whereas the difference model makes an identification if the best-matching lineup member is sufficiently better than the next-best matching lineup member, irrespective of how good the matches are on an absolute scale. Our results favored the difference model over the BAC model.

9:40–9:55 (16)

A Cognitive Theory of How People Learn to Select Strategies. JÖRG RIESKAMP, *Max Planck Institute for Human Development*—It has been widely assumed that people possess a strategy repertoire for inferences. The strategy selection learning theory specifies how people select strategies from this repertoire (Rieskamp, 2006, *JEP:LMC*, 32; Rieskamp & Otto, 2006, *JEP:G*, 135). The theory holds that individuals select strategies proportional to their subjective expectations of how well the strategies solve particular problems and the expectations are updated by reinforcement learning. The theory is compared to an adaptive network model that assumes information integration according to a connectionist network, whose weights are modified by error correction learning. These theories were tested against each other in an experimental study with a dynamic environment in which the performance of inference strategies changed. In this situation a quick adaptation to the new situation was not observed; rather, individuals stuck to the strategy they had successfully applied previously, as was most strongly predicted by the strategy selection learning theory.

Visual Perception

Beacon B, Friday Morning, 8:00–10:00

Chaired by Stephen R. Mitroff, *Duke University*

8:00–8:15 (17)

Staying in Bounds: Contextual Constraints on Object File Coherence. STEPHEN R. MITROFF, JASON T. ARITA, & MATHIAS S. FLECK, *Duke University*—Coherent visual perception necessitates the ability to track objects as the same entities over time and motion. Calculations of such object persistence are constrained by specific rules and here we explore these rules through object files: visual representations that track entities over time and motion as the same persisting objects and store information about the objects. We present three new findings. First, objects files are constrained by “boundedness”; persisting entities should maintain a single closed contour. Second, object files are constrained by “containment”; all the properties of a persisting object should reside within the object itself. Third, object files are sensitive to the context in which an object appears; the same physical entity that can instantiate object-file formation in one context cannot in another. This contextual influence demonstrates for the first time that object files are sensitive to more than just the physical properties contained within any given display.

8:20–8:35 (18)

The Role of Surface Features in Establishing Object Correspondence

Across Motion and Occlusion. ANDREW HOLLINGWORTH, *University of Iowa*, & STEVEN L. FRANCONERI, *Northwestern University*—Visual perception is frequently disrupted by saccades, blinks, and occlusion, generating a problem of object correspondence: How does the visual system establish the mapping between objects visible before and after the disruption? According to the Object File Theory of Kahneman, Treisman, and Gibbs (1992), objects are addressed by spatial position, and perceptual correspondence is established solely by spatiotemporal continuity. Here, we demonstrate that objects also can be addressed by their surface features, such as color. In a modified version of the Kahneman et al. paradigm, participants viewed two colored disks that were filled briefly by novel shapes before moving behind an occluder, which was removed to reveal the two disks containing two shapes. In a shape change-detection test requiring access to remembered shape information, performance was superior when shape-color consistency was maintained before and after occlusion. These data indicate that spatiotemporal information is not necessarily privileged in object correspondence operations.

8:40–8:55 (19)

Capacity Limits of Encoding and Retrieval During Change Detection. MELISSA R. BECK, *Louisiana State University*—It has been proposed that about 4 objects can be successfully tracked over time in a visual change detection task. However, this capacity limit may be caused by limits on the ability to encode information and on the ability to retrieve information. The capacity limits of encoding and retrieval were examined by varying the number of objects that were relevant to the change detection task and by providing a retrieval cue in the postchange scene on half of the trials (an arrow pointing at the potential postchange object). When a retrieval cue was provided, only limits on encoding affected change detection performance. When a retrieval cue was not provided, limits on both encoding and retrieval affected performance. Performance was high and equivalent on the postcue and the no postcue trials when 4 items needed to be encoded for the change detection task, indicating that 4 items can be encoded and retrieved efficiently. However, accuracy was 9% higher in the postcue condition when 7 items needed to be encoded for the change detection task and 14% higher when 10 items needed to be encoded. Using Pashler's (1988) formula for calculating capacity limits, it was found that averaged across set sizes 7 and 10, the capacity for encoding was 4.6 objects (postcue condition), but only 2 of these objects could be successfully retrieved (no postcue condition). Therefore, when the number of objects that need to be encoded outstripped the limits of encoding, retrieval limits further impaired performance.

9:00–9:15 (20)

Testing the Neural Synchrony Hypothesis for Visual Grouping and Selective Attention. MARIUS USHER & SAMUEL CHEADLE, *Birkbeck College, University of London*, & FRANK BAUER, *LMU Munich*—According to the neural synchrony hypothesis Gestalt-grouping and selective attention are mediated by synchronous gamma-band neural activity. To examine this theory we carried out a number of psychophysical experiments testing temporal binding (the ability to detect targets which are distinguished from background only by temporal information), temporal judgments of flickering stimuli and the effect of gamma-band flicker on spatial attention within a Posner type paradigm. We find that (1) although for unstructured target elements the temporal-binding resolution is slower than 60 msec, when the target elements are organized according to smooth contours, the resolution is increased to 10–20 msec, (2) the ability to judge the phase of flicker of elements is affected by the spatial organization of intervening elements, (3) a subliminal 50-Hz flicker triggers spatial attention in a Posner type paradigm. The results are discussed in relation to the neural synchrony hypothesis.

9:20–9:35 (21)

Figure–Ground Segregation Can Occur Under Inattention. RUTH KIMCHI, *University of Haifa*, & MARY A. PETERSON, *University*

of Arizona—We examined whether figure–ground segregation can occur without attention. On each trial, participants performed a demanding change-detection task on a small target matrix at fixation. The matrix was presented on a task-irrelevant scene of alternating regions organized into figures and grounds by convexity. Independent of any change in the target, the figure–ground organization of the scene backdrop could also change or remain the same on each trial. Change/no change in scene organization produced congruency effects upon speed and accuracy for the target-change task. This effect arose even though, when probed with surprise questions, participants could report neither the figure–ground status of the region on which the target appeared in the preceding frame or whether the figure–ground organization of the scene had changed on the preceding trial. When attending to the scene backdrop, participants could make these reports highly accurately. These results suggest that figure–ground segregation can occur under inattention.

9:40–9:55 (22)

Emotional Cues Improve and Impair Visual Perception. RENÉ ZEELLENBERG & BRUNO R. BOCANEGRA, *Erasmus University Rotterdam*—Although previous studies have demonstrated enhanced identification of emotional stimuli, the mechanisms underlying this perceptual enhancement remain unclear. In the present study, rather than investigating perception of an emotional target stimulus we investigated the influence of an emotional cue on the visual identification of a subsequent neutral stimulus. By manipulating cue–target intervals and cue visibility we were able to show both perceptual improvements and impairments due to the emotional status of the cue. These results provide direct behavioral evidence for a two-fold effect of emotion on visual perception: (1) a general enhancement in the efficiency of processing emotional stimuli that carries over to neutral stimuli, and (2) a stimulus-specific enhancement through which emotional stimuli attain prioritized capacity-limited processing. The latter mechanism results in enhanced identification of emotional stimuli at the expense of impaired identification of neutral stimuli.

**Brain and Language Processing
Seaview, Friday Morning, 8:00–9:20**

Chaired by Joseph Dien, University of Kansas

8:00–8:15 (23)

Neural Correlates of Sentence Priming: Convergent ERP and fMRI Findings. JOSEPH DIEN & AMINDA J. O'HARE, *University of Kansas*, & CARY R. SAVAGE, *University of Kansas Medical Center*—In Dien, Frishkoff, Cerbone, and Tucker (2003), event-related potential data from a sentence priming experiment yielded, in addition to the N400, a frontal P400 component that correlated with cloze probability and a 216-msec Recognition Potential (RP) effect that correlated with unexpectedness of the sentence ending. In the present report, this experiment was replicated with 11 participants in a 3T scanner. Sentences were presented at the rate of one word per second, with half the endings being incongruent, while being read for comprehension. The frontal P400 was found to correspond to a left premotor region effect and the RP effect was found to correspond to a left parahippocampal gyrus effect. These findings suggest that different levels of the system represent expectancies differently, with one level (the RP) maintaining a range of activations and another level (the P400) representing just a single primary activation.

8:20–8:35 (24)

Reading With Two Hemispheres. ORNA PELEG & ZOHAR EVIATAR, *Haifa University* (sponsored by Zohar Eviatar)—We examined the relative contribution of phonological, lexical, and contextual sources of information to word reading in the two cerebral hemispheres. Using heterophonic and homophonic homographs in Hebrew, we show different timelines of meaning activation in the two visual fields (VFs). In the LVF(RH) both dominant and subordinate mean-

ings of homographs are facilitated in both early (150-msec) and later (250-msec) SOAs. In the RVF(LH), both meanings of homophones are facilitated in the two SOAs, whereas for heterophones, facilitation for related meanings is delayed (only in the 250-msec SOA). We show that meaning activation is differentially sensitive to lexical and contextual sources of information in the VFs, and that phonological codes provide early sources of constraints only in the RVF(LH). Our results suggest that in the LH meaning activation lags behind phonological processing. The results are discussed in terms of their implications for models of reading and hemispheric contribution to this process.

8:40–8:55 (25)

The Metaphorical Brain: From Hemispheric Asymmetry to Hemispheric Dynamics. MIRIAM FAUST, *Bar-Ilan University*—Previous research has led to conflicting findings regarding the involvement of the right hemisphere (RH) in metaphor comprehension. The present research project used convergent experimental techniques, including behavioral, imaging, ERPs, and TMS, to explore the role of the left and right hemispheres in metaphor comprehension behavior. The stimuli in all studies were two-word expressions denoting literal, conventional metaphoric, and novel metaphoric meaning, as well as unrelated word pairs and the task was semantic judgment. The findings indicate that both hemispheres work in concert in a complex dynamical pattern during literal and figurative language comprehension. However, during the comprehension of novel metaphors there are some stages of considerable RH involvement, mainly of posterior superior temporal areas.

9:00–9:15 (26)

Mental Grammar, Implicit Learning, and Subcortical Region. DEZSO NEMETH, PETER KLIVENYI, GABRIELLA GARDIAN, TAMAS SEFCSIK, & LASZLO VECSEI, *University of Szeged* (sponsored by Alan D. Baddeley)—Numerous theories claim that the motor and procedural systems are the cognitive background of mental grammar and sentence processing. The main purpose of our studies is to map the relationship between implicit learning and mental grammar, and the role of subcortical brain regions. In a dual-task experiment the healthy subjects' implicit learning was measured by a serial reaction time task, and at the same time subjects were tested on sentence processing, word processing, and mathematical tasks. The results show that implicit learning was significantly worse when the parallel task was sentence processing than when it was controls. In our second study concerning patients with basal ganglia degeneration (Huntington's disease), results show that production of complex morphology and implicit learning are impaired. The implication of the results is that there is relationship between implicit learning and sentence processing, more precisely the operation of mental grammar.

**Skill Acquisition
Shoreline, Friday Morning, 8:00–9:40**

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

8:00–8:15 (27)

Spaced Practice and the Sleep Enhancement Effect in Motor Skill Learning. TIMOTHY C. RICKARD, DENISE J. CAI, CORY RIETH, COLIN ARD, & JASON J. JONES, *University of California, San Diego*—It is widely believed that sleep consolidation enhances skilled performance. Our investigation of this topic, however, has identified three characteristics of prior studies that appear to explain the performance enhancement without recourse to sleep consolidation: time-of-day confounds, data averaging, and massed practice. When all three factors are corrected, the sleep enhancement effect is eliminated. Massed practice results in fatigue that dissipates between sessions. The data distinguish between performance- and learning-based fatigue accounts, with implications for optimization of training.

8:20–8:35 (28)

Abstracting Concepts and Patterns: Is Spacing the “Enemy of In-

duction”? NATE KORNELL & ROBERT A. BJORK, *UCLA* (read by Robert A. Bjork)—Learning about a new concept or category by observing examples—that is, inductive learning—happens constantly, from a baby learning a new word to a doctor classifying x-rays. What influence, though, does the spacing of such exemplars have on the efficiency of induction? We designed two experiments to test Ernst Z. Rothkopf’s assertion that “spacing is the friend of recall, but the enemy of induction.” In both experiments participants studied paintings by 12 different artists. A given artist’s paintings were presented either consecutively (massed) or interleaved with other artists’ paintings (spaced). Memory was tested using a cued-recall task in Experiment 1 and a recognition task in Experiment 2. To our surprise, inducing artists’ styles profited from spacing, not massing. Massed practice, however, apparently created a sense of fluent induction: Participants rated massing as more effective than spacing for learning an artist’s style even after their own test performance had demonstrated the opposite.

8:40–8:55 (29)

Learning Algebra by Exploration. ANGELA BRUNSTEIN & JOHN R. ANDERSON, *Carnegie Mellon University*—A major component of learning a skill like algebra is knowing which operators are appropriate for what situations. This study investigated learning to solve algebra-isomorphic problems either by exploration or by a step-by-step instruction. Instructed participants performed better on early problems, whereas explorers performed better on solving related problems later on. Explorers were less likely to acquire shallow operators that only applied in the original learning situation. Exploring problems on their own also enhanced participants’ capabilities for debugging and acquiring new operators. More importantly, exploration also changed the way they perceived new situations: Although these situations were new to all participants, explorers were better able to focus on task relevant aspects. Therefore, they were more likely to choose the correct operators in new situations.

9:00–9:15 (30)

What Does It Take to Link a Cue With a Behavior in Human Skill Acquisition? HAL PASHLER, *University of California, San Diego*, EDWARD VUL, *MIT*, & TIMOTHY C. RICKARD, *University of California, San Diego*—Much has been learned about when mental linkages are (and are not) formed in Pavlovian conditioning and in contingency judgments, but far less is known about what principles govern the acquisition of cue–behavior linkages in human skill acquisition. In several experiments, we had subjects make speeded responses based upon an instructed stimulus–response mapping. Additional redundant cues were also presented at certain times within each training trial, reliably predicting the appropriate response. In some cases these cues did not appear until it was too late to use them. The results (assessed in various types of transfer-test blocks) shed light upon whether acquisition of cue–behavior linkages requires (1) actual experience using the cue to select a response during training, (2) perceiving the cue prior to selecting the response on the training trial, or (3) merely having the cue appear, correlated with the response, even if it was not useful or timely.

9:20–9:35 (31)

How Conceptualizing Music Affects Novice Trumpeters’ First Sound Attempts. MATTHEW STEINFELD, MICHAEL F. SCHOBER, & MICHELLE F. LEVINE, *New School for Social Research* (read by Michael F. Schober)—To what extent do novice musicians need to conceptualize music as they acquire musical skill? We tested novice trumpeters (individuals who could not read written music and who had never played a wind instrument before) in their first encounter with a trumpet, under three different conditions: (1) simply following fingered instructions; (2) hearing the to-be-achieved pitches before following the fingered instructions; and (3) hearing and singing the to-be-achieved pitches before following the fingered instructions. If conceptualizing the music and hearing it internally matter, as McPherson

(2005) has proposed, then novice trumpeters who hear and sing the pitches should be able to play the desired pitches more often and more accurately than when they simply follow fingered instructions. The results reflect this pattern, and are consistent with a model of musical production that suggests working from internally represented sound to action is more effective than acting without musical conceptualization.

SYMPOSIUM: Mechanisms of Cognitive Development: Domain-General Learning or Domain-Specific Constraints? Regency ABC, Friday Morning, 9:40–12:00

Chaired by Vladimir M. Sloutsky, Ohio State University

9:40–9:55 (32)

Mechanisms of Cognitive Development: Domain-General Learning or Domain-Specific Constraints? VLADIMIR M. SLOUTSKY, *Ohio State University*—How do children come to acquire language, to individuate objects, to navigate in space, to use numbers, and to have concepts? For the past two decades, the prevailing answer has been that the environmental input is fundamentally indeterminate and therefore learning is organized by a set of innate domain-specific constraints. However, a growing body of evidence indicates that the input is more systematic than previously believed and that there are powerful domain-general learning mechanisms capable of exploiting these regularities and building sophisticated domain-specific knowledge. Although no single comprehensive learning account of cognitive development has been offered yet, there are accounts of how infants and children extract regularities from the input, to acquire language, to learn to navigate in space, and to form concepts. This symposium will focus on domain-general learning and its role in language learning (Christiansen, Smith), conceptual development (McClelland, Sloutsky), and spatial navigation (Newcombe). Successes and limitations of the domain-general learning account will be discussed (Goldstone).

10:00–10:15 (33)

Self-Organizing “Constraints” on Word Learning. LINDA B. SMITH, *Indiana University*, & HANAKO YOSHIDA, *University of Houston*—Growing evidence suggests that children learn how to learn language, creating language learning mechanisms that fit the learning task, as they proceed. One line of evidence supporting this view concerns cross-linguistic differences—not just in what children know about their language, but in the very processes and strategies they use to learn language. This talk will present evidence on the developmental emergence of cross-linguistic differences in language learning in 12- to 36-month-old children learning Japanese or English as their first and only language. The evidence shows emerging differences in strategies of noun learning, verb learning, and in such important distinctions as animate and inanimate.

10:20–10:35 (34)

Statistical Learning and Language: In Search of Underlying Neural Constraints. MORTEN H. CHRISTIANSEN, *Cornell University*, CHRISTOPHER M. CONWAY, *Indiana University*, & LUCA ONNIS, *Cornell University*—Over the past decade, statistical learning—the discovery of structure by way of statistical properties of the input—has emerged as an important paradigm for studying domain-general constraints on language acquisition. The basic assumption of this research is that statistical learning and language are subserved by the same mechanisms, an assumption for which there is little neural evidence. We therefore used event-related potentials (ERPs) to investigate the distribution of brain activity while adults performed (1) a natural language reading task and (2) a statistical learning task involving sequenced stimuli. The same positive ERP deflection, the P600 effect, typically linked to difficult or ungrammatical syntactic processing, was found for structural incongruencies in both natural language as well as statistical learning and had similar topographical distributions. These results suggest that the same neural mechanisms are recruited

for both syntactic processing of language stimuli and statistical learning of complex sequential patterns more generally.

10:40–10:55 (35)

Getting Smart: The Role of Domain-General Learning in the Development of Flexible Behaviors. VLADIMIR M. SLOUTSKY, *Ohio State University*—People can rely on different kinds of information in different situations: even 4- to 5-year-olds were relying on linguistic labels when inferring a biological property, while relying on appearance when inferring a physical property. It has been argued that such flexibility cannot be acquired associatively and it requires rich conceptual knowledge about the world. We propose an associative learning account of smart flexibility: if Cue X is predictive in Context A and Cue Y is predictive in Context B, then participants should learn this context–cue contingency, thus attending to Cue X in Context A and to Cue Y in Context B. Evidence supports this argument: After learning, 4- to 5-year-olds generalized by relying on one cue in Context 1 and on another cue in Context 2, which they did not do before learning. Furthermore, this learning was implicit and flexibility was observed in various generalization tasks, including property induction and word learning.

11:00–11:15 (36)

Spatial Adaptation: Origins and Development. NORA S. NEWCOMBE, *Temple University*—Debate in developmental psychology concerning the origins of knowledge often centers on the question of what capabilities are available at the start of life. Although this question is important, understanding subsequent development, and the mature cognitive architecture to which the developing child is headed, also has crucial implications for the nativist–empiricist debate. This talk will consider the evidence on two contrasting approaches to the origins of spatial knowledge. In a modular view, various sources of spatial information are processed independently by innate mechanisms. In adaptive combination models, information sources are combined, using mechanisms that weight sources based on their potential usefulness and that change with experience.

11:20–11:35 (37)

Can Domain-Specific Constraints Arise From Domain-General Learning Mechanisms? JAMES L. MCCLELLAND, *Stanford University*—A perspective on cognitive and conceptual development will be presented, within which sensitivity to domain-specific constraints arises from domain-general mechanisms applied to different types of information. These mechanisms have been employed in parallel-distributed processing models that explain how sensitivity to domain-specific structure arises gradually over development, how this sensitivity provides a basis for appropriate inference in domain-specific task situations, and how the results of such inferential processes can then be stored in memory and retrieved for later use (Rogers & McClelland, 2004). The talk will stress recent applications of these ideas to data from young children's performance in tasks requiring attribution of causal powers to objects based on the outcomes of events in which these and other objects participate.

Capture and Control of Attention

Regency DEFH, Friday Morning, 10:20–12:00

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

10:20–10:35 (38)

Perceptual Load Influences Attentional Capture by Abrupt Onsets. JOSHUA D. COSMAN & SHAUN P. VECERA, *University of Iowa* (read by Shaun P. Vecera)—The abrupt appearance of a new object captures attention, even when the object is task irrelevant. But this attentional capture is reduced in dual-task situations (Boot et al., 2005) and by fixating nononset targets (Christ & Abrams, 2006). We asked if perceptual load affected attentional capture. Subjects searched for a target letter through low-load (set size = 1) and high-

load (set size = 6) displays. Two irrelevant flankers also appeared, one as an onset and the other as a nononset. Onset flankers affected search in low-load, but not high-load, displays. This modulation of attentional capture was not caused by generalized slowing when searching through high-load displays; search for a single perceptually degraded target slowed response times but did not affect attentional capture. These findings demonstrate that attentional capture is abolished when searching through complex visual displays.

10:40–10:55 (39)

Unexpected Abrupt Onsets Can Override Top-Down Set for Color. CHARLES L. FOLK, *Villanova University*, & ROGER W. REMINGTON, *University of Queensland*—It is well established that a top-down set for a location (i.e., focused attention) or a feature property (e.g., color) can eliminate attentional capture by irrelevant abrupt onsets. However, Neo and Chua (in press) have recently shown capture by infrequent abrupt onsets even under focused attention. The present experiments tested whether infrequent abrupt onsets can also override a top-down set for a feature property such as color. In both spatial cuing and RSVP tasks, colored targets were preceded by frequent or infrequent abrupt onset distractors. Consistent with previous work, frequent onset distractors had no effect on search for colored targets. Infrequent onset distractors, however, produced a pattern of performance indicative of attentional capture. The results suggest that violations of expectancy may give rise to stimulus-driven capture of attention, consistent with early work on the orienting reflex (Sokolov, 1963).

11:00–11:15 (40)

Is Top-Down Guidance Possible in Singleton Search? CARLY J. LEONARD & HOWARD E. EGETH, *Johns Hopkins University* (read by Howard E. Egeth)—While it is clear that the goals of an observer influence behavior, their role in the guidance of visual attention has been much debated. In particular, there has been controversy over whether top-down knowledge can influence attentional guidance in search for a singleton item that is already salient on a bottom-up account (Theeuwes, Reimann, & Mortier, 2006). One suggestion is that passive intertrial priming accounts for what has been called top-down guidance (e.g., Maljkovic & Nakayama, 1994). In the present study, participants responded to the shape of a singleton target among homogeneous distractors in a trial-by-trial cuing design. We examined the influence of target expectancy, trial history, and target salience (manipulated by varying the number of distractors). Top-down influence resulted in fast RTs that were independent of display size, even on trials that received no priming. Our findings show there is a role for top-down guidance, even in singleton search.

11:20–11:35 (41)

Differences Between Covert Attention and Eye Movements in Top-Down and Bottom-Up Interaction. XINGSHAN LI & KYLE R. CAVE, *University of Massachusetts* (read by Kyle R. Cave)—This study explored how top-down and bottom-up factors are integrated when controlling covert attention and eye movements. Top-down factors (informative location cues, search strategy) and bottom-up factors (an orientation singleton) were manipulated systematically. There were three main findings. (1) An endogenous cue controlled covert attention independently from bottom-up factors. (2) An irrelevant singleton captured eye movements, but only in singleton detection mode. Eye movement control differed from covert attention control in that it showed competition between top-down and bottom-up factors. Although competition is necessary in eye movement control because only one location can be fixated at a time, it is less important in covert attention, because top-down and bottom-up factors can exert their effects on different locations simultaneously. (3) The control of search strategy between singleton detection mode and feature detection mode was not perfect. Some salient singletons could capture attention even in feature search mode.

11:40–11:55 (42)

Systems of Attentional and Oculomotor Capture. SHU-CHIEH WU,

NASA Ames Research Center, & ROGER W. REMINGTON, *University of Queensland* (read by Roger W. Remington)—An external stimulus can sometimes cause an involuntary shift of attention (attentional capture) or eye fixation (oculomotor capture). Oculomotor capture has been assumed to arise from attentional capture, and has been used to demonstrate the ability of stimuli to capture attention involuntarily. However, the presumed causal link between attention and oculomotor capture is weakened by evidence that certain stimuli effective in capturing attention are not effective in capturing the eyes. We (Wu & Remington, 2003) have also shown oculomotor capture by transient stimuli that do not produce attentional capture when subjects maintain fixation. Here, we argue that a wide range of results on capture can be understood in terms of two interacting brain systems, one associated with the bottom-up orienting of the eyes, the other with top-down-mediated orienting of attention. We review the empirical evidence for distinguishing these systems, and how this distinction can reconcile theoretical disputes.

Judgments and Reasoning

Beacon A, Friday Morning, 10:20–12:00

Chaired by Teresa A. Treat, Yale University

10:20–10:35 (43)

A Role for Correlation-Detection Processes in Acquaintance-Initiated Sexual Aggression? TERESA A. TREAT, *Yale University*, & RICHARD J. VIKEN & RICHARD M. MCFALL, *Indiana University*—We evaluate whether men at risk of exhibiting sexual aggression toward acquaintances make more biased and error-ridden judgments about the covariation between women's sexual interest (SI) and the provocativeness of their dress (POD). Five hundred ninety undergraduate males completed a Correlation-Detection Task with photo stimuli that depicted normatively attractive undergraduate females who varied both in SI and POD. Participants viewed 16 rapidly presented photos on each trial and rated the covariation between the two dimensions; true correlations between the dimensions varied from -1.0 to $+1.0$ across 9 trials. Participants then completed sexual-aggression measures. Multilevel signal-detection analyses revealed that (1) both high- and low-risk participants perceived an illusory correlation in the stereotypically consistent direction; and (2) high-risk men showed significantly lower sensitivity to the manipulated correlation than low-risk men. These findings suggest that sexual aggression may be maintained in part by erroneous evaluations of the covariation of women's affect and dress.

10:40–10:55 (44)

The Impact of Partner Knowledge on Judgment Accuracy. MATTHEW E. JACOVINA & RICHARD J. GERRIG, *Stony Brook University* (read by Richard J. Gerrig)—People often face circumstances in which they must make choices for other individuals (e.g., when buying a gift or recommending a movie). We tested the hypothesis that such judgments may become more difficult when people acquire excessive information about the individual for whom they are making the choice. In our research, participants obtained the answers to 4 or 12 questions about another individual (e.g., What is your favorite game?). They subsequently viewed displays of four objects (e.g., four types of fruit) and attempted to select the one object they thought the other individual was most likely to choose. Participants who acquired more information were less likely to match the other individual. In particular, participants with relatively more knowledge were likely to change their judgments from popular choices (as determined by a norming study) to less popular choices. These results suggest that partner knowledge may prompt people to overthink some judgments.

11:00–11:15 (45)

Category Overlap and Numerical Estimation: Evidence for a Retrieval-Insensitive Distribution Matching Process. NORMAN R.

BROWN & ROBERT B. LATIMER, *University of Alberta*—The present study was designed to determine how categorical range overlap affects numerical estimation. Participants studied lists composed of 25 mammal and 25 city names and then estimated the list position of each item. List position was determined largely by category membership, with most items from one category occupying the first 25 list positions and most items from the other category occupying the final 25 positions. Blend, the degree to which items from one category were mixed among items from the other, was manipulated between subjects. As predicted, category-inconsistent items (items in the minority when presented) often elicited category-consistent responses; in-migration increased with blend and decreased with other factors known to improve item memory. Surprisingly, category-consistent items sometimes elicited category-inconsistent responses; out-migration increased linearly with blend, but was unaffected by item-memory factors. Thus, distribution-matching and item knowledge play a role in this task, although distributional beliefs are unaffected by item-knowledge availability.

11:20–11:35 (46)

Editing Outliers and Distorting Data: The Role of Variability in Human Contingency Judgments. JASON M. TANGEN, *University of Queensland*—Detecting and evaluating relations among events is a fundamental component of cognition and is entirely pervasive, arising in everyday activities as well as complex decision making. In assessing relationships, people with different prior theories do not regard evidence in the same way, and over- or underweight particular instances to fit their assumptions. A substantial body of work in social cognition has examined our tendency to distort observed relations in the direction of our prior assumptions. However, the absence of variability in the materials used in 40 years of causal and contingency learning research has prevented any sort of investigation of this topic. I will discuss the introduction of variability to human contingency judgments and the psychological processes involved in distorting perceived relationships to coincide with our prior assumptions.

11:40–11:55 (47)

Exploring Boundary Conditions for the Conjunction Fallacy in Probabilistic Reasoning. DOUGLAS H. WEDELL & RODRIGO MORO, *University of South Carolina*—Two experiments used within-subjects designs to examine how conjunction errors depend on (1) choice versus estimation tasks, (2) probability versus frequency language, and (3) conjunctions of two likely events versus conjunctions of likely and unlikely events. All problems included a three-option format verified to minimize misinterpretation of the base event. In both experiments, conjunction errors were lower for estimation than for choice. Errors were also reduced when likely events were conjoined, with this reduction greater for estimation, an interaction effect. Shifting conceptual focus from probabilities to frequencies did not affect conjunction error rates. Analyses of numerical estimates for a subset of the problems provided support for the use of three general models by participants in estimation. Strikingly, the order in which each task was carried out (choice vs. estimation) did not affect the pattern of results, supporting the idea that the response mode strongly determines the mode of thinking.

Movement Control

Beacon B, Friday Morning, 10:20–12:00

Chaired by Martina Rieger

Max Planck Institute for Human Cognitive and Brain Sciences

10:20–10:35 (48)

Spatial Representations in Skilled Typing: Keys and Names. MARTINA RIEGER, *Max Planck Institute for Human Cognitive and Brain Sciences*—Seeing a letter automatically activates effector-dependent and spatial representations in skilled typists (Rieger, 2004). Here spatial representations were further investigated; the spatial position (key-

congruence) and name (name-congruence) of keys on a keyboard were dissociated. In two experiments participants responded with crossed hands to the color of colored letters on a keyboard. In Experiment 1 the keys were without names; in Experiment 2 the keys were renamed. This resulted in effector-congruent, incongruent, and different name-/key-congruent conditions. An effect of effector-congruence was always found. In Experiment 1 participants showed facilitation in the key-congruent/name-neutral condition. In Experiment 2 participants showed interference in the key-congruent/name-incongruent condition. No effect was obtained in the key-incongruent/name-congruent condition. Thus, key names are neither sufficient nor necessary for the activation of spatial representations in skilled typing. However, key names are processed, and if they do not match the keys they disturb the development of spatial representations.

10:40–10:55 (49)

Disruption of Timing by Delayed Auditory Feedback As a Function of Movement Kinematics. PETER Q. PFORDRESHER & XIAOJUN SHAN, *University at Buffalo*—It is well known that timing of rhythm production is disrupted by delayed auditory feedback (DAF), and that disruption varies with delay amount. We tested the hypothesis that disruption depends on the state of the movement trajectory at the onset of DAF. Participants tapped isochronous rhythms at a rate specified by a metronome while hearing DAF of differing amounts. Three-dimensional motion capture was used to analyze movement trajectories. Intertap intervals (ITIs) varied as an approximately sinusoidal function of feedback condition; they were longest for shorter delays (<50% of ITIs) and sped up for longer delays (>50%). Finger velocity, but not position, predicted change to ITIs: timing slowed when DAF coincided with positive velocities (upward swing) and sped up when DAF coincided with negative velocities. Thus, DAF's effect on timing may not constitute "disruption" per se, but may instead reflect associations between perceived stimulus onsets and phases within movement trajectories.

11:00–11:15 (50)

Anticipatory Finger Movements in Musical Sequences. CAROLINE PALMER & WERNER GOEBL, *McGill University*—Rapid sequential tasks such as music performance require that finger motion trajectories be computed and executed during the production of other motion trajectories, conditions which often reflect coarticulation. We investigated the anticipatory movements of pianists' fingers toward piano keys in performances at different tempi, while manipulating the sequential distance between repetitions of specific finger movements. Skilled pianists performed melodies from memory in a synchronization-continuation task at four different fast rates while a passive motion capture system recorded the pianists' fingers and piano keys. Anticipatory movements of a finger toward its next keypress began later in absolute time but sooner in relative time (number of sequence events) at faster rates than at slower rates. Furthermore, these anticipatory movements were larger and sooner for less coupled fingers, indicating that coarticulatory properties of sequential finger movements constrain anticipatory motion in timed sequential tasks.

11:20–11:35 (51)

Tremor As a Bridge: The Continuous Flow of Information From Intention to Action. RAJAL G. COHEN & DAVID A. ROSENBAUM, *Pennsylvania State University* (read by David A. Rosenbaum)—The question of how intentions are translated into actions has been addressed with a variety of approaches, ranging from philosophy to neurophysiology. Here, we asked a new question about such translation, using a measure based in cognitive neuroscience. The question was whether intentions are translated into actions discretely, in a stage-wise fashion, or continuously, in a cascade? Our approach to this question was inspired by the observation that microsaccades, the tiny eye movements that arise during visual fixation, are more likely to occur in the direction of forthcoming movement than in the opposite direction. We asked whether a similar phenomenon applies to physiologi-

cal tremor of the upper extremity. Consistent with the continuous translation hypothesis, we found that when people pause before moving, the small movements inherent in their pauses are biased along the axes of forthcoming voluntary movement. This outcome suggests that tremor offers a new window into mental function.

11:40–11:55 (52)

Mirror Neurons in Humans? MORTON ANN GERNSBACHER, JENNIFER L. STEVENSON, & EMILY K. SCHWEIGERT, *University of Wisconsin, Madison*—Mirror neurons were so named after Rizzolatti and colleagues' serendipitous discovery during single-cell recording in macaques: A set of neurons in ventrolateral premotor cortex fired both when the monkey spontaneously executed an action, such as reaching for a pellet, and when the monkey spontaneously observed a conspecific executing the same action. We searched the 269 articles indexed through the year 2006 on PubMed and Psych Abstracts with the terms "mirror neuron/s" and "mirror neuron system." We discovered that no human neuroimaging study had actually replicated this effect, including Rizzolatti and colleagues' (1995/1996) human PET experiments, from which Rizzolatti cautioned that "brain imaging experiments carried out in humans have failed up to now to convincingly demonstrate the existence of a cortical circuit similar to that described in the monkey," but which are nonetheless cited by the vast majority of articles claiming that mirror neurons have been observed in humans.

Recognition Processes

Seaview, Friday Morning, 9:40–12:00

Chaired by William E. Hockley, Wilfrid Laurier University

9:40–9:55 (53)

Opposing Strength-Based Mirror Effects for Words Versus Pictures: Evidence for Within-List Criterion Changes. WILLIAM E. HOCKLEY, *Wilfrid Laurier University*—Strength-based mirror effects are seen when the hit rate is higher and the false alarm rate is lower following strongly encoded study lists compared to more weakly encoded lists. Hockley and Niewiadomski (in press) demonstrated opposing mirror effects for item and associative recognition by differentially varying the presentation rate of items and pairs within lists. They interpreted these results as indicating that participants adopted different decision criteria for item and associative recognition tests. In the present experiments separate and opposing mirror effects were found by manipulating the presentation rate of words and pictures (line drawings) between and within lists. If strength-based mirror effects occur because participants use a more conservative decision criterion for strong compared to weak lists, then the present results demonstrate that participants can adopt different decision criteria for words and pictures and alternate between these criteria on a trial-by-trial basis during the course of the recognition test.

10:00–10:15 (54)

Is Familiarity-Based or Recollection-Based Recognition Faster: The Source of the Contradicting Findings. JERWEN JOU, *University of Texas, Pan American*—Response-signal paradigm experiments showed that recognition decisions made under earlier response deadlines are familiarity-based whereas those made under later deadlines are recollection-based. This supports the idea that recollection-based recognitions take longer than familiarity-based recognitions. In contrast, Remember-Know paradigm experiments showed that Remember-responses (recollection-based) are faster than Know-responses (familiarity-based). Is there a coherent explanation for these two contradictory findings? It is suggested that the two experimental paradigms measure two different dimensions of a recognition process. That is, the response-signal experiments measure the difficulty levels of a recognition (e.g., easier global recognitions take place earlier than detailed recognitions), whereas the Remember-Know paradigm measures the strength of memory. In this study, difficulty levels of recognition and degrees of learning were independently manipulated. The

results suggest that response-signal experiments and Remember–Know judgments measure different aspects of a recognition process, possibly providing a coherent explanation for the two contradicting findings.

10:20–10:35 (55)

Perceptual Disfluency Effects in Recognition Memory. DAVID E. HUBER, *University of California, San Diego*, TEDRA FAZENDEIRO, *University of Denver*, PIOTR WINKIELMAN, *University of California, San Diego*, & TIM CURRAN, *University of Colorado*—A series of 5 forced-choice recognition experiments demonstrated that immediate repetition priming produces a gradual transition from positive to negative priming as a function of the prime duration. Specifically, brief supraliminal primes produced a recognition preference for primed words (Experiments 1, 2, and 5) whereas long-duration primes produced a recognition preference against primed words (Experiments 3–5). Experiment 2 demonstrated that priming shifts occur even when participants accurately recognize brief primes. In Experiments 3–5, a cued recall task revealed that priming effects only occur for recognition without recall, and in Experiment 4, independent manipulation of the recollective and familiarity components of recognition provided further evidence that priming affects familiarity. All experiments included a variety of controls against strategic discounting, supporting the claim that negative priming can arise naturally as a result of the transition from perceptual fluency to perceptual disfluency.

10:40–10:55 (56)

Confidence and Accuracy in Recognition Memory for Faces. ANDREW J. HEATHCOTE & MELISSA PRINCE, *University of Newcastle*—Signal detection analysis indicates that studied (old) items have both a greater mean and *SD* for memory strength than do unstudied (new) items. Supporting evidence comes from Receiver Operating Curves (ROCs) based on new–old choice confidence, and so it assumes that confidence and accuracy depend on the same underlying memory-strength dimension. In contrast, Koriat’s (1997) accessibility theory assumes that other factors may influence confidence. Busey, Tunnicliff, Loftus, and Loftus (2000) examined this issue using Bamber’s (1979) state-trace analysis, which supported a two-dimensional model of the confidence–accuracy relationship. These results, and ROC results for data averaged over participants, were interpreted as supporting accessibility theory. However, subject average ROC results can be misleading (Malmberg & Xu, 2006). We replicated Busey et al. and a related experiment (Loftus, Oberg, & Dylan, 2004) and applied ROC analysis to individual participant data to further test the nature of the confidence–accuracy relation.

11:00–11:15 (57)

The “Testing Effect” in Recognition Memory. K. A. CHALMERS & H. E. TURON, *University of Newcastle*—The “testing effect” refers to the finding that completion of a memory test not only assesses what one has learned, but also increases memory performance on a subsequent test. The role of word frequency, study duration, and orthographic distinctiveness on the magnitude of the testing effect was examined in a series of recognition memory experiments. In each experiment, undergraduate students studied a list of words prior to completing two yes/no recognition memory tests. On Test 1, recognition of studied (targets) and nonstudied items (distractors) was tested. On Test 2, recognition of items from the Test 1 list, plus new distractor items was tested. The testing effect was observed, with recognition accuracy higher for Test 2 than for Test 1. The magnitude of the effect varied over manipulations of word frequency, study duration, and orthographic distinctiveness. Whether the results support explanations based on retrieval effects or changes in decision criteria is discussed.

11:20–11:35 (58)

Repetition and Memory: A Multitask Approach. DOUGLAS L. HINTZMAN, *University of Oregon*—Recently there has been a re-emergence of cumulative strength models of the effects of repetition on episodic memory. Strength is a scalar construct, and these models

are generally tested against a scalar memory measure—typically, recognition d' . But many memory tasks have been devised, and each provides a different window onto the operation of the same memory system. I will describe research using several different memory-judgment tasks, employing a method that looks at the degree of independence, or dissociation, among memory measures. The results of this research pose a serious challenge to the claim that repetition simply strengthens a memory trace.

11:40–11:55 (59)

A Simplified Conjoint Recognition Paradigm for the Measurement of Gist and Verbatim Memory. CHRISTOPH STAHL & CHRISTOPH KLAUER, *University of Freiburg* (sponsored by Ute J. Bayen)—The distinction between verbatim and gist memory traces postulated by Fuzzy Trace theory has furthered our understanding of numerous phenomena in various fields, such as false memory research, research on reasoning and decision making, and cognitive development. To measure verbatim and gist memory empirically, an experimental paradigm and multinomial measurement model has been proposed, but rarely applied. In the present article, a simplified Conjoint Recognition paradigm and multinomial model is introduced and validated as a measurement tool for the separate assessment of verbatim and gist memory processes. A Bayesian metacognitive framework is applied to validate guessing processes. Similarities and differences of the new paradigm and the Source Monitoring paradigm are also highlighted.

Language Production

Shoreline, Friday Morning, 10:00–12:00

Chaired by Lise Abrams, *University of Florida*

10:00–10:15 (60)

Grammatical Class Influences How Nonwords Prime Tip-of-the-Tongue Resolution. LISE ABRAMS, *University of Florida*, KATHERINE K. WHITE, *College of Charleston*, LISA A. MERRILL, *University of Florida*, & LEE ANNE HAUSLER, *College of Charleston*—Previous research shows that phonologically related words help resolve tip-of-the-tongue (TOT) states, but only for words in a different grammatical class from the TOT word. Two experiments used phonologically related nonwords to examine whether existing lexical representations were necessary for priming. Participants saw questions and attempted to produce target answers. They categorized unretrieved targets as TOTs or unknown words and heard a list containing words and nonwords, one of which was a nonword prime or unrelated nonword. Primes contained the target’s first syllable and had a suffix consistent with the target’s grammatical class, different from the target’s grammatical class, or unassociated with grammatical class. When target retrieval was re-attempted, different part-of-speech primes facilitated TOT resolution whereas same part-of-speech primes did not, similar to studies using word primes. Primes without grammatical suffixes also increased TOT resolution. The results demonstrate that nonwords can activate grammatical class, influencing subsequent production of phonology for resolving TOTs.

10:20–10:35 (61)

A Word-Order Constraint on Phonological Activation. NIELS JANSSEN & F.-XAVIER ALARIO, *CNRS and Université de Provence* (sponsored by Jonathan Grainger)—In many languages, word-order rules impose major constraints on linguistic behavior. Despite their importance, little is known about how these rules operate. We report an influence of word-order on the activation of phonological representations during language production. Participants were presented with colored objects (e.g., blue rake), and named either the color (e.g., blue) or the object (e.g., rake). The phonological onset similarity between color and object name was manipulated (e.g., red rake vs. blue rake). In Experiment 1, French speakers showed a phonological congruency effect in color but, surprisingly, not in object naming. In Experiment 2, English speakers yielded the opposite pattern: A phono-

logical congruency effect in object, but not in color naming. Differences in the typical order of object nouns and color adjectives in French and English provide a plausible account for the cross-linguistic contrast in phonological activation.

10:40–10:55 (62)

Word Preparation Addresses Syllables but Not Segments in Mandarin Chinese. JENN-YEU CHEN, *National Cheng Kung University*, PADRAIG G. O’SEAGHDHA, *Lehigh University*, & KUAN-HUNG LIU, *National Cheng Kung University* (read by Padraig G. O’Seaghdha)—In Mandarin, speakers benefit from foreknowledge of what the first syllable of a disyllable will be, but not what the onset is (Chen, Chen, & Dell, 2002). We replicated the absence of an onset preparation benefit for disyllables (Experiment 1). Then we provided stricter tests using monosyllables. We found no preparation effect whether targets were cued by other monosyllables that could form a compound (Experiment 2) or that could not (Experiment 3), or by a nonlexical symbol (Experiment 4). These results are in marked contrast to implicit priming results with European languages. We outline a theory in which advance planning addresses the primary level of phonological encoding below the word—syllables in Mandarin, segments in English and other Indo-European languages. In Mandarin, segments may be activated but are not prepared until after syllable production begins. Thus, the control structure for word encoding is fundamentally different in these languages.

11:00–11:15 (63)

Interactive Effects in Speech Production: Feedback or Perceptual Monitoring? MELISSA M. BAESE & MATTHEW A. GOLDRICK, *Northwestern University* (read by Matthew A. Goldrick)—Interactive effects are well documented at lexical and phonological levels of the production system (e.g., the mixed error effect; Dell, 1986). Acoustic analysis reveals such effects extend to postphonological processes: Lexical properties of words modulate their phonetic properties. Specifically, voice onset time (VOT) varies according to lexical neighborhood structure. For example, the /k/ in “cod” has a longer VOT than the /k/ in “cop.” This reflects contrasting neighborhood structure: “cod” has a highly similar neighbor “god,” whereas “cop” does not (“gop” is not an English word). We then examine the source of this interactive effect. It could reflect enhancement of articulation to help perception (listener modeling) or feedback-driven enhancement of lexical and phonological representations. To contrast these accounts, participants produced words in an interactive task where phonetic enhancement was unnecessary for successful communication.

Consistent with a production-internal feedback mechanism, phonetic enhancement was still present in speakers’ productions.

11:20–11:35 (64)

Amnesic H.M.’s Sentence Production: Parallel Deficits in Memory and Language. DON G. MACKAY & CHRISTOPHER B. HADLEY, *UCLA*, & LORIE JAMES, *University of Colorado, Colorado Springs*—To test conflicting hypotheses regarding amnesic H.M.’s language abilities, this study examined H.M.’s sentence production on the Language Competence Test. The task for H.M. and 8 education-, age-, and IQ-matched controls was to describe pictures using a single grammatical sentence containing 2 or 3 prespecified target words. The results indicated selective deficits in H.M.’s picture descriptions: H.M. produced fewer single grammatical sentences, included fewer target words, and described the pictures less completely and accurately than did the controls. However, H.M.’s deficits diminished with repeated processing of unfamiliar stimuli, and virtually disappeared for familiar stimuli, selective effects that help explain why some researchers claim that H.M.’s language production is intact. Besides resolving the conflicting hypotheses, this study demonstrates parallel deficits and sparing in H.M.’s language and memory, and replicates other well-controlled sentence production results. Present results comport in detail with binding theory but pose problems for system theory accounts of H.M.’s condition.

11:40–11:55 (65)

Not Saying What’s on Your Mind: How Speakers Avoid Grounding References in Privileged Information. LIANE WARDLOW LANE & VICTOR S. FERREIRA, *University of California, San Diego* (read by Victor S. Ferreira)—Speakers’ descriptions of shared objects sometimes implicitly refer to private information (i.e., privileged objects). In Experiment 1, speakers coped with a cognitive pressure to attend to privileged objects and a communicative pressure to avoid referring to privileged objects. The results show that when cognitive and communicative pressures compete, cognitive pressures win: Speakers implicitly referred to privileged objects more, even at the expense of communicative success. Experiment 2 showed that this was not due to task confusion. Experiment 3 directly tested whether increased attention causes increased references to privileged objects. The results showed more references to privileged information when privileged objects were made relatively more salient. Experiment 4 combined the attention manipulations of Experiments 1 and 3, revealing that they were not independent, suggesting that the separate effects were caused by similar or related mechanisms. Overall, speakers are compelled to cope with cognitive pressures, even at the expense of communicative efficacy.

**SYMPOSIUM: Reuniting Motivation and Cognition:
Motivational Factors in Learning and Performance**
Regency ABC, Friday Afternoon, 1:30–3:50

Chaired by *W. Todd Maddox and Arthur B. Markman*
University of Texas, Austin

1:30–1:45 (66)

Reuniting Motivation and Cognition: Motivational Factors in Learning and Performance. W. TODD MADDOX & ARTHUR B. MARKMAN, *University of Texas, Austin*—Psychology typically makes a conceptual distinction between motivation (processes that drive an individual to act) and cognition (processes by which information is processed). Despite the separation of these factors within psychology, there are good reasons to unify research on motivation and cognition. Because motivation drives action, there is no cognition in the absence of motivational influences. Furthermore, cognitive neuroscience and clinical neuropsychology suggest that the brain areas responsible for motivational influences are not anatomically or functionally separable from those responsible for information processing. The goal of this symposium is to present research that reunites research on motivation and cognition. Talks will address foundational issues about the structure of the motivational–cognition interface. This work explores the motivation–learning interface as well as the effects of motivation on expert performance (e.g., choking under pressure). The symposium concludes with a discussion that links the topics together and points out directions for future research.

1:50–2:05 (67)

Using Classification to Understand the Motivation–Cognition Interface. ARTHUR B. MARKMAN & W. TODD MADDOX, *University of Texas, Austin*—Our research explores the cognitive consequences of motivational incentives in the form of potential gains or losses that are contingent on overall task performance. The influence of incentives depends on whether local task feedback provides rewards or punishments. Using perceptual classification tasks, we demonstrate that gain incentives lead to more flexible use of explicit rules when the participants gain points in their feedback than when they lose points. Loss incentives lead to more flexible performance when participants lose points than when they gain points. This fit between global and local rewards is beneficial for performance for tasks that call for flexible rule use, but not for tasks that require implicit integration of information from multiple dimensions in a manner that is not easily verbalized. This work has implications for our understanding of stereotype threat, the cognitive neuroscience of learning and performance, and the cognitive deficits that arise with mental disorders.

2:10–2:25 (68)

Structural and Dynamic Elements in Means–Ends Relations: Multifinality Quest and the Range of Means to a Focal Goal. ARIE W. KRUGLANSKI & CATALINA KOPETZ, *University of Maryland, College Park*—This presentation introduces the concept of multifinality quest for means that while serving the current explicit (or focal) goal serve also other cognitively active objectives. The simultaneous presence of several goals is usually thought to introduce goal–conflict, implying the need to exercise goal choice. Such conflict may be avoided via “multifinal” means affording joint pursuit of the conflicting goals. Multifinal means typically constitute a subset of all the means to a focal goal one could consider. Accordingly, the activation of additional goals should narrow the set of acceptable means to a focal objective. Moreover, the quest for “multifinal” means should constrain the set of acceptable activities to ones that benefit the entire set of active goals. Our experiments demonstrate this phenomenon and identify its two moderators. One moderator concerns the feasibility of finding multifinal means given the nature of the activated goals (their relatedness). The second moderator concerns the individuals’ commitment to the focal explicit goal, that tends to “crowd out”

the alternative goals. Both moderators liberate the means to the focal goal from constraints imposed by the alternative goals, hence increasing the set size of means generated to the focal goal.

2:30–2:45 (69)

Individual Differences in Motivation and Their Effects on Cognitive Performance. ALAN PICKERING, *University of London*—A long-established tradition in biologically based theories of personality is to propose that individuals differ in the functioning of basic motivational systems. In particular, individuals are thought to vary in the reactivity of the system dealing with appetitive motivation and approach behavior, while there is argued to be independent variation in another system dealing with aversive motivation and avoidance behavior. A control system (dealing with motivational conflicts) has also been proposed. Differing motivational contexts will engage these systems differentially and will thus alter the effects of personality on behavior. We show here also that neurocomputational models of learning under appetitive motivational contexts are very sensitive to interindividual differences in key parameter settings that might plausibly reflect biological variation underlying aspects of personality. We therefore argue that, when exploring motivational effects on cognition, one would improve understanding and increase statistical power if one considered personality variables. We illustrate these ideas further with behavioral findings from cognitive paradigms.

2:50–3:05 (70)

Motivation, Emotion, and Attention: A Dynamic Approach. ZHENG WANG, *Ohio State University*, & JEROME R. BUSEMEYER, *Indiana University*—Real time data were collected to measure the emotion, attention, and the channel choices that participants made while watching television. The hedonic valence and arousal levels of television content were manipulated. Continuous self-report of emotion, physiological responses (heart rate to measure attention, skin conductance to measure arousal, and facial EMG to measure hedonic valence), and channel-changing behavior were measured. The data were analyzed and interpreted using a state space model, where emotional television information was dynamic input that affected the latent motivational states, which in turn were reflected by the observational measures associated with them. Dynamics of the motivational states is described by a transition equation, and relationships between the latent motivational states and observational variables (heart rate, skin conductance level, zygomatic activity, corrugator activity, and self-reported arousal, negativity, and positivity) were identified. These motivational variables then provide the inputs that drive a diffusion model of channel-changing behavior.

3:10–3:25 (71)

Performance Under Pressure: Insights Into Skill Failure and Success. SIAN L. BEILOCK, *University of Chicago*, & MARCI S. DECARO, *Miami University*—We explored how individual differences in working memory (WM) and consequential testing situations impact math problem-solving strategies and performance. Individuals performed multistep subtraction and division problems under low- or high-pressure conditions and reported their problem-solving strategies (Experiment 1). Under low pressure, the higher their WM, the better their math performance and the more likely they were to use computationally demanding algorithms (vs. simpler shortcuts) to solve the problems. Under pressure, higher WMs switched to simpler (and less efficacious) problem-solving strategies and their performance suffered. Experiment 2 turned the tables, using a math task for which a simpler strategy was optimal. Now, under low pressure, the lower their WMs, the better their performance. And, under pressure, higher WMs’ performance increased by employing the simpler strategies used by lower WMs. WM availability influences how individuals approach math problems, with the nature of the task performed and the performance environment dictating skill success or failure.

Visual Search**Regency DEFH, Friday Afternoon, 1:30–3:30***Chaired by Jeremy M. Wolfe**Brigham & Women's Hospital and Harvard Medical School***1:30–1:45 (72)**

Is Pink Special? The Evidence From Visual Search. JEREMY M. WOLFE, *Brigham & Women's Hospital and Harvard Medical School*, ANINA N. RICH, *Macquarie University*, ANGELA BROWN & DELWIN LINDSEY, *Ohio State University*, & ESTER REIJNEN, *University of Basel*—Desaturated red is named “pink.” Other desaturated colors lack such color terms in English. They are named for objects (lavender) or, more often, are named using compound words, relative to the saturated hue (pale green). Does pink have a special “categorical” status making it easier to find in visual search tasks? Observers searched for desaturated targets midway (in xyY space) between saturated and desaturated distractors. Search was faster and more efficient when saturated distractors and desaturated targets were in the red range than when they were any other hues. This result was obtained (1) with items as bright and saturated as possible, (2) when all items were isoluminant, or (3) when the separation in CIE xy from target to distractors was equated across hues. But is pink really special? Maybe not. Search remained fast and efficient with a range of targets that were not categorically “pink” but might be characterized as skin tones.

1:50–2:05 (73)

Efficient Segregation of Moving and Stationary Objects in Visual Search. TODD S. HOROWITZ, *Harvard Medical School*, & ANINA N. RICH, *Macquarie University*—How efficiently can the visual system guide attention to moving or stationary objects? We constructed displays of two spatially interleaved search sets, composed of randomly moving and stationary disks. Each set consisted of 4, 8, or 12 gray disks marked with white lines. Observers were instructed to search for a vertical line target among distractors tilted $\pm 30^\circ$, in either the moving or the stationary set (blocked). The target could be present or absent in each set independently. Segregation by motion was highly efficient. Target-present RTs for both conditions were unaffected by the number of items in the irrelevant set. However, the irrelevant set was not completely suppressed; a target in the irrelevant set slowed target-absent RTs. Finally, search through randomly moving disks (21 msec/item) was just as efficient as search through stationary disks (23 msec/item). The visual system makes optimal use of motion information in visual search.

2:10–2:25 (74)

The Effect of Task-Irrelevant Objects on Learning the Spatial Context in Visual Search. ADRIAN VON MÜHLENEN, *University of Warwick*, & MARKUS CONCI, *LMU Munich*—During visual search, the spatial configuration of the stimuli can be learned when the same displays are presented repeatedly. This in turn can facilitate finding the target (contextual cuing effect). This study investigated how this effect is influenced by the presence of a task-irrelevant object. Experiment 1 used a standard T/L search task with “old” display configurations presented repeatedly among “new” displays. A green filled square appeared at unoccupied locations within the search display. The results showed that the typical contextual cuing effect was completely eliminated when a square was added to the display. In Experiment 2 the contextual cuing effect was reinstated by simply including trials where the square could appear at an occupied location (i.e., below a stimulus). These findings are discussed in terms of an account that depends on whether the square is perceived as part of the search display or as part of the display background.

2:30–2:45 (75)

Different Causes for Attention Interference in Focused and Divided Attention Tasks. ASHER COHEN & GERSHON BEN SHAKHAR,

Hebrew University—Distractors carrying task-relevant information often affect performance in both focused and divided attention (e.g., visual search) tasks. In divided attention tasks it is generally assumed that task-relevant distractors “capture” attention. There is less agreement on the cause of interference in focused attention tasks. Typically, the nature of task-relevant distractors is different in the two paradigms, rendering a direct comparison difficult. In the present study, we created a paradigm in which we can compare directly focused and divided attention tasks, and we use the same type of response-related distractors for both tasks. Several experiments show that these distractors interfere with performance in both tasks, but there is a fundamental difference between the two types of interference. Whereas response-related task-relevant distractors indeed capture attention in visual search, attention gradient rather than attention capture causes interference in focused attention tasks.

2:50–3:05 (76)

Experience-Guided Search: A Theory of Attentional Control. MICHAEL C. MOZER, *University of Colorado*, & DAVID BALDWIN, *Indiana University*—Visual search data are often explained by the Guided Search model (Wolfe, 1994, 2007), which assumes visual-field locations are prioritized by a saliency map whose activity is effectively a weighted sum of primitive-feature activities. The weights are determined based on the task to yield high saliency for locations containing targets. Many models based on this key idea have appeared, and to explain human data, all must be “dumbed down” by restricting the weights and/or corrupting the saliency map with noise. We present a formulation of Guided Search in which the weights are determined by statistical inference based on experience with the task over a series of trials. The weights can be cast as optimal under certain assumptions about the statistical structure of the environment. We show that this mathematically elegant and parsimonious formulation obtains accounts of human performance in a range of visual search tasks.

3:10–3:25 (77)

Not All Visual Memories Are Created Equal. CARRICK C. WILLIAMS, *Mississippi State University*—Two experiments investigated differences in the impact of number of presentations and viewing time on visual memory for search objects. In Experiment 1, participants searched for real-world targets (e.g., a green door) 2, 4, 6, or 8 times in a field of real-world conjunction distractors, followed by a memory test for the presented objects. Visual memory improved across presentations, but the rate of improvement was unequal for different object types: Target memory improved more with each presentation than did distractors. In Experiment 2, eye movements were monitored while participants searched arrays either 2 or 4 times, followed by a memory test. The overall memory results replicated Experiment 1. Importantly, regression analyses indicated that number of search presentations had a large effect on target memory with little additional impact of total viewing time, whereas the opposite was true of distractors. Both experiments demonstrate differences in processing of target and distractor memories.

Judgment and Decision Making**Beacon A, Friday Afternoon, 1:30–3:30***Chaired by John S. Shaw, Lafayette College***1:30–1:45 (78)**

Public Predictions of Future Performance. JOHN S. SHAW & SARAH A. FILONE, *Lafayette College*—Two experiments tested whether public predictions about one's performance on an anagram task would have an impact on the number of anagrams actually solved. Before working on two sets of anagrams, 243 participants made predictions about how many anagrams they would solve in each set. Manipulated variables included Prediction Privacy (public vs. private) and Performance Privacy (public vs. private). Consistent with self-

presentation theory, participants who made public predictions about private performances were overconfident about their task performance, while all other participants were underconfident. In addition, Prediction Privacy interacted with Self-Monitoring status (high vs. low) on performance outcomes, such that high self-monitors who made public predictions worked the hardest and solved the most anagrams, whereas low self-monitors who made private predictions worked the least hard and solved the fewest anagrams. These findings have important theoretical and practical implications concerning how people's public predictions may be related to their future performance.

1:50–2:05 (79)

Randomness Is Not a Unitary Concept. BRUCE D. BURNS & CECILIA R. COX, *University of Sydney*—When people are told to regard a process as random, what do they think that means? This was examined in a series of questionnaires that presented university students with nine statements and asked them to rate each with regard to how characteristic they were of a random process (from *must be true to irrelevant*). The results revealed widespread disagreement as to what characteristics were defining for a process labeled random. Factor analysis found three factors consistently. The first was a predictiveness factor on which loaded statements about the lack of predictiveness, patterns, and streaks. A second factor was independence/noncausality on which equality of probabilities of outcomes also loaded. Correlations of scores based on these two factors were significant but consistently low. ACT scores correlated with independence/causality scores. These results suggest that what people understand about a process when told it is random is surprisingly variable.

2:10–2:25 (80)

Framing Effects Under Cognitive Load: Working Memory and Risky Decisions. PAUL WHITNEY, CHRISTA A. RINEHART, JOHN M. HINSON, ALLISON L. MATTHEWS, & AARON K. WIRICK, *Washington State University*—Recent studies of cortical activity during positively and negatively framed decisions indicate that the emotional circuitry in the orbitomedial PFC, and to a lesser extent the WM circuits of the dorsolateral PFC, are involved in framing effects. The present study provides complementary behavioral evidence on framing and risky decisions under conditions in which the available WM resources and affective context were experimentally manipulated. Participants made choices between a sure monetary gain or loss and a gamble that could result in keeping a larger amount of money. In the load conditions, each decision was made while maintaining a cold (digit) or a hot (affectively negative or positive word) load in WM. Both hot and cold loads influenced risk taking, but the effects did not interact with the decision frames. The results have important implications for dual process views of decision making.

2:30–2:45 (81)

Cognitive Aging and the Adaptive Selection of Decision Strategies. RUI MATA, LAEL J. SCHOOLER, & JÖRG RIESKAMP, *Max Planck Institute for Human Development* (read by Lael J. Schooler)—Does aging compromise decision-making abilities? Or does experience offset losses due to age-related cognitive decline? We investigated younger and older adults' strategy selection in environments favoring either the use of information-intensive strategies or simpler, information-frugal strategies. Older adults looked up less information, took longer to process it, and used simpler, less cognitively demanding strategies in both environments compared to younger adults. Nevertheless, younger and older adults seem to be savvy decision makers in that they adapted their information search and strategy selection as a function of environment structure. After taking environment into account, measures of fluid intelligence, not crystallized intelligence, explained age-related differences in information search and strategy selection. Thus, while older adults, like younger adults, may know which strategies are appropriate for a given environment, cognitive decline may force them to rely on simpler strategies, which may or may not lead to a loss in performance.

2:50–3:05 (82)

Free Riding and Altruism in Vaccination Decisions. MENG LI, JEFFREY VIETRI, & GRETCHEN B. CHAPMAN, *Rutgers University*, & ALISON GALVANI & DAVID THOMAS, *Yale University* (read by Gretchen B. Chapman)—Vaccination protects the vaccinated individual and also benefits nonvaccinated others through herd immunity. Thus, nonvaccinated individuals can “free ride” on the vaccination of others. A Web-based study of 296 college students explored whether altruism (benefiting others) and free riding motivates vaccination decisions. Four “free riding” scenarios varied the nonvaccinated proportion (.90, .40, .10, and .00) of the population who could potentially transmit the disease to the participant. Participants' mean rated likelihood to vaccinate varied greatly across these four scenarios (76%, 65%, 52%, 26%; $p < .0001$). Four “altruism” scenarios held constant the infection risk to the participant but varied the proportion (.90, .40, .10, and .00) of the population that was unvaccinated and could therefore benefit from the participant's vaccination. Here, the mean likelihood to vaccinate did not vary across scenarios (70%, 70%, 69%, 68%; $p = .68$). Thus, participants were eager to free ride but reluctant to benefit others.

3:10–3:25 (83)

The Interaction of Food-Quantity Differences and Temporal Presentation on the Amount of Food People Consume. JESSICA M. CHOPLIN & LAURA MOTYKA, *DePaul University*—Previous research suggests that judgments of food quantity affect the amounts of food people eat. In two experiments, we investigated the interaction of food-quantity differences and temporal presentation on participants' judgments of food quantity and the amounts they ate. In Experiment 1, participants viewed two quantities of food presented either simultaneously or sequentially and later recalled the quantities. In Experiment 2, participants viewed two serving bowls of pasta salad presented either simultaneously or sequentially and ate as much or as little as they wished from the smaller bowl. The amounts they ate were inversely related to biases in judgments of food quantity.

Inhibitory Processes in Memory Beacon B, Friday Afternoon, 1:30–2:50

Chaired by Lili Sahakyan
University of North Carolina, Greensboro

1:30–1:45 (84)

Intentional Forgetting Is Easier After Two “Shots” Than One. LILI SAHAKYAN, PETER F. DELANEY, & EMILY R. WALDUM, *University of North Carolina, Greensboro*—Three experiments evaluated whether the magnitude of the list-method directed forgetting effect was strength dependent. Throughout these studies, items were strengthened via operations known to increase both item and context strength (spaced presentations), as well as manipulations that increment the item strength without affecting the context strength (processing time and processing depth). The assumptions regarding which operations enhance item and context strength were based on the “one-shot” hypothesis of context storage (Malmberg & Shiffrin, 2005). The results revealed greater directed forgetting of strong items compared to weak items, but only when strength was varied via spaced presentations (Experiment 1). However, equivalent directed forgetting was observed for strong and weak items when strengthening operations increased item strength without affecting the context strength (Experiment 2 and Experiment 3). These results supported the predictions of the context hypothesis of directed forgetting (Sahakyan & Kelley, 2002) and the “one-shot” hypothesis of context storage.

1:50–2:05 (85)

Inhibiting Intrusive Memories: Neural Mechanisms of Successful and Failed Control Over the Retrieval of Unwanted Memories. BENJAMIN J. LEVY & MICHAEL C. ANDERSON, *University of Oregon* (read by Michael C. Anderson)—In the aftermath of trauma,

people often experience intrusive reminders, and make efforts to exclude the unwanted memory from awareness. Prior work has established that suppressing retrieval in this way recruits executive control regions in the dorsolateral prefrontal cortex (DLPFC) that down-regulate activation in the hippocampus, impairing later retention. Here, we investigate the neurobiological mechanisms underlying the intrusion experience. In an adapted version of the “think/no think” procedure, subjects reported after each suppression trial whether the unwanted memory had intruded into awareness. The results show that although subjects initially report many intrusions (~50%), these intrusions decline with practice, with later memory impairment predicted by this decline. Moreover, intrusions were associated with decreased engagement of the DLPFC and elevated activity in the hippocampus. These findings suggest that intrusive memories reflect a failure to engage DLPFC during suppression, and that successful down-regulation of hippocampal activation is an essential component of memory control.

2:10–2:25 (86)

Independent Cues Are Not Independent. GINO CAMP, DIANE PECHER, HENK G. SCHMIDT, & RENÉ ZEELENBERG, *Erasmus University Rotterdam*—Retrieval practice with particular items from memory (e.g., orange) can result in forgetting of related items (e.g., banana) that are associated to the same cue (e.g., FRUIT). This retrieval-induced forgetting effect can be explained by both interference and inhibitory processes. The independent cue technique has been developed to differentiate between the contributions of interference and inhibition to the forgetting effect. Independent cues are not associated to the practiced item (e.g., monkey-b___ for banana). Inhibition theory predicts forgetting with this type of cue. However, interference theory predicts forgetting only with the studied category (FRUIT) and does not predict forgetting with independent cues. Therefore, forgetting with independent cues is seen as an empirical criterion for inhibition. However, in three experiments, we demonstrate experimentally that, even when participants are only cued with independent cues, studied categories are activated at test. Thus, independent cues may not differentiate effectively between interference and inhibition.

2:30–2:45 (87)

Long-Term Episodic Inhibition and Sleep. MIHALY RACSMANY, *Hungarian Academy of Sciences*, MARTIN A. CONWAY, *University of Leeds*, & GYULA DEMETER, *Budapest University of Technology and Economics* (sponsored by Martin A. Conway)—Studies of retrieval inhibition have persistently found that retrieval practice of selected category items from a previously studied list reduces recall of studied unpracticed items from the same category. Past research suggests that this effect is short-term. Two experiments investigated the long-term effect of retrieval practice and its relationship to sleep. In both experiments two groups of subjects undertook a selective practice paradigm with a 12-h delay between practice and recall. One group (sleepers) had a full night’s sleep during delay, while the other group (nonsleepers) recalled at the end of the day. Both groups showed highly reliable retrieval-induced forgetting. In the second experiment a surprise free recall procedure was used. A significant inhibitory effect for the sleepers was again found but there was no reliable effect for the nonsleepers. These findings are considered in terms of consolidation of the contents of episodic memories.

Word Processing

Seaview, Friday Afternoon, 1:30–3:30

Chaired by Julie E. Boland, *University of Michigan*

1:30–1:45 (88)

Contextual Modulation of Dominant Homophone Meaning in the Visual World. LILLIAN CHEN & JULIE E. BOLAND, *University of Michigan* (read by Julie E. Boland)—In a visual world eye tracking study, participants heard homophones in either neutral or subordinate-

biased contexts (e.g., NEUTRAL, Amanda didn’t supervise her little brother, who ended up dropping the glasses; BIASED, The dishwashers washed the plates, the silverware, and finally the glasses). At homophone onset, four pictures appeared: subordinate homophone meaning (drinking glasses), dominant meaning shape competitor (handcuffs, for eyeglasses), and two unrelated pictures. The shape competitor was used to index subliminal activation of the dominant meaning. Context influenced the proportion of fixations on both the subordinate picture and the shape competitor, beginning with the second fixation after the pictures appeared. Nonetheless, the shape competitor attracted more fixations than expected by chance, even in the subordinate-biased condition. This pattern is similar to the subordinate-bias effect reported in reading experiments (Binder & Rayner, 1998): Context modulates the activation of homophone meanings, but the dominant meaning remains partially activated in subordinate-biased contexts.

1:50–2:05 (89)

Selection of Homograph Meaning: Implicit Memory Effects in Episodic Memory. DAVID S. GORFEIN, *Adelphi University*, VINCENT R. BROWN, *Hofstra University*, & EMILY EDWARDS, *University of Texas, Arlington*—Traditional research in meaning selection for ambiguous words (homographs/homophones) has focused on semantic tasks such as the selection of a meaning for the ambiguous word in a biasing context and for the same word presented later in a similar or different semantic context. We have previously demonstrated that an ambiguous word presented along with a picture consistent with its secondary meaning induces a bias which is maintained across relatively long time intervals, many intervening trials, changes in task context, and changes in response requirements. These findings are now extended to transfer from the initial secondary-meaning picture priming task to an episodic memory task, free recall. The data support the interpretation that the picture priming task alters the meaning representation of the words, thereby affecting the frequency and pattern of recall not only for the ambiguous words themselves, but for words related to the ambiguous words’ initially dominant and secondary meanings.

2:10–2:25 (90)

Bricks Don’t Breathe: Semantic Decisions Are Made by Weighing Evidence For and Against Category Membership. DIANE PECHER & RENÉ ZEELENBERG, *Erasmus University Rotterdam*, & ERIC-JAN WAGENMAKERS, *University of Amsterdam*—In the animal decision task words are categorized as animals or nonanimals. Deadline models propose that decisions are based on activation of an animal feature in combination with a temporal deadline (Carreiras, Perea, & Grainger, 1997; Forster & Hector, 2002). Instead, we propose that the decision process weighs several features that provide partial evidence for either an animal or a nonanimal decision. If this weighing provides strong evidence for either response, performance is better than if the weighing provides only weak evidence for either response. In Experiment 1 performance was worse for words having features correlated with the opposite response (e.g., organic for a nonanimal) than for words not having such features. In Experiment 2 nonanimal responses were faster than animal responses if the proportion of nonanimals was high. These results are problematic for a deadline model but consistent with a model combining evidence from different features.

2:30–2:45 (91)

An REM Model for Animal Decision. ERIC-JAN WAGENMAKERS, *University of Amsterdam*, & DIANE PECHER & RENÉ ZEELENBERG, *Erasmus University Rotterdam*—In animal decision, people have to quickly decide whether or not words such as “mountain” or “parrot” refer to an animal. This task requires that people access both orthographic and semantic information. Previous research has shown that (1) activation of semantic information occurs before orthographic processing is complete; (2) performance for typical animals (e.g., dog) and nonanimals (e.g., computer) is better than performance for

less typical animals (e.g., shrimp) and nonanimals (e.g., tree); (3) “nonanimal” decisions can be faster than “animal” decisions. Here, we introduce a REM model to account for these findings. In the model, orthographic and semantic information accumulate over time. Semantic information from a particular lexical representation is weighted by the posterior probability that the representation matches the stimulus orthographically. The present research supports the notion of parallel access to a feature-based semantic representation for composite concepts such as “animalness.”

2:50–3:05 (92)

Semantic and Emotional Effects in Lexical Decision, Naming, and Perceptual Identification. LEE H. WURM & SEAN R. SEAMAN, *Wayne State University*—Previous research shows that the subjective danger and usefulness of words affect recognition times. Usually an interaction is found: Increasing danger predicts faster RTs for words low on usefulness, but increasing danger predicts slower RTs for words high on usefulness. We explore the nature of this interaction using three experimental tasks. The interaction is found in all tasks. It holds for nouns, verbs, and adjectives. It is significant over and above effects of variables such as frequency, length, concreteness, age of acquisition, imageability, and familiarity. The interaction cannot be characterized as a speed versus accuracy trade-off. We believe its origin is an approach/withdraw response conflict induced by stimuli that are both dangerous and useful. It may be a manifestation of the rapid evaluation effects pervasive in the literature. Post hoc analyses also show that danger and usefulness explain as much variance as Valence and Arousal, or Evaluation, Potency, and Activity.

3:10–3:25 (93)

Anticipatory Effects in Delayed Naming: The Role of the Hazard Function Probability. MICHAEL J. CORTESE, *University of Nebraska, Omaha*—Two experiments examined anticipatory effects in delayed naming performance by varying the hazard function probability (HFP) of the response signal. In Experiment 1, critical stimuli were named at a 1,300-msec delay. The HFP equaled .33 in one condition and 1.0 in another condition. When the HFP equaled 1.0, naming latencies were 36 msec faster than when the HFP equaled .33. Experiment 2 compared naming latencies for three delays (900 msec, 1,100 msec, and 1,300 msec) that were distributed uniformly in one block of trials (i.e., the HFP increased systematically across the delay intervals) and exponentially in another block of trials (i.e., the HFP remained constant at .50 across the delay intervals). Naming latencies decreased along with delay interval only in the uniform distribution condition. Based on these results, researchers who use the delayed naming task should employ an exponential distribution schedule in order to guard against anticipatory effects.

Spatial Cognition

Shoreline, Friday Afternoon, 1:30–3:50

Chaired by Amy Lynne Shelton, Johns Hopkins University

1:30–1:45 (94)

Place and Response Mechanisms in Human Environmental Learning. AMY LYNNE SHELTON, STEVEN A. MARCHETTE, & NAOHIDE YAMAMOTO, *Johns Hopkins University*—Place learning and response learning reflect two spatial learning systems. Less is known about the role these systems play in environmental learning in humans than in rats. In behavioral and neuroimaging experiments, we investigated whether these different learning systems could be observed using (1) task differences within individuals and (2) individual differences within tasks. For task differences, a comparison of environmental learning from ground-level and aerial perspectives revealed patterns of brain activation and subsequent memory performance that suggested distinct but overlapping learning systems. Focusing on individual differences within a given perspective, we found differences in the brain activation and the subsequent memory per-

formance as a function of gender and spatial skills. The differential patterns of brain activation were localized to regions typically associated with place and response learning. Taken together, we assert that humans, like other animals, have multiple systems that may be preferentially engaged across tasks and individuals.

1:50–2:05 (95)

Spatial Memory: Categorical and Metric Encoding of Location in Complex Scenes. THOMAS F. SHIPLEY, MARK P. HOLDEN, LONGIN J. LATECKI, NORA S. NEWCOMBE, & SHANNON L. FITZHUGH, *Temple University*—How do we remember object locations? Intuitively, we remember that our keys are *on* a table, and roughly 5 inches to left of the center. A Bayesian combination of categorical and metric information offers an optimal memory strategy under uncertainty, and prior research (e.g., Huttenlocher, Hedges, & Duncan, 1991) supports the use of such a strategy for simple figures. We report the results of several studies that confirm the use of a combination of categorical and coordinate information to estimate location in complex scenes. Subjects' errors in recall indicate they encoded the location of single objects categorically, as within a bounded region. However, rather than encoding the location relative to the center of the category, the metric encoding appears to locate objects within a region relative to the spine (the line of local symmetry) of the region.

2:10–2:25 (96)

Toward an Embodied Account of Spatial Memory: Egocentric Experience Trumps Intrinsic Structure. DAVID WALLER, NATHAN GREENAUER, & CATHERINE MELLO, *Miami University*—Mou and McNamara's (2002) theory of human spatial representation holds that memory is organized by intrinsic reference systems (those based on the spatial structure of a configuration of objects, and not on the surroundings or on the observer) and codes interobject spatial relationships. However, the degree to which perceptually salient intrinsic axes of a layout of objects are used to organize spatial memory is an open question. We show that salient intrinsic axes in a layout of objects are neither necessary nor sufficient for people to use a nonegocentric reference system in organizing spatial memory. Additional experiments demonstrated that when people used nonegocentric reference systems, the selection of a reference direction was influenced by their action possibilities during encoding. We suggest that what are often interpreted as nonegocentric reference systems may be better conceptualized as imagined egocentric reference systems because they are so closely tied to potential personal (embodied) experience.

2:30–2:45 (97)

Do Humans Have an Internal Compass Like Other Mammals Do? M. JEANNE SHOLL, *Boston College*—A head-direction (HD) cell fires when the animal's head points in the cell's preferred allocentric direction, irrespective of the animal's location in the environment. The cells have been studied extensively in rats, and although their role in navigation is not fully understood, they are undoubtedly the neural basis of a rat's "sense of direction." While there is neuropsychological and neuroimaging data consistent with a human allocentric-heading system, human HD cells have yet to be discovered. The present paper will describe some behavioral evidence from our laboratory showing that people can recover from a pictured scene, the allocentric direction their body faced in the actual environment when looking at the scene straight on. Perhaps revealingly, people differ widely in their ability to do this, and these differences correlate with self-reported sense of direction. The behavioral findings will be discussed in the context of theoretical models of HD-system function in rats.

2:50–3:05 (98)

Longer Segments of Slopes Are Overestimated More Than Short Segments. BRUCE BRIDGEMAN, MERRIT HOOVER, ERIC M. CHIU, & JOSHUA R. QUAN, *University of California, Santa Cruz*—

Observers overestimate the slopes of hills with verbal measures, but are more accurate with body-based motor matching techniques, an example of contrast between cognitive and sensorimotor visual information. We replicated this effect using arm posture measured with digital photography rather than a tilt board for the motor measure, eliminating body contact with the hardware. Judged slopes are too steep at long distances, measured by having observers estimate segments of slopes between themselves and markers; at 16 m an 11° hill is verbally estimated at nearly 30°; the motor estimate is much lower. At 1 m, however, estimates are more accurate with both measures. What happens when observers traverse the slope before estimating it, giving them short-distance, presumably more accurate perceptual information at every point on the slope? Their overestimates are just as great as those of observers who did not traverse the slope. Appearance dominates knowledge of the terrain.

3:10–3:25 (99)

The Perception of Four-Dot Configurations. MARY C. PORTILLO, CARL HAMMARSTEN, SHAIYAN KESHVARI, STEPHEN W. JEWELL, & JAMES R. POMERANTZ, *Rice University* (read by James R. Pomerantz)—Perceivers see stars in the night sky configured into dozens of nameable constellations. With simpler stimuli, two-point configurations are organized into a straight line, and three points into a triangle. How do we perceive configurations of four points, as when four coins are tossed randomly on the floor: as quadrilaterals, as straight lines, curves, Y patterns, Ls, Ts, or yet others? We presented 328 patterns that systematically sampled the space of all possible 4-dot arrangements (ignoring size scale, orientation, and reflections) for subjects to free-classify based on perceived similarity. We then cluster-analyzed their responses. The structure of their classifications was captured by a hierarchy of 14 clusters of patterns. The first bifurcation occurred between patterns having 3 dots in a straight line versus those that did not. Further branches suggest an ordered set of rules for grouping dot patterns, including grouping by proximity, linearity, parallelism, and symmetry.

3:30–3:45 (100)

Spatio-numerical Associations Between Perception and Semantics. PETER KRAMER, IVILIN STOIANOV, CARLO UMITÀ, & MARCO ZORZI, *University of Padua* (sponsored by Johannes C. Ziegler)—Stoianov, Kramer, Umiltà, and Zorzi (*Cognition*, in press) found an interaction, between visuospatial and numerical information, that is independent of response selection effects (e.g., the SNARC effect). This Spatial-Numerical Association between Perception and Semantics (SNAPS) emerges when a spatial prime follows (backward priming), but not when it precedes (forward priming), a numerical target. Here, we investigate the time course and nature of the SNAPS effect. We used nonspatial, verbal parity judgments and number comparisons and, to dissociate the SNAPS effect from other numerical effects, we compared conditions with and without priming. The results show that the SNAPS effect is inhibitory and peaks when the prime follows the target by about 100 msec. Moreover, we observed a main effect of number size even in the parity judgment task, contrary to earlier claims. This latter finding has important implications for current models of the representation of numerical magnitude.

Selective Attention

Regency ABC, Friday Afternoon, 4:10–5:30

Chaired by Zhe Chen, *University of Canterbury*

4:10–4:25 (101)

Implicit Perception in Object Substitution Masking. ZHE CHEN, *University of Canterbury*, & ANNE TREISMAN, *Princeton University*—Object substitution masking (OSM; Enns & Di Lollo, 1997) refers to reduced target discrimination when the target is surrounded by a sparse mask that does not overlap with the target in space but

trails it in time. In two experiments, we used a novel approach to investigate the extent of processing of a masked target in OSM. We measured response compatibility effects between target and mask, both when the offsets were simultaneous and when the mask offset was delayed. Participants made a speeded response to the mask followed by an accuracy only response to the target, then categorizing their responses to the target as “see” or “guess.” Targets and masks matched or differed at a feature level in Experiment 1 and at a categorical level in Experiment 2. Evidence for OSM as well as a dissociation between perception and awareness was found in both experiments.

4:30–4:45 (102)

Intertrial Biasing of Selective Attention Leads to Blink-Like Misses in RSVP Streams. ALEJANDRO LLERAS & BRIAN LEVINTHAL, *University of Illinois, Urbana-Champaign*—When participants are required to report the case of the color-oddball letter in a single-target RSVP stream, their ability to do so is modulated by the position of the target in the RSVP stream, and more crucially, by the match or mismatch between the current target color and the color of distractors in the prior RSVP stream. When the target is presented in the color of the distractors in the previous trial RSVP stream, participants very often miss the target (performance is at chance) when the target is presented early on in the RSVP stream. Performance recovers for later target positions in the RSVP stream. The pattern of performance (cost and recovery) is strongly reminiscent of the attentional blink, even though only one target is to be detected on any given trial and more than 2 sec have elapsed since the end of the previous trial.

4:50–5:05 (103)

The Time Course of Goal-Driven Saccadic Selection. WIESKE VAN ZOEST & MIEKE DONK, *Vrije Universiteit, Amsterdam* (sponsored by Mieke Donk)—Four experiments were performed to investigate goal-driven modulation in saccadic target selection as a function of time. Observers were presented with displays containing multiple homogeneously oriented background lines and two singletons. Observers were instructed to make a speeded eye-movement to one singleton in one condition and the other singleton in another condition. Simultaneously presented singletons were defined in different dimensions (orientation and color in Experiment 1), or in the same dimension (i.e., orientation in Experiment 2, color in Experiments 3 and 4). The results showed that goal-driven selectivity increased as a function of saccade latency and depended on the specific singleton combination. Yet, selectivity was not a function of whether both singletons were defined within or across dimensions. Instead, the rate of goal-driven selectivity was related to the similarity between the singletons; when singletons were dissimilar, accuracy as a function of time increased more rapidly than when they were similar.

5:10–5:25 (104)

Tracking of Visual Objects Containing Textual Information. LAURI OKSAMA & JUKKA HYÖNÄ, *University of Turku* (sponsored by Jukka Hyönä)—Do properties of textual identity information associated with moving targets influence visual tracking? In real-world visual environments, such as air traffic displays, targets to be tracked contain textual information (e.g., call signs). In the present study, the textual information appeared within rectangles that moved around the computer screen. Four factors were manipulated in the experiments: (1) number of targets (2–6), (2) length of textual information (5 vs. 10 character words), (3) familiarity of textual information (existing words vs. pronounceable pseudowords), and (4) speed of object movement. We observed that performance accuracy decreased as a function of target set-size, text length, word unfamiliarity, and target speed. We argue that the results are consistent with the recently proposed serial model of dynamic identity–location binding (MOMIT), which states that identity–location bindings for multiple moving objects become more difficult when target identification consumes more time (e.g., as text length increases).

Applications of Source Monitoring
Regency DEFH, Friday Afternoon, 3:50–5:30

Chaired by Linda A. Henkel, Fairfield University

3:50–4:05 (105)

Repetition and Source Memory in an Eyewitness Context. CALEB E. NANNES & KRISTI S. MULTHAUP, *Davidson College* (read by Kristi S. Multhaupt)—We will review the literature on source memory in eyewitness contexts, focusing on the effect of misinformation repetition. Zaragoza and Mitchell (1996) reported the intriguing finding that misinformation repetition increased source memory errors while simultaneously increasing correct responses (i.e., identifying question-only items as from a video and as from questions, respectively). We extended this work into the traditional misinformation paradigm in which misinformation was presented in narratives rather than in questions. Misinformation was presented in 0 (control), 1, or all 3 narratives. Once-presented misinformation increased reports of seeing the detail in both the narratives (correct) and the video (errors) compared with control items. Repetition effects remained for the correct source (saying the narrative-only items came from the narratives), but not for the source errors (saying narrative-only items came from the video). We will discuss how procedural factors affect the likelihood of repetition increasing errors, including the implications for everyday memory.

4:10–4:25 (106)

How Photographs Distort Our Memories: Source Confusions After Seeing Pictures of Imagined Events. LINDA A. HENKEL, *Fairfield University*—Viewing photographs can lead people to misremember details about events and even falsely remember events that never occurred. Two experiments investigated whether photographs increase people's false claims of performing actions they did not actually do. Participants performed and imagined performing actions that could leave behind evidence the action had been completed (e.g., tear the card in half, crumple the paper). Later they were exposed to photographs 0, 1, or 3 times showing some of the imagined actions in a state of completion, and later had to indicate which actions they had actually performed. The presentation of photographs was found to increase source errors: Participants 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, and this was related to how many times the photo had been viewed. Findings are interpreted via the source monitoring framework.

4:30–4:45 (107)

Interpersonal Source Monitoring in Simulated Investigative Interviews of Eyewitnesses. D. STEPHEN LINDSAY, C. A. ELIZABETH BRIMACOMBE, LEORA C. DAHL, & MELISSA A. BOYCE, *University of Victoria*, & JOHN TURTLE, *Ryerson University*—We monitor the sources of one another's memory reports. Such interpersonal source monitoring is usually tacit/unconscious, and it is not very accurate, but people routinely make inferences as to the provenance and reliability of others' reports. Our research group has been exploring such inferences in the context of simulated police investigations. In our procedure, undergraduates role-playing as police officers interview a witness, search a data base of potential suspects, and collect eyewitness identification evidence. Participant-investigators tend to put too much stock in participant-witnesses' eyewitness identification judgments (unless viewing conditions lead to very high accuracy rates, in which case participant-investigators' reliance on participant-witnesses is justified). Also, participant-investigators show only very limited sensitivity to participant-witnesses' accuracy.

4:50–5:05 (108)

Social and Emotional Aspects of Source Monitoring. NANCY FRANKLIN, SARAH J. BARBER, & SHANNA ALLEN, *Stony Brook University*—Three recent lines of research in our lab speak to social and emotional phenomena impacting source judgments. (1) We have

found that although self-relevance improves memory in standard paradigms, it also leads to predictable self-serving distortions. (2) We have extended a classic finding, that source discriminability improves source memory, to the realm of social intelligence. Namely, people with greater perspective-taking skills are worse at discriminating self-generated from other-generated items in memory. (3) Previous work shows that mood can produce both selective memory and judgment effects. Our work suggests that some of these effects may be attributable to source biases, and is consistent with the argument that angry people, operating on “hot cognition,” base their behavior on more heuristic processing, whereas sad people think more analytically. All of these findings will be discussed inside a larger theoretical framework for understanding source memory and the functions it serves.

5:10–5:25 (109)

Are Age-Related Episodic Memory Deficits Caused by High-Confidence Misrecollections? CHAD S. DODSON, *University of Virginia*—I will review work showing that older adults frequently make high-confidence errors when recollecting details about past events. When matched with younger adults on overall accuracy, older adults more often make high-confidence errors on source identification (i.e., who-said-what) and cued-recall tests but not on old-new recognition and general knowledge tests. Moreover, these high-confidence errors cannot be explained by age-related differences in the use of the confidence rating scale. These high-confidence misrecollections, however, are consistent with a misrecollection account of cognitive aging. This account proposes that all age-related episodic memory deficits are caused—in part—by older adults' propensity to experience compelling misrecollections.

Animal Cognition

Beacon A, Friday Afternoon, 3:50–5:30

Chaired by Robert G. Cook, Tufts University

3:50–4:05 (110)

Temporal Control of Mental States in Pigeons. ROBERT G. COOK & HARA A. ROSEN, *Tufts University*—We have recently discovered a phenomenon in pigeons involving the temporal anticipation of complex rule changes or task switches in a single discrimination setting. In a two-alternative conditional discrimination task involving a single pair of stimuli, three pigeons had to discriminate among a matching rule applicable to the first half of a session and an oddity rule that was enforced over the second half of the session. All birds successfully learned this ordered discrimination and the results of four tests suggested an internal clock mediated their task switching behavior. Implications for the serial organization of behavior are considered.

4:10–4:25 (111)

Evidence of Base-Rate Neglect by Pigeons in Matching-to-Sample. THOMAS R. ZENTALL, *University of Kentucky*, TRICIA S. CLEMENT, *Stanford University*, & KELLY A. DIGIAN, REBECCA A. SINGER, & HOLLY C. MILLER, *University of Kentucky*—In conditional discrimination learning (matching-to-sample) by pigeons, (comparison) choice is hypothesized to depend on (1) the conditional probability of reinforcement given a conditional (sample) stimulus and (2) the overall probability of reinforcement for comparison choice in the absence of a sample. We show that, independent of these two probabilities, sample frequency also affects comparison choice. The implication of this finding is that sample frequency is dissociated (stored separately) from conditional probability. Thus, in the absence of memory for the sample, pigeons are biased to choose comparisons based on overall sample frequency and not just on the probability of reinforcement associated with the two comparison stimuli.

4:30–4:45 (112)

Dissociation of “Uncertainty” Responses and “Middle” Responses in Capuchin Monkeys. MICHAEL J. BERAN, *Georgia State University*,

& J. DAVID SMITH, JUSTIN J. COUCHMAN, & MARIANA V. C. COUTINHO, *University at Buffalo*—Researchers continue to explore nonhuman animals' metacognitive capacity, but some studies still encourage competing low-level, behavioral descriptions of so-called "Uncertainty" responses. We evaluated the force of these behavioral descriptions as six capuchin monkeys completed two density-discrimination tasks. In one task, difficult stimuli could be avoided through an Uncertainty response. This task allowed the first evaluation of uncertainty responding by a New World primate species. In the other task, the same stimuli could be rewarded through a Middle response. Capuchins essentially did not use the Uncertainty response at all. However, they used the Middle response naturally and easily. This indicates that the Uncertainty response is responsive to a different and subtler psychological signal that capuchins did not monitor compared to the Middle response. These results undermine behavioral interpretations of some uncertainty-monitoring performances and highlight questions concerning the nature of the different and subtler psychological signal that occasions the Uncertainty response.

4:50–5:05 (113)

What Is Learned When Concept Learning Fails. ANTHONY A. WRIGHT, *University of Texas Medical School, Houston*, & JEFFREY S. KATZ, *Auburn University*—Rhesus monkeys gradually learned the same/different abstract concept as the training set was expanded from 8 to 128 color pictures. What they learned (or more accurately did not learn) prior to concept learning is the topic of this talk. Other rhesus monkeys trained with a subset of the training pairs were tested with the untrained pairs following acquisition. These and other results show that it is unlikely these subjects learned the training-pair configurations, the if-then rules for training pairs, or default responses to the more numerous stimulus-pair class (different pairs). Ruling out these possibilities suggests that the relationship between the training-pair pictures was being learned but that this learning did not generalize to novel stimuli either because it was tied to the specific features of the training stimuli or because performance was disrupted by the novel stimuli.

5:10–5:25 (114)

Binding in Visual Short-Term Memory by Pigeons. JEFFREY S. KATZ, *Auburn University*, & ROBERT G. COOK, *Tufts University*—Pigeons were trained in a new procedure to test for visual binding errors between the feature dimensions of color and shape. Pigeons learned to discriminate a target compound from 15 nontarget compounds constructed from four color and shape values by choosing one of two hoppers in a two-hopper choice task. The similarity of the target to nontarget stimuli influenced choice responding. Next, pigeons learned to detect a target compound presented with a nontarget compound in the same trial under conditions of simultaneity and sequentiality. Nontarget trials were arranged to allow for the testing of binding errors. Binding errors occurred at the start of two-item training but disappeared with experience indicating the impact of learning on binding in visual short-term memory.

Working Memory

Beacon B, Friday Afternoon, 3:10–5:30

Chaired by Carmi Schooler, National Institute of Mental Health

3:10–3:25 (115)

Brain Lesion and Memory Functioning: Short-Term Memory Deficit Is Independent of Lesion Location. CARMİ SCHOOLER, LESLIE J. CAPLAN, & ANDREW J. REVELL, *Section on Socio-Environmental Studies, NIMH, IRP, NIH*, & ANDRES M. SALAZAR & JORDAN GRAFMAN, *Cognitive Neuroscience Section, NINDS, IRP, NIH*—We analyzed the effects of patterns of brain lesions from open penetrating head injuries on memory performance in participants of the Vietnam Head Injury Study (Grafman et al., 1988). Classes of lesion patterns were determined by mixture modeling (Muthén & Muthén, 2004). Memory performance, at least a decade

after the injury, was assessed for short-term memory, semantic memory, verbal episodic memory, and visual episodic memory. The striking finding was that short-term memory deficits were observed in all classes of brain-injured individuals, regardless of lesion location pattern. Deficits in semantic memory, verbal episodic memory, and visual episodic memory depended on lesion location, in a manner roughly consistent with the existing neuropsychological literature. The theoretical and clinical implications of the striking, seemingly, permanent short-term memory deficits in individuals with open penetrating head injuries are discussed.

3:30–3:45 (116)

Working Memory, Executive Control, and Mind-Wandering in Lab and in Life. JENNIFER C. McVAY & MICHAEL J. KANE, *University of North Carolina, Greensboro* (read by Michael J. Kane)—The executive-attention theory of working memory capacity (WMC) proposes that WMC span tasks predict individual differences in fluid cognitive abilities primarily because span reflects domain-general, attention-control abilities (Engle & Kane, 2004). Supportive evidence comes from findings that variation in WMC predicts task performance requiring conscious control of habitual responses or attentional focus; in particular, subjects with lower WMC exhibit frequent "goal neglect," where they understand and recall task goals but fail to act according to those goals in the moment. Here, we explored whether WMC-related variation in goal neglect was mediated by the propensity for off-task thought, or mind-wandering. Thought-sampling methods probed subjects about their thought content during either daily-life activities (via programmed Palm Pilots) or computerized laboratory tasks of executive control. WMC predicted mind-wandering rates during cognitively demanding daily-life activities and during laboratory executive tasks; moreover, individual differences in executive-task performance was jointly predicted by WMC and mind-wandering rate.

3:50–4:05 (117)

The Serial-Order Problem in Short-Term Memory. BENNET B. MURDOCK, *University of Toronto*—Two main findings that any model of serial order must explain are the list length effect and the serial-position effect. Why can subjects recall 3–4 words perfectly but no more than 1 when list length exceeds memory span? Why the primacy and recency that was discovered before Ebbinghaus? A revision of the TODAM serial-order model shows that this is a natural consequence of a distributed memory system which also produces primacy, and recency comes from anti-learning. This revision also solves most of the problems that are commonly cited to discredit chaining models, and extensions to list learning will be discussed.

4:10–4:25 (118)

Resolution in Visual Working Memory Is Determined by the Number Rather Than the Complexity of the Stored Items. EDWARD AWH & BRIAN BARTON, *University of Oregon*—Using a change detection task, Awh, Barton, and Vogel (2007) observed that a fixed number of items were represented in visual working memory regardless of complexity. However, because mnemonic resolution is limited, some changes between complex objects were missed—even when the critical item was in memory—because of errors in comparing the sample and test. Using the probability of these comparison errors to define mnemonic resolution, we found that the number of items that an individual could maintain did not predict the resolution of those memories, suggesting that number and resolution are distinct facets of memory ability. Nevertheless, there are strong interactions between these factors, with monotonic reductions in resolution for each additional item stored. By contrast, wide variations in the total information load of the sample array had no influence on mnemonic resolution when the number of items in memory was held constant.

4:30–4:45 (119)

Dissecting Effects of Complexity and Similarity on Visual Working Memory. YUHONG V. JIANG, *University of Minnesota*, WONMOK

SHIM, MIT, & TAL MAKOVSKI, *University of Minnesota*—Is the number of objects one can hold in visual working memory (VWM) constant, or is it variable, such that VWM holds more simple objects than complex objects? Previous studies produced conflicting results. Although VWM for “complex” objects is worse than for “simple” objects, this difference may reflect effects of similarity rather than complexity. To dissect complexity from memory-probe similarity, we measured VWM performance for complex (face identity along a morphing continuum) and simple attributes (line orientation), at different memory load and different memory-probe similarities. At memory load 1, face performance was worse than line performance when faces changed in steps of 10% and lines changed in steps of 5 degrees. As memory load tripled or quadrupled, this difference was reversed rather than exacerbated, such that face performance was better than line performance at these steps. We conclude that complex objects don’t fill up VWM capacity faster than simple objects.

4:50–5:05 (120)

Discrete Fixed-Resolution Representations in Visual Working Memory. WEIWEI ZHANG & STEVEN J. LUCK, *University of California, Davis* (read by Steven J. Luck)—Some researchers have proposed that visual working memory stores a limited set of discrete, fixed-resolution representations, whereas others have proposed that working memory consists of a pool of resources that can be allocated flexibly to provide a small number of high-resolution representations or a large number of low-resolution representations. We addressed this controversy by using a color recall task that provides independent measures of the number of representations stored in working memory and the resolution of each representation. We show that, when presented with more than a few objects, observers store a high-resolution representation of a subset of the objects and retain no information about the others. We further show that memory resolution varies over a narrow range that cannot be explained in terms of a general resource pool but can be well explained by a model consisting solely of a small set of discrete, fixed-resolution representations.

5:10–5:25 (121)

Selective Storage and Maintenance of an Object’s Features in Visual Working Memory. GEOFFREY F. WOODMAN, *Vanderbilt University*, & EDWARD K. VOGEL, *University of Oregon*—It has been shown that we have a highly capacity-limited representational space with which to store objects in visual working memory. However, most objects are composed of multiple feature attributes and it is unknown whether observers can voluntarily store a single attribute of an object without necessarily storing all of its remaining features. In this study, we used a masking paradigm to measure the efficiency of encoding and neurophysiological recordings to directly measure visual working memory maintenance while subjects viewed multifeature objects and were required to remember only a single feature or all of the features of the objects. We found that measures of both encoding and maintenance varied systematically as a function of which object features were task relevant. These experiments show goal-directed control over which features of an object are selectively stored in working memory.

Sentence Processing

Seaview, Friday Afternoon, 3:50–5:30

Chaired by Peter C. Gordon
University of North Carolina, Chapel Hill

3:50–4:05 (122)

Independence of Sentence Processing and Reasoning. YOON-HYOUNG LEE & PETER C. GORDON, *University of North Carolina, Chapel Hill* (read by Peter C. Gordon)—A new method is presented for examining the interaction of sentence processing with other cognitive processes in which both the syntactic complexity of a sentence and the difficulty of reasoning about the information in that sentence are manipulated. In the experiments sentence complexity was manip-

ulated through the use of different types of relative clauses. Difficulty of reasoning was manipulated by whether or not the structure of a two-clause sentence made it possible to use explicit information in the two clauses to make a transitive inference about the relationship between two entities that were not explicitly related in the sentence by verbs. Reading time and response-accuracy data support the conclusion that reasoning in this task occurs after basic processes of sentence interpretation, and that those processes are not influenced by the cognitive demands of reasoning.

4:10–4:25 (123)

Sense, Structure, and Sentence Comprehension. MARY HARE & TRACY TABACZYNSKI, *Bowling Green State University*, KEN MCRAE, *University of Western Ontario*, & JEFF ELMAN, *University of California, San Diego*—Meaning and structure are related in language: Many verbs have multiple senses, which tend to occur in different syntactic structures. We examined whether such meaning–structure correlations influence comprehension of sentences containing verbs like *burn*, which have both a change-of-state and a causative sense, with the first biased toward intransitive structures (*the popcorn burned*) and the second toward transitives (*the popcorn burned his fingers*). Pairs of transitive and of intransitive sentences were created, with the same verb preceded by a subject NP that was either a good patient or good cause/instrument for the event the verb described. Intransitive sentences were read more quickly in the postverbal region when the subject NP was a good patient than when it was a good cause; the opposite was true for transitive sentences. This suggests that the subject NP serves as a biasing context, activating different verb senses and consequently different expectations about upcoming structure.

4:30–4:45 (124)

The Syntactic Use of Idioms: The Competence Model. PATRIZIA L. TABOSSI, *University of Trieste*—Idioms (e.g., *kick the bucket*) are syntactically defective expressions; that is, they cannot enter all the syntactic operations that comparable literal strings can accept. For example, the passive sentence *The bucket was kicked by Paul* can be used literally, but loses its figurative meaning. However, idioms can undergo many syntactic operations and what determines people’s ability to use these expressions in a syntactically appropriate fashion is still a wide-open question. The paper presents a model of how speakers/listeners can accomplish this task, along with empirical evidence in support of its claims. According to this model, one’s linguistic competence, along with the knowledge of the meaning of an idiom, imposes constraints on what operations that idiom can or cannot accept. The advantages of the proposed hypothesis compared with alternative theoretical views are discussed.

4:50–5:05 (125)

BOLD Signal Response to Implicit Syntactic Processing. DAVID N. CAPLAN, *Massachusetts General Hospital*, & GLORIA S. WATERS, *Boston University*—BOLD signal was measured while 16 participants made timed font change detection judgments in sentences that varied in their syntactic form (subject- and object-extracted sentences). Accuracy was above 85% for all sentence types. RTs showed unimodal distributions for all sentence types, indicating that the participants processed all sentences similarly. There were longer RTs to object- than to subject-extracted sentences without font changes and longer RTs for sentences in which the font change occurred at the embedded noun or verb of object- compared to subject-extracted sentences, indicating that sentences were processed to the level of syntactic structure. BOLD signal increased for object-extracted sentences without font changes in left supramarginal gyrus. The result provides evidence that left supramarginal gyrus plays a role in implicit syntactic and associated semantic processing of object-extracted relative clauses.

5:10–5:25 (126)

Contingent Cue Facilitation and No Structural Priming for Reduced Relatives. GAIL MAUNER & TODD D. REEVES, *University at Buf-*

falo—Four moving-window online reading experiments sought to replicate structural priming for reduced relatives observed in late eye tracking measures (Traxler & Pickering, 2004) and to determine whether priming would be eliminated if distractors contained similar contingent cues (i.e., repeated verbs and agentive by-phrases) as experimental items. Kim and Mauener (2007) demonstrated that including the same contingent cues in distractors eliminated priming for ambiguous sentential complements. Although structural priming was never observed, split-half analyses of the experiments revealed facilitated processing of reduced relative targets in the second halves of experiments relative to the first halves, with strongest effects emerging when there was a combined contingent cue (i.e., verbs and agentive by-phrases both repeated in prime and target). Moreover, as contingent learning cues were progressively disrupted, the ambiguity effect size increased. Previously reported facilitation in the processing of reduced relatives may be due, at least in part, to contingent cuing.

Motor Control

Shoreline, Friday Afternoon, 4:10–5:30

Chaired by Jerome Cohen, University of Windsor

4:10–4:25 (127)

Factors Affecting Rats' Fear of Falling on the Horizontal Ladder. JEROME COHEN, ANCA MATEI, & XUE HAN, *University of Windsor*—Many factors affect our fear of falling as we climb above uneven terrain. Chief among them are our perception of the depth of the ground below us, our prior experience with prior falling episodes, and our current age-related balance/motor control. To more systematically investigate these factors, we have conducted a series of experiments with rats on the horizontal ladder that transverses over “shallow” and “deep” areas of flooring. We analyze how easily rats recover their running speeds to baseline after experiencing collapsible rungs at various locations on the ladder as a function of these three variables. We discuss how our methodology and experimental designs can be incorporated in neuroscience research concerning motor control and balance.

4:30–4:45 (128)

Stroke Therapy Using Wearable Robots and Ramachandran Mirror Technique Produces Functional Improvement. MICHAEL K. McBEATH, FLAVIO DASILVA, & THOMAS G. SUGAR, *Arizona State University*, NANCY E. WECHSLER, *Midwestern University*, & JAMES KOENEMAN, *Kinetic Muscles, Inc.*—We tested functional recovery of long-term hemiparetic stroke patients utilizing a videogame-based repetitive motion task. Conditions were designed to

manipulate both motor stimulation and a sense of bimanual agency. Nine patients with varying severity of hemiparesis participated in four 1-month therapy conditions comprised of hour-long, biweekly therapy sessions: (1) control, a nontreatment period; (2) robot only repetitive motion, externally controlled, robot-assisted movements of effected arm; (3) optical mirror, illusory percept of arm motion induced by moving unaffected arm in front of sagittally oriented mirror; and (4) robotically coupled motion, actively controlled, robot-assisted movements of affected arm that mimic unaffected arm. The results confirmed significant functional motor improvement during test therapies compared to the control period, with all three test therapies showing promise for some recovery. The findings support the clinical value of an integrated therapy structure that induces broad neural engagement including robot-assisted motor therapy and allowing individuals to experience purposeful bimanual agency, even if illusory.

4:50–5:05 (129)

Visual Prism Adaptation and Hemispheric Asymmetry. GORDON M. REDDING, *Illinois State University*, & BENJAMIN WALLACE, *Cleveland State University*—Under conditions producing spatial realignment in the visual eye–head sensory–motor system, visual straight ahead was asymmetrically shifted more leftward for leftward displacement when tested from the left than from the right hemisphere. In contrast, visual straight ahead was shifted by the same amount for testing from both hemispaces with rightward displacement. These results are consistent with the hypothesis that left and right visual hemispaces are asymmetrically represented in the two hemispheres: Both hemispaces are represented in the right hemisphere, but only the right hemisphere is represented in the left hemisphere.

5:10–5:25 (130)

Rapid Effects of Omega-3 Fats on Brain Function. SETH ROBERTS, *University of California, Berkeley*—I measured the effect of omega-3 fats on my brain by comparing flaxseed oil (high in omega-3) with other plant fats (low in omega-3) and with nothing. Flaxseed oil improved my balance, increased my speed in a memory-scanning task and in simple arithmetic problems, and increased my digit span. The first three effects were very clear ($t > 6$). The effects of flaxseed oil wore off in a few days and appeared at full strength within a day of resumption. The best dose was at least 3 tablespoons/day, much more than most flaxseed oil recommendations. Supporting results come from three other subjects. Because the brain is more than half fat, it is plausible that type of dietary fat affects how well it works. The most interesting feature of these results is the speed and clarity of the improvement. The tools of experimental psychology may be used to determine the optimal mix of fats for the brain with unusual clarity.

Lexical Representations**Regency ABC, Saturday Morning, 8:00–9:20***Chaired by Stavroula-Thaleia Kousta, University College London***8:00–8:15 (131)**

Believe It or Not, Abstract Words Have a Processing Advantage Over Concrete Words. STAVROULA-THALEIA KOSTA, DAVID P. VINSON, & GABRIELLA VIGLIOCCO, *University College London*—It is currently taken for granted that concrete words have a processing advantage over abstract words. This advantage is assumed to arise because concrete words are more imageable (Paivio, 1986) or have higher context availability (Schwanenflugel & Shoben, 1983). In three lexical decision experiments and an analysis of lexical decision and word naming reaction times for approximately 2,000 words from the English Lexicon Project (Balota et al., in press), we show that once imageability and context availability (along with 15 other lexical and sublexical variables) are controlled for, it is abstract words that have an advantage over concrete words. We discuss how this advantage arises as a result of differences in content and organization of semantic representations for abstract and concrete words. These results force a radical revision of our theories of the way in which abstract and concrete lexical knowledge is acquired, represented, and processed.

8:20–8:35 (132)

Psycholinguistic and Corpus Investigations of Verbal Event Structures. GAIL MCKOON & ROGER RATCLIFF, *Ohio State University*—Lexical semantic representations for verbs of two classes are investigated: “manner of motion” verbs (e.g., *run*) and “change of location” verbs (e.g., *arrive*). The lexical structures of change of location verbs are complex in that they include a location and a change to that location by the entity engaging in the verbal event. The structures of manner of motion verbs are simpler because they include only an entity engaging in an activity. This differential complexity is demonstrated empirically in three ways: Lexical access is significantly faster for manner of motion verbs than for change of location verbs, as shown by lexical decision response times; short-term memory is significantly better for manner of motion verbs, as shown by response times for yes/no recognition; and sentence comprehension is significantly faster for manner of motion verbs, as shown by sentence reading times.

8:40–8:55 (133)

The Advantage of Arbitrariness Over Systematicity in Language Learning. PADRAIC MONAGHAN, *University of York*, & MORTEN H. CHRISTIANSEN, *Cornell University* (read by Morten H. Christiansen)—Why aren’t systematic sound–meaning mappings (i.e., sound symbolism) more prevalent in language? We propose that sound symbolism is avoided because it is redundant alongside more reliable contextual information. Neural network simulations corroborated this suggestion: The model learned arbitrary mappings better than systematic mappings when contextual information was also present, as arbitrariness maximized the information present in the environment. The patterns of errors for systematic mappings indicated that individual form–meaning mappings were less well differentiated, resulting in within-category confusion between items. We tested this effect in an artificial language learning study, where adult participants learned to match sentences to pictures of either objects or actions. In the systematic condition, words referring to the same category (objects or actions) sounded similar. In the arbitrary condition, there was no within-category similarity. The human data confirmed the modeling results, suggesting that arbitrary sound–meaning mappings facilitate language learning in a contextually rich language environment.

9:00–9:15 (134)

Roses Are Red and White Boys Are Stuffy: Automatic Stereotype Priming Reflects General Prejudice in the Culture. PAUL VERHAEGHEN, *Georgia Institute of Technology*, SHELLEY N. AIKMAN,

Gainesville State College, & ANA B. VAN GULICK, *Brown University*—It has been argued that stereotype priming (response times are faster for stereotypical word pairs, such as *black–poor*, than for non-stereotypical word pairs, such as *black–balm*) reflects an individual’s level of prejudice. We show, in three experiments, that stereotype priming effects associated with race, gender, and age can be explained through semantic co-occurrence in the culture: (1) Once objective associative strength between word pairs is taken into account, stereotype priming effects become nonsignificant; (2) the relationship between response time and associative strength is identical for social primes and nonsocial primes; and (3) the correlation between associative-value-controlled stereotype priming and self-report measures of racism, sexism, or ageism is near zero. The racist/sexist/ageist in all of us appears to be a mere reflection of the surrounding culture.

Associative Learning**Regency DEFH, Saturday Morning, 8:00–10:20***Chaired by Dennis J. Delprato, Eastern Michigan University***8:00–8:15 (135)**

Failures to Detect Cue-Independent Retroactive Interference. DENNIS J. DELPRATO, *Eastern Michigan University*—Nearly a century after the discovery of what is called retroactive inhibition (or interference-RI), M. C. Anderson and collaborators offered the first viable conceptual and operational framework for determining if inhibitory processes indeed participate in this and related classes of forgetting. The main theoretical hypothesis is that inhibition acts directly on representations of target items; therefore, inhibition functions as a cue-independent source of forgetting that is separate from associative or cue-dependent effects such as competition/blocking and associative weakening. Four experiments used paired words across two successive lists in within-list manipulations of baseline and interference conditions. Cue-independent RI could have occurred at 11 comparisons over the experiments when cues not episodically associated with targets under interference conditions were used on retention tests. Despite (1) using a variety of cues and testing conditions (e.g., paced, unpaced, forced) and (2) obtaining cue-dependent RI in all experiments, cue-independent RI was never found.

8:20–8:35 (136)

A Unified Theory of All-or-None (A-O-N) and Incremental Learning Processes. CHIZUKO IZAWA, *Stanford University*—The A-O-N versus incremental learning debate was examined under study–test–rest (S–T–R) Presentation-Programs SSSSSST, SSST, ST, S, and STTTTTT in a relatively simple paired-associate learning (PAL) situation. Learning performances jumped from the unlearned to the learned state in the A-O-N fashion, notwithstanding small nonsignificant incremental trends during some precriterion trials. HR and GSR data noted relaxation occurring abruptly a few trials before actual learning. Thus, relaxation might facilitate mastery. Unlearned items lacked such sudden jumps for all three response measures. An inclusive, third perspective—that is, a unified theory—is advocated: A-O-N learning can be regarded as a special case of incremental learning (PAL) (cf. Estes’ mathematical derivations, 1959). The former is associated with simple/easy learning situations, whereas the latter involves complex/difficult learning situations. The two views need not continue as a dichotomy since they derive from two extremes of the same dimension—namely, the simple/easy and complex/difficult learning situations.

8:40–8:55 (137)

A Couple of Weird Things About Feedback Effects in Paired-Associate Learning. REED HUNT, *University of Texas, San Antonio*, MELISSA D. MCCONNELL, *University of North Carolina, Greensboro*, & REBEKAH E. SMITH, *University of Texas, San Antonio*—Pashler, Cepeda, Wixted, and Rohrer (2005) reported that in paired-associate learning, immediate feedback did not affect performance on initially correct items when a subsequent test occurred a week later.

This is an interesting result because feedback entailed repetition of the item. Our experiment examines the reliability of this result as a function of delay of second test and contrasts immediate feedback with delayed feedback on the premise that delayed feedback is analogous to spaced repetition. Perhaps immediate feedback's ineffectiveness is the result of massed repetition. To the contrary, all combinations of feedback timing and second test delay replicated Pashler et al.'s result for initially correct responses. The data also contained a potentially important new result in the form of exaggerated rates of commission errors following immediate feedback. This finding is important because virtually every study of feedback reports significant perseveration of initial commission errors onto later tests.

9:00–9:15 (138)

Working Memory Load Boosts Learning in a Blocking Paradigm: An fMRI Study. CHRISTIAN C. LUHMANN, NICHOLAS B. TURK-BROWNE, & MARVIN M. CHUN, *Yale University*—Blocking is a classic phenomenon in which learning is suppressed when events are completely predictable. Associative learning theory explains blocking (and other forms of learning) by relying on prediction error. However, critics of associative theory have demonstrated that performing a difficult secondary task during learning attenuates blocking, suggesting that blocking stems from nonassociative processes. The present fMRI experiment sought to evaluate these accounts of blocking. Subjects completed two runs of a learning task, one with load and one without. Behaviorally, blocking was only observed under no load. Activity in right prefrontal cortex also exhibited a blocking effect under no load. Like behavior, the neural blocking effect in this region was significantly reduced under load. Activity in this region also conformed to a variety of additional predictions from associative learning theory. These results suggest that working memory load actually increases the amount of learning during blocking, supporting an associative account.

9:20–9:35 (139)

Selective Attention and Blocking in Human Learning. MARK B. SURET, MIKE E. LE PELLEY, & THOMAS BEESLEY, *Cardiff University* (sponsored by Mark E. Bouton)—Blocking refers to the finding that learning about the relationship between a cue and an outcome is reduced if that cue is trained in compound with a second cue that has been previously established as a reliable predictor of the outcome. It has previously been proposed that blocking reflects a reduction in the amount of attention paid to the blocked cue. We present evidence from a study of human learning that is consistent with this suggestion. However, in this experiment (as in all others looking at attentional effects in human learning) the relative predictiveness of the cues involved is confounded with differences in their absolute associative strength. A second experiment deconfounds these variables; results indicate that it is absolute strength, rather than relative predictiveness, that is the crucial determinant of stimulus processing. These results provide a challenge to the prevailing view of the operation of selective attention in learning.

9:40–9:55 (140)

Associative Learning and Stereotype Formation: The Influence of Learned Predictiveness. MIKE E. LE PELLEY, *Cardiff University*, STIAN J. REIMERS, *University College London*, & GUGLIELMO CALVINI, *Cardiff University*—Stereotypes are beliefs about traits that are shared by members of a social group. Stereotype formation is complicated by the fact that target individuals belong to several groups simultaneously (by gender, age, race, etc.). Hence, stereotype formation can be seen as a categorization problem, in which people learn to associate certain category features (but not others) with traits. What, then, determines the extent to which a given category feature supports stereotype formation? One possibility (deriving from studies of animal conditioning) is that biases in stereotype formation reflect the operation of associative mechanisms allowing for changes in the “associability” of cues as a consequence of differences in their prior predictiveness. We demonstrate that this is indeed the case. In

more general terms, our results indicate that an appreciation of the mechanisms underlying animal conditioning and associative learning can aid our understanding of relatively complex examples of human learning and behavior.

10:00–10:15 (141)

Group Predictiveness Bias in Social Stereotype Formation and Expression: Bias in Group Associability or Simple Response Strength Effect? GUGLIELMO CALVINI & MIKE E. LE PELLEY, *Cardiff University*, & STIAN J. REIMERS, *University College London*—Mechanisms of associative learning appear to govern the ability to attribute traits and behavioral dispositions to social categories and to form social stereotypes. Furthermore, the predictive history of social categories seems to determine the strength of such stereotypic associations. Learning that membership of a group reliably predicts neutral events determines the strength of positive or negative beliefs subsequently formed about the group. However, group predictiveness might also affect the strength of evaluative responses elicited by group membership. To test such hypothesis, a series of experiments was conducted whereby participants experienced group predictiveness after forming an evaluation of the group's behavior. The results indicate that learning that a social group is a poor predictor after forming a strong evaluation does not moderate evaluative responses to the group. This confirms that group predictiveness only biases the formation of stereotypic associations, whereas it does not affect the strength of the responses to the group.

Recall Processes

Beacon A, Saturday Morning, 8:00–10:00

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

8:00–8:15 (142)

Context Fluctuation and Time-Dependent Memory Phenomena. STEVEN M. SMITH, *Texas A&M University*—Why do memory phenomena such as long-term recency, reminiscence, expanding retrieval practice effects, and spacing of repetitions effects depend upon temporal parameters? Estes (1955) said, “. . . an unfilled temporal interval never remains permanently satisfying as an explanatory variable,” and he suggested that statistical properties of random environmental events during temporal intervals (what some have referred to as “contextual fluctuation”) can explain many such effects. Can contextual fluctuation be experimentally manipulated? The results of a powerful manipulation of environmental context effects, operationally defined as background movie scenes for stimulus words, indicate strong effects of context reinstatement on recall. Context fluctuation was manipulated, holding time constant, by showing many changing movie scenes versus showing one long relatively constant scene. Effects of faster scene changes (i.e., more context fluctuation) resembled effects of longer time intervals on long-term recency.

8:20–8:35 (143)

The Interaction of Task Context and Temporal Context in Free Recall. SEAN M. POLYN, *University of Pennsylvania*, KENNETH A. NORMAN, *Princeton University*, & MICHAEL J. KAHANA, *University of Pennsylvania*—The principle of encoding specificity states that memory retrieval will be most successful when the memory cues available at retrieval match those present at study. Here, we investigate the ability of the memory system to alter the set of available cues on the fly during the search process, by retrieving and maintaining contextual details associated with the studied items. Thus, by retrieving context, the human memory system can make the brain state resemble the state it was in during encoding, facilitating further recalls. We investigated this dynamic in a series of free-recall experiments in which encoding task context varied within a list. Subjects exhibited clustering of recalls by task context; this effect interacted with temporal clustering. We present a model of memory search based on Howard and Kahana's Temporal Context Model that explains these re-

sults by the simultaneous use of task and temporal context representations to probe memory.

8:40–8:55 (144)

The Zero-Sum Trade-Off and Scallop Effects in Spacing Designs. PETER F. DELANEY, *University of North Carolina, Greensboro*, & PETER P. J. L. VERKOEIJEN, *Erasmus University Rotterdam*—The present work explored two systematic within-list serial position effects that arise from including repeated presentations of items within a list: the zero-sum trade-off effect and the scallop effect. A zero-sum trade-off effect occurs when the height in the primacy region of the serial position function is inversely correlated with the height in the rest of the list. Unequal zero-sum trade-off effects across experimental conditions can be mistaken for other effects if primacy and recency regions are discarded from recall, or if ceiling effects occur in the primacy region. A scallop effect occurs when people use repeated long presentations to consolidate the preceding short presentations, as when several massed items follow several spaced items. The scallop effect results in some spaced items being better recalled than others, which can be confused with lag effects.

9:00–9:15 (145)

Exploring the Limits of Memory Access Control and Binding Mechanisms. MICHAEL S. HUMPHREYS, KRISTA L. MURRAY, & ANGELA M. MAGUIRE, *University of Queensland*—An analogue to the problem of remembering where you parked today, in the face of interference from prior parking memories, was instantiated by having participants learn a long list before learning a series of short lists. After each short list they received two cues. Both cues could refer to the short list (no-switch trials) or the first cue could refer to the long list and the second to the short list (switch trials). Each experiment made the task of focusing retrieval progressively more difficult. In the first experiment switch and no-switch trials occurred in blocks and in the second and third they were randomly intermixed. In addition, in the third experiment the same words were used in the long and short lists (an AB ABr paradigm, which requires a 3-way binding). In all three experiments participants were able to flexibly focus their retrieval efforts though it came with a cost.

9:20–9:35 (146)

Divided Attention and Repetition at Study: Effects on Group Recall. LUCIANE P. PEREIRA-PASARIN & SUPARNA RAJARAM, *Stony Brook University* (read by Suparna Rajaram)—Collaborative inhibition refers to the phenomenon that a group that works together performs worse than a nominal group where an equal number of individuals work alone and their nonredundant responses are pooled. We asked whether collaborative inhibition can be reduced under conditions where poorer or stronger individual memory changes the strength of individual organization. Participants studied categorized word lists and performed a free recall test in groups of 3 (collaborative) or individually (nominal). In Experiment 1, divided attention at study predictably reduced recall and weakened the individual subjective organization (ARC scores) of information. Critically, and as a result, collaborative inhibition also reduced following divided attention encoding. In Experiment 2, repetition at study predictably improved recall and strengthened individual subjective organization. Consequently, this opposite effect on organization also reduced collaborative inhibition. We discuss when collaboration can benefit or hurt individual performance and the role of individual organization in modulating this process.

9:40–9:55 (147)

The Ins and Outs of Memory: Written Versus Spoken Recall. RONALD T. KELLOGG, *St. Louis University*—Explicit memory is known to depend on input modality, with recent events showing a strong advantage when presented aurally rather than visually. The effects of output modality are less clear, but a writing deficit is plausible. In contrast to speaking, writing uses both phonological and or-

thographic representations that must be maintained in working memory for relatively long intervals due to slow motor output. It is also less practiced and automatic compared with speaking. Because writing makes greater demands on working memory storage and executive attention, it may reduce retrieval effort as a consequence. The evidence from word list recall is mixed, with some data even supporting the opposite conclusion of a writing superiority effect. However, recalling texts, complex visual events, autobiographical events, and category exemplars all show a writing deficit. These tests all require a significant degree of retrieval effort that writing appears to disrupt.

Cognitive Control

Beacon B, Saturday Morning, 8:00–9:40

Chaired by Keith A. Hutchison, Montana State University

8:00–8:15 (148)

Attentional Control, Relatedness Proportion, and Target Degradation Effects on Semantic Priming. KEITH A. HUTCHISON, *Montana State University*—Past research has demonstrated that target degradation effects (degradation \times priming interactions) only occur when participants receive a stimulus list with many related items (i.e., a relatedness proportion, RP, of .50 or more). In this study, participants completed both an attentional control battery (Ospan, Antisaccade, and Stroop tasks) and a semantic priming task in which target words were presented either clearly or visually degraded and RP was manipulated within participants, within blocks using prime color to indicate the probability (.78 or .22) a to-be-named target would be related. Replicating Hutchison (2007), significant RP effects occurred and linearly increased with attentional control, indicating participants' flexible use of an effortful conscious expectancy process. However, overall target degradation effects occurred that were not dependent upon conditional RP or levels of attentional control, suggesting that degradation effects are not under participants' conscious control and are a function of overall, rather than conditional, RP

8:20–8:35 (149)

Cognitive Control, Task Goals, and Memory. FREDERICK VERBRUGGEN, *Ghent University and Vanderbilt University*, & GORDON D. LOGAN, *Vanderbilt University*—Cognitive control theories attribute control to executive processes that adjust and control behavior online. Theories of automaticity attribute control of skilled behavior to memory retrieval (MR). We contrasted online adjustments (OA) with MR, elucidating their roles in controlling performance in the stop-signal paradigm. We found evidence of short-term OA after unsuccessful stopping. In addition, we found that MR can slow responses for 1–10 trials after successful inhibition, suggesting the automatic retrieval of task goals. Based on these findings, we concluded that cognitive control can rely on both MR and OA.

8:40–8:55 (150)

Postconflict Slowing Depends on Relative Frequency of Conflict. WIM NOTEBAERT, WIM GEVERS, WIM FIAS, & TOM VERGUTS, *Ghent University*—Cognitive control processes impose behavioral adaptations after the detection of conflict (e.g., incongruent Stroop stimuli) and errors. The literature reveals that adaptation after conflict differs from adaptation after errors; after an error, reaction times increase, while this is not observed after conflict trials. An important difference between errors and conflict trials is the frequency of their occurrence: Whereas conflict typically occurs on 50% of the trials, errors occur with a much lower frequency. In this study, we investigated whether the frequency of conflict trials determines the occurrence of postconflict slowing. When conflict occurred on 25% of the trials, postconflict slowing was observed, but when conflict occurred on 75% of the trials, slowing was observed after nonconflict (congruent) trials. This suggests that slowing is not triggered by conflict (or error), but rather by the detection of unexpected events. The results are discussed in terms of conflict monitoring theory.

9:00–9:15 (151)

Conflict-Triggered Goal Shielding: Effects of Conflict on Cognitive Control and Background Monitoring. THOMAS GOSCHKE & GESINE DREISBACH, *Technical University of Dresden*—Action control in a changing environment requires that one shields current goals from distracting information (goal shielding) while at the same time monitoring the environment for potentially significant stimuli that may afford a goal switch (background monitoring). Response conflicts modulate the balance between goal shielding and background monitoring as indicated by reduced susceptibility to interference after response conflicts. Such conflict-adaptation effects have been attributed to enhanced recruitment of cognitive control on trials following conflicts. Here, we show that conflicts trigger increased goal shielding already on the current conflict trial. Participants performed a spatial compatibility task during which they had to notice rare prospective memory (PM) cues. PM cues were overlooked more often on trials involving response conflicts, indicating increased shielding of the current goal and inhibition of distractors on the current trial. Thus evidence for enhanced recruitment of control following conflict may partly reflect aftereffects of goal shielding on the current conflict trial.

9:20–9:35 (152)

Individual Differences in Executive Control Functions. OLGA CHUNTONOV & DANIEL GOPHER, *Technion, Israel Institute of Technology* (read by Daniel Gopher)—We studied individual differences in the control abilities to focus and mobilize attention within the task-switching paradigm. A digit or a letter classification task was performed in a 40-trial block. Tasks were switched with 10% or 50% probability. Performance in uniform blocks was compared with task-switching blocks. Additional manipulations were presentation of flankers of the same or other task, and use of two versus four response keys (bivalent vs. univalent conditions). Manipulations had strong influence on performance. Correlational analysis showed strong and reliable individual differences. However, the two response conditions had only a single factor accounting for both focusing and switching performance. In the four separate response conditions, there were two correlated factors for switching and focusing performance. The requirement to change responses appears to involve a different control mechanism, which was not tapped when task probability, perceptual interference levels, stimulus type, or S–R mapping rules change.

Word Recognition

Seaview, Saturday Morning, 8:00–9:40

Chaired by Niels O. Schiller
Leiden Institute for Brain and Cognition

8:00–8:15 (153)

Type of Letter Effects in Reading Aloud: The Case of Vowels Versus Consonants. NIELS O. SCHILLER, *Leiden Institute for Brain and Cognition*—Readers need to extract meaningful information from orthographic representations in order to understand words and sentences. Recognition of printed words in alphabetic script during reading is mediated by some orthographic processing involving at least the word's component letters or graphemes. However, there are suggestions in the literature that orthographic representations of words may include more than a flat string of graphemes. For instance, it has been proposed that they are hierarchically structured, with multiple tiers representing different aspects of orthographic representations such as the consonant–vowel (CV) status of graphemes or the grapho-syllabic structure of words. The present study supports this proposal through investigating the effect of type of grapheme (vowel vs. consonant) on the masked onset priming effect (MOPE). It was found that C-initial words show a standard MOPE, whereas V-initial words do not. The implications of this result for reading and reading disorders are discussed.

8:20–8:35 (154)

Masked Priming by Misspellings: When Is Near Enough Good

Enough? JENNIFER S. BURT & BRIAN SHERMAN, *University of Queensland*—A masked prime consisting of a misspelling of an 8- to 9-letter target word may facilitate identification of the target. A series of masked priming experiments assessed the impact of misspelled primes in the lexical decision task as a function of target frequency, phonological similarity to the target, and prime–target SOA. Low-frequency targets showed facilitation at SOAs of 47 and 80 msec regardless of the phonological similarity of the prime and target. High- and medium-frequency targets showed equivalent facilitation by phonologically similar and dissimilar primes at the short SOA. At the long SOA, high-frequency targets failed to show priming and medium-frequency targets were facilitated by phonologically similar but not dissimilar primes. Priming by misspellings appears to depend upon the speed of target processing and the impacts of early orthographic and later phonological information from the prime.

8:40–8:55 (155)

Masked Priming Effects With Horizontal and Vertical Text. KENNETH I. FORSTER, XIAOMEI QIAO, & NAKO WITZEL, *University of Arizona*—Strong masked priming effects are obtained despite changes in the absolute positions of letters (transposition priming), e.g., *jugde*–*JUDGE*. A suggested explanation is that the relative positions of most of the letters are still preserved. This requires the existence of relative position detectors such as open bigrams, which represent words in terms of discontinuous elements (e.g., *jd*, *jd*, *ud*, etc.). How such detectors are formed is open to question. One possibility is that these detectors code for spatial relations between letters (e.g., *j* is to the left of *d*). If so, then transposition priming should not be obtained when spatial relations are transformed, as in vertically displayed English text. However, this should not be the case for Japanese and Chinese readers.

9:00–9:15 (156)

Masked Priming of Orthographic Neighbors: An Examination of the Lexical Competition Assumption. STEPHEN J. LUPKER, *University of Western Ontario*, COLIN J. DAVIS, *Royal Holloway University of London*, & JASON R. PERRY, *University of Western Ontario*—The key assumption in McClelland and Rumelhart's (1981) IA model is that lexical activation is a competitive process. Specifically, when a word is read, the word's lexical unit and those of its orthographic neighbors become activated. The activated units then mutually inhibit one another until the activation of one unit reaches threshold. In the present experiments, different types of masked primes were used in a lexical decision task in order to control the initial pattern of lexical activation and, hence, the nature of the inhibition. Primes were either letters that distinguish between two neighbors (e.g., *C####* for the targets *CLOUD* or *ALoud*) or nonwords (or partial words) with only one neighbor (e.g., *digar* or *#igar* for *CIGAR*) or many neighbors (e.g., *neach* or *#each* for *BEACH* or *PEACH*). The results indicate that primes that activate more potential competitors produce smaller priming effects, providing support for the lexical competition assumption.

9:20–9:35 (157)

Neighborhood Effects in Word Recognition: It's Not Where You Live, It's How You Get Home. JAMES S. MAGNUSON & DANIEL MIRMAN, *University of Connecticut and Haskins Laboratories*—Having more neighbors (similar sounding or looking words) speeds visual word recognition, but slows spoken word recognition. It is sometimes suggested that this may be because written words can be experienced in parallel, whereas spoken words are necessarily experienced serially. To our knowledge, this has neither been tested nor elaborated with a mechanistic explanation. We tested whether serial experience of visual words would reverse neighborhood effects by using low-contrast, high-pass filtered words that induce letter-by-letter reading (Fiset et al., 2006). One group performed lexical decision with unfiltered text, and another with filtered text. The unfiltered group showed the expected large neighborhood advantage, whereas the filtered group showed the opposite effect. Thus, mode of experi-

ence may indeed account for opposite effects of neighborhood in visual and spoken word recognition. We show how this result follows naturally from accounts based on attractor dynamics or basic principles of the interactive activation framework.

Event Cognition
Shoreline, Saturday Morning, 8:00–10:00

Chaired by Michael E. Young
Southern Illinois University, Carbondale

8:00–8:15 (158)

Stimulus Dynamics Alter the Perception of Time: Faster Is Longer. JOSHUA S. BECKMANN & MICHAEL E. YOUNG, *Southern Illinois University, Carbondale* (read by Michael E. Young)—The purpose of the present study was to observe the functional relationship between stimulus dynamics and stimulus duration discrimination. Participants performed a bisection task requiring the judgment of the duration of a stimulus (a sphere) that rotated on its *y*-axis at various rates. In Experiment 1, temporal discrimination was observed under four rotation speeds (88.9, 44.4, 22.2, and 0 deg/sec). Participants' duration judgments were longer the faster the sphere was rotated. In Experiment 2, the original effect was replicated across a much wider range of rotation speeds (711.1–2.7 deg/sec). In Experiment 3, we demonstrate that the effect is increased or decreased by establishing contingencies based on time or stimulus change. These results are used to test various quantitative models of temporal discrimination by adapting them for sensitivity to stimulus change (thus reflecting stimulus dynamics) rather than the mere passage of time.

8:20–8:35 (159)

Continuity Editing in Narrative Film and the Perception of Event Boundaries. JOSEPH P. MAGLIANO, *Northern Illinois University*, JEFFREY M. ZACKS & KHENAN M. SWALLOW, *Washington University*, & NICOLE SPEER, *University of Colorado*—Narrative films typically consist of hundreds of camera shots that are edited together. These edits influence the viewer's perception of narrative continuity. We explored the impact of edits that affect spatial, temporal, and action continuity on the perception of event boundaries by looking at participants' behavioral segmentation of a narrative film, and brain activity while viewing the same film (using functional MRI). Edits that produced discontinuities in action more frequently coincided with judgments that a new event had begun than did spatial or temporal discontinuities. Moreover, the perception of event boundaries was attenuated when discontinuities in space and time were not accompanied by discontinuity in action. Patterns of brain activity during edits suggested that perceptual systems are selectively engaged when edits introduce spatiotemporal discontinuities that co-occur with action continuity, but not when there is discontinuity of actions. Such processing may allow viewers to bridge these discontinuities and treat the continuing action as a single ongoing event

8:40–8:55 (160)

Perceptual Events May Be the “Episodes” in Episodic Memory. KHENAN M. SWALLOW, JEFFREY M. ZACKS, & RICHARD A. ABRAMS, *Washington University* (read by Jeffrey M. Zacks)—The perception of everyday activities is structured in time such that people segment continuous activity into events. A theory of event perception proposed by Zacks and colleagues (2007, *Psychological Bulletin*) makes two predictions about the relationship between event segmentation and memory. First, when a boundary between two events is crossed working memory is updated to represent the new event, rendering information from the previous event less available. Second, information that is present at event boundaries receives more intensive processing, which increases its strength in long-term memory. To test these predictions we administered object recognition tests to participants as they watched movie clips. Recognition test performance supported both predictions. Together with new imaging data,

these data provide compelling evidence that event boundaries act as a form of control over memory processes.

9:00–9:15 (161)

Moving Through Space: What and Where. GABRIEL A. RADVANSKY & ANDREA K. TAMPLIN, *University of Notre Dame*—In two experiments, people memorized a map of a building, including the locations of objects within the rooms of the building. Following memorization, people navigated a virtual reality environment of the memorized building and were probed with object names from all of the rooms, following a procedure developed in research on text comprehension (e.g., Bower & Morrow, 1990; Rinck & Bower, 1993) and extended to Virtual Reality (e.g., Radvansky, Tamplin, & Copeland, 2007). We observed that responses to probes were markedly slower in the room a person had just entered relative to the other rooms in the building. A follow-up experiment having people progress through a year using a monthly calendar showed the opposite pattern. This suggests that the suppression effect of the first experiment is due to how a person moves through space, not to a general cognitive progression through a series.

9:20–9:35 (162)

The Role of Risk in Perceiving and Remembering Events. SHULAN LU, LONNIE WAKEFIELD, & DEVIN PIERCE, *Texas A&M University, Commerce*—Studies are inconclusive regarding the role of the beginnings and the ends of events. The present study investigated how risk affects the processing of beginnings and ends. For example, people risk their fingers while cutting celery. Participants viewed films that had risks at either the beginning or the end while their eye movements were recorded, then answered true or false to statements regarding the beginnings and ends. When events had risks at the beginnings as opposed to no risks, there were longer fixations, more correct, and faster answers to the beginnings. When events had risks at the ends as opposed to no risks, there were slightly more correct answers regarding ends, but longer fixations before the end points. The present study suggested that people attend more to the beginning when an event has risks at the beginning and that people make perceptual predictions of the risks at the ends.

9:40–9:55 (163)

On the Path Toward Understanding the Dynamics of Aspect in Descriptions of Motion Events. TEENIE MATLOCK, *University of California, Merced*, CAITLIN FAUSEY, *Stanford University*, & SARAH CARGILL & MICHAEL SPIVEY, *Cornell University*—How do people process aspectual markers in English? What's the difference between “David hiked” and “David was hiking”? Research has examined the function of aspect across languages or its role in the construction of situation models, but little is known about the dynamics of aspect in processing motion events. Here, we use a novel mouse-trajectory paradigm, adapted from Spivey, Grosjean, and Knoblich (2005) to investigate the time course of understanding motion events with different aspectual forms. Participants first heard a simple past or past progressive description that included information about movement toward a destination. Next they clicked on a character and dragged it into a picture to match the sentence. The results revealed differences in mouse trajectories toward destinations (e.g., greater adherence to the path itself during movement). The findings have implications for motion verb comprehension, event understanding, and perceptual simulation.

SYMPOSIUM: Embodied Perception and Cognition
Regency ABC, Saturday Morning, 9:40–12:20

Chaired by Maggie Shiffrar, Rutgers University, Newark

9:40–9:55 (164)

Symposium Title: Embodied Perception and Cognition. MAGGIE SHIFFRAR, *Rutgers University, Newark*, & DENNIS PROFFITT,

University of Virginia—Traditionally, researchers in perception and cognition have overlooked the fact that brains exist within bodies. Recent research, however, suggests that the body helps to define how people see and understand the outside world. The goal of this symposium is to provide an integrated overview of state of the art research on embodied perception and cognition. The speakers represent a diversity of approaches and techniques directed at the study of how having a body and moving that body changes the way people perceive, represent, and understand their physical and social environments. The central topics in this symposium include perception–action coupling, spatial perception, attention, motion perception, action understanding, and representational momentum. The presentations will be designed for a wide audience, and thus, will be of interest to experts and non-experts alike.

10:00–10:15 (165)

The Perception of Action-Scaled Affordances. BRETT FAJEN, *Rensselaer Polytechnic Institute*—What kinds of theoretical ideas are needed to do justice to the inextricable link between perception and action that is characteristic of so many routine and skilled behaviors? I will argue that the tight linkage between perception and action is neatly captured by the theory of affordances, according to which movements are guided by perceiving possibilities for action. My focus will be on action-scaled affordances—that is, possibilities for action that are constrained by limitations on actors' ability to move, such as how fast one can run, how sharply one can turn, and how hard one can decelerate. To perceive action-scaled affordances is to perceive the world in units that are directly related to one's action capabilities. I will show how the perception of action-scaled affordances plays a fundamental role in performing tasks such as steering, braking, and intercepting, for which information in optic flow and movement are tightly coupled.

10:20–10:35 (166)

How Motor Constraints and Experience Influence Perception. GÜNTHER KNOBLICH, *Rutgers University, Newark*—Do our action capabilities influence how we perceive our own actions and those of others? Cognitive psychologists and neuroscientists have long assumed that perception and action are clearly separated. Contrary to this supposition, I will defend the view that perception and action are closely linked. I will present two recent studies supporting this view. The first study demonstrates that Fitts's law does not only constrain how we move ourselves but that it also constrains what we perceive as doable for others. The second study addressed the role of expertise in perception. It demonstrates that keyboard actions affect pitch perception in pianists but not in novices. Such results strongly support the assumption that the motor system plays a crucial role in perception.

10:40–10:55 (167)

The Bio-Energetic Scaling of Perceived Space. DENNIS PROF-FITT, *University of Virginia*—The visual perception of spatial layout relates people's body and goals to the opportunities and bio-energetic costs of acting in the environment. Spatial perceptions are influenced, not only by optical and ocular-motor information, but also by people's purposes and physiological state. For example, under constant viewing conditions, the apparent incline of hills increases when people are tired or encumbered by wearing a heavy backpack. Hills also appear steeper to people who are experiencing blood glucose depletion, are in poor physical condition, or are elderly and in declining health, compared with those who are young, healthy, and fit. Apparent distances are similarly influenced by the bio-energetic state of the body; reduced bio-energetic potential results in an increase in apparent distances. In essence, the perceptual system scales spatial layout to the bio-energetic costs of intended actions.

11:00–11:15 (168)

Influences of the Body on Spatial Attention. CATHERINE L. REED & JOHN P. GARZA, *University of Denver*—The study of spatial at-

tention traditionally focuses on how it is influenced by the location of objects within the visual environment. However, a primary function of spatial attention is to plan physical actions. When events occur in the world, we need to integrate visual information with our current body position to help us prepare effective responses to these events. Furthermore, our current actions can subsequently influence further deployments of attention. Thus, spatial attention must be considered within the context of the body. In this talk, we will present research demonstrating that one's own body can influence spatial attention mechanisms: Hand position, function, and action are shown to be important influences on the prioritization of functional space near the body and the direction of attention. Together this work emphasizes a need for an embodied theory of spatial attention.

11:20–11:35 (169)

Seeing Yourself in Others. MAGGIE SHIFFRAR, *Rutgers University, Newark*—Effective social behavior requires the accurate and rapid perception of other people's actions. When a nearby person moves toward you, your visual system analyzes that movement so that you can determine whether that person is reaching out to shake your hand, to fix your tie, or to punch you. Psychophysical studies of the perception of human movement indicate that observers use their own bodily experience to interpret the actions of other people. For example, observers demonstrate greater visual sensitivity to point-light depictions of their own actions than to the actions of other people. This sensitivity enhancement is independent of visual experience. Indeed, enhanced visual sensitivity to self-generated motion occurs even when the observer's past actions appear on someone else's body. Finally, a study of hand perception by individuals born without hands further supports the hypothesis that observers use internal representations of their own body to perceive movement.

11:40–11:55 (170)

Predicting Movements That Are Hard to Perform: Biomechanics and Representational Momentum. MARGARET WILSON & JESSY LANCASTER, *University of California, Santa Cruz*—Human bodies are perceived differently than other stimuli—specifically, biomechanical knowledge of one's own body is recruited in perceiving others' bodies (e.g., Kourtzi & Shiffrar, 1999). Wilson and Knoblich (2005) propose more specifically that motor knowledge is used for perceptual prediction, to cast forward into the immediate future and simulate probable outcomes of others' movements. We support this claim using the phenomenon of representational momentum (RM), by showing that observers are sensitive to biomechanical constraints in generating these simulations. RM of human bodies is maximized for downward movements, and movements shown in the direction that they were originally filmed. In contrast, upward and backward movements exert a "drag" on the forward projection of RM. All the shown movements are biomechanically possible, but some are more natural and easy than others. This appears to affect observers' ability to generate robust simulations of these movements.

12:00–12:15 (171)

Tool Use and Intention Affect Perceived Distance. JESSICA WITT, *Purdue University*—Near space is defined relative to the extent of arm's reach, and thus, near space is scaled by reachability distance. Tool use extends reaching extent, and in so doing, it rescales spatial perceptions within near space. Compared to when no tool is held, objects that are beyond arm's reach appear closer when people intend to reach with a tool that allows the objects to be touched. This is one of several examples demonstrating that behavioral potential affects perception. Little is known, however, about what underlying mechanisms might be responsible for such action-specific influences on perception. Experiments are presented that implicate motor simulation as a mediator of these effects. When people view a surface with an intention to act, people perform a motor simulation of the intended action, and thereby, scale perceived space in terms of the simulated action and its outcome.

Skill Retention and Transfer
Regency DEFH, Saturday Morning, 10:40–12:00

Chaired by Thomas H. Carr, Michigan State University

10:40–10:55 (172)

When Adults Think Like Kids About Equality: Schema Activation and Time Pressure in Mathematical Problem Solving. SIVBOUNG C. GO, *Michigan State University*, PERCIVAL G. MATTHEWS & BETHANY RITTLE-JOHNSON, *Vanderbilt University*, & THOMAS H. CARR, *Michigan State University* (read by Thomas H. Carr)—When elementary-school-aged children solve $5 + 7 + 4 = 6 + _$, the most common response is 22 and the next most common response is 16—quite different from the algebraically correct response of 10. This error is thought to represent a mathematical misunderstanding of “equality” and its symbol, the equals sign. As a consequence of this misunderstanding, the equality symbol elicits various “add them up” strategies—add every number you see, or add to the equals sign and report what you get—rather than “make the two sides balance,” which is the mathematically correct understanding. College students get such problems right—if given unlimited time. But if practiced on simple addition and put under time pressure, they once again think like children, showing that old strategies don’t die. Instead they must be suppressed, and they can compete with newer and better strategies under demanding conditions.

11:00–11:15 (173)

Reverse Association in Simple Multiplication Is Task Dependent. JAMIE I. D. CAMPBELL & NICOLE D. ROBERT, *University of Saskatchewan*—Last year we reported a failure to find evidence that repetition of specific factoring problems ($54 = ? \times ?$) facilitated performance of corresponding multiplication problems ($6 \times 9 = ?$), and no evidence of facilitative transfer from multiplication ($6 \times 9 = ?$) to factoring ($54 = ? \times ?$). These negative results cast doubt on claims that memory for multiplication facts ($6 \times 9 = 54$) incorporates bidirectional links from factors to product and from product to factors. This year, we report two studies that did produce facilitative transfer in both directions between factoring and multiplication. Bidirectional transfer depends upon the type of transfer paradigm employed.

11:20–11:35 (174)

Typing Titles: Situation Model Development, Task Interference, and Typing Skill. TRINA C. KERSHAW, *University of Massachusetts*—Situation model development can be hindered by text properties, such as the lack of a title (cf. Bransford & Johnson, 1972), or by a competing task, such as proofreading. Research suggests that for highly skilled typists, transcription typing does not interfere with concurrent tasks such as text comprehension (cf. Gentner, 1988). However, when typists use an altered keyboard layout, it is likely that their situation model development will be hindered. Participants with varying levels of typing skill completed a transcription typing task of passages with or without a title on a regular or altered keyboard layout. The effects of skill interference on situation model development will be examined with respect to level of typing skill. Implications for theories of text comprehension, skill acquisition, and negative transfer will be discussed.

11:40–11:55 (175)

Physical but Not Mental Practice Yields Retroactive Interference. ERICA L. WOHLDMANN, *California State University, Northridge*, & ALICE F. HEALY & LYLE E. BOURNE, *University of Colorado*—Eighty participants were trained to type 64 four-digit numbers 5 times each and were tested immediately on both practiced (old) and new numbers. Half the participants typed using their right index finger, and the remaining half typed using their left index finger. Next, participants were assigned to 1 of 4 conditions. They either mentally or physically practiced typing the old numbers 5 times each using either the same or the opposite hand as during initial training. On a final test,

all participants typed physically old and new numbers with the finger used initially. Reversing the hand used during practice led to slower execution times than did maintaining the same hand throughout practice (reflecting retroactive interference), but only with physical practice, not with mental practice. These results are consistent with the hypothesis (Wohldmann, Healy, & Bourne, 2007) that physical, but not mental, practice strengthens a representation that includes effector-dependent response execution processes.

Modeling Word Processing
Beacon A, Saturday Morning, 10:20–12:00

Chaired by Christopher T. Kello, George Mason University

10:20–10:35 (176)

Large-Scale Modeling of Lexical Processing. DARAGH E. SIBLEY & CHRISTOPHER T. KELLO, *George Mason University* (read by Christopher T. Kello)—No current model of lexical processing includes the tens of thousands of mono- and multisyllabic words that exist in real lexicons. No single connectionist model has simulated both word naming and lexical decision tasks for real words. Two modeling innovations are presented and used to build a large-scale connectionist model of word reading that simulates both naming and lexical decision. One innovation is to adapt simple recurrent networks for learning and processing nearly 75,000 orthographic and phonological wordforms of English. The other innovation is to integrate the representation and processing of wordforms using localist units, which enables the simulation of lexical decision in one mode of processing and word naming in another, without architecturally distinct mechanisms. Processing generalizes to pseudowords because activations can be distributed over the localist units. Model performance is compared with naming and lexical decision data for over 25,000 words taken from the eLexicon database.

10:40–10:55 (177)

Developmental Dyslexia and the Dual Route Model of Reading: Simulating Individual Differences and Subtypes. JOHANNES C. ZIEGLER, *CNRS and University of Aix-Marseille*—Developmental dyslexia is investigated in the context of the dual route cascaded model of reading aloud (DRC). Four tasks were designed to assess each representational level of the DRC: letter level, orthographic lexicon, phonological lexicon, and phoneme system. The data showed no single cause of dyslexia, but rather a complex pattern of phonological, phonemic, and letter processing deficits. Individual reading performance was simulated by adding noise at a level proportional to the underlying deficit(s) of each individual. The simulations not only accounted for individual reading patterns but also for different dyslexia profiles discussed in the literature (i.e., surface, phonological, mixed, and mild dyslexia). Thus, taking into account the multiplicity of underlying deficits on an individual basis provides a parsimonious and accurate description of developmental dyslexia. The present work highlights the necessity and merits of investigating dyslexia at the level of each individual rather than as a unitary disorder.

11:00–11:15 (178)

Nested Incremental Modeling: The CDP+ Model of Reading Aloud. MARCO ZORZI, *University of Padua*, CONRAD PERRY, *Swinburne University of Technology*, & JOHANNES C. ZIEGLER, *CNRS and University of Aix-Marseille* (sponsored by Patrick Lemaire)—We present a new Connectionist Dual Process model, CDP+, which builds upon the strengths of previous models while eliminating their weaknesses. Contrary to the Dual-Route Cascaded model, CDP+ is able to learn and produce graded consistency effects. Contrary to the Triangle model, CDP+ accounts for serial effects and has more accurate nonword reading performance. CDP+ also beats all previous models by an order of magnitude when predicting individual item-level variance on large databases. Extensions of the CDP+ model to the reading of bi-syllabic words are discussed.

11:20–11:35 (179)

Dynamic Processes in Visual Word Recognition: A New Theoretical Challenge. SHANNON O'MALLEY & DEREK BESNER, *University of Waterloo* (read by Derek Besner)—New findings illustrate how the effect of word frequency in reading aloud is context sensitive in a way unanticipated to date. These findings are taken to suggest that the underlying processing is dynamic in a way largely unanticipated to date. Several theoretical accounts are considered.

11:40–11:55 (180)

On the Biological and Computational Plausibility of Grandmother Cells. JEFFREY S. BOWERS, *University of Bristol*—Advocates of the PDP approach often highlight the similarity between the distributed representations learned in connectionist models and the neural networks implemented in the brain. Models with localist coding, including localist network models that learn, are often rejected on the basis of their biological implausibility. In this talk I review a variety of single-cell recording studies that undermine the common assumption that neuroscience data are more consistent with the PDP approach. Indeed, the field of neurophysiology is predicated on the (well-demonstrated) fact that the activity of single neurons correlates with perception and action. This observation is problematic for the PDP assumption that knowledge is coded in a distributed manner. I also challenge some of the common functional (computational) criticisms that are raised against models that include localist representations.

Visual Attention

Beacon B, Saturday Morning, 10:00–12:00

Chaired by Raymond M. Klein, *Dalhousie University*

10:00–10:15 (181)

Two Flavors of Inhibition of Return. ANA CHICA & JUAN LUPIÁÑEZ, *University of Granada*, & TRACY L. TAYLOR & RAYMOND M. KLEIN, *Dalhousie University* (read by Raymond M. Klein)—Inhibition of return (IOR) refers to slower reaction times to targets presented at previously stimulated or inspected locations. Taylor and Klein (2000) showed that IOR can affect both input and output processing, depending on whether the oculomotor system is in a quiescent or in a prepared state, respectively. If the motoric flavor of IOR is truly nonperceptual and nonattentional, no IOR should be observed when the responses to targets are not explicitly spatial. When the eyes moved to the peripheral cue and back to center before the target appeared (to emphasize the motoric component), IOR was generated in a detection task (for which motor preparation is important) but not in a color discrimination task. This same discrimination task showed IOR when the motoric component was not activated, by preventing eye movements to the cue. Thus, the motoric flavor of IOR, elicited by oculomotor programming is restricted to output processing.

10:20–10:35 (182)

Inducing Inhibition of Return in One Person Based on the Actions of Another. GEOFF G. COLE & PAUL A. SKARRATT, *University of Durham*, & ALAN KINGSTONE, *University of British Columbia*—Welsh et al. (2005) reported a highly novel inhibition of return (IOR) effect in which the phenomenon is induced in one person through the observation of another person's actions. They showed that participants were slower to make reaching responses to a location that had previously been responded to by another person (compared to a location where no previous response had been made). The present study examined whether this socially modulated IOR effect occurs when the observer only knows where the other person has responded, rather than actually seeing the response being made. The results showed the presence of IOR both when the reaching response was visible and when the response location was only inferred. This suggests that IOR can be induced on the basis of a higher order inference of the biological behavior of another individual.

10:40–10:55 (183)

Effects of Exogenous and Endogenous Orienting of Attention on Change Detection. GARY C.-W. SHYI & KIT-MAN YUEN, *National Chung Cheng University*—A large number of studies now show that people are surprisingly poor at detecting significant changes in visually presented scenes. In the present study, we conducted three experiments to investigate the relationship between orienting attention and change detection. In Experiments 1 and 2 we demonstrated, respectively, that exogenous and endogenous orienting can influence allocation of attention, which in turn can affect participants' performances on change detection. In Experiments 3, we compared and contrasted the relative dominance of exogenous versus endogenous orienting as a function of time course. The results showed that when both exogenously and endogenously attended items were provided, the timing of onset appearance was critical to determine whether exogenous or endogenous control would be activated, which in turn may enhance the performance of detecting changes. The implications of our findings for the role of attention in change blindness and change detection are discussed.

11:00–11:15 (184)

Masking and Decay in the Attentional Blink for Detection and Orientation Discrimination. BRADLEY J. WOLFGANG & PHILIP L. SMITH, *University of Melbourne*—The attentional blink (AB) is a transient perceptual deficit that is characterized by a reduction in second target performance following the correct identification of a first target presented between 100 and 500 msec earlier. The AB is thought to occur when inattention combines with a limitation in the availability of second target information. Theoretically, such a limitation could be (1) induced by visual masking, or (2) occur through passive stimulus decay in unmasked displays. We investigated the masking requirements for the detection and discrimination of two near-threshold Gabor patch stimuli. For detection, the AB was only found when stimuli were backward masked; for discrimination, an AB was obtained in both masked and unmasked displays. The decay-based AB for discrimination was additionally shown to depend on spatial frequency. We suggest that the attentional demands of perceptual processing interact with masking and stimulus decay to determine the strength of stimulus representations in visual short-term memory.

11:20–11:35 (185)

Whole Versus Partial Report: The Attentional Blink in RSVP Sentences. MARY C. POTTER, *MIT*, MARK NIEUWENSTEIN, *Vrije Universiteit Amsterdam*, & NINA STROHMINGER, *University of Michigan*—An attentional blink in RSVP target search (errors in reporting T2 at an SOA of about 200 msec) disappears when all items must be reported; instead, performance drops over serial position (Nieuwenstein & Potter, 2006). In contrast to unrelated items such as letters, words that form a sentence are easily remembered in RSVP (Potter, 1984). Would target words in sentences escape an attentional blink? Subjects either reported two red words (T1 and T2) or the whole sentence. There was a blink for T2 at an SOA of 187 msec in partial report, but in whole report T1 and T2 were easily remembered. When the sentence was scrambled, whole report dropped but partial report was unaffected: T1 was now better in partial than in whole report, but T2 (at an SOA of 187 msec) was again worse. The attentional blink is not due to memory processing of T1, but to selection.

11:40–11:55 (186)

Hold Everything! Hand Position Alters Vision. RICHARD A. ABRAMS, FENG DU, CHRISTOPHER C. DAVOLI, & WILLIAM H. KNAPP, *Washington University*—The present study explored the manner in which hand position may affect visual perception. We studied three classic visual attention tasks (visual search, inhibition of return, and attentional blink) during which the participants held their hands either near the stimulus display, or far from the display. Remarkably, the hands altered visual processing: People shifted their at-

tention between items more slowly when their hands were near the display. The same results were observed for both visible and invisible hands. This enhancement in vision for objects near the hands reveals a mechanism that could facilitate the detailed evaluation of objects for potential manipulation, or the assessment of potentially dangerous objects for a defensive response.

False Memory
Seaview, Saturday Morning, 10:00–12:00

Chaired by Ken McRae, University of Western Ontario

10:00–10:15 (187)

Schema-Based Gist and Backward Associations in False Memories. DAVID R. CANN, KEN McRAE & ALBERT N. KATZ, *University of Western Ontario* (read by Ken McRae)—We used recall and recognition tasks to examine predictions of two major theories of false memories. We manipulated backward associative strength, a central factor in activation monitoring theory, and gist strength, a central factor in fuzzy trace theory. We used common word lists from Deese/Roediger–McDermott (DRM) studies, and developed a new type of list (Gist lists). In recognition, the Gist lists, which are strong in terms of schema-based gist but low on backward associative strength, produced a similar proportion of false memories as DRM lists which had slightly lower gist strength, but far greater backward associative strength. Furthermore, DRM lists equated with the Gist lists on backward associative strength but differing on gist strength produced a lower proportion of false recognition memories. Due to differences in source monitoring, the recall results were more consistent with activation monitoring theory. Thus, this research provides evidence for aspects of both theories.

10:20–10:35 (188)

Gist Effects of Emotion on True and False Memory. CHARLES J. BRAINERD, *Cornell University*, L. M. STEIN, *PUCRS*, MARK L. HOWE, *Lancaster University*, VALERIE F. REYNA, *Cornell University*, & G. ROHENKOHL & R. FAVARIN DO SANTOS, *PUCRS*—We report a series of experiments that dealt with how the emotional content of study materials influences true and false memory. The object was to determine, using conjoint-recognition methodology, whether emotion effects were due to variations in the quality of verbatim or gist memories. The basic procedure was the same in all experiments: Subjects studied “emotional” DRM lists (i.e., list words varied in emotional valence and/or arousal). The major effect was that negative valence substantially elevated false memory and that it moderately elevated true memory. When the data were analyzed with the conjoint-recognition model, negative valence appeared to be a pure gist effect: The meaning-similarity parameters for false memory and true memory were both elevated. In addition to pinpointing gist memory as the locus of the valence effect, the model analyses ruled out some other hypotheses (e.g., that negative emotion increases false memory by disrupting true memories).

10:40–10:55 (189)

Source Judgments for True and False Memories Are Based on Memory Construction Rather Than Memory Strength. IRA E. HYMAN, REID A. NELSON, & CHRISTOPHER L. SHARP, *Western Washington University*—We investigated possible distinctions between true and false memories. Using DRM word lists, we presented participants sets of words presented in six colors. Each set contained items related and unrelated to a critical lure. On a recognition test, participants labeled a target old or new, rated their confidence, and were asked to state the color in which it had been presented. Contrary to a Single Strength Signal Detection Theory prediction, the percentage of words for which a color was claimed did not vary as a function of confidence. Instead claims of source information were based on the ability to construct source information, lending some support for Source Monitoring theory.

11:00–11:15 (190)

The Role of Metacognitive Strategies in the Rejection of False Memories. DAVIDE BRUNO & PHILIP A. HIGHAM, *University of Southampton*, & TIMOTHY J. PERFECT, *University of Plymouth* (sponsored by Timothy J. Perfect)—The production and rejection of false memories has been a topic of interest for a long time in the field of recognition memory. In particular, many studies have focused on how memorability influences acceptance and rejection of false alarms. If an item is very memorable (e.g., one’s own name) and such item is employed as a distractor at test, participants will tend to reject it very confidently. The present research is concerned with evaluating the metacognitive strategies participants employ to reject distractors. Experiments are presented where memorability is manipulated as a function of item strength (repetition) and of type of item (regular words, regular nonwords, and irregular nonwords). Also, participants’ confidence in accepting or rejecting distractors is assessed with the aid of type-2 signal detection interpretations

11:20–11:35 (191)

Generalizing the fSAM Model: Simulation of Core False Recall Effects. DANIEL R. KIMBALL & TROY A. SMITH, *University of Texas, Arlington*—Kimball, Smith, and Kahana (*Psychological Review*, in press) demonstrated that the fSAM model—the first fully specified quantitative model of false recall—could simulate several core findings involving false recall of DRM lists, including developmental patterns, specific list effects, association strength effects, and true–false correlations. Participants frequently intrude an unstudied critical word while recalling a DRM list comprising its strongest semantic associates. The fSAM model assumes that, during encoding, an unstudied word’s associations to list context strengthens in proportion to its joint strength of semantic association to all co-rehearsed words. During retrieval, words receive preference in proportion to their joint strength of semantic association to recently recalled words. We now report results showing that the fSAM model generalizes to other DRM false recall effects, including the effects of repeated study, repeated testing, repeated study–test trials, presentation rate, levels of processing, critical word presentation, and blocked versus random presentation of multiple lists.

Adjustments in Speech Recognition
Shoreline, Saturday Morning, 10:20–12:00

Chaired by Lynne C. Nygaard, Emory University

10:20–10:35 (192)

Perceptual Adaptation to Systematic Variation in Speech. JESSICA E. DUKE & LYNNE C. NYGAARD, *Emory University*, & JENNIFER S. QUEEN, *Rollins College* (read by Lynne C. Nygaard)—The present study investigated the time course of perceptual learning of talker- and accent-specific properties of spoken language. Adult native English speakers were exposed to Spanish-accented English for either 1 or 3 days of training and were tested both on the following day and six weeks after initial training. During training, listeners transcribed words and received feedback on their performance. At test, listeners transcribed novel words spoken by familiar and unfamiliar accented talkers. Overall, listeners trained on Spanish-accented speech for 1 or 3 days of training performed better than untrained controls. However, the benefits of additional training on performance and long-term retention may depend on the amount of variability encountered during training. The results suggest that exposure to accented speech allows listeners to perceptually adapt to systematic variation in the speech signal and to generalize accent-specific learning to novel words produced by both familiar and unfamiliar talkers.

10:40–10:55 (193)

The Effect of Experience on the Perception of Dialectal Variation. MEGHAN SUMNER & ARTHUR G. SAMUEL, *Stony Brook University*—Dialectal variation complicates the task of recognizing spo-

ken words. When living in a new dialect region, however, processing difficulties associated with dialectal variation dissipate over time. Through a series of priming tasks (form priming, semantic priming, and long-term repetition priming), we investigate the role of experience in the perception and representation of dialectal variation. The main questions addressed are: (1) How are cross-dialect variants recognized and stored, and (2) how are these variants accommodated by listeners with different levels of exposure to a particular dialect? Three claims are made based on the results: (1) Dialect production is not representative of dialect perception and representation, (2) experience is linked with a listener's ability to recognize and represent spoken words, and (3) there is a general benefit for having the status as the "ideal" variant, even if this variant is not the most common one.

11:00–11:15 (194)

First Impressions and Last Resorts: How Listeners Adjust to Speaker Variability. TANYA KRALJIC, *University of California, San Diego*, & ARTHUR G. SAMUEL & SUSAN E. BRENNAN, *Stony Brook University*—The study of speech perception is fundamentally the search for processes that support perceptual constancy—the perception of a variable physical signal as relatively constant. Little reliable acoustic invariance exists in speech. We propose that speech perception processes recover invariants not about the signal, but about the source that produced the signal, and examine the evidence the system can use to do so. We find perceptual learning for properties of speech resulting from idiosyncratic speaker characteristics; the same properties are not learned when they can be attributed to incidental factors. In the absence of explicit attribution, the perceptual system may rely on episodic order (a "first-impressions" heuristic), but this heuristic can be overridden when relevant pragmatic information is available (e.g., if the listener sees that the speaker has a pen in her mouth). Perceptual learning is a powerful mechanism for coping with variability, but is applied flexibly and conservatively.

11:20–11:35 (195)

Exploring the Relationship Between Face Familiarity and Speechreadability. KAREN LANDER, *University of Manchester*—

Theories of face perception suggest independence between identity and visual speech processing (Bruce & Young, 1986). In two experiments we explore how face familiarity influences speechreadability. In Experiment 1, we compare the speechreading performance from participants who are, or are not, artificially familiarized with the speaker. First, we measured baseline speechreading performance. Next, participants either view the speaker telling a story (familiarized group) or complete a pen and paper puzzle (control group). Speechreading performance is then measured again. Finally, participants view another story or complete another puzzle before speechreading performance is re-measured. The results suggest that speechreading performance improves faster when the participant is more familiar with the speaker. In Experiment 2 we explore this effect by comparing speechreading performance from a personally familiar face and an unfamiliar one. The results are discussed with regard to the independence of facial identity and visual speech processing and the factors that influence speechreading.

11:40–11:55 (196)

Penetrability of Speech Segmentation Strategies by Attentional Factors. SVEN L. MATTYS, *University of Bristol*—Although common in everyday listening conditions, attentional loads have been largely ignored in the literature on spoken-word recognition and segmentation. Here, we investigated whether listeners' segmentation strategies are affected by a concurrent attentional load [the penetrability hypothesis] and, if so, whether the nature of the load (lexical-semantic vs. acoustic-phonetic) interacts with the nature of the segmentation strategy (knowledge-driven vs. signal-driven) (the domain-specificity hypothesis). Participants performed a segmentation task in one ear while performing either semantic categorization or phoneme monitoring on unrelated stimuli in the other ear. Compared to baseline, both loads were found to increase knowledge-driven segmentation. The results show that speech-processing mechanisms are penetrable by attentional factors and that this effect is not domain specific: Reliance on meaning is elevated whenever a processing load is encountered, regardless of the nature of the load. This result is discussed relative to theories of segmentation that give primacy to knowledge-driven strategies.

SYMPOSIUM: Toward a Cognitive Psychology of Collective Memory: Methods, Data, and Theories
Regency ABC, Saturday Afternoon, 1:30–3:50

Chaired by Amanda J. Barnier, Macquarie University

1:30–1:45 (197)

Toward a Cognitive Psychology of Collective Memory: Methods, Data, and Theories. AMANDA J. BARNIER, *Macquarie University*—In recent years, across many disciplines, there has been increasing interest in the relationships among individuals remembering alone, individuals remembering in a group, and the group itself remembering. Cognitive psychologists have contributed a range of clever paradigms to this area, which map the reciprocal influences of individuals and their social groups on both remembering and forgetting. In this symposium, presenters describe experiments that used a range of paradigms (including collaborative recall, social contagion, and adaptations of retrieval-induced forgetting), that focused on a range of target material (from relatively simple material to more complex, emotional, personal memories), and that collected data from a range of participants (including younger adults or older adults, from laboratory settings and applied settings). Based on these methods and data, the presenters develop and discuss theoretical interpretations that will best capture the cognitive psychology of individual and collective memory.

1:50–2:05 (198)

Individual and Group Retrieval Efforts Modulate Later Memory Outcomes. HELENA M. BLUMEN & SUPARNA RAJARAM, *Stony Brook University* (read by Suparna Rajaram)—Group retrieval is a common social practice and one that is often emphasized in educational settings (e.g., study groups). Yet, the effects of group retrieval on later individual memory remain poorly understood. To understand this relationship, we compared three hypotheses—the individual-strategy hypothesis, the combined-strategy hypothesis and the group-strategy hypothesis—and tested the roles of two opposing cognitive processes, namely, anticipated benefits from re-exposure to study material during collaboration and losses from retrieval disruption that can occur because of other group members' output. Participants studied unrelated words and completed three successive recall trials in one of four conditions—III (individual–individual–individual), ICI (individual–collaborative–individual), CII (collaborative–individual–individual), and CCI (collaborative–collaborative–individual). The results support the group-strategy hypothesis and the individual-strategy hypothesis by showing that integrating other group members' output through repeated group recalls (CCI) and securing individual retrieval organization prior to group recall (ICI) are important for benefiting from re-exposure during group collaboration.

2:10–2:25 (199)

Collaboration Among Older Adults: The Role of Retrieval Manipulations. MICHELLE L. MEADE, *Montana State University*, & HENRY L. ROEDIGER III, *Washington University*—Age differences in collaborative inhibition were examined across repeated retrieval attempts. Subjects studied categorized word lists and were then given two consecutive recall tests and a final recognition test. On the first recall test, subjects were given cued or forced recall instructions and recalled the lists either alone or in collaboration with another subject of the same age group. Collaborative inhibition was found for both young and older adults on cued and forced recall tests. Of interest was how this initial recall influenced subsequent memory performance. The subsequent cued recall test and the final recognition test were each taken individually. No lasting effect of collaborative inhibition was obtained when young and older adults were subsequently tested on an individual cued recall test or when subjects were tested on a final recognition test.

2:30–2:45 (200)

The Mystery of Stimulated Cognition in Collaborative Recall.

VERLIN B. HINSZ, *North Dakota State University*—People tend to believe that other people facilitate their recall of temporarily forgotten material. This belief is akin to socially cued recall and is consistent with the notion of stimulated cognition in that social interaction creates new solutions and responses. In contrast, combinations-of-contributions theory holds that group interaction cannot be truly creative and that group performance cannot exceed an optimal combination of the member contributions (e.g., memories). These contrasting perspectives are examined in a laboratory experiment involving the recall of information from a murder mystery. The recall performance of interacting dyads is compared to relevant individual conditions. Consistent with earlier research, dyads were found to achieve higher levels of recall performance, but did not exceed that expected from a direct combination of dyad member recollections. Moreover, the results demonstrated collaborative interference rather than socially cued recall. The results from a number of recall measures are inconsistent with the stimulated cognition perspective.

2:50–3:05 (201)

Interpersonal Source Monitoring of Eyewitness Evidence. D. STEPHEN LINDSAY, C. A. ELIZABETH BRIMACOMBE, LEORA C. DAHL, & MELISSA A. BOYCE, *University of Victoria*—When one person listens to another's memory report, the auditor evaluates (if only implicitly) the veracity of the speaker's report. Such evaluations may be based on beliefs regarding the speaker's expertise and/or on supposed cues to reliability in the speaker's behavior (e.g., fluency, amount of detail, apparent confidence). My colleague Elizabeth Brimacombe, our students, and I have been exploring interpersonal metamemory in the context of simulated forensic investigations in which subject/investigators interview a witness to a video-taped crime, search a data base of potential suspects, rate the probability that their suspect is the culprit ($p[S = C]$), administer a lineup identification test to the witness, and re-rate $p[S = C]$. We find that undergraduate subject/investigators put far too much stock in witnesses, especially under conditions that lead witnesses to perform poorly, and that subject/investigators are as swayed by unreliable witnesses as by reliable ones. I'll review some of these experiments and discuss their implications.

3:10–3:25 (202)

Socially Shared Retrieval-Induced Forgetting of People's Flashbulb Memories of September 11. WILLIAM HIRST & ALIN COMAN, *New School for Social Research*—Something as commonplace as a conversation can shape and reshape memories. Although most work has focused on memory implantation, Cuc, Koppel, and Hirst (2007) recently demonstrated that silences in a conversation—specifically, a speakers' failure to recall aspects of a memory shared by a listener—will induce the listener to forget the unmentioned material more than would be expected if the conversation had never taken place. We extend this finding of socially shared retrieval-induced forgetting to emotionally intense material and to conversations about different, but related memories. We collected in a structured interview flashbulb memories of September 11, formed pairs, and then asked each pair to share their memories. A final recognition test for the information collected in the structured interview followed. Response times were recorded. Socially shared retrieval-induced forgetting was observed. Even when one talks about different emotionally intense events, conversations can alter memory.

3:30–3:45 (203)

Social Contagion of Autobiographical Memories. AMANDA J. BARNIER, *Macquarie University*, TASNEEM KHAN, *University of New South Wales*, & CELIA B. HARRIS & JOHN SUTTON, *Macquarie University*—Roediger and Meade's social contagion paradigm illustrates the impact of collaboration on individual memory. To examine its impact on more complex, self-relevant material, we adapted the procedure to autobiographical memories. In Session 1, participants individually recalled recent events such as their 18th birthday.

In Session 2, they described these events to a confederate and listened as the confederate described similar (scripted) events. They then took turns to describe the major points of each other's memories. Crucially, the confederate slipped positive or negative "contagion items" into their re-telling of participants' memories (e.g., "you thought your 18th birthday would be a major turning point"), which were not part of participants' original recall. On a final individual test, participants often incorporated, and even elaborated on, the false information from the confederate. Such "contagion" highlights the ways in which collaboration shapes individual remembering, even of memories that we assume that we "own."

Models of Recognition Processes
Regency DEFH, Saturday Afternoon, 1:30–3:30

Chaired by Scott D. Slotnick, Boston College

1:30–1:45 (204)

No Recollection in Recollection-Based Paradigms: ROC Analysis Supports a Continuous (Single-Process) Memory Model. SCOTT D. SLOTNICK, *Boston College* (sponsored by Scott D. Slotnick)—The dual-process model assumes memory is based on familiarity or the threshold process of recollection, whereas the single-process unequal variance model assumes memory is a continuous signal detection process. These models can be tested as the dual-process model predicts positively curved (U-shaped) source memory z -transformed receiver operating characteristics [z ROCs, plots of z (hit rates) vs. z (false alarm rates)] and the recently modified unequal variance model predicts linear or negatively curved (inverted U-shaped) source memory z ROCs. At study, in five source memory experiments, short lists of visual items were presented to the left or right of fixation. At test, responses to each item included a spatial location memory confidence rating (these were used to generate source memory ROCs and z ROCs). Critically, source memory z ROCs were negatively curved in all experiments, opposite in curvature to that predicted by the dual-process model and in support of the modified unequal variance model.

1:50–2:05 (205)

Testing the Threshold Nature of Recollection Using a Second-Choice Procedure. COLLEEN M. PARKS & ANDREW P. YONELINAS, *University of California, Davis*—We tested the predictions of various hybrid models of recognition that assume that recognition relies on a signal detection familiarity process and a threshold recollection process. In a four-alternative forced-choice recognition test, subjects were required to make a recognition response, as well as a second response in case the first one was wrong. When recognition performance is dominated by recollection, the models predict little to no relationship between first- and second-choice accuracy, whereas when familiarity contributes more to performance the models predict a positive relationship. As predicted, we found a fairly strong first–second choice relationship in a test of item recognition, but not in a standard associative recognition test. Moreover, a modest relationship emerged in associative recognition under conditions designed to allow familiarity to provide more substantial support of associative recognition. These results provide further evidence that recollection is subject to failure and is therefore well-described as a threshold process.

2:10–2:25 (206)

Controlled and Automatic Retrieval Processes: A New Test of the Independence Assumption. EDGAR ERDFELDER, MONIKA UN-DORF, TINA-SARAH AUER, & LUTZ CÜPPER, *University of Mannheim*—Dual-process models of recognition memory assume that both controlled recollection and automatic activation contribute to memory performance. A largely unresolved issue is whether both processes are uncorrelated (independence model), positively correlated (redundancy model), or negatively correlated (exclusivity model). We present and test the correlated-processes signal-detection

(CPSD) model, a dual-process measurement model that provides measures for both processes and the sign of their correlation. We report a series of experiments designed to test the validity of the model's memory and response bias parameters. In addition, we assessed process correlations in each of the experimental conditions. The results support the psychological validity of the CPSD model and corroborate the independence model of controlled and automatic retrieval processes.

2:30–2:45 (207)

Criterion or Distribution Shifts? The Within-List, Strength-Based Mirror Effect. PHILIP A. HIGHAM, *University of Southampton*, HELEN TAM, *University of Bristol*, DAVIDE BRUNO, *University of Southampton*, & TIMOTHY J. PERFECT, *University of Plymouth*—A common interpretation of the strength-based mirror effect in recognition memory is that participants adopt a more conservative old/new criterion following a strongly encoded list compared to a weakly encoded list. Furthermore, because participants do not vary their criterion on an item-by-item basis, the mirror effect is not observed if strength is varied within a single list. We present data that undermine this general notion, demonstrating strength-based mirror effects within lists when the list structure and test labels are appropriate. However, rather than interpret the results in terms of item-by-item criterion shifts, we suggest that the underlying distributions are located on different places on the strength-of-evidence scale. The results are discussed in terms of two classes of recognition memory models that are compatible with this distributional account: Differentiation models and multiprocess signal-detection models incorporating a metacognitive component.

2:50–3:05 (208)

The Relationship Between Old/New and Forced-Choice Recognition Memory Performance. YOONHEE JANG, JOHN T. WIXTED, & DAVID E. HUBER, *University of California, San Diego* (read by John T. Wixted)—Three models have been advanced to explain asymmetrical ROCs commonly observed on old/new recognition memory tasks. The unequal-variance signal-detection (UVSD) model assumes that recognition decisions are based on a continuous memory strength process that is governed by two Gaussian distributions. The dual-process signal-detection (DPSD) model assumes that recognition decisions are based either on a threshold-recollection process or on a continuous familiarity process. The mixture signal-detection (MSD) model holds that recognition memory decisions are based on a continuous memory strength process, but the old item distribution consists of a mixture of two equal-variance Gaussian distributions with different means. We tested the ability of these three models to predict two-alternative forced-choice recognition performance based on an ROC analysis of old/new recognition performance. The UVSD model explained more variance than either the DPSD or the MSD model. The UVSD model-based parameter estimates were also more sensible than those of the other two models.

3:10–3:25 (209)

Modeling Confidence Judgments in Recognition Memory. ROGER RATCLIFF & JEFFREY J. STARNES, *Ohio State University*—A model for confidence judgments in recognition memory that assumes that evidence for each confidence category is accumulated in a separate leaky diffusion process is presented. The model makes predictions for both the accuracy and RT distributions for each confidence judgment. Stimulus information is assumed to be represented as a normal distribution of values on a familiarity dimension. Confidence criteria are placed on this dimension and the accumulation rate for each response category is determined by the area under the distribution between the confidence criteria. The model incorporates several different but identifiable sources of variability which results in the standard interpretation of the z ROC function being no longer valid. Deviations of the slope from unity reflect both decision criterion settings across confidence criteria as well as differences in familiarity distribution standard deviations.

Animal Learning**Beacon A, Saturday Afternoon, 1:30–2:50***Chaired by Aaron P. Blaisdell, UCLA***1:30–1:45 (210)**

Development of an Automated Open Field for Examining Learning and Cognition in Pigeons. KENNETH J. LEISING, MICHAEL PARENTEAU, DENNIS GARLICK, STEVE BADELT, & AARON P. BLAISDELL, *UCLA* (read by Aaron P. Blaisdell)—We report behavioral experiments with pigeons using a new technology developed in our lab. The Automated Remote Environmental Navigation Apparatus (ARENA) consists of a network of stimulus–response modules that communicate wirelessly with a central computer. Pigeons were first autoshaped with grain reinforcement to peck at an ARENA module. Second, they rapidly learned a simultaneous color-discrimination using two ARENA modules. Third, pigeons acquired a conditional discrimination in which two ARENA modules were simultaneously lit with one of six colors—three colors signaling one module as the S+ and three colors signaling the other module as the S+. Finally, an array of eight ARENA modules was used to demonstrate overshadowing, with some modules serving as landmarks and others as response goals. Landmarks closer to the goal overshadowed spatial control by more distal landmarks. We demonstrate many advantages to automated open-field data collection, including reduced experimenter bias and increased consistency and throughput.

1:50–2:05 (211)

Parallels Between Second-Order Conditioned Excitation and Conditioned Inhibition. GONZALO P. URCELAY, JAMES E. WITNAUER, & RALPH R. MILLER, *Binghamton University* (read by Ralph R. Miller)—Experiments conducted in our laboratory have suggested that feature negative training (A+/AX–) results in second-order excitation to X after relatively few AX– trials and conditioned inhibition after many AX– trials. Parallel results can also be obtained when the context instead of a punctuate cue A mediates these excitatory and inhibitory effects (i.e., explicitly unpaired presentations of + and X–). In this presentation, we will review different manipulations (trial spacing, CS preexposure, and posttraining extinction) that result in symmetrical (but behaviorally opposing) effects on second-order excitation and conditioned inhibition. These basic phenomena (second-order excitation and conditioned inhibition) and the effect of different manipulations that impact these processes are readily explained by SOCR, a formal version of the extended comparator hypothesis (Stout & Miller, in press). These provocative results provide empirical grounds for further theoretical developments that explain second-order excitation and conditioned inhibition within a single framework.

2:10–2:25 (212)

Backward Blocking in First-Order Conditioning. KOUJI URUSHIHARA, *University of Hokkaido*, & RALPH R. MILLER, *Binghamton University*—Three lick suppression experiments with rats investigated backward blocking in first-order conditioning. The experiments demonstrated that backward blocking is difficult to obtain in conventional first-order conditioning situations, as priorly determined, and that backward blocking is obtainable in first-order conditioning if the target cue did not have (at least temporarily) the potential to control behavior at the time of elemental training with three different procedures, (1) forward blocking the compound stimulus with a third cue and then inducing release from forward blocking following elemental training with the backward blocking cue, (2) conducting compound and elemental training with backward temporal relationships to the US and assessing associative effects using second-order conditioning, and (3) extinguishing the target cue following compound training and conducting elemental training in a context different from that used in compound training, and then testing the target cue in the context that had been used for compound training (i.e., renewal).

2:30–2:45 (213)

Comparison of Learning Methods Applied to Dogs by Novice Handlers. STANLEY COREN, *University of British Columbia*—Little research has looked at the effectiveness of various methods of dog training when applied by novice dog trainers. Three groups of novice dog owners were trained to apply luring, physical prompting, or the traditional physical prompting with leash corrections in order to teach their dogs pet positional changes (specifically, sit, down, and stand). The performance of the dogs was monitored over 3 weeks and lure training was found to be most effective, whereas the traditional physical prompting with leash corrections was the least effective. In addition, measures of animal attitude and emotion (body signals and responsiveness to owners) was different for the different methods, with lure training producing the best responses, while physical prompting with corrections produced fewer approach responses to the handler. These results have clear implications for pet dog owners seeking to train their dogs effectively.

Timing and Attention**Beacon B, Saturday Afternoon, 1:30–3:10***Chaired by John J. McDonald, Simon Fraser University***1:30–1:45 (214)**

Electrical Neuroimaging Reveals Timing of Attentional Control in Human Brain. JOHN J. McDONALD & JESSICA J. GREEN, *Simon Fraser University*—The frontal lobes are believed to orchestrate attentional-control operations underlying our ability to shift attention in space. Functional brain imaging has revealed frontal and parietal activity in attention-cuing tasks, but due to the sluggishness of the fMRI signal, the sequence of attentional-control operations in the human brain remains unknown. Here, we used an analytical technique called beamforming to reconstruct both the timing and anatomical sources of low-frequency brain waves associated with attentional control. Following a signal to shift attention, control activity was seen in parietal cortex 100–200 msec prior to activity in frontal cortex. Parietal cortex was then re-activated prior to anticipatory biasing of activity in occipital cortex. The magnitudes of early parietal activations as well as later activations were strongly predictive of the degree of attentional improvement in perceptual performance. These results demonstrate that voluntary control of spatial attention involves initial feedforward activations prior to top-down attentional control.

1:50–2:05 (215)

Temporally Selective Attention Modulates Perception of Rapidly Presented Information. LISA D. SANDERS, LORI ASTHEIMER, WILLIAM BUSH, & AHREN FITZROY, *University of Massachusetts, Amherst*—Selective attention provides a mechanism by which people preferentially process subsets of stimuli when faced with overwhelming amounts of information. Spatially selective attention is important for perceiving complex scenes in which multiple objects are presented simultaneously at different locations. We present evidence from a series of experiments that indicate temporally selective attention plays an important role in perception when more information than can be processed in detail is presented rapidly. Specifically, participants can direct selective attention both to different levels of hierarchically organized rhythms and to distinct time points. Doing so modulates auditory and visually evoked potentials at early perceptual stages. Furthermore, directing temporally selective attention to hierarchical levels and specific time points affects perception of the rapidly changing acoustic features that constitute speech. Language experience and proficiency affect the skill with which listeners select the most relevant features and differentially process attended and unattended information in speech streams.

2:10–2:25 (216)

Timing and Task Switching Without Interference. CLAUDETTE FORTIN, *University of Laval*, RICHARD J. SCHWEICKERT, *Purdue*

University, & RÉMI GAUDREAU, *University of Laval* (read by Richard J. Schweickert)—Recent studies suggest that timing and executive functions are closely related. Interference between timing and one executive function, task switching, was examined in three experiments. Memory search and a digit task (odd–even) were performed in four conditions: search–search, search–digit, digit–search, and digit–digit. In a control condition, participants provided RT responses in each of the two tasks (T1 followed by T2). In a timing condition, participants responded to T2 at the end of an interval production in which T2 was interpolated (T1 followed by T2 concurrent with timing). When responding in T2 required a task switch, RTs were longer but produced intervals were unaffected. A dissociation was found in the last experiment: Longer RTs were obtained (1) by increasing memory load and (2) by task switching, whereas time productions were lengthened by increasing memory load only, not by task switching. These results suggest that timing is independent of task switching.

2:30–2:45 (217)

Temporal Contexts in Choice Response Time. TRISH VAN ZANDT & MARI RIESS JONES, *Ohio State University* (read by Mari Riess Jones)—The theory that a simple choice among N alternatives entails the gradual accumulation of evidence over time is widely accepted and consistent with recent neurophysiological studies. Although mathematical models embracing this idea vary, all assume that evidence accumulation can be represented as a stochastic process that terminates when the level of accumulated evidence exceeds a fixed criterion. Typically, a “front-end” signal detection theory offers parameters based on stimulus factors that determine variability in the rates of this accumulation process. We show that temporal properties of a task context within an experiment can affect this accumulation process. We present data indicating that subjects exploit task rhythm to improve their performance. A diffusion model describes the choice task, and an entrainment model (Large & Jones, 1999) describes modulation of diffusion parameters. Together these two models can explain some of the observed findings, including an elimination of a speed–accuracy trade-off.

2:50–3:05 (218)

Movement Timing and Concurrent Working Memory Tasks: Effects of Age and Musical Skill. RALF TH. KRAMPE, ANN LAVRYSEN, & MIHALIS DOUMAS, *University of Leuven*—Multipurpose timing mechanisms such as those underlying simple tapping are typically assumed to operate autonomously and to be located in subcortical regions (e.g., cerebellar or basal ganglia). From this perspective, interference from cognitive tasks seems unlikely. We show, in contrast, that even simple tapping suffers from simultaneous engagement in working memory or executive control tasks. Under dual-task conditions participants tend to play faster, more variable, and they show stronger trends. In a study with children (8-, 10-, and 12-year-olds), young and older adults, we demonstrate that dual-task costs show a U-shaped function with age, even if cognitive demands are individually adjusted for. At the same time, musical skill pertains a timing advantage that grows with age from childhood to adulthood and remains stable until old age.

Language and Thought

Seaview, Saturday Afternoon, 1:30–3:10

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

1:30–1:45 (219)

Attention to Manner of Motion in a Speeded Classification Task. ALAN W. KERSTEN, SIMONE L. CHIN, & MONICA A. CEDENO, *Florida Atlantic University*—Prior research demonstrates that speakers of English, a language in which frequent reference is made to the way a creature moves, attend more strongly to manner of motion under some circumstances than do speakers of languages in which manner of motion is less prominent. The present research examined whether English speakers’ attention to manner of motion is limited to high-

level problem-solving tasks, in which explicit linguistic mediation is likely, or whether it generalizes to a lower level, perceptually based task. English speakers played a video game in which they shot down enemy creatures while leaving friendly creatures unharmed. Participants were given a perfectly valid color cue to classify the creatures. Unbeknownst to participants, the manner of motion of a creature was also strongly predictive. Participants were faster and more accurate at shooting down enemy creatures that moved like prior enemy creatures, even without conscious awareness of the manner of motion cue.

1:50–2:05 (220)

Mrs. Giraffe and Mr. Elephant: The Influence of Grammatical Gender on German Speakers’ Inductive Reasoning in the Animal Domain. HENRIK SAALBACH, *ETH Zurich*, MUTSUMI IMAI, *Keio University*, & LENNART SCHALK, *ETH Zurich* (read by Mutsumi Imai)—In German, grammatical gender assignment is independent of the referent’s biological sex (e.g., even a male giraffe is grammatically treated as feminine, and referred to by the female pronoun). We examined whether grammatical gender affects German speakers’ inductive generalization of sex-specific biological properties by comparing German- and Japanese-speaking children and adults. The grammatical gender contributed more strongly than the animal’s typicality for predicting German 5-year-olds’ willingness to generalize the sex-specific property to the target animal, while they drew inductive inference about non-sex-specific biological properties in accord with typicality. Japanese children’s willingness to make inductive generalization is only determined by typicality of the target animal both for the sex-specific and non-sex-specific properties. Grammatical gender also influenced German adults’ inductive inference of sex-specific biological properties though in a more subtle way than children. We discuss how grammatical gender interacts with universal constraints in German speakers’ inductive inference about sex-specific and nonspecific properties.

2:10–2:25 (221)

Do English and Mandarin Speakers Think Differently About Time? LERA BORODITSKY, *Stanford University*—Do the languages we speak shape the way we think? Some previous work demonstrated that speakers of English and Mandarin think about time differently. This work has recently been brought into question. Here I present new evidence that once again demonstrates a difference between English and Mandarin speakers’ construals of time. Both languages use horizontal and vertical spatial language to talk about time. For example, in English we might say that the best is *ahead* of us, or we may move a meeting *up*. In English, vertical metaphors are relatively infrequent and horizontal metaphors predominate. In Mandarin, both horizontal and vertical metaphors are frequent. Importantly, vertical metaphors are much more frequent in Mandarin than they are in English. Here I present evidence that Mandarin speakers don’t just talk about time vertically more frequently than English speakers; they also think about time vertically more frequently than do English speakers.

2:30–2:45 (222)

Distinguishing Facts From Opinions: A Cross-Cultural Comparison. JING FENG & MITCHELL RABINOWITZ, *Fordham University* (read by Mitchell Rabinowitz)—What features do people use to distinguish facts from opinions? Last year we presented data that suggested that people consider a fact to be something that you believe and think others would also judge it to be true; an opinion is something that you think might or might not be true and others may or may not agree with it. We found that people used these features when discriminating between statements taken from general knowledge and from a newspaper article. We also found that while there was consensus as to what the features were that distinguishes a fact from an opinion, there was little consensus as to what actually was a fact or an opinion. The purpose of the present study was to assess whether this pattern of results generalizes across cultures (American vs. Chinese) and with varying content.

2:50–3:05 (223)

Testing the Whorfian Hypothesis: Lateralized Presentation and Color Recognition. CLARK G. OHNESORGE, *Carleton College*, GEORGE KACHERGIS, *Indiana University*, & AARON FANTA, *Epic Systems*—In recent years, several papers report effects consistent with the Whorfian hypothesis, the claim that one's language exerts an influence on perceptual and cognitive tasks. Generally it is unclear whether the asserted influence of language is on early (perceptual) processes or later (decisional) processes. Using a lateralized color detection task we replicate the findings of a representative paper, (Gilbert, Regier, Kay, & Ivry, *PNAS*, 2006) and extend them through a modification of the basic task in a design that uses response time as the dependent variable. Our findings support their conclusion that language seems to exert an influence in this task. We also present data from a study employing a 2AFC task allowing a strong test of the claim that linguistic influence exerts itself at the perceptual level. In this task we find no evidence to support the claim of an influence of language at the perceptual level.

**Multisensory Integration and Auditory Perception
Shoreline, Saturday Afternoon, 1:30–3:10**

Chaired by Adele A. Diederich, Jacobs University

1:30–1:45 (224)

Too Old to Integrate? A Cross-Modal Study With the Elderly. ADELE A. DIEDERICH, *Jacobs University*, & HANS COLONIUS, *Oldenburg University*—Saccadic reaction time (SRT) to visual targets tends to be faster when auditory stimuli occur in close temporal or spatial proximity even when subjects are instructed to ignore the non-target (focused attention paradigm). Here it is investigated whether this facilitation is modulated by the subjects' age. One group consisted of college students (age: 20–23 years), the other of elderly (age: 65–75 years). Auditory nontargets (white noise) were presented 100, 50, or 0 msec before or 50 msec after the visual target (LED). Mean SRT of the elderly was about twice as long as for the college students. Multisensory response enhancement (MRE), a measure of relative speed-up of responses in the bimodal versus the visual-alone condition, was larger for the elderly. The time-window-of-integration (TWIN) model for multisensory integration in SRT, developed by the authors, is utilized to disentangle the effects of peripheral sensory processing from multisensory integration efficiency.

1:50–2:05 (225)

Neural Correlates of Multisensory Integration of Ecologically Valid Audiovisual Events. JEAN VROOMEN & JEROEN STEKELENBURG, *Tilburg University*—A question that has emerged over recent years is whether audiovisual (AV) speech perception is a special case of multisensory perception. Electrophysiological (ERP) studies have found that auditory neural activity (N1 component of the ERP) induced by speech is suppressed and speeded up when a speech sound is accompanied by concordant lip movements. In Experiment 1, we show that this AV interaction is not speech-specific. Ecologically valid non-speech AV events (actions performed by an actor such as handclapping) were associated with a similar speeding up and suppression of auditory N1 amplitude as AV speech (syllables). Experiment 2 demonstrated that these AV interactions were not influenced by whether A and V were congruent or incongruent. In Experiment 3 we show that the AV interaction on N1 was absent when there was no anticipatory visual motion, indicating that the AV interaction only occurred when visual anticipatory motion preceded the sound. These results demonstrate that the visually induced speeding-up and suppression of auditory N1 amplitude reflect multisensory integrative mechanisms of AV events that crucially depend on whether vision predicts when the sound occurs.

2:10–2:25 (226)

Apparent Causality and Audio-Visual Synchrony Perception. ROB L. J. VAN EIJK, *Eindhoven University of Technology*, ARMIN

KOHLRAUSCH, *Philips Research Laboratories and Eindhoven University of Technology*, JAMES F. JUOLA, *University of Kansas and Eindhoven University of Technology*, & STEVEN VAN DE PAR, *Philips Research Laboratories* (read by James F. Juola)—In audio-visual synchrony perception, the proportion of “synchronous” responses is not symmetric around physical synchrony, but centers around an audio delay called the point of subjective simultaneity (PSS). We investigated whether an observer's causal interpretation influences the PSS. We used an animation of Newton's Cradle, showing a left-to-right pendulum movement, in three conditions: (1) the entire stimulus, (2) the left half, or (3) the right half. In Conditions 1 and 2, the visual movement appeared to cause a collision sound, whereas in Condition 3 the sound appeared to cause the visual movement. Conditions 1 and 2 yielded typical PSSs, whereas for Condition 3, perceptual synchrony coincided with physical synchrony. Opposite results were found using a temporal-order judgment (TOJ) paradigm. Such response shifts indicate that PSSs found in synchrony judgment experiments are influenced by apparent causal relations between auditory and visual stimuli, whereas TOJs are driven by strategies that are at best indirectly related to perceived causality.

2:30–2:45 (227)

Are Valid Auditory Cues Helpful? ADAM J. REEVES & BERTRAM SCHAREF, *Northeastern University*—We asked whether a valid cue, one that indicates the frequency of an upcoming auditory signal, helps detection. Forty millisecond signals and cues were presented in continuous 50- or 60-dB noise. Signals were near threshold, and cues 4 to 8 dB above. A valid frequency cue presented just before a signal of uncertain frequency reduces the well-known deleterious effect of frequency uncertainty. However, when signal frequency is certain, the cue interferes with detection over the next 100 msec or so by up to 2 to 3 dB. This “forward interference” effect is about the same whether the cue is ipsi- or contralateral to the signal, so is not forward masking, and it is less for invalid cues. Attending to the cue apparently not only aids focusing on the critical band containing the upcoming signal, but also interferes by absorbing processing resources that otherwise would go to the signal.

2:50–3:05 (228)

Hypervigilance Does Not Increase the Loudness of Unpleasant Sounds. MARK HOLLINS, DANIEL E. HARPER, SHANNON M. GALLAGHER, & WILLIAM MAIXNER, *University of North Carolina, Chapel Hill*—Hypervigilance, a feature of some chronic pain conditions such as fibromyalgia and temporomandibular joint disorder (TMJD), is a heightened attentiveness to, and perhaps a perceptual amplification of, painful sensations. McDermid et al. (1996) proposed, mainly on the basis of noise tolerance data, that this amplification may extend to aversive stimuli that are not painful. To test directly the idea that hypervigilance involves an increase in perceived intensity of painless but aversive stimuli, we asked individuals with TMJD ($n = 10$), and healthy control subjects ($n = 11$), to estimate the loudness of auditory stimuli (two-tone combinations) ranging from soft to unpleasantly loud (35–90 dB SPL). Although the TMJD subjects were significantly more hypervigilant than the controls based on questionnaire (PILL) responses, the loudness estimates of the two groups were equivalent across the intensity range. The results indicate that hypervigilance need not be accompanied by an increase in the subjective intensity of all aversive stimuli.

Face Processing**Regency ABC, Saturday Afternoon, 4:10–5:30**

Chaired by K. Suzanne Scherf, University of Pittsburgh

4:10–4:25 (229)

Developmental Trajectory of Visual Object Recognition Revealed by fMRI. K. SUZANNE SCHERF, *University of Pittsburgh*, MARLENE BEHRMANN, *Carnegie Mellon University*, KATE HUMPHREYS,

Kings College London, & BEATRIZ LUNA, *University of Pittsburgh*—Very little is known about how the ventral visual cortex becomes organized for processing faces or any other visual category. We investigated developmental changes in brain function that are related to children's emerging abilities to represent and recognize faces, places, and objects. Our results suggest that children demonstrate adult-like organization in object- and place-related cortex, but no consistent face-selective activation in the right hemisphere until adolescence, and in the left hemisphere until adulthood. We will also report results from an ongoing study investigating developmental changes in the nature of the specific face-related computations in classical face regions using an fMRI adaptation paradigm. These results suggest that the transition from childhood to early adolescence appears to represent an important transition in the development of face-specificity in the ventral visual cortex and shed light on models of functional brain development more broadly.

4:30–4:45 (230)

Extraordinary Face Recognition Ability. RICHARD RUSSELL, *Harvard University*, BRAD DUCHAINE, *University College London*, & KEN NAKAYAMA, *Harvard University*—Following media coverage of developmental prosopagnosia, several individuals contacted us to self-identify as having significantly better than ordinary face recognition ability. They describe their face recognition abilities in strong terms, such as “. . . if I've seen your face before I will be able to recall it. It happens only with faces.” We have tested two of these individuals, confirming exceptional ability in each case. On two tests of face recognition they performed significantly better than control subjects, receiving the highest scores of any subject. On a visual memory task with abstract art images, they performed near the high end of the range of the control subject performance. On a face discrimination task with upright and inverted faces, these two individuals showed larger inversion effects than did control subjects, who in turn show larger inversion effects than did people with developmental prosopagnosia, suggesting a relation between face recognition ability and inversion effect magnitude.

4:50–5:05 (231)

Featural and Configural Properties in Face Perception: Comparing Apples and Oranges. JAMES W. TANAKA, *University of Victoria*, MARTHA KAISER, *Rutgers University*, & DANIEL N. BUB, *University of Victoria*—All faces are created equal in the sense that every face shares a common set of basic eyes, nose, mouth features that are arranged in a similar configuration. Successful individuation of a particular face must therefore depend on our ability to perceive subtle differences in featural and configural face properties. In this talk, I will present a psychophysical test that parametrically measures the perception of featural and configural information in faces and nonface objects presented in their upright and inverted orientations. I will show how this scale can be used to assess the recognition strategies of normal adults, patients with prosopagnosia, and children with autism spectrum disorder.

5:10–5:25 (232)

The Ability to Learn New Faces Peaks at Age 30. KEN NAKAYAMA, *Harvard University*, & LAURA T. GERMINE & BRAD DUCHAINE, *University College London*—Many studies have tracked the development of face recognition in childhood. No studies have traced the course of face learning ability from early-adolescence throughout the life span. Employing a Web-based variant of the Cambridge Face Memory Test (CFMT), we acquired data from over 22,000 volunteer subjects. Tracing performance year by year, from age 11 to 67, we show it rises steeply initially reaching a peak at age 30 and falling gradually thereafter. An earlier age peak for learning nonface objects is suggested by our within-category car recognition tests ($N = 3,000$) as well as published data on words and digits. While this late peak for faces is surprising, it is consistent with recent neuro-imaging studies showing the slower maturation of face specific areas in the brain as

well as with theoretical accounts requiring prolonged experience with faces for optimal performance.

Development and Evolution of Cognition Regency DEFH, Saturday Afternoon, 3:50–5:30

Chaired by Edward A. Wasserman, *University of Iowa*

3:50–4:05 (233)

How Infant Cognition and Infant Word Learning Interact. LESLIE B. COHEN, *University of Texas, Austin*—Based upon research conducted in our laboratory I will discuss three issues in the infant word learning literature that can benefit from an understanding of infant cognition. The first examines how adult social referencing factors influence the development of infant attention and word learning. The study shows separate influences of attention directing and referential cues. The second shows how the inclusion of a verbal label can influence infants' organization of new categories. The use of one or two labels can determine whether one or two categories are formed. The third indicates how different laboratory procedures (novelty preference vs. intermodal preferential looking) can lead to very different results regarding infants' attachment of labels to categories. Together these three lines of research highlight the importance of taking into account the interaction between infant cognition and infant word learning.

4:10–4:25 (234)

Action and the Discovering Abstract Descriptions of Object Shape. LINDA B. SMITH, *Indiana University*—It is commonplace to think of chairs as being all the same shape, chair shape. But rocking chairs, desk chairs, and over-stuffed chairs are only the same shape under some abstract description of object shape. Even more abstract descriptions relate the shapes of things that can be containers, or that can fit into narrow holes, or that can be used to reach and drag some distant object. This talk will present evidence of significant changes in children's representation of object shape during the period of 18–24 months, changes that appear tightly tied to action on and with objects. This is also a developmental period marked by the emergence of tool use, symbolic play, and the rapid acquisition of common noun categories.

4:30–4:45 (235)

A Vocabulary Test for Pigeons (*Columba livia*). EDWARD A. WASSERMAN, DANIEL I. BROOKS, OLGA F. LAZAREVA, & MICHELLE A. MINER, *University of Iowa*—Three pigeons successfully learned to name 8 distinctively different black-and-white photographs from each of 16 different basic-level categories by pecking one of 16 multicolor lexigrams. New categories and new lexigrams were progressively added to the pigeons' training regimen in order to emulate children's ever expanding verbal vocabularies. Pigeons' naming behavior reliably transferred to 4 novel photographs from the different categories. Additional tests disclosed that the pigeons' choice by exclusion and the experimenters' programming of correction trials following errors contributed to the birds' selection of a new lexigram in response to a new category. Analysis of the pigeons' mistakes showed that two factors—lexigram location and basic-level category—affected the distribution of naming errors; the sequence in which the categories were learned did not affect confusion errors. These results closely accord with vocabulary learning by human and nonhuman primates.

4:50–5:05 (236)

Metacognition and Metamemory Across Species. ROBERT R. HAMPTON, *Emory University*—Metacognition, or thinking about thinking, allows one to both monitor and control cognitive processing. Metamemory is a particularly interesting type of metacognition because it facilitates the appropriate selection of current behavior based on accumulated experience, and it supports regulation of learning—for example, by controlling the allocation of study effort. Fol-

lowing work on the development of these capacities in humans, investigators have recently begun to study metacognition in nonhuman species, particularly monkeys. I will briefly summarize these findings from nonhumans and highlight some methodological issues critical in the study of metacognition in nonverbal subjects. Consideration of these issues prompts some re-evaluation of the diversity of metacognitive phenomena in humans.

5:10–5:25 (237)

Tapping Into Tool Use. DOROTHY M. FRAGASZY, *University of Georgia*—Monkeys and apes, like humans, may use tools to extend the reach of the hand and to afford mechanical advantage, as in using a hammer, a rake, or a probe. These achievements arise through similar developmental trajectories across species, until tool use blossoms in young humans during early childhood to include forms not seen in other primates. I describe tool use in terms of spatial relational reasoning, and discuss the spontaneous development and variations of tool use in monkeys, apes, and humans in natural settings from this perspective. This exercise highlights evolutionary and developmental continuities in this domain, and clarifies in what sense tool use in humans differs from that of other primates.

Memory Processes

Beacon A, Saturday Afternoon, 3:10–5:30

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

3:10–3:25 (238)

The Production Effect: Improving Explicit but Not Implicit Memory. COLIN M. MACLEOD, NIGEL GOPIE, KATHLEEN L. HOURIHAN, & KAREN R. NEARY, *University of Waterloo*—A series of experiments investigated the production effect—that speaking or “mouthing” a word during study improves explicit memory, relative to reading a word silently. The effect is restricted to within-subjects designs where only some individual words are produced. It is not evident when a single repeated manual or vocal response is made to some words. We argue that producing a subset of studied words makes those words distinctive, and that distinctiveness is useful for discriminating studied from unstudied words at the time of test. Production is consistently beneficial in explicit memory, even incrementing the generation effect. Yet production consistently failed to benefit the implicit memory test—sped reading aloud—that would appear to be optimally transfer appropriate. This is also consistent with the distinctiveness account: Distinctiveness is relevant only for conscious recollection. The production effect represents a simple but powerful mechanism for improving explicit memory for selected information.

3:30–3:45 (239)

Reconsolidation of Episodic Memories: The Conditions That Trigger Updating. REBECCA GOMEZ & ALMUT HUPBACH, *University of Arizona*, OLLI HARDT, *McGill University*, & LYNN NADEL, *University of Arizona*—Consolidated memories re-enter a labile state at the time they are reactivated. During this time, memories can be modified and subsequently require reconsolidation. We recently demonstrated reconsolidation effects in human episodic memory: Memory for a list of objects was modified by the presentation of a new list, if and only if participants were reminded of the first learning episode before learning the new list. The reminder was comprised of three different components: the experimenter, a reminder question, and the spatial context. We have now evaluated the contribution of each of those reminder components, and showed that the spatial context carries the reminder effect. An additional study looked at the boundary conditions for contextual reminders. We found that the spatial context triggers reconsolidation only in unfamiliar but not in familiar contexts.

3:50–4:05 (240)

Encoding During Retrieval: Effects in Recognition but Not in Free Recall. MARTIN BUSCHKUEHL, SUSANNE M. JAEGLI, HELEN

WYLER, & WALTER J. PERRIG, *University of Bern*—Previous research (Buckner et al., 2001) showed that the encoding effect of recognition judgments on new words in a following unexpected second recognition task was the same as in conditions of deep encoding and intentional learning. We extended the used experimental design in adding a free recall task to the unexpected recognition task in order to test the hypothesis that the performance in free recall is better in the intentional condition compared to the incidental ones. As expected, we could replicate the effects by Buckner et al. for the recognition data, but surprisingly, we found no differences at all in the free recall, regardless of the encoding condition. We assume that although we could establish an episodic memory representation accessible in data driven retrieval in the recognition performance, this representation was not deep enough to show up in the self-initiated free recall, producing a phenomenon of amnesia in healthy subjects.

4:10–4:25 (241)

The Influence of Prior Knowledge in an Analog Recall Task. MARK STEYVERS & PERNILLE HEMMER, *University of California, Irvine*—Our memory for events can be shaped by prior knowledge for those events, an influence that is often regarded as a source of bias leading to inaccurate reconstructions of actual events. However, a Bayesian analysis of reconstructive memory suggests that prior knowledge should be utilized when our episodic memory system is noisy. With an analog recall memory task involving natural objects, we show how the remembered sizes of objects regress toward the prior mean size for those objects. For example, a larger than average apple shown at study tends to be remembered as a somewhat smaller apple at test. Using a Bayesian approach, we estimate the relative contributions of prior knowledge and episodic traces in reconstructive memory. In accordance with the model, we find that the prior exerts the strongest influence when the participants has not seen the object very often or is uncertain about recognizing the object.

4:30–4:45 (242)

Remembering to Do Things for Others: When Incentives Hurt. MARIA A. BRANDIMONTE, *Suor Orsola Benincasa University*, DONATELLA FERRANTE, *University of Trieste*, CARMELA BIANCO, *Suor Orsola Benincasa University*, & MARIA G. VILLANI, *Parthenope University*—Memory for intentions, or prospective memory, often involves remembering to do things for others rather than for oneself. Yet, virtually nothing is known about prosocial prospective memory. In two experiments, we explored the effects of different types of rewards on prosocial prospective remembering. Across the experiments, participants received material and/or nonmaterial rewards for their prosocial prospective behavior. The results revealed that prospective memory was better when the participant’s action had a social relevance as compared to a standard nonsocial condition. They also showed that prosocial prospective memory was equally good under high- and no-incentive conditions. However, consistent with social and economic theories of altruism, when a small explicit incentive was introduced, it crowded out intrinsic motivation, hence reducing prosocial remembering. These effects emerged with both material and nonmaterial rewards. These results shed new light on the relationship among cognitive, social, and motivational mechanisms underlying memory for intentions.

4:50–5:05 (243)

When Emotional Expectations Fail to Become Reality, Memory Suffers. MARA MATHER & MARISA KNIGHT, *University of California, Santa Cruz*—Neutral stimuli that previously preceded aversive events elicit emotional reactions when encountered again. However, presentation of the emotional harbinger alone, without the emotional outcome, eventually leads to the extinction of the aversive reaction. Although much research has focused on extinction of conditioned behaviors, little is known about the impact of expectation and outcome on explicit memory. Our findings reveal amnesia for events that involve unfulfilled emotional expectations (both negative and positive).

In several experiments, memory was impaired for new contextual information presented with an emotional harbinger when the anticipated negative or positive emotional outcome did not occur. Furthermore, there was retrograde amnesia for the emotional harbinger itself as well as forgetting of neutral information following it. This emotional harbinger effect may help shed light on the mechanisms of disorders involving impaired emotional expectations, such as anxiety, phobias, and compulsive gambling.

5:10–5:25 (244)

Quantitative Review of 25 Years of Research on Prospective Memory. BOB UTTL & KIMBERLY BALTIMORE, *Red Deer College*—We rely upon prospective memory proper (ProMP) to bring back to awareness previously formed plans and intentions at the right place and time—for example, a plan to buy groceries en route home. ProMP is distinguished from other subdomains of prospective memory (ProM) such as vigilance/monitoring and habitual ProM. Our meta-analysis of several hundred articles accumulated over 25 years of research on ProM shows that (1) many studies suffer from widespread methodological problems (e.g., ceiling effects, small sample sizes) and conceptual confusions (e.g., failure to distinguish between ProM subdomains), (2) many aspects of ProM have received no or only minimal attention (e.g., event cued ProMP examined in natural settings), and (3) the ProM instruction to ongoing task start delay as well as a number of ProM cues encountered by each participant influence performance on ProM tasks, supporting the distinction between vigilance/monitoring and ProMP.

Categorization

Beacon B, Saturday Afternoon, 3:30–5:30

Chaired by Donald A. Schumsky, University of Cincinnati

3:30–3:45 (245)

Response-Time Approach to Contrasting Rule and Exemplar Models of Classification. ROBERT M. NOSOFKY & MARIO FIFIC, *Indiana University, Bloomington*—We collect response-time data in tasks of speeded classification to contrast the predictions of serial-processing rule-based models, parallel-processing rule-based models, and exemplar models. The paradigm builds upon the “systems-factorial-technology” used by researchers for identifying alternative mental-processing architectures. Initial validation tests show that in conditions involving separable-dimension stimuli and in which observers are given explicit instructions for use of a serial rule-based strategy, the technology recovers the use of this strategy. Ongoing tests contrast the predictions from the models in situations involving integral-dimension stimuli and in situations in which observers learn category structures via induction over training exemplars. Beyond contrasting rule and exemplar models, the research aims to unite mental-architecture and random-walk approaches to modeling choice and response times.

3:50–4:05 (246)

Similarity and Categorization, Single or Multiple Processes? An Application of the Reverse Association Test. TAKASHI YAMAUCHI, *Texas A&M University*—The reverse association test (Dunn & Kirsner, 1988) is a powerful procedure to assess the link between underlying cognitive processes and task performance. It offers strong evidence for the presence of multiple processes/systems underlying two related tasks. However, this test has not been fully utilized. The test often requires a large scale single study employing at least 6 independent manipulations. Furthermore, the statistical procedure to verify reverse association has not been clearly delineated. This article examines the relationship between categorization and similarity judgments and presents practical solutions for these problems. First, a meta-analytic procedure comparing multiple studies is proposed. Second, a contrast analysis for the detection of reverse association is illustrated in a case study. This case study reveals reverse association in categorization and

similarity judgments, providing additional evidence for the view that categorization and similarity rely on separable cognitive processes.

4:10–4:25 (247)

Promoting the Use of Less Likely Category Alternatives in Property Induction With Uncertain Categories. BRETT K. HAYES & BEN R. NEWELL, *University of New South Wales*—Three experiments examined how people make property inferences about instances whose category membership is uncertain. Participants were shown two categories and a novel instance with a feature that indicated the instance was more likely to belong to one category (target) than to the other (nontarget). Participants then made categorization decisions and property inferences about the novel instance. In some conditions property inferences could only be made by considering both target and nontarget categories. In other conditions predictions could be based on both categories or on the target category alone. Like previous studies (e.g., Murphy & Ross, 1994, 2005), we found that many people made predictions based on consideration of only the target category. However, the prevalence of such single-category reasoning was reduced by highlighting the costs of neglecting nontarget alternatives and by asking for inferences before categorization decisions. The implications for process models of uncertain inference are discussed.

4:30–4:45 (248)

Judging Discrete and Continuous Quantity: In Large Sets, Number Counts. HILARY C. BARTH, *Wesleyan University*—Recent studies suggest that interference from automatically extracted irrelevant quantitative dimensions affects adults’ judgments of discrete and continuous quantity. Four experiments provide evidence against this idea. Adults made judgments of the total continuous quantity present in a set of elements. Continuous amount was not rapidly and automatically extracted; comparisons of possible models of individual performance demonstrate that participants arrived at estimates of total continuous amount through at least four different unconscious computations. A fourth experiment required participants to make judgments of the number of elements in a set. Comparisons of possible models of individual performance show that a single model can explain each participant’s responses, and that all participants based their judgments on discrete number. These findings demonstrate large qualitative differences between adults’ routes to discrete and continuous quantity: the computation of total continuous quantity is inaccurate and idiosyncratic, unlike the quick and effective extraction of discrete numerical information.

4:50–5:05 (249)

Absolute Frequency Identification: How a Sequence of Events Can Affect People’s Judgments. PETKO KUSEV & PETER AYTON, *City University London*, PAUL VAN SCHAIK, *University of Teesside*, & NICK CHATER, *University College London* (sponsored by James Hampton)—Theories of absolute identification and categorization established over past decades have revealed people’s inability to classify or judge perceived objects independently of their context. Our series of experiments shows that judged frequencies of sequentially encountered stimuli are affected by certain properties of the sequence configuration: Representations of a category do not only depend on (1) the number of stimuli/chunks in the sequence (2) the relation of the current stimulus to the immediately preceding stimulus, and (3) relations between stimuli further back versus recent stimuli but also on (4) simple sequence characteristics. Specifically, a first-run effect occurs whereby people overestimate the frequency of a given category of event when that category is the first repeated category to occur in the sequence. While current theories of absolute identification and categorization cannot account for these results, the simplicity framework, suggested in this paper, accounts for this and other context effects on judgment tasks.

5:10–5:25 (250)

Evolutionary Models of Color Categorization Based on Discrimination. KIMBERLY A. JAMESON, NATALIA L. KOMAROVA, LOUIS

NARENS, & RAGNAR STEINGRIMSSON, *University of California, Irvine*—We present computational modeling results that bear on a classic controversy in psychology: The factors contributing to human color categorization across individuals and cultures (Jameson, 2005). We investigated specific processes by which shared color lexicons evolve from interactions in societies of communicating agents. Previous simulation studies have evaluated some constraints thought to be contributors to color lexicon evolution across different societies (Steels & Belpaeme, 2005). We use evolutionary game-theory to examine constraints appropriate for simulated individual agents and societies of agents (Komarova, 2004); however, our simulations involve only hue categorization (rather than general color categorization) based on stimulus j.n.d. differences (rather than on complex perceptual processing). Under these conditions we find a new pattern of results regarding robust agent-based color categorization solutions. The present findings have implications for theories of human color naming and categorization, and the formation of human semantic categories that are shared cross-culturally.

Reasoning and Problem-Solving
Seaview, Saturday Afternoon, 3:30–5:30

Chaired by Richard Catrambone, Georgia Institute of Technology

3:30–3:45 (251)

Principle-Based Physics Instruction: Effects on Classroom Performance. RICHARD CATRAMBONE, MATTHEW KOHLMYER, MICHAEL SCHATZ, & MARCUS J. MARR, *Georgia Institute of Technology*—In 2006, the School of Physics at Georgia Tech began offering sections of an introductory physics course that use the “Matter and Interactions” (M&I) curriculum. M&I emphasizes analyzing problems starting from the three fundamental mechanical principles: momentum, energy, and angular momentum. This is in contrast to the traditional intro course where students often learn to use many special case formulas (e.g., constant acceleration kinematics equations), or to match given problems to known examples or solutions. Initial analyses of performance on common final exam problems by Tech students from traditional and M&I classes indicates that M&I students are more successful solving novel problems. We are also examining whether the emphasis on a few principles throughout the M&I course will lead those students to be more resistant to confusion based on surface features of problems and whether they are reliably better able to recognize which principles are relevant for new problems.

3:50–4:05 (252)

Mind Reading Aliens: Causal Forces and the Markov Assumption. MICHAEL R. WALDMANN, RALF MAYRHOFER, & YORK HAGMAYER, *University of Göttingen*—One of the most fundamental assumptions underlying causal Bayes nets is the Markov constraint. According to this constraint, an inference between a cause and an effect should be invariant across conditions in which other effects of this cause (i.e., common-cause model) are present or absent. Following up on previous work of Rehder and Burnett (2005) we show that this constraint is regularly violated and that the size of violations varies depending on abstract assumptions about underlying mechanisms. Stronger violations are observed when the cause node of the model rather than the effect nodes are described as agents (thought senders vs. mind readers). This finding shows that causal Bayes nets lack crucial information about the physical instantiation of causal dependencies, and therefore often fail as a psychological model.

4:10–4:25 (253)

The Semantics of Negation in Causation. PHILLIP WOLFF, ARON K. BARBEY, & CHRISTOPHER VAUGHAN, *Emory University*—Negation in causation is present when causes or effects are expressed in terms of their absence—for example, “The absence of nicotine causes withdrawal” or “Pain causes lack of sleep.” Many theories of causation, including logical and statistical approaches, imply that ex-

pressions of causation involving negation are symmetrical; for example, *not-cause* implies *prevent* and *prevent* implies *not-cause*. In contrast, the transitive dynamics model (Barbey & Wolff, 2007) predicts that these different expressions are often related to each other asymmetrically—for example, *not-cause* implies *prevent*, but *prevent* often does not imply *not-cause*. The predictions of the dynamics model were supported in three experiments in which people paraphrased causal expressions taken from the Internet or described animations depicting complex causal interactions. The results support the view that certain kinds of causal reasoning depend on force dynamics instead of purely logical or statistical representations.

4:30–4:45 (254)

Any Reason Is Better Than None: Implausible Reasons in Argumentation. CHRISTOPHER R. WOLFE & MICHAEL J. ALBRECHT, *Miami University*, & ANNE M. BRITT, *Northern Illinois University*—Two experiments examined the consequences of supporting claims with plausible and implausible reasons and warrants. Experiment 1 participants rated agreement with the neutral claims. Then they were given either “good” (believable) or “bad” (implausible) reasons, coupled with good or bad warrants, before providing a second rating. Good reasons increased agreement more than did bad reasons. However good warrants only had a positive effect when coupled with good reasons. Bad reasons produced higher agreement ratings than did claims supported by no reason at all. Experiment 2 examined the consequences of domain specific knowledge on argumentation. Upper class undergraduate participants, either history or environmental science majors, rated arguments from U.S. history, environmental science, or everyday reasoning domains. Claims supported by empirically good reasons were generally rated higher than unsupported claims. However claims supported by false reasons were often rated higher than unsupported claims. This was often the case for participants with greater domain knowledge.

4:50–5:05 (255)

The Use of Schematic Knowledge During a Creative Generation Task. CYNTHIA M. SIFONIS, *Oakland University*—This experiment examines how complex knowledge structures such as schemas are used during creative idea generation. Participants were asked to imagine and describe a restaurant frequented by a race of bird-like aliens. Descriptions of the aliens and the generation task were designed to prime participants’ schematic knowledge of either fast food or fine dining restaurants. Participants’ descriptions of the alien restaurant were coded for the presence of schema-typical fast food and fine dining restaurant features. The results indicated that priming participants’ fine dining restaurant schemas resulted in the inclusion of significantly more schema-typical fine dining restaurant features than schema-typical fast food restaurant features into the novel product. The converse was true when participants’ fast food restaurants were primed prior to the generation task. Participants in both conditions were equally likely to make their creative products more unique by applying their knowledge of birds, aliens, and technology to the generative task.

5:10–5:25 (256)

Relating Comprehension and Belief: The Role of Sentence Informativeness. URI HASSON, *University of Chicago*—What is the relation between comprehension and belief? Some theories hold that believing the content of a statement is an intrinsic aspect of comprehension, but that considering a statement’s falsity is an optional and more difficult secondary process. Here, three studies are reported showing that individuals do in fact consider the falsity of statements, and they are more likely to do so for statements that are informative when false (e.g., *this person is a liberal*) than for statements that are not (e.g., *this person is tall*). In two studies, suggesting that statements are true increased endorsement rates for statements (vs. no-suggestion), but only for statements noninformative when false. A third study showed that participants that endorsed statements more frequently endorsed them

more quickly, indicating they did not consider their falsity, but this only held for statements noninformative when false. Thus, semantic properties of statements determine whether people consider their falsity.

Discourse Processing
Shoreline, Saturday Afternoon, 3:30–5:30

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

3:30–3:45 (257)

Transfer Across Seemingly Unrelated Narratives: A Similarity-Based Explanation. GARY E. RANEY, FRANCES DANIEL, JOANNA C. BOVEE, FIONA LYNCH, & TOM VADAKARA, *University of Illinois, Chicago*—According to Raney (2003), repetition effects and transfer benefits across texts will be larger if the situation models of the texts overlap than if they do not overlap. Klin, Ralano, and Weingartner (in press) tested this aspect of Raney's model. They had readers read two supposedly unrelated stories that shared a sentence and measured transfer (processing time of target sentences in the second story). They concluded that transfer was found across unrelated stories. To make this claim, Klin et al. must demonstrate that their story pairs are unrelated. We present passage similarity ratings from 4 studies supporting the conclusion that their story pairs are related. Similarity ratings were largest in those conditions where Klin et al. found fastest processing times and were smallest where Klin et al. found slowest processing times. We discuss these findings in relation to other research that proposes evidence of transfer across unrelated passages.

3:50–4:05 (258)

Verb Aspect and Event Simulations. CAROL J. MADDEN, *Erasmus University Rotterdam*, & DAVID J. THERRIAULT, *University of Florida*—According to embodied frameworks of language comprehension, pictures of instruments in use (open umbrella, uncapped pen) should better match readers' simulations of described events than instruments not in use (closed umbrella, capped pen). This effect may be stronger for events described as ongoing (imperfective aspect) rather than completed (perfect aspect). Participants read imperfective (was playing) and perfect (had played) event descriptions, word by word in a rebus paradigm, with the critical instrument word replaced by a picture of that instrument in use or not in use. Keypresses to advance through in-use pictures were faster than keypresses for not in-use pictures in both imperfective and perfect sentences. Furthermore, keypresses on the two words following the picture, as well as sentence-final sensibility judgments also showed the in-use advantage, although only for imperfective sentences. These findings suggest that there are aspectual differences in the time course of perceptual simulations of events.

4:10–4:25 (259)

Cognitive and Neurological Bases of Inferential Processes During Reading. PAUL VAN DEN BROEK, ALEX MERKLE, & ELISSA IOS KARAGEORGIOU, *University of Minnesota*, PANAYIOTA KENDEOU, *McGill University*, & ART LEUTHOLD & APOSTOLOS GEORGIOPOULOS, *University of Minnesota*—How do we understand what we read? Reading comprehension is a complex process that involves the interpretation of unfolding text information using prior knowledge and the construction of a coherent representation of the text in the reader's mind. In the present set of studies, we begin to explore the neurological bases of this complex process using magnetoencephalography (MEG). First, we use the Landscape Model theory of reading comprehension to make predictions about the specific

moment-by-moment comprehension activities during the reading of various texts. Next, we collect MEG data during reading for comprehension of these texts. Finally, we draw connections between the model and behavioral data to better understand the cognitive and neurological bases of reading comprehension.

4:30–4:45 (260)

Memory for Functional Relations in Text and Problem Solving. JOHN B. BLACK, *Teachers College, Columbia University*—This research investigated the relationship between participants' memories for various kinds of information in expository texts and the participants' abilities to solve problems using that information. Of particular interest were participants' memories for functional relations that describe how one entity changes as a function of changes in another entity, how integrated the memory for these functional relations is, and how well the participants can use this information to solve "what-if" problems (i.e., problems where a change is described and the participants have to figure out what other changes will occur). College students read texts describing systems of interacting entities, then recalled the texts, drew pictures of the text contents, and then solved the "what-if" problems. The relationships between memory for the functional relations, the integration of those memories, and the problem solving performance were examined.

4:50–5:05 (261)

Age-Related Changes in Spoken Discourse Comprehension. MITCHELL S. SOMMERS, SANDRA HALE, JOEL MYERSON, & NATHAN S. ROSE, *Washington University*, & NANCY TYE-MURRAY & BRENT SPEHAR, *Washington University Medical School*—Previous research on adult age-related differences in speech comprehension has focused primarily on lower levels in the language comprehension process (i.e., phoneme and word perception, and, to a lesser extent, sentence comprehension). In contrast, the present study examined potential age-related differences in spoken discourse comprehension. To this end, we measured spoken discourse comprehension for three different passage types (lectures, interviews, and oral histories) using three types of comprehension questions (information, integration, and inference). In addition, we measured auditory sensitivity as a potential mediator of age-related differences. Consistent with previous studies, we found that spoken language comprehension declines as a function of age during adulthood. Importantly, we also found that taking into account normal age-related changes in auditory function did not substantially reduce this deficit. Instead, our results indicate that age-related differences in cognitive processes are primarily responsible for the deficits in spoken discourse comprehension.

5:10–5:25 (262)

Bill Clinton on the Middle East: Perspective in Media Interviews. CAMELIA SULEIMAN, *Florida International University*, & DANIEL C. O'CONNELL, *Georgetown University* (read by Daniel C. O'Connell)—Four TV and two radio interviews given by Bill Clinton after the publication of his memoirs in June 2004 are examined for expressions of perspective on the Middle East. Bill Clinton's personal perspective is clearly reflected in his choice of referencing terms for parties in the Middle East conflict: The Israeli and Palestinian points of view are designated by first-person and third-person pronominals, respectively. A similar relationship is found for his references to the USA and Iraq. His perspective is manifested in his references to countries, people, and individual political leaders. Such references thus become expressions of a more general frame of power relationships in discourse, in which a progressive, advanced world is compared with a primitive, violent world. Implications for a theory of personal perspective in discourse and for the dialogic nature of perspective are discussed.

Task Switching**Regency ABC, Sunday Morning, 8:00–9:40***Chaired by Catherine M. Arrington, Lehigh University***8:00–8:15 (263)**

Stimulus–Task Binding in Voluntary Task Switching: The Role of Prior Experience in Task Choice. CATHERINE M. ARRINGTON & RACHEL L. PAUKER, *Lehigh University*—Stimulus–task binding has been hypothesized to underlie some performance deficits on switch trials in task-switching paradigms. We examined the effect of individual stimuli on task choice in a voluntary task-switching (VTS) paradigm where subjects are allowed to choose which task to perform on each trial. Subjects performed large/small or living/nonliving judgments on single-word stimuli under instructions to perform the tasks equally often in a random order. Stimulus–task binding was measured as a match to the initial categorization of an item in all subsequent presentations of that stimulus. When subjects voluntarily choose the initial categorization, the probability of match to initial was substantial (.669). This effect was reduced (.522), but still significant, when the initial categorization was determined by the experimenter. The roles of prior experience with a stimulus and stimulus identity in VTS suggest that task choice is a complex process involving interactions of internal and external factors.

8:20–8:35 (264)

Strategic Control Over Task-Set Inhibition. ULRICH MAYR, *University of Oregon*, & STEPHAN STEGT, *University of Bonn*—We (Mayr & Bell, 2006) recently suggested that rate of switching in a voluntary switching situation depends on whether individuals adopt a “continuous-flow” or a “discrete-event” strategy. Theoretically, the discrete-event strategy is characterized by inhibition after each trial, thereby clearing the slate for an unbiased choice of the next-trial task. In Experiment 1, we instructed subjects to either treat trials as a stream of interdependent stimulus–response instances or as distinct events. As expected, discrete-event subjects showed higher switch rates. In addition, they exhibited longer no-switch and faster switch RTs than did continuous-flow subjects, which is consistent with the use of inhibition to segregate consecutive events. In Experiment 2, we tested the inhibition prediction directly, by assessing the effect of strategy on the backward-inhibition effect (Mayr & Keele, 2000). As expected, we found substantial backward inhibition after discrete-event, but none after continuous-flow instruction. Thus, inhibition seems to be under some strategic control.

8:40–8:55 (265)

Response Effects in Voluntary Task Switching. ANDRE VANDIERENDONCK, JELLE DEMANET, & BAPTIST LIEFOOGHE, *Ghent University*—In voluntary task switching, participants are free to select the task to perform, as long as they perform both tasks an approximately equal number of times and perform the tasks in a random order. Previous research (Mayr & Bell, 2006) demonstrated an influence of sequences of stimuli on this pattern of alternation. Following this up, we investigated the role of response sequences by manipulating the compatibility of the response layout in task selection and task execution. We were interested in the effects of the intertrial interval on the response used to indicate the subsequent task selection. Three experiments demonstrated that task selection latencies were affected by these response variations, whereas the task-repetition probabilities and task selection randomness only varied with the intertrial interval. These results show that while response effects influence task-level processes, they do not come into play in the process of task selection.

9:00–9:15 (266)

Proactive and Concurrent Interferences in Task-Switching. MYEONG-HO SOHN, E. ZITA PATAI, & REBECCA B. WELDON, *George Washington University*—Cognitive control is required to minimize the interference effect on the performance of the goal-relevant

task. In this study, we examined the effects of proactive and concurrent interferences. The proactive interference occurs when the current task is different from the most recent task. The concurrent interference occurs when the current target is accompanied with a distractor. Participants performed two perceptual classification tasks and two semantic classification tasks in a task-switching paradigm. In general, participants were more fluent with perceptual than with semantic tasks. When switching between different tasks, the latency of semantic tasks was slower when preceded by perceptual tasks. In addition, the semantic tasks were performed slower when the concurrent distractor was associated with another semantic task. The perceptual tasks were not affected by the types of distractors or transitions. These results suggest that the interference effect depends on the strength of the relevant and irrelevant tasks.

9:20–9:35 (267)

Hierarchical Plans Can Produce Nonhierarchical Behavior. GORDON D. LOGAN & DARRYL W. SCHNEIDER, *Vanderbilt University*—Hierarchical plans structure behavior by dividing a set of tasks into subsets and specifying which subset to perform at which time. Usually, the sequence of tasks in the plan mirrors the sequence of tasks the person performs—the plan says “do A, then B” and the person does A then B—making it hard to determine whether the observed evidence of hierarchical control reflects plan-level processing or task-level processing. We separated these levels of processing by having subjects memorize two task sequences and then perform a randomly cued task at one of the serial positions in a sequence (e.g., “alpha 3” meant “perform task three from list alpha”). Response times were longer when subjects switched between sequences than when they repeated sequences, indicating hierarchical plan-level processing. We present a model that illustrates how structured plans control sequences of responses that do not mirror the sequence in the plan.

Memory**Regency DEFH, Sunday Morning, 8:00–10:00***Chaired by Moshe Naveh-Benjamin
University of Missouri, Columbia***8:00–8:15 (268)**

Is Older Adults’ Associative Memory Deficit Mediated by Age-Related Sensory Decline? MOSHE NAVEH-BENJAMIN, ANGELA KILB, & YOKO HARA, *University of Missouri, Columbia*—Numerous studies show age-related decline in episodic memory. One of the explanations for this decline is an associative deficit hypothesis, which attributes part of older adults’ declining episodic memory performance to their difficulties encoding and retrieving separate features of episodes as cohesive entities (e.g., Naveh-Benjamin, 2000). Here, we evaluate the degree to which this deficit is partially mediated by sensory loss associated with increased age. In two experiments, young adults were presented with visually and auditorily degraded word pairs. Their memory for both the components and the associations of these degraded pairs was then tested using word and associative recognition tests, respectively. We also used groups of older adults with nondegraded stimuli. The results and their theoretical implications will be discussed.

8:20–8:35 (269)

Ventromedial Prefrontal Damage Impairs Source but Not Associative Memory. ELISA CIARAMELLI, *Rotman Research Institute*, & JULIA SPANIOL, *Ryerson University* (read by Julia Spaniol)—Both associative recognition (AR) and source memory (SM) are thought to capture episodic binding. However, whether these tasks tap the same cognitive and neural systems is unclear. Here, we show a dissociation between AR and SM in patients with lesions in ventromedial prefrontal cortex. Thirteen patients, including 6 with spontaneous confabulation, and 13 controls studied picture–word pairs and received an old–new recognition test. Lures included rearranged pairs (studied

items in new pairings), inverted-format pairs (studied pairs in which the picture–word format of each item was switched), half-old pairs (1 studied item, 1 unstudied item), and new pairs (2 unstudied items). Patients, particularly those with confabulation, committed more false alarms to inverted-format pairs than did controls. In contrast, false alarms to rearranged pairs and other lures did not differ between groups. These findings suggest that AR and SM tap distinct processes, with only the latter depending on ventromedial prefrontal cortex.

8:40–8:55 (270)

Cognitive Functioning Mediates the Use of Distinctive Processing in Reducing Memory Illusions. AYANNA K. THOMAS, *Tufts University*, & MARK A. McDANIEL, *Washington University*—Recent studies suggest that distinctive processing can reduce errors of commission (Arndt & Reder, 2003). The present study examines the relationship between two aspects of distinctive processing (item-specific and relational) in younger adults, high frontal lobe functioning (FLF) older adults, and low FLF older adults. Variables presumed to affect both relational and item-specific processing were manipulated. Younger adults and high FLF older adults showed reductions in errors of commission when item-specific processing was executed. Furthermore, item-specific processing did not necessarily lead to impoverished relational processing; however, low FLF older adults showed reductions in errors of commission only when relational processing was impoverished. The results suggest that item-specific and relational processing may be performed in parallel and may not compete for finite resources. However, cognitive decline did affect the use of item-specific and relational information. These findings suggest a model that accounts for distinctive processing as a function of age-related cognitive decline.

9:00–9:15 (271)

Adaptive Memory: Is Survival Processing Special? JAMES S. NAIRNE & JOSEFA N. S. PANDEIRADA, *Purdue University*—Nairne, Thompson, and Pandeirada (2007) recently proposed that our memory systems might be “tuned” to remember information that is processed for survival, perhaps as a result of fitness advantages accrued in our ancestral past. Across several experiments participants showed superior memory when unrelated words were rated for survival, at least when compared with several “deep” processing control conditions. The present experiments extend this “survival effect” to related lists containing survival-relevant categories. Rating words for survival in a categorized list, compared to rating the same words for pleasantness, produced the best recall, even though individual-item processing (e.g., rating for pleasantness) in a related list is thought to be an optimal procedure for enhancing subsequent recall. We also report the results of a category-sorting experiment in which items were sorted into the same four categories, but those categories were labeled as either survival-relevant or not.

9:20–9:35 (272)

Differential Effects of Emotional Content in Working Memory and Recognition. SUSANNE M. JAEGGI, MARTIN BUSCHKUEHL, & WALTER J. PERRIG, *University of Bern* (sponsored by Rudolf Groner)—Emotional content enhances memory performance. In general, there is a positive recall bias and sometimes, there is a slight advantage for negative material, which is explained by attentional processes. Only a few studies investigate the impact of emotional content on both working memory performance and long-term memory within subjects. We used a working memory task with neutral, happy, and angry faces as emotional stimuli. In a surprise recognition task 1 h after task completion, participants had to indicate which faces were presented in the working memory task before. We found differential effects of emotional content in the working memory task and recognition: Whereas in the working memory task, performance was best for the angry faces, participants had the longest reaction times to the angry faces in the recognition task, a dissociation which is interpreted by automatic and attention-related processes in the working memory condition, and by mood-repair processes in the recognition task.

9:40–9:55 (273)

Inhibition of Eye Movements to Memorized Locations. ARTEM V. BELOPOLSKY & JAN THEEUWES, *Vrije Universiteit Amsterdam*—Recent research has shown a direct link between spatial working memory and activation of the eye movement system. It was argued that keeping a location in working memory may be nothing else than the preparation of an eye movement. The present study further examined this question. Participants were asked to maintain a location in memory and on half of the trials to make a saccade in response to a central cue. On half of the trials, the location of the saccade target coincided with a location kept in memory. We found that participants were slower in making a saccade to a location kept in spatial working memory relative to other locations. This inhibition was significantly greater than inhibition of return caused by the mere presentation of the cue. The results suggest strong involvement of oculomotor system in maintenance of spatial working memory.

Concept Learning

Beacon A, Sunday Morning, 8:00–10:00

Chaired by Carol A. Seger, *Colorado State University*

8:00–8:15 (274)

Four Lessons From Cognitive Neuroscience for Category Learning. CAROL A. SEGER, *Colorado State University*—First, abstraction and generalization processes in category learning are situational and limited. Some neural systems can generalize to new stimuli; others cannot. Second, cognitive processes recruited during a categorization task that researchers often assume to be inconsequential in actuality affect learning. For example, small differences in the characteristics of the feedback signal in category learning tasks have significant effects on neural recruitment and resulting learning. Third, categorization is procedural (that is, reliant on motor systems) to a greater degree than generally appreciated. Neural systems underlying motor processing are recruited during categorization, and category knowledge is often specific to a particular associated motor response. Fourth, the same neural systems are often recruited regardless of whether category learning is implicit or explicit. Therefore, the accessibility of learning to conscious awareness may not be a fundamental distinction that can be used to differentiate between learning systems.

8:20–8:35 (275)

Mental Models and Boolean Concept Learning. GEOFFREY P. GOODWIN & PHILIP N. JOHNSON-LAIRD, *Princeton University*—A common source of new concepts is a Boolean combination of existing concepts—for example, pregnant or nursing women, and not on medication. As this example illustrates, any Boolean concept can be defined solely from a combination of properties using negation (not), conjunction (and), and inclusive disjunction (or). A common intuition underlying theories of the learning of these concepts is that individuals attempt to simplify the information presented to them; for example, they seek a parsimonious decision tree or, in a recent account, a minimal description of the concept. Here, we show that the intuition is correct, but that what is minimized is neither a decision tree nor a description, but the mental models of the concept. A single, theoretically derived parameter—number of mental models—predicts the difficulty of learning Boolean concepts better than more elaborate previous accounts. The results of a new experiment also corroborate the theory.

8:40–8:55 (276)

Task Switching in Category Learning: Evidence for Stimulus-Dependent Representation. MICHAEL A. ERICKSON, *University of California, Riverside*—ATRIUM, a multiple-system model of category learning, posits that within a single category-learning task people can learn to utilize different systems with different representations to classify different stimuli. This is referred to as stimulus-dependent representation (SDR). The use of SDR implies that people are switching from task to task as trials demand. Thus, the use of SDR can be

assessed via slowed RTs following a representation switch. Additionally the use of SDR requires control of executive attention to keep inactive representations from interfering with the current response. Participants were given a category learning task composed of one- and two-dimensional substructures. Control of executive attention was measured using a working memory capacity (WMC) task. Participants who used SDR showed greater slowing of responses following a substructure switch, and a greater correlation between learning performance and WMC. These results provide support for the principle of SDR in category learning.

9:00–9:15 (277)

Attention Dynamics in Category Learning. AARON B. HOFFMAN & BOB REHDER, *New York University* (read by Bob Rehder)—Theories of human category learning assume that attention plays a central role in modulating the influence of cues on learners' behavior. However, each theory incorporates attention in a different way. Three experiments used eye tracking to record the attention dynamics of human learners as they acquired novel categories. Changes in the pattern of eye fixations were compared to predictions of two prominent connectionist learning models: Kruschke's (1992) ALCOVE (attention learning covering map) and Kruschke and Johansen's (1999) RASHNL (rapid attention shifts n' learning). Across the three experiments we found that people exhibited early and rapid attention shifts. The early shifts were coupled with subsequent suboptimal attention profiles, in which people continued to attend to irrelevant information, in Experiments 1 and 2, or to more information than the minimum required, in Experiment 3. These findings are interpreted as being more consistent with RASHNL's predictions regarding attention than with ALCOVE's.

9:20–9:35 (278)

Extremely Selective Attention: Eyetracking Studies on Dynamic Attentional Allocation to Stimulus Features. MARK BLAIR, MARCUS WATSON, FIL MAJ, & CALEN WALSH, *Simon Fraser University*—Selective attention is an important part of most theories of category learning. This allows them to model empirical results that show that people learn to attend to features that are helpful for distinguishing the categories being acquired, and learn to ignore features that are not. Attentional allocation is thus assumed to be dynamic, because it shifts with experience to optimize categorization performance. Typically, however, attention is also assumed to be consistently allocated to all categories and all stimuli. We report results that violate this assumption. Subjects learned several categories with differing numbers of informative features, so the optimal attentional distribution varied across stimuli. Using an eyetracker to measure attention, our results show that subjects readily learn to vary their attentional allocation in response to specific stimulus features. We examine some details of this dynamic process.

9:40–9:55 (279)

Cognitive Dynamics From Eye Movements: Representational Change As a Phase Transition. DAMIAN G. STEPHEN, REBECCA SULLIVAN, JAMES A. DIXON, & JAMES S. MAGNUSON, *University of Connecticut* (read by James A. Dixon)—Capturing the dynamics of cognition has been a long-standing, fundamental challenge for cognitive science. The present research demonstrates that the phase space of cognition can be reconstructed through a time series of action—specifically, the changing position of eye-gaze. Participants were asked to solve simple gear-system problems by predicting the motion of a target gear, given the turning direction of a driving gear. Participants initially solved the problems by simulating the motion of the gears, but then spontaneously discovered a mathematical solution to the problem. Using the eyetracking time series to reconstruct phase space, we show that the emergence of the mathematical solution constitutes a phase transition. Specifically, real-time discovery of the mathematical relation was predicted by a decrease in system entropy, a hallmark of phase transitions in dynamical systems. Thus, the pres-

ent study demonstrates the emergence of higher order cognitive phenomena through nonlinear dynamics.

Pronouns and Reference

Beacon B, Sunday Morning, 8:00–9:20

Chaired by Amit Almor, *University of South Carolina*

8:00–8:15 (280)

An fMRI Investigation of Repeated Reference in Discourse. AMIT ALMOR, VEENA A. NAIR, JEREMY L. MAY, LEONARDO BONILHA, JULIUS FRIDRIKSSON, & CHRIS RORDEN, *University of South Carolina*—Repeated reference is an important part of coherent discourse but very little is known about the brain basis of processing repeated reference in discourse. A recent functional magnetic resonance imaging (fMRI) study (Almor, Smith, Bonilha, Fridriksson, & Rorden, *in press*) found that reading a repeated proper name reference (e.g., *Joe*) to a salient discourse referent leads to increased activation in temporal regions and intraparietal sulcus (IPS) in comparison to reading a pronoun reference (e.g., *he*). This was interpreted as indicating the involvement of spatial brain circuits (IPS) in the management and manipulation of representations of discourse referents (temporal regions). The conclusions of this study were, however, limited by the fact that it did not manipulate the salience of referents. We report the results from an fMRI experiment which aimed to address this limitation by comparing the brain activation associated with reading pronoun and repeated name references to salient and non-salient referents.

8:20–8:35 (281)

The Role of Attention During Pronoun Comprehension. JENNIFER E. ARNOLD & SHIN-YI C. LAO, *University of North Carolina, Chapel Hill*—Discourse features (e.g., first mention) are claimed to put referents in discourse focus, rendering them accessible to listeners during processes like pronoun comprehension. Two experiments investigated the relationship between such “discourse focus” and visual focus of attention. Listeners viewed a picture of two gender-matched characters, and decided if it matched the story they heard—for example, “Doggy is flying a kite with Birdy . . . He . . .” The pronoun referred to either the first or second character. A visual capture cue (highlighting around one character) appeared briefly during the first clause, either right before the mention of the second character (Experiment 1) or at trial onset (Experiment 2). In a combined analysis of the two experiments, participants were more likely to say that the story did not match the picture when the pronoun referred to the second-mentioned character. Additionally, the visual capture cue modulated the first-mention bias, suggesting a relationship between discourse and visual attention.

8:40–8:55 (282)

Processing Differences for Pronouns and Reflexive Pronoun Anaphors. SHELIA M. KENNISON, SONDRAL. NOLF, & JAMES E. VAUGHN III, *Oklahoma State University*—A series of experiments investigated how pronouns (*he* and *she*) and how reflexive pronoun anaphors (*himself* and *herself*) were resolved with gender ambiguous antecedents (e.g., *doctor, nurse, patient*). Processing differences were observed for the two type of referents, with the largest difference being observed when referents were resolved with gender neutral antecedents. In two of the four experiments, individual differences in working memory were assessed. Participants' processing was related more strongly to working memory during the processing of pronouns than during the processing of anaphors. Implications for models of referential processing will be discussed.

9:00–9:15 (283)

Fillers As Metacognitive Collateral Signals: Evidence From Language Comprehension. DALE J. BARR, *University of California, Riverside*, & MANDANA SEYFEDDINIPUR, *Stanford University*—

Based on evidence from spoken language corpora, Clark and Fox Tree (2002) hypothesized that the fillers “um” and “uh” represent signals of anticipated major and minor delay, respectively. But if they are genuine signals of delay, then they should show effects on the listener. Two mouse-tracking experiments supported this prediction. Listeners expected a speaker to refer to something new following an “um” but not following an “uh,” and only when “um” was followed by a sufficiently long pause (Experiment 1). Furthermore, this expectation was based on active perspective taking rather than on a learned association between a particular pattern of disfluency and new information: Listeners expected information that would be new for the current speaker, even though that information was old for them (Experiment 2). These findings suggest that “uh” and “um” are metacognitive collateral signals that draw listeners’ attention to a speaker’s cognitive state.

Movement, Distance, and Depth Perception
Seaview, Sunday Morning, 8:00–9:20

Chaired by Maggie Shiffrar, Rutgers University, Newark

8:00–8:15 (284)

Facing Apparent Motion: A Translating Eyeball Illusion. SONGJOO OH & MAGGIE SHIFFRAR, *Rutgers University, Newark* (read by Maggie Shiffrar)—Traditional models of the human visual system assume that all classes of visual images are initially analyzed in the same way. From this perspective, the same processes are employed when observers view crashing waves and smiling children. We tested this assumption by investigating whether face perception changes motion perception. In psychophysical studies, we tested the perception of classic apparent motion phenomena. Wertheimer (1912) initiated Gestalt psychology with the finding that two sequentially presented static dots can appear as one translating dot. When these two dots are positioned in the eye sockets of an upright face, the perception of translation stops. Face processing also impacts a modified Ternus (1926) display such that dots that appeared to move independently instead appear to move together in as eyes in a face. These results suggest that the visual analysis of facial motion differs from other motion analyses.

8:20–8:35 (285)

Why Do Moving Objects Interfere With the Visibility of Stationary Ones? JUDITH AVRAHAMI & OREN FLEKSER, *Hebrew University*—The fact that moving objects interfere with the visibility of stationary ones has been known for a long time (Bonneh, Cooperman, & Sagi, 2001; Grindley & Townsend, 1966; MacKay, 1960), but its cause is still in dispute. To achieve some insight into the phenomenon the time required for detecting a gradually appearing Gabor stimulus on the background of moving dots was measured. The direction and speed of the dots and the orientation and spatial frequency of the Gabor were manipulated. When its spatial frequency was high, the Gabor stimulus was harder to detect when its orientation was orthogonal to the direction of the moving dots than when parallel; the difference increased with faster dots. Surprisingly, the opposite was true when the spatial frequency of the Gabor was low. These results provide clues as to what the eye must be doing when watching moving objects and when perceiving stationary ones.

8:40–8:55 (286)

Testing Two Accounts of a Failure of Perceptual Separability. STEPHEN C. DOPKINS, *George Washington University*—In the complex distance task, the stimuli vary on two spatial dimensions and the error rate for distance judgments regarding one dimension depends on the interstimulus distance on both dimensions. According to the mean-shift integrality (MSI) account, this phenomenon reflects the mental representation of the stimuli; the mean of the distribution for a stimulus on each dimension of the representation depends on the level of the stimulus on both spatial dimensions. According to the derived distance (DD) account, the phenomenon reflects the distance es-

timination process; the distance between a pair of stimuli on a given dimension is derivative of the distance between them on both dimensions—distance on a given dimension can only be assessed to the degree that the dimension’s scale is made greater than the scale of the other dimension. The DD account fit the data from several experiments better than the MSI account did.

9:00–9:15 (287)

A Substantial Genetic Contribution to Stereoscopic Depth Judgments Further Than Fixation. JEREMY B. WILMER & BENJAMIN T. BACKUS, *University of Pennsylvania*—One in three individuals is blind to some range of stereoscopic depth for briefly presented stimuli (1). We tested precision of depth estimation from stereopsis in 65 identical and 35 fraternal twin pairs using a recently developed test (2). Precision for each individual was calculated as the increment in disparity that caused an increment in reported depth on 75% of trials. Using structural equation modeling we estimated the influences of genetic and environmental factors on stereoscopic precision. Almost all reliable individual variation in “far” precision (beyond fixation) was attributable to genes (57%, 38%–70%*), but genes did not contribute to individual variation in “near” precision (closer than fixation; 0%, 0%–26%*). Thus specific genetic markers may correlate with far stereopsis and therapeutic interventions may be most successful if they target near stereopsis. *±1SE. (1) Richards, W. (1970) *Experimental Brain Research*, 10, 380–388. (2) van Ee, R., & Richards, W. (2002) *Perception*, 31, 51–64.

9:20–9:35 (288)

Extremal Edges and Gradient Cuts: New Cues to Depth and Figure–Ground Perception. STEPHEN E. PALMER & TANDRA GHOSE, *University of California, Berkeley*—Extremal edges (EEs) and gradient cuts (GCs) are powerful cues to depth and figure–ground organization that arise from shading and texture gradients, where convex, smoothly curved surfaces occlude themselves (EEs) or are occluded by other surfaces (GCs). Ecological constraints imply that the EE side of the shared edge should be seen as closer and figural, and experimental evidence shows that they are. Indeed, EEs readily dominate even combinations of well-known classical figure–ground cues (e.g., size and convexity). The GC side of a shared edge tends to be seen as a farther/ground surface. The strength of GC effects depends strongly on the relation between the shared edge and the gradient’s equiluminance contours, including the angle between them and the alignment of inflection points along the edge with luminance minima and maxima along the shading gradient. Together they strongly determine the perception of relative depth across an edge and figure–ground assignment.

Picture Processing and Imagery
Shoreline, Sunday Morning, 8:00–10:00

Chaired by James R. Brockmole, University of Edinburgh

8:00–8:15 (289)

Prioritizing New Objects for Eye Fixation in Scenes: Effects of Object–Scene Consistency. JAMES R. BROCKMOLE & JOHN M. HENDERSON, *University of Edinburgh*—Recent research suggests that new objects appearing in real-world scenes are prioritized for eye fixations and by inference, for attentional processing. We examined whether semantic consistency modulates the degree to which new objects appearing in a scene are prioritized for viewing. New objects were added to photographs of real-world scenes during a fixation (new object with transient onset) or during a saccade (new object without transient onset). The added object was either consistent or inconsistent with the scene’s meaning. Object consistency did not affect the efficacy with which transient onsets captured attention, suggesting that transient motion signals capture attention in a bottom-up manner. Without a transient motion signal, the semantic consistency of the new object affected its prioritization with new inconsistent objects fixated sooner than new consistent objects, suggesting that attention

prioritization without capture is a top-down memory-based phenomenon at least partially controlled by object identity and meaning.

8:20–8:35 (290)

Repetition Blindness for Rotated Objects: Viewpoint Invariance and Viewpoint Dependence. WILLIAM G. HAYWARD, *University of Hong Kong*, GUOMEI ZHOU, *Sun Yat-Sen University*, WAI-FUNG MAN, *University of Hong Kong*, & IRINA M. HARRIS, *University of Sydney*—In temporal streams of briefly presented stimuli, observers often miss the repetition of an item, a finding termed repetition blindness (RB). In four experiments, we examined the effects of RB for objects that are rotated between presentations within the stream. Experiment 1 used line drawings of familiar objects, and found significant RB across all viewpoint conditions, with relatively little variation in its magnitude. Experiments 2 and 3 used a similar procedure but employed shaded images as stimuli and two different axes of rotation; here, RB varied across viewpoints but was highest at moderate rotations and lower at either large or small rotations. In Experiment 4, novel objects were used as stimuli, and the results showed the same quadratic pattern of RB found in Experiments 2 and 3. Patterns of RB in these experiments show the influences of both view-specific and view-invariant processes in object recognition.

8:40–8:55 (291)

Nonindependence of High and Low Spatial Frequencies in Picture Memory. WILLIAM PERIA, REBECCA NICHOLS, & GEOFFREY R. LOFTUS, *University of Washington* (read by Geoffrey R. Loftus)—We considered the hypothesis that low and high spatial frequency information in a naturalistic scene contribute independently to the representation used for eventual recognition. This hypothesis failed in two experiments wherein pictures containing only low spatial frequencies, only high spatial frequencies, or all spatial frequencies (the pixel sum of the low and high spatial frequency components) were shown at varying durations in the study phase of a recognition test. Two parameter-free tests, the log-duration parallel test and the reciprocal-duration additivity test, demonstrated independence failure. Specifically, the data implied synergy: Access to the full range of spatial frequencies produced better performance than would be expected on the basis of the two individual frequency components combining independently. A power function fit the data essentially perfectly, the two parameters of which are “liftoff,” the minimum duration required for any memory at all, and growth rate. The observed synergy is captured in a lower-than-predicted-by-independence liftoff value.

9:00–9:15 (292)

Neural Correlates of Object–Spatial Visual Cognitive Style. MICHAEL MOTES, *University of Texas, Dallas*, & MARIA KOZHEVNIKOV, *George Mason University* (read by Maria Kozhevnikov)—The visual system processes object properties (such as shape and color) and spatial properties (such as location and spatial relations) in distinct systems, and this distinction extends to visual imagery and visual cognitive style. We conducted an fMRI study to investigate the neural underpinning of the individual differences in object versus spatial-visual processing. Nine individuals with preferences for object imagery processing (object visualizers) and eight individuals with preferences for spatial processing (spatial visualizers) were scanned while working through a visual processing task. Although the two groups showed equivalent behavioral performance on the task, object visualizers showed lower bilateral neural activity in lateral occipital complex and lower right-lateralized neural activity in dorsolateral prefrontal cortex. The data indicate that object visualizers showed greater object-processing neural efficiency than the spatial visualizers, and that neural efficiency can be considered a mediator of visual cognitive style.

9:20–9:35 (293)

Boundary Extension in the Auditory Domain. JOANNA L. HUTCHISON, TIMOTHY L. HUBBARD, & G. ANDREW HILLIS, *Texas Christian University* (read by Timothy L. Hubbard)—The pres-

ent experiments examined whether boundary extension occurred for auditory stimuli. Participants heard a target excerpt from music or literature, followed by a probe containing the same content but differing in length; participants compared the length of the probe to the length of the target. In Experiment 1, targets were relatively long, and a tendency toward boundary restriction was observed. If longer auditory targets are analogous to wide-angle pictures in studies on visual boundary extension, then this result parallels that in the delay condition of Intraub et al. (1992). Experiment 2 compared shorter (or “close-up”) excerpts and medium (or “prototypical”) excerpts, and Experiment 3 compared longer (or “wide-angle”) excerpts and medium excerpts. The results were consistent with Intraub et al.’s (1992) delay condition results for visual boundary extension, converging on boundary extension when relatively closer targets were presented, but boundary restriction when relatively wider angle targets were presented.

9:40–9:55 (294)

Understanding Picture Understanding Through Art. HELMUT LEDER, *University of Vienna* (sponsored by Irving Biederman)—Art provides the prototypical stimulus for examining processes involved in aesthetic perception. Recently, we proposed an information-processing stage model explaining processes involved in aesthetic experiences, particularly of modern art (Leder et al., 2004). Essential is the processing stage of cognitive mastering, where it is claimed that perceivers aim to understand what they see. Such understanding is particularly relevant for abstract art, which by definition has no clear content. With respect to our model, I present data from studies wherein artworks varied in presentation time, whether they were accompanied with elaborative or descriptive titles (Leder et al., 2006), or whether extra information was presented regarding their stylistic features (Belke et al., 2006). These variations enabled the examination of the processes involved in acquiring meaning in the perception of art. In addition, I present a discussion of how artworks might be special and how they are suitable for investigating general higher order perceptual processes.

Neural Mechanisms of Attention Regency ABC, Sunday Morning, 10:00–12:00

Chaired by Glyn W. Humphreys, *University of Birmingham*

10:00–10:15 (295)

Distinct Neural Mechanisms Modulate Effects of Working Memory and Priming on Visual Selection: Differential Responses in a Fronto-Thalamic Network. GLYN W. HUMPHREYS, DAVID SOTO, & PIA ROTSHTEIN, *University of Birmingham*—Visual selection can be modulated both when items in working memory (WM) match a stimulus in the field and also by implicit priming linked to stimulus repetition across time. We used functional magnetic resonance imaging (fMRI) to assess the neural correlates of these memory-based effects on selection. We show, for the first time, opposite effects on the pattern of activity in superior frontal gyrus, mid-temporal, and occipital areas known to respond to the presence of stimulus repetitions. Whereas the reappearance of a stimulus held in WM enhanced activity in these regions, mere stimulus repetition elicited a suppressed response. Furthermore, a fronto-thalamic network was uniquely sensitive to the behavioral relevance of a match between the contents of WM and the visual array, enhancing activity when the contents of WM matched the critical target of selection. Effects on visual selection from WM and implicit priming depend on distinct neural mechanisms.

10:20–10:35 (296)

Goal- and Stimulus-Driven Orienting in Patients With Parietal Lesions. SARAH SHOMSTEIN, *George Washington University*, & MARLENE BEHRMANN, *Carnegie Mellon University*—Recent neuroimaging studies suggest that the temporo-parietal junction (TPJ) mediates stimulus-driven attentional orienting, whereas the superior

parietal lobule (SPL) subserves goal-directed orienting. Here, we investigated the independence of these attentional subsystems in patients with attentional deficits following an acquired lesion to the dorsal (SPL) or ventral (TPJ) parts of the attentional network. Patients completed a goal-directed attentional shifting task and a visual contingent capture task. Patients with lesioned SPL but spared TPJ exhibited difficulties with goal-directed attentional orienting as well as exhibited a “hyper-capture” phenomenon. Patients with lesioned TPJ but spared SPL performed normally on the goal-directed orienting task, while remaining immune to capture. These findings suggest that in the normal functioning system, the two types of attentional orienting are not entirely independent, but, rather, goal-directed attentional control (SPL) carries information regarding what is important to the task at hand and thus constrains bottom-up attentional capture (TPJ).

10:40–10:55 (297)

Action Relations Reduce Spatial Extinction Through Configural Coding. JANE RIDDOCH & GLYN W. HUMPHREYS, *University of Birmingham* (sponsored by Glyn W. Humphreys)—Patients with parietal lesions have shown recovery from extinction when pairs of objects share an action relation (e.g., a bottle pouring into a glass) relative to when they do not (e.g., a bottle pouring away from a glass) (Ridloch et al., 2003, 2006). We investigated the visual constraints on this effect. We show that the advantage for objects sharing an action relation is significantly reduced when stimuli are inverted, whereas inversion does not affect unrelated objects. Similarly changing the size of the objects relative to one another reduces the effects of action relations on extinction. We suggest that the effects of action relation are based on high-level configural grouping of stimuli, which reduces spatial competition between the stimuli in patients with parietal damage.

11:00–11:15 (298)

Word Fragmentation on the Stroop Task: An Event-Related Potential Study. SOLEDAD BALLESTEROS, JOSÉ MANUEL REALES, & FRANCISCO MUÑOZ, *UNED*—Fifteen adults were presented with congruent, incongruent, and neutral stimuli at four levels of fragmentation while performing the Stroop task. Reaction times and event-related potentials (ERPs) were recorded. An early negative component with a peak-amplitude at 85 msec was found that was larger for the more degraded stimuli at occipital-parietal areas. At 200 msec, a negative potential larger for the most fragmented stimuli in incongruent condition reflected the Stroop effect. From 250 to 400 msec, congruent stimuli showed a larger positive deviation relative to both neutral and incongruent conditions. This bilateral positive potential was larger for the more degraded stimuli. Congruence resolution signalled by a positive ERP and larger for the more fragmented stimuli occurred before the incongruent condition. A late larger negativity for the most fragmented stimuli than for the completed words peaked at 450 msec and was sensitive to the congruent–incongruent conflict. This ERP effect displays a centro-parietal topography.

11:20–11:35 (299)

The Shifting Sands of Conflict Processing. ROBERT WEST, *Iowa State University*—Studies using functional neuroimaging methodologies reveal that conflict processing is associated with recruitment of anterior and lateral prefrontal cortex, parietal cortex, and anterior cingulate. However, there is striking variation in the pattern of recruitment that is observed across studies using PET, fMRI, and ERP methods. In this study I examined the influence of two factors (level of practice and trial pacing) on ERPs elicited during the Stroop task. When there was 500 msec between trials, practice led to a shift from medial frontal recruitment early in the task to lateral frontal and parietal recruitment later in the task. When there was 2,000 msec between trials, the shift in recruitment over time was much less pronounced. These results are consistent with current theories of cognitive control and indicate that investigators need to consider both of these factors when interpreting the results of studies of conflict processing.

11:40–11:55 (300)

The Cognitive Control and Representation Systems of the Human Brain. WALTER S. SCHNEIDER, MICHAEL W. COLE, ROBERT GOLDBERG, & SUDIR PATHAK, *University of Pittsburgh*—A fundamental distinction of human cognition and cortical processing is the interaction of representation specific areas (e.g., visual object, motor action) and domain general control systems (e.g., attention, decision, response mapping, affect coding). We detail the function, anatomy, and interaction of these cortical systems based on behavioral, fMRI, anatomical (DTI), and functional connectivity methods. We relate the cortical systems view to automatic and control processing as well as semantic representation. The representation areas are involved in representation specific encoding, recognition, similarity judgment, episodic recall, and automatic coding. The control system components are tightly coupled, showing differential activity based on comparison decision (anterior cingulate cortex and presupplementary motor area), goal processing (dorsolateral prefrontal cortex), stimulus filtering (inferior frontal junction), arousal (anterior insular cortex), attentional control (posterior parietal cortex), and affect assessment (amygdala and orbitofrontal cortex).

The Nature of Thinking

Regency DEFH, Sunday Morning, 10:20–12:00

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

10:20–10:35 (301)

Putting the Psychology Back Into Psychological Models: Mechanistic Versus Rational Approaches. BRADLEY C. LOVE & MATT JONES, *University of Texas, Austin*, & YASUAKI SAKAMOTO, *Stevens Institute of Technology*—Two basic approaches to explaining the nature of the mind are the rational and mechanistic approaches. Rational analyses attempt to characterize the environment and the behavioral outcomes that humans seek to optimize, whereas mechanistic models attempt to simulate human behavior using processes and representations analogous to those used by humans. We compared these approaches on their accounts of how humans learn the variability of categories. The mechanistic model departs in subtle ways from rational principles, due to its incremental process of updating category representations. The model holds that people adjust their estimates of a category's mean and variance through error-driven learning, based on discrepancies between new category members and the current representation of the category. The model yields a prediction, which we verify, regarding the effects of order manipulations that the rational approach does not anticipate. We suggest that psychological advances are primarily driven by consideration of process and representation, and that rational accounts trail these breakthroughs.

10:40–10:55 (302)

Smarter Than We Think: Conflict Monitoring in Decision Making. WIM DE NEYS, *University of Leuven*, OSHIN VARTANIAN, *University of Toronto*, VINOD GOEL, *York University*, & GÉRY D'YDEWALLE, *University of Leuven* (sponsored by Géry d'Ydewalle)—Human thinking has been characterized as an interplay between an intuitive and logical reasoning process. Although monitoring the output of the two systems for conflict is crucial to avoid decision making errors there are some widely different views on the efficiency of the process. Kahneman (2002) claims that the monitoring of the heuristic system is typically quite lax whereas others such as Sloman (1996) claim it is flawless and people typically experience a struggle between what they “know” and “feel” in case of a conflict. We present a set of behavioral and fMRI studies that contrasted these views. Implicit behavioral conflict detection measures and the activation pattern of the lateral and medial (ACC) prefrontal cortex during decision making both point to the flawless nature of the monitoring: Although people frequently fail to inhibit illogical intuitive beliefs they do detect that their responses are not fully warranted.

11:00–11:15 (303)

Identifying Category Representations Through Sequential Effects in Learning. MATT JONES, *University of Texas, Austin*—Sequential effects can be surprisingly informative about the nature of cognitive representations, because they show how those representations shift with learning. I illustrate this principle with an application to perceptual categorization. Simulations and analytical results show that models that assume different types of category representations yield qualitatively different patterns of recency effects (defined as the dependence of the current response on the previous feedback). Exemplar models predict that recency effects are a direct function of the similarity between present and previous stimuli, whereas theories based on prototypes, rules, or decision bounds predict more complex patterns. Data from two experiments are in close agreement with the predictions from exemplar theory and in conflict with other approaches.

11:20–11:35 (304)

Embodying Abstract Concepts. DANIEL CASASANTO & SANDRA LOZANO, *Stanford University*—Abstract concepts like intelligence, time, or value present a challenge for “embodied” theories according to which thoughts are perceptual simulations: How can we perceptually simulate things we can never perceive? Conceptual Metaphor Theory offers a potential solution. Linguistic metaphors (e.g., *a long time*, *a high grade*, *a deep mystery*) suggest many of our abstract ideas are constituted, in part, by mental representations of perception and motor action. To test this proposal, we investigated relationships between manual motor actions and the meanings of abstract words, using novel Stroop-like Motor-Meaning Congruity tasks. The first set of experiments showed that perceptuo-motor representations were activated automatically when participants instantiated abstract concepts. Further visual hemifield experiments localized these congruity effects in the right hemisphere, consistent with predictions of embodied theories. Finally, experiments comparing motor-meaning congruity effects in right- versus left-handed participants demonstrated that motor experience determines how we perceptually simulate abstract concepts.

11:40–11:55 (305)

Assessing the Neural Bases of Conceptual Combination With fMRI. G. ANDREW JAMES, *Emory University*, W. KYLE SIMMONS, *National Institute of Mental Health*, ARON K. BARBEY, *National Institute of Neurological Disorder and Stroke*, & XIAOPING P. HU & LAWRENCE W. BARSALOU, *Emory University* (read by Lawrence W. Barsalou)—Many neuroimaging studies of individual concepts have found that conceptual processing relies on well-established networks in the brain’s modal systems for perception, action, and introspection. Neuroimaging studies, however, have generally not addressed the fundamental process of conceptual combination in which people combine two or more concepts to form complex conceptual structures. An fMRI experiment was conducted to identify general mechanisms involved in conceptual combination, and to assess whether conceptual combination recruits modality-specific brain networks. Conceptual combination was assessed by contrasting the processing of simple noun phrases (modifier plus head noun) with the individual concepts comprising them. On each trial, a modifier from one of three modalities (mental state, motion, location) was presented alone, followed by a head noun presented alone. Analyses identified brain areas associated with modifiers versus head nouns, processing both kinds of words in isolation versus in conceptual combination, and modality-specific effects associated with the modifiers.

Bilingualism**Beacon A, Sunday Morning, 10:20–12:00***Chaired by Natasha Tokowicz, University of Pittsburgh***10:20–10:35 (306)**

Choices, Choices, Choices: The Consequences of Activating Too Many Translation Alternatives. NATASHA TOKOWICZ, *University*

of Pittsburgh, ERICA B. MICHAEL, *University of Maryland Center for Advanced Study of Language*, & COURTNEY J. SMITH, *University of Pittsburgh*—In translation production, words with multiple translations are translated more slowly than words with one translation (Tokowicz & Kroll, in press). Previous research suggests that this slowdown is due to active competition between alternatives. In this study, we investigated the role of individual differences, measured in terms of working memory span and Stroop interference, in resolving this type of ambiguity. English–Spanish bilinguals translated single- and multiple-translation words in both directions. In addition to replicating the previous slowdown for words with multiple translations, individuals with higher working memory span and higher Stroop interference translated more slowly overall than did the remainder of the individuals, after taking word knowledge into account. The pattern was the same for single- and multiple-translation words. These results suggest that individuals with higher span and interference activate additional translation alternatives (e.g., Tokowicz, Michael, & Kroll, 2004). We discuss the findings in relation to models of bilingual memory representation.

10:40–10:55 (307)

Bilingual Lexical Access in Context: Evidence From Eye Movements During Reading. MAYA LIBBEN & DEBRA A. TITONE, *McGill University* (read by Debra A. Titone)—Current models of bilingualism (e.g., BIA+) posit that lexical access during reading is not language selective. However, much of this research is based on the processing of words in isolation. We investigate whether language nonselectivity is attenuated for words embedded in sentence contexts that bias the target language (e.g., Schwartz & Kroll, 2006). Eye movements were recorded as French–English bilinguals read English sentences containing cognates (*piano*), interlingual homographs (*coin*, meaning “corner” in French), or matched control words. Sentence contexts were high or low semantically constraining. The results showed significant facilitation for cognates and inhibition for interlingual homographs in low-constraint sentences in both gaze duration and fixation count, but not first fixation duration. This cognate facilitation and homograph inhibition was absent for high-constraint sentences. Thus, semantically constrained sentences modulate language selectivity during lexical access for both cognates and interlingual homographs. Implications for models of bilingual lexical access are discussed.

11:00–11:15 (308)

Word Recognition in Sentence Contexts By Bilinguals. WOUTER DUYCK, EVA VAN ASSCHE, DENIS DRIEGHE, & ROBERT J. HARTSUIKER, *Ghent University*—Research on bilingualism has shown that lexical access in visual word recognition by bilinguals is not selective with respect to language. The present study investigated language-independent lexical access in bilinguals reading sentences, which constitutes a strong unilingual linguistic context. In the first experiment, Dutch–English bilinguals performing an L2 lexical decision task were faster to recognize identical and nonidentical cognate words (e.g., *banaan–banana*) presented in isolation than control words. A second experiment replicated this effect when the same set of cognates was presented as the final words of L2 low-constraint sentences. In a third experiment using eyetracking, we showed that early target reading time measures also yield cognate facilitation, but only for identical cognates. In a fourth eyetracking experiment, similar results were obtained with cognates embedded in L1 sentences. These results suggest that sentence contexts influence, but do not nullify, cross-lingual lexical interactions during early visual word recognition by bilinguals.

11:20–11:35 (309)

The Influence of Foreign Accent on Morphological Processing in English. LAURIE B. FELDMAN & DANA BASNIGHT BROWN, *University at Albany and Haskins Laboratories*, & YUKI KANAI, *University at Albany*—We used a cross-modal priming procedure to explore the processing of irregular and regular English verb forms in

monolinguals and bilinguals (Japanese–English). Pairs included irregular nested stem (*drawn*–DRAW), irregular change stem (*ran*–RUN), and regular past-present verbs presented in American and Japanese accents. Native speakers of English revealed comparable facilitation (10%) for regular and nested stem irregulars, less (6%) for stem change irregulars, and attenuated facilitation when auditory primes were accented in Japanese. Japanese bilinguals matched for proficiency across accent also showed robust facilitation for regular and nested stem irregulars and less for stem change irregulars. Magnitudes were comparable when auditory primes were pronounced with Japanese and English accents. Interpretation focuses on the phonologies of native and nonnative perception and production.

11:40–11:55 (310)

The Comprehension of Idiomatic Expressions by Spanish–English Bilinguals. ROBERTO R. HEREDIA, OMAR GARCIA, & MARY R. PENECALE, *Texas A&M International University*—Spanish–English bilinguals were exposed to idiomatic expressions classified as identical across Spanish and English (“ojo por ojo” vs. “an eye for an eye”), similar (“to hit the nail in the head” vs. “dar en el clavo”), and different (“to kick the bucket” vs. “Estirar la pata”). In Experiment 1, bilinguals participated in a reading task. In Experiment 2, bilinguals made lexical decisions to visually presented targets that were related (literal: “water” or nonliteral: “death”) or unrelated to a preceding idiom (“to kick the bucket”). Experiment 1 revealed that contrary to previous findings, bilinguals were faster to read idiomatic expressions classified as different than identical or similar. Experiment 2 showed facilitatory priming effects for the three idiom types. However, the priming effect for the identical idioms was greater. In general, the results showed that during the comprehension of idioms, bilinguals consider both possible meanings (i.e., literal and nonliteral) simultaneously.

Metacognition and Its Measurement

Beacon B, Sunday Morning, 9:40–12:00

Chaired by Janet Metcalfe, Columbia University

9:40–9:55 (311)

Time and People’s Metacognitions of Agency. JANET METCALFE, *Columbia University*, TEAL S. EICH & ALAN D. CASTEL, *UCLA*, & MATTHEW J. GREENE, *Columbia University*—People’s metacognitive judgments of their own control were compared to their judgments of performance. After playing a game in which they tried to catch the Xs and avoided touching the Os, they made judgments of performance or control. Of focal interest were cases in which the control of the mouse was time lagged to the participants’ movements by 125, 250, or 500 msec. Time lagged conditions were contrasted to conditions matched for noise—the *turbulence* conditions—that did not include the time delay correlation. College students felt more in control than performance judgments warranted with the systematic time lag. With the turbulence manipulation they felt less in control than performance judgments warranted. We will discuss a view of people’s feelings of agency that is suggested by these results. Data on an equivalent experiment with elders will also be presented.

10:00–10:15 (312)

Memory Conjunction Errors: Emergent Structure and Metacognitive Control. MICHAEL F. VERDE, *University of Plymouth*—A common form of false memory is the conjunction error, the mistaken recognition of a lure created from the elements of different objects or episodes. Much evidence suggests that false recognition of conjunction lures depends on the familiarity of their individual elements. The present study argues that such an account is incomplete: Not only the individual identity but also the structural relationship of elements determines false recognition. Experiments using photographic scenes examine whether emergent structure (1) mediates element familiarity and (2) determines the metacognitive decision rules by which we control recognition errors.

10:20–10:35 (313)

Understanding the Hypercorrection Effect: Why High Confidence Errors Are Easily Corrected. LISA K. FAZIO & ELIZABETH J. MARSH, *Duke University* (read by Elizabeth J. Marsh)—The hypercorrection effect is the finding that high-confidence errors are more likely to be corrected after feedback than are low-confidence errors (Butterfield & Metcalfe, 2001). There are at least two possible explanations for this finding. The surprise hypothesis states that feedback that is incongruent with one’s expectations is surprising, and thus is more likely to be elaboratively processed and hence remembered. The knowledge hypothesis posits that subjects have more domain-related knowledge for high-confidence answers, making it easier to integrate the feedback with prior knowledge. Data from two different paradigms support the surprise hypothesis. First, the effect occurs in an episodic memory paradigm, for which subjects do not have background knowledge. Second, in a source memory paradigm, subjects show better memory for the surface features of surprising feedback. Surprise indicates a miscalibration between one’s memory and the feedback, and directs the rememberer to the errors that are most essential to correct.

10:40–10:55 (314)

Perceptual Cues Can Lead to Metacognitive Illusions. MATTHEW G. RHODES, *Colorado State University*, & ALAN D. CASTEL, *UCLA*—Perceptual information can capture attention and is utilized when judging size or depth. However, the interpretation of perceptual cues can also produce cognitive illusions. In the present study, we examined how the font size of to-be-remembered words influences predicted memory performance. Participants studied words for a later recall test that varied in font size and made judgments of learning (JOLs) for each item. JOLs were found to vary as a function of font size, with larger font sizes given higher JOLs, whereas little relationship was evident between font size and recall. Thus, perceptual cues influenced JOLs, possibly due to encoding fluency. We extend these findings to an auditory domain and also demonstrate that the effect is modified when participants study word pairs of varying associative strength. Overall, these data suggest that under some circumstances, perceptual information is relied on when making metacognitive judgments and this can lead to metacognitive illusions.

11:00–11:15 (315)

You Knew It All Along but I Only Knew It All Along Somewhat. DANIEL M. BERNSTEIN, *Kwantlen University College*, WILLIAM PERIA, *University of Washington*, GINA LEWANDOWSKI, *University of Chicago*, JANICE CHEN, *Stanford University*, GEOFFREY R. LOFTUS, *University of Washington*, & BOAZ KEYSAR, *University of Chicago*—When we learn the outcome to a problem, we tend to think that we knew it all along and that others would also know it (hindsight bias). We present a series of experiments ($N = 443$) involving hindsight bias for oneself and others. In Experiments 1 and 2, subjects identified degraded pictures of celebrities and common objects that clarified gradually on a computer screen. Later, when the identity of each picture was known, subjects indicated when they thought that they had identified each picture previously (*self* condition) or when they thought that the person seated behind them had identified the picture previously (*other* condition). We found hindsight bias for self and other; however, the magnitude of the bias was greater for other than for self. In Experiment 3, we replicated this effect using verbal materials. We conclude that hindsight bias is greater for others than for oneself.

11:20–11:35 (316)

Bias in the Gamma Coefficient As a Measure of Metacognitive Accuracy. MICHAEL E. J. MASSON, *University of Victoria*, & CAREN M. ROTELLO, *University of Massachusetts, Amherst*—Signal detection theory provides a means of assessing discrimination accuracy independent of response bias, but its application depends on distributional assumptions such as normal distributions with equal variance.

The Goodman–Kruskal gamma coefficient, G , has been proposed as a “nonparametric” measure of accuracy in perceptual and memory discrimination tasks as well as in metacognitive judgments. This measure is widely used, particularly in tasks that assess metamemory performance. We demonstrate that G is not free of distributional assumptions after all, and that the computed value of G systematically deviates from its actual value under realistic conditions. This finding implies that caution is needed when using G as a measure of accuracy and an alternative measure is recommended. Application of this alternative measure requires no change in how data are typically collected in metacognition experiments.

11:40–11:55 (317)

Type I Error Rates and Power Analyses for Single-Point Sensitivity Measures. CAREN M. ROTELLO, *University of Massachusetts, Amherst*, MICHAEL E. J. MASSON, *University of Victoria*, & MICHAEL F. VERDE, *University of Plymouth*—Experiments often produce a hit rate and a false-alarm rate in each of two conditions. These response rates are summarized into a single-point sensitivity measure such as d' and t tests are conducted to test for experimental effects. Using large-scale Monte Carlo simulations, we evaluate this research strategy with four commonly used single-point measures (d' , A' , percent correct, and gamma) and a newly proposed measure (gammaC). We ask two questions: (1) Assuming two conditions that differ only in response bias, what is the Type I error rate for each measure? (2) Assuming two conditions that differ in true sensitivity, what is the power of each measure to detect that effect? Our simulations indicate that power is similar for these measures, but that the Type I error rates are often unacceptably high. Type I errors are minimized when the selected sensitivity measure is theoretically appropriate for the data.

Memory in the Real World Seaview, Sunday Morning, 10:00–12:00

Chaired by Ruth S. Day, *Duke University*

10:00–10:15 (318)

Memory Failures in the Real World: What Were Those Side Effects? RUTH S. DAY, *Duke University*—Both doctors and patients must remember key information about medications, especially their potential side effects. Otherwise both may fail to recognize serious side effects and take appropriate actions when they occur. Doctors should be able to remember side effects well, since they have considerable medical knowledge and experience. However, this research shows that they are no better than laypersons. Participants studied medication information then we tested them using several memory tasks. Overall memory for side effects was very poor, for both doctors and laypersons. However both groups improved dramatically when the same information was presented in new displays, designed to enhance the “cognitive accessibility” of the information. Cognitive accessibility trumped many factors, including prior knowledge, memory load, and motivation. Cognitive accessibility may play an important role in many memory experiments, independent of their stimulus content.

10:20–10:35 (319)

Remembering Products, Not Faces: “Refreshing Recollection” of Eyewitnesses in Product Liability Situations. J. TRENT TERRELL & CHARLES A. WEAVER III, *Baylor University* (read by Charles A. Weaver III)—Eyewitness identification usually involves witnesses of a crime selecting suspects from a lineup. Eyewitness memory is also critical in product liability cases, where a person identifies particular products (usually containing asbestos) suspected of causing current illnesses (usually cancer). Due to the diseases’ latency periods, the illness often occurs decades after possible exposure. To assist witnesses in identifying products, attorneys often “refresh” their memories by showing them product photographs prior to identification. We showed witnesses a video containing various products. After 10-min or 1-week delays, subjects viewed photographs of products and told these “may”

help them in later tests. Subjects selected the products shown in photographs nearly 90% of the time, even if those photographs were misleading. In subsequent experiments, subjects viewed photographs of nonexistent products created using Photoshop (“Smucker’s barbecue sauce”). Subjects later identified these fictitious products approximately half the time. Implications for “refreshing recollection” of eyewitnesses are discussed.

10:40–10:55 (320)

Discriminating Fact From Fiction in Recovered Memories of Childhood Sexual Abuse. ELKE GERAERTS, *Harvard University*, D. STEPHEN LINDSAY, *University of Victoria*, HAROLD MERCKELBACH & LINSEY RAYMAEKERS, *Maastricht University*, MICHELLE M. ARNOLD, *University of St Andrews*, & JONATHAN S. SCHOOLER, *University of British Columbia*—Are individuals able to forget and then later accurately recover episodes of traumatic events such as childhood sexual abuse? According to some investigators, many recovered memory experiences are the products of overly suggestive therapy rather than reflecting true memory recovery. According to other investigators, such experiences can be genuinely forgotten and recovered quite accurately later in life. In this talk, I present research focusing on individuals who report having recovered a memory of childhood sexual abuse, examining two classes of people: those who gradually recovered childhood abuse during suggestive therapy, and those who spontaneously recovered being abused. In both groups, we assessed whether the abuse could be independently corroborated as well as cognitive markers believed to be sensitive to memory suggestibility and metamemory. This research reveals striking differences in these two types of memory recovery, both in terms of corroboration and memory ability. Possible mechanisms underlying genuine recovered memory experiences will be discussed.

11:00–11:15 (321)

Guided Cognition of Unsupervised Learning: Designing Effective Homework. Part 2. WILLIAM B. WHITTEN II, MITCHELL RABINOWITZ, & SANDRA E. WHITTEN, *Fordham University*—Guided Cognition structures study tasks to engage students in specific, observable cognitive events that elicit underlying cognitive processes. We identified cognitive events that commonly occur in classrooms and that have correlates in the experimental literature, then designed some into homework. Last year we reported that quiz performance was better after Guided Cognition homework than after Traditional homework on Shakespeare’s *Macbeth*, for average and advanced English literature students. Subsequent experiments using Conrad’s “The Secret Sharer” and Anouilh’s *Becket* determined this advantage was due neither to differences in time spent on the two forms of homework, nor to teaching that preceded the homework. Recent experiments using Shakespeare’s *Macbeth* determined that these results are not due to novelty and that Guided Cognition experience can influence thinking during subsequent unguided learning. Detailed analysis indicates that visualizing, role-playing, brainstorming, divergent thinking, and relating to prior experience may each contribute to the Guided Cognition learning advantage.

11:20–11:35 (322)

Applying the Principles of Testing and Spacing to Long-Term Retention of Course Information. SHANA K. CARPENTER, *University of California, San Diego*, NICHOLAS J. CEPEDA, *York University*, & DORIS ALVAREZ & HAL PASHLER, *University of California, San Diego*—Spaced repetition and testing have been shown to enhance memory in short-term laboratory studies. Their utility for promoting long-term retention in classroom situations is not clear, however. We explored 8th grade students’ memory for U.S. history facts (e.g., Ulysses S. Grant became president of the U.S. in 1869), depending on whether the facts were reviewed after 3 days, versus 3 months. Students reviewed some facts through testing (Who became president of the U.S. in 1869?) followed by feedback (Ulysses S. Grant), and they reviewed other facts by simply rereading them. Nine months later, stu-

dents received a final test covering the facts they reviewed through testing versus rereading, and some that they never reviewed. Retention was greatest for facts that were reviewed through testing after a 3-month delay, suggesting that the principles of testing and spacing can be readily applied to improving retention of U.S. history.

11:40–11:55 (323)

The Role of Attention in Episodic Memory Impairment During Nicotine Withdrawal. PAUL S. MERRITT, ADAM COBB, & LUKE MOISSINAC, *Texas A&M University, Corpus Christi*, & ELLIOT HIRSHMAN, *George Washington University*—Previous research has shown reductions in memory performance following 24 h of abstinence from tobacco use (Hirshman et al., 2004). A central question from this research is whether this is a primary effect of withdrawal from nicotine or due to reductions in attention also observed during withdrawal (Hirshman et al., 2004). We tested 25 moderate to heavy smokers when smoking normally (ad lib) and after 24 h without tobacco use (abstinent). Participants completed a recognition memory test under both full and divided attention encoding conditions, in addition to f digit span, selective attention task, and mental rotation. The most significant finding was a reduction in memory performance during abstinence which was equivalent across full and divided attention conditions. No effects of withdrawal from nicotine were observed for the other tasks. Tobacco abstinence appears to have a primary effect on episodic memory performance, which may have consequences for individuals abstaining from tobacco.

Speech Recognition Shoreline, Sunday Morning, 10:20–12:00

Chaired by Heather Bortfeld, Texas A&M University

10:20–10:35 (324)

Early Word Recognition May Be Stress-Full. HEATHER BORTFELD, *Texas A&M University*, & JAMES MORGAN, *Brown University*—In a series of studies, we examined how mothers naturally stress words across multiple mentions in speech to their infants and how this marking influences infants' recognition of words in fluent speech. We first collected samples of mothers' infant-directed speech using a technique that induced multiple repetitions of target words. Acoustic analyses revealed that mothers systematically alternated between emphatic and nonemphatic stress when talking to their infants. Using the headturn preference procedure, we then tested 7.5-month-old infants on their ability to detect familiarized bisyllabic words in fluent speech. Stress of target words (emphatic and nonemphatic) was systematically varied across familiarization and recognition phases of four experiments. The results indicated that, although infants generally prefer listening to words produced with emphatic stress, recognition was enhanced when the degree of emphatic stress at familiarization matched the degree of emphatic stress at recognition.

10:40–10:55 (325)

Influence of Visual Speech on Phonological Processing by Children. SUSAN JERGER, *University of Texas, Dallas*, MARKUS F. DAMIAN, *University of Bristol*, MELANIE SPENCE, *University of Texas, Dallas*, & NANCY TYE-MURRAY, *Washington University School of Medicine*—Speech perception is multimodal in nature in infants, yet dominated by auditory input in children. Apparent developmental differences may be specious, however, to the extent performance has been assessed implicitly in infants and explicitly in children. We assessed implicitly the influence of visual speech on phonological processing in 100 typically developing children between 4 and 14 years. We applied the online cross-modal picture word task. Children named pictures while attempting to ignore auditory or audiovisual distractors whose onsets were congruent or conflicting (in place of articulation or voicing) relative to picture–name onsets. Overall, congruent onsets speeded naming and conflicting onsets slowed naming. Visual speech

significantly (1) enhanced phonological effects in preschoolers and preteen/teenagers but (2) exerted no influence on performance in young elementary school children. Patterns of results will be related to abilities such as speechreading, input/output phonology, vocabulary, visual perception, and visual processing speed.

11:00–11:15 (326)

Asynchrony Tolerance in the Multimodal Organization of Speech. ROBERT E. REMEZ, DARIA F. FERRO, & KATHRYN R. DUBOWSKI, *Barnard College*—Studies of multimodal presentation of speech reveal that perceivers tolerate large temporal discrepancy in integrating audible and visible properties. Perceivers combine multimodal samples of speech resolving syllables, words, and sentences at asynchronies greater than 180 msec. A unimodal test exploiting sine wave speech revealed that asynchrony tolerance in auditory speech differs critically from audiovisual speech perception. Is this difference in tolerance due to the reliance on dynamic sensory attributes, or a true difference between uni- and multimodal organization? New tests used sine wave synthesis of speech in an audiovisual presentation. Perceivers transcribed audiovisual sentences differing in asynchrony of a tone analog of the second formant relative to a visible face articulating a sentence. Asynchronies ranged from 250 msec to 250-msec lag. The results revealed time-critical similarities and differences between perceptual organization of unimodal and multimodal speech. The implications for understanding perceptual organization and analysis of speech will be discussed.

11:20–11:35 (327)

Effects of Time Pressure on Eye Movements to Visual Referents During the Recognition of Spoken Words. DELPHINE DAHAN, *University of Pennsylvania*—Eye movements to visual referents are increasingly being used as a measure of lexical processing during spoken-language comprehension. Typically, participants see a display with four pictures and are auditorily instructed to move one of them. The probability of fixating a picture as participants hear the target's name has been assumed to reflect lexical activation of this picture's name. Here, we more closely examined the functional relation between fixations and lexical processing by manipulating task demands. Half of the participants were asked to complete the task as quickly as possible, and half were under no time pressure. The frequency of target- and distractor-picture names was varied. Time pressure affected the speed with which participants fixated the target picture. Importantly, it also greatly amplified the impact of lexical frequency on fixation probabilities. Thus, the relation between lexical activation and fixation behavior is only indirect, and, we argue, mediated by a decisional component.

11:40–11:55 (328)

Audiovisual Alignment Facilitates the Detection of Speaker Intent in a Word-Learning Setting. ELIZABETH JOHNSON & ALEXANDRA JESSE, *Max Planck Institute for Psycholinguistics*—Caregivers produce distinctive speech-accompanying movements when addressing children. We hypothesized that the alignment between speakers' utterances and the motion they impose upon objects could facilitate joint attention in caregiver–child interactions. Adults ($N = 8$) were videotaped as they taught the proper name of a toy to 24-month-olds. The toy's motion was extracted from the video to animate a photograph of the toy. In a forced-choice task, adults ($N = 24$) watched side-by-side animations (a forward and reversed version of the same animation) and were asked to choose which toy the speaker was labeling. Performance was above chance (75% correct). Performance was hindered when the speech was reversed, but not when it was low-pass filtered, suggesting that adults rely on the alignment between the motion imposed on the labeled toy and the utterance's prosody to detect speaker intent. We are currently testing whether this amodal information modulates 24-month-olds' attention in a word-learning setting.

POSTER SESSION I
Grand Ballroom, Convention Center
Thursday Evening, 6:00–7:30

• INFERENCES •

(1001)

Motor Priming As a Result of Inferences in Sentence Comprehension. CHRISTOPHER M. WARREN, MICHAEL E. J. MASSON, & DANIEL N. BUB, *University of Victoria* (sponsored by A. A. J. Marley)—The role of action representations in language comprehension was examined. Subjects listened to sentences and were cued to make a gesture related or unrelated to a manipulable object mentioned in the sentence. Gesture production was faster when the gesture was related to the object. Variations in sentence context showed dissociable priming effects between functional gestures (associated with an object's use) and volumetric gestures (associated with an object's shape), even when manual interaction was not explicitly mentioned in the sentence. When the sentence described a nonphysical interaction (*the man looked at the calculator*), implying intention to use the object, only functional gestures were primed. When the sentence described a non-manual physical interaction (*the man stepped on the calculator*), implying that the object should be moved, only volumetric gestures were primed. These results suggest that motor representations are activated as a result of inferential processes during sentence comprehension.

(1002)

Hemisphere Differences in Knowledge-Based Inferences: Domain Makes a Difference. CONNIE SHEARS, AMANDA HAWKINS, ANDRIA VARNER, LINDSEY LEWIS, & JENNIFER HEATLEY, *Chapman University*—Language comprehension emerges when the left hemisphere (LH), utilizing a fast mechanism based on strongly associated words, and the right hemisphere (RH), using a slower mechanism based on distant associations, share information derived from discourse (Beeman et al., 2000). This study investigates the role of knowledge domain across hemispheres, hypothesizing that the RH may demonstrate inference processes for planning knowledge whereas the LH may demonstrate inference processes for knowledge of physical cause and effect. Sixty-eight participants completed divided-visual-field reading tasks based on 2-sentence stimuli that relied on these knowledge areas. Inference processes were measured by probe word recognitions. The results showed that readers made more planning inferences from the RH and more physical inferences from the LH, indicating that inference processes occur from each hemisphere dependent upon the knowledge domain required to support it. These data extend previous findings, specifying that hemispheric differences in language processes are also based on knowledge domains.

(1003)

Influences on the Generation of Instrumental Inferences During Text Comprehension. JOEL A. HAGAMAN & WILLIAM H. LEVINE, *University of Arkansas*—Relationships between visual, verbal, and general working memory (measured with a variety of instruments) and the propensity to generate instrumental inferences during text comprehension were examined. Inferencing was measured with a lexical decision task. In an inference condition, participants read about a character performing an action (e.g., *The cook was slicing vegetables . . .*) and were required to make a lexical decision on a related noun (e.g., *knife*). In the control condition, the text was not as strongly related to the probe word (e.g., *The cook was steaming vegetables . . . knife*). It was predicted that individuals scoring high on the working memory measures would show the largest differences between these conditions. The results indicated that, whereas inferences were generated, their relation to working memory was opposite from predictions. The results are discussed in terms of individual differences in attentional control.

(1004)

Do Readers' Trait Inferences Influence the Generation of Predictive

Inferences? MARK A. CASTEEL, *Pennsylvania State University, York*—Previous research has shown that readers can construct trait inferences about narrative characters. These trait inferences have been shown to influence the processing of later text that is either consistent or inconsistent with the narrative. Other research has shown that readers can generate predicted outcomes of highly likely events, even when they are not needed for comprehension. The present research expands upon these two areas by examining whether trait inferences mediate the likelihood that readers will generate predictive inferences. Participants read narratives that suggested a likely character trait. Later, the narratives suggested a likely predictive inference that either was or was not relevant to the character trait. Reading latencies to a critical target sentence about the inference were recorded. The results help to delineate the influence of trait inferences on later discourse comprehension. Implications for theories of discourse processing will be discussed.

(1005)

Separable Electrophysiological Effects Underlie N400s Elicited by New Versus Inferred Information During Comprehension. VAUGHN R. STEELE, EDWARD M. BERNAT, PAUL F. COLLINS, PAUL VAN DEN BROEK, CHRISTOPHER J. PATRICK, & CHAD J. MARSOLEK, *University of Minnesota*—Successful comprehension of scenarios requires inferring information that is not explicitly presented in the text. After an inference is generated, how is inferred/expected information processed differently from new information? We used event-related potentials (ERPs) and time-frequency analysis to investigate neural correlates of the processes that occur after a causal coherence inference has been made during comprehension. Participants read short inference-promoting texts and performed a lexical decision after each text. Target words were either unrelated or inference-related to the preceding text. Consistent with previous N400 reports, unrelated words elicited greater negativity than did inference-related words. Using time-frequency analysis of the N400, we found evidence for dissociable neural processes. Early theta activation was associated with detecting a lack of coherence between expected and incoming information (greater for unrelated than for inference-related words), but later delta activation was associated with integrating incoming information with the text representation (greater for inference-related than for unrelated words).

(1006)

Bilingual Resonance: Reactivating Text Elements Between L1 and L2. BROOKE LEA, *Macalester College*, PAUL VAN DEN BROEK & JAZMIN CEVASCO, *University of Minnesota*, & AARON MITCHEL, *Pennsylvania State University*—Memory-based text processing research has focused on how distal text concepts are reactivated by an automatic resonance process. In a typical experiment, an adjective-noun pair such as “leather couch” is presented as a contextual cue early in a passage, and then repeated later in the passage. Concepts associated with the first instance of the cue are reactivated upon presentation of the second instance of the cue. Researchers agree that feature overlap is fundamental to triggering resonance, but little is known about how overlap is defined psychologically. We gave English-Spanish bilinguals passages that were partly in English and partly in Spanish, and crossed L1 and L2 with the beginning and end of each passage to determine the effect that cue encoding in one language has on the translated counterpart encoded in the other language. The results showed robust resonance effects both within and between languages, and a modest L2 proficiency effect.

• SPEECH PERCEPTION •

(1007)

A Model of Discrimination Change Due to Unsupervised Category Learning. BRENDEN M. LAKE, GAUTAM K. VALLABHA, & JAMES L. McCLELLAND, *Stanford University* (sponsored by James L. McClelland)—The learning of perceptual categories often leads to

changes in discrimination and perceived similarity within and across category boundaries, even when category learning is unsupervised. The online mixture estimation model (Vallabha, McClelland, Pons, Werker, & Amano, in press) provides an account of unsupervised vowel category learning by treating categories as Gaussian distributions whose parameters are gradually estimated. We extend the model to pairwise discrimination, defined as the extent to which two stimuli are members of different estimated categories. We address three findings: Infants' discrimination of speech sounds is better after exposure to a bimodal rather than a unimodal distribution (Maye, Werker, & Gerken, 2002), infants' discrimination of vowels is affected by acoustic distance (Sabourin & Werker, 2004), and perceived similarity is affected by order of typical versus atypical category exemplars (Polk, Behensky, Gonzalez, & Smith, 2002). The model also makes predictions about the development of discrimination during perceptual learning.

(1008)

Nonsimultaneous Context Effects for Speech-Like Stimuli. JEREMY R. GASTON, RICHARD E. PASTORE, JESSE D. FLINT, & ANJULI BOSE, *Binghamton University*—A well known speech perception finding is that the physical properties that cue consonant identity can differ substantially as a function of vowel context. Might vowel properties alter the accessibility of consonantal cues? Addressing this question, the present work investigates the effects of vowel formant-like stimuli on the ability to recognize aspects of speech-like targets. For both frequency transitions and brief noise bursts, a subsequent stimulus provided significant backward recognition masking relative to those same stimuli in isolation, with the amount of interference dependent on both the target-masker frequency relationship and the complexity of the masker. The opposite effect, forward recognition contrast, was found for the temporal reversal of the stimuli. If these results for speech-like stimuli generalize to speech, they would, at a minimum, provide a perceptual account for the physical changes in consonantal cues across vowel contexts.

(1009)

Perception of Cross-Modal Speech Alignment. RACHEL M. MILLER, KAUYUMARI SANCHEZ, & LAWRENCE D. ROSENBLUM, *University of California, Riverside* (sponsored by Lawrence D. Rosenblum)—Talkers are known to produce utterances that partly imitate, or align to, the speech they hear. Alignment occurs both during live conversation and when a talker is asked to shadow recorded words. Recent evidence reveals that talkers also align toward the speech they see. When asked to shadow lipread words from a speaker, subjects will produce utterances that sound more like those of the speaker. Previously, alignment has been determined by naive raters asked to judge the auditory similarity between a speaker's and subjects' utterances. To determine whether alignment is also apparent across modalities, raters were asked to judge the relative similarity between a speaker's visual (video) utterance and two audio utterances of the subject. Raters judged the speaker's visual utterance as more similar to subjects' shadowed utterances than to subjects' baseline (read text) utterances. This suggests that raters are indeed sensitive to the cross-modal similarity that occurs during alignment.

(1010)

Speeded Choice Responses to Audiovisual Speech. KAUYUMARI SANCHEZ, RACHEL M. MILLER, & LAWRENCE D. ROSENBLUM, *University of California, Riverside*—Speakers are nearly as fast at shadowing an unpredicted syllable (/ba/, /va/, or /da/; choice condition), as they are at uttering a single assigned syllable (/ba/; simple condition) following presentation by a model. One explanation for these speeded choice reaction times is that listeners are extracting articulatory information that can serve to prime their own gestures. To test the articulatory versus auditory nature of this priming information, an audiovisual test of choice reaction times was conducted. Speeded choice reaction times were observed for an audiovisually

fused syllable (audio /ba/ + visual /ga/, perceived as “da”), suggesting that priming information does exist at the gestural level. These findings suggest that the common currency facilitating a speeded production can take an informational form that exists cross-modally. The results are also consistent with transcranial magnetic stimulation findings that show responsiveness in specific articulatory muscles dependent on audiovisually integrated speech information.

(1011)

Cognitive Consequences of Parallel Language Processing in Bilinguals. HENRIKE K. BLUMENFELD & VIORICA MARIAN, *Northwestern University*—Bilinguals' activation and control of word networks across languages was examined using eyetracking and negative priming. Experiment 1 found that, when listening to words, bilinguals activated cross-linguistic competitors from sparse, but not dense, phonological neighborhoods, suggesting that cross-linguistic competitors from large neighborhoods are inhibited by similar words. Competition resolution from cross-linguistic networks may place additional demands on inhibitory control in bilinguals. Experiment 2 tested the hypothesis that bilingual experience modulates cognitive inhibition mechanisms during auditory comprehension. The results suggest that monolinguals inhibit within-language competitors to resolve ambiguity, whereas bilinguals may resolve competition equally efficiently without the use of overt inhibition. To draw connections between consequences of bilingualism in the linguistic and nonlinguistic domains, Experiment 3 compared performance on the eyetracking/negative priming paradigm with performance on measures of executive control (linguistic Stroop, nonlinguistic Stroop, and Simon tasks). Together, results suggest a link between parallel language activation in bilinguals and executive control mechanisms.

(1012)

The Nature of Memory Representations for Surface Form of Spoken Language. SABRINA K. SIDARAS & LYNNE C. NYGAARD, *Emory University* (sponsored by Lynne C. Nygaard)—This study examined the nature of memory for surface characteristics of spoken words by evaluating the effects of indexical and allophonic variation in implicit and explicit memory tasks. During the study phase for all tasks, participants were presented with a list of words that varied by speaker and pronunciation. In the test phase, words were repeated either in the same or different voice and with the same or different pronunciation. The results showed that in both explicit and implicit memory tasks, changes from study to test in pronunciation and voice interacted to influence memory performance. A memory benefit was found for items repeated in the same rather than in a different voice but only when pronunciation stayed the same from study to test. These findings suggest that the relative specificity of memory representations for spoken language may depend on the interaction of surface and phonological form.

(1013)

Cognitive Predictors of Lipreading Ability in Hearing Adults. JULIA E. FELD & MITCHELL S. SOMMERS, *Washington University* (sponsored by Mitchell S. Sommers)—Previous research has shown extensive individual variability in lipreading ability, even among participants sampled from homogenous populations. Despite considerable research on factors that predict individual differences in lipreading, it remains unclear what traits or abilities underlie the observed variability in visual-only speech perception. In part, the absence of reliable predictors of lipreading can be attributed to the use of narrow sets of predictor variables within individual studies. The present study therefore examined the ability of a broad range of factors, including working memory, processing speed, verbal learning, personality, and perceptual closure, to account for individual differences in lipreading ability. Multiple measures of each of these factors were obtained along with lipreading measures for consonants, words, and sentences. To date, only verbal processing speed has emerged as a significant predictor of lipreading ability for all three types of stimuli.

(1014)

Comparing Perceptual Adaptation With Naturally Produced Fast Speech and Time-Compressed Speech. IVY L. LIU, *University at Buffalo*, CONSTANCE M. CLARKE-DAVIDSON, *University of Alberta*, & PAUL A. LUCE, *University at Buffalo*—Our purpose was to explore perception of the dual components of speech produced at a fast rate: rate of information flow and phonetic differences from normal rate speech. Previous research has shown that time-compressed speech is easier to process than naturally produced fast speech, presumably due to less careful articulation in fast speech (Janse, 2004). Other research has demonstrated that listeners adapt within 10 sentences to time-compressed speech in which rate of information is increased but phonetic characteristics are unaltered (Dupoux & Green, 1997). We further explored differences in perception of time-compressed and natural fast speech in the context of perceptual adaptation. We compared adaptation to semantically anomalous sentences produced at a fast rate versus time-compressed from a normal rate. Initial results indicate a different pattern of adaptation to time-compressed and natural fast speech. Based on these findings, we consider the possibility that rate and phonetic adaptation are separate processes.

(1015)

Talker Specificity Effects in the Perception of Foreign-Accented Speech. CONOR T. MCLENNAN, *Cleveland State University*, & JULIO GONZÁLEZ, *Universitat Jaume I*—Our research examines the circumstances in which talker variability affects spoken word perception. Based on previous time-course work, we hypothesized that talker specificity effects would be more robust when processing is relatively slow. We further hypothesized that spoken word processing would be significantly slower for listeners presented with foreign-accented speech than for listeners presented with speech produced by native speakers (and thus produced without a foreign accent). Consequently, we predicted that more robust talker specificity effects would be obtained for listeners presented with foreign-accented speech. Our results confirmed these hypotheses: Listeners presented with foreign-accented speech made lexical decision responses significantly more slowly than listeners presented with nonaccented speech. Crucially, talker specificity effects were only obtained for listeners presented with foreign-accented speech. The results are consistent with previous time-course findings, and add to our knowledge of the circumstances under which variability affects the perception of spoken words.

• MOTOR CONTROL •

(1016)

Resistance to Slow Motion: Strategies for Moving Near Preferred Speeds. ROBRECHT P. R. D. VAN DER WEL & DAVID A. ROSENBAUM, *Pennsylvania State University* (sponsored by David A. Rosenbaum)—A great deal of research has focused on how people respond to challenges of moving above preferred movement rates. Much less work has focused on how people respond to challenges of moving below preferred rates. To address this issue, we asked participants to move a dowel back and forth between two large targets in time with an auditory metronome whose rate varied from slow to fast. The kinematics of participants' movements at each of the driving frequencies revealed that participants did not simply scale their movement rates with driving frequency, but used one or more of the following strategies to avoid moving slowly: (1) increasing dwell times; (2) subdividing movement time intervals; and/or (3) increasing movement path length. The results suggested that the selection of movement speed is constrained at the low end of the frequency spectrum as well as at the high end.

(1017)

Response-Response Interference in Simultaneously Executed Oculomotor and Manual Responses. LYNN HUESTEGGE & IRING

KOCH, *RWTH Aachen University*—Previous research on the coordination of eye and hand movements has mainly focused on grasping movements, implying experimental paradigms where subjects have to respond with both effector systems to a common target. In the present study, we analyze on a more general level to what extent concurrently performed eye and hand movements interact. For this purpose, in Experiment 1 subjects had to respond to an auditory stimulus with either a buttonpress (manual response), a saccade to a visual target (oculomotor response), or both. In Experiments 2 and 3, the difficulty of response selection in the manual task was increased: Subjects had to cross hands and respond to the auditory stimulus with either the spatially corresponding hand or button. The results indicate that both manual and oculomotor responses generally suffer from dual task conditions, and that oculomotor response times are severely prolonged with increasing difficulty of the simultaneous manual task.

(1018)

Effects of Perceived Distance, Time-To-Contact, and Momentum on Obstacle Avoidance: The Chainmail Experiment. HUGO BRUGGEMAN & WILLIAM H. WARREN, JR., *Brown University* (sponsored by William H. Warren, Jr.)—Is obstacle avoidance controlled by perceived distance or time-to-contact with an obstacle? To dissociate these hypotheses, we vary physical walking speed, body weight, and the visual gain in a virtual environment. Fajen and Warren's (*JEP:HPP*, 2003) locomotor dynamics model predicts later turns with higher walking speed or greater weight if distance is the control variable, but predicts the opposite if time-to-contact is the control variable. Participants walked to a goal around an obstacle whose position varied in an ambulatory virtual environment. Visual gain was manipulated by making the optical motion in the display slower, matched, or faster than actual walking speed. Body weight was increased by 25% using chainmail and weight vest. Model predictions are evaluated against the human data to empirically determine whether obstacle avoidance is controlled by distance or time-to-contact. The weight manipulation allows us to analyze the influence of momentum and to specify the model's damping term.

(1019)

Why Are Two Hands Better Than One? AMANDA L. STEWART, J. DEVIN MCAULEY, & STEVEN M. SEUBERT, *Bowling Green State University* (sponsored by J. Devin McAuley)—Within-hand timing variability during bimanual rhythmic performance (e.g., repetitive tapping) is reduced in comparison with unimanual rhythmic performance (Helmuth & Ivry, 1996). To explain the bimanual advantage, Helmuth and Ivry proposed that in-phase bimanual movements involve averaging the output of two clocks prior to execution, whereas unimanual movements involve only a single clock. The present study replicated the bimanual advantage using methods that matched Helmuth and Ivry (1996; Experiment 1) but additionally found differences in the amount of temporal drift between the bimanual and unimanual conditions that were positively correlated with the magnitude of the bimanual advantage. The latter result suggests that the bimanual advantage is at least partially an artifact of Weber's law. Overall, the results of this study suggest that a comprehensive explanation of the bimanual timing advantage is multifaceted.

(1020)

Action Effects in the PRP Paradigm: Locating Processes of Intentional Response Coding. MARKO PAELECKE & WILFRIED KUNDE, *Martin Luther University Halle-Wittenburg*—Ideomotor theories of action control assume that actions are represented and accessed by codes of their sensorial effects. Consistent with this view, Hommel (1993) demonstrated that the direction of the Simon effect can be inverted by intentionally recoding the responses in terms of their response-incongruent action effects. In the present study, we examined the contribution of several dissociated processes to this inversion of the Simon effect. 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 the stimuli and the intended (to-be-produced) action effects as well as the required transformation of action effects into the responses. We found an inverted Simon effect only with a long SOA, but an influence of the effect–response transformation with all SOA levels. These results suggest that at least two processes underlie the inversion of the Simon effect.

(1021)

What Is So Hard About Bimanual Coordination? Evidence for Conceptual Interactions Between Bimanual Responses. KIMBERLY HALVORSON, TANA TRUELOVE, & ELIOT HAZELTINE, *University of Iowa*, & SIAN L. BEILOCK, *University of Chicago* (sponsored by Sian L. Beilock)—Dual-task costs are robust when both tasks require manual responses, and RTs are usually longer when the two responses must be made with different hands than with the same hand (HazelTine et al., in press). In contrast, expert typists prefer letter dyads that, if typed, would produce the least motor interference (i.e., are produced with different hands), while novice typists show no preference (Beilock & Holt, 2007). We compared unimanual and bimanual keypresses to examine how task representations affect bimanual coordination. Expert typists saw two stimuli each indicating a single keypress on a computer keyboard. With spatially compatible stimuli, participants were slower when the two responses required different hands. However, when letters corresponding to the keys on the keyboard were used as stimuli, no bimanual costs were observed. The results suggest that bimanual costs emerge from conceptual codes and provide a glimpse into the central representations underlying discrete RT tasks.

(1022)

Interhand Coordination Across Age. ROBERT M. KOHL, RAYMOND W. MCCOY, & CRYSTAL M. RADER, *College of William & Mary*—There is much evidence to indicate that interhand coordination is temporally/spatially linked during maximal (speed) conditions. This linkage was investigated across age. Young adults ($M = 19.7$ years) and elders ($M = 78.2$ years) were compared during responses in which their hands moved maximally/simultaneously the same distance (28 cm) while one hand negotiated a 20- or 2-cm barrier. The results indicated that young adults were significantly faster (M , SEM) than elders in dual-handed movement time (52 msec, 11 msec), peak velocity (.26 m/sec, .036 m/sec), and time to peak velocity (47.9 msec, 6.8 msec) but similar in dual-handed reaction time and peak height. However, all relative barrier and nonbarrier hand comparisons of dependent variables produced very similar results across age, illustrating a strong hand linkage. Hence, these results indicated that an increase in age negatively impacted maximal dual-handed responses but did not impact the linkage of interhanded coordination.

(1023)

Coordination Strategies in Unimanual Circling Movements. SANDRA DIETRICH, MARTINA RIEGER, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences* (sponsored by Martina Rieger)—To investigate the coordination of unimanual movements with external events, we used a circling task that required participants to coordinate hand movements with a clockwise circling stimulus. We dissociated the actual movement from its effect by means of transformed feedback. This was done to determine whether coordination takes place between movement and stimulus or between movement effect and stimulus. Stimulus and effect were presented next to each other (Experiment 1) or within each other (Experiment 2). Additionally, we varied stimulus–effect relation (symmetric/parallel) and movement phase (in-phase/anti-phase). The results indicate that the external movement effect is more important for its coordination with external events than is the movement itself. However, whereas for easy tasks visual feedback seems to suffice, more complex tasks additionally seem to integrate proprioceptive feedback. We argue that feedback from the actual movement and its external effect are merged to allow optimal performance.

• COGNITIVE CONTROL •

(1024)

Tracking Objects of Conflict Through Episodic Memory. MICHIEL M. SPAPÉ & BERNHARD HOMMEL, *Leiden University* (sponsored by Gezinus Wolters)—When people are required to respond with the right to a stimulus appearing left, they are slower than when features of perception and action correspond. Such effects can drastically change and even reverse after noncorresponding trials, which is typically understood to be caused by adapting to conflict. Measuring sequences of conflict, however, inexorably means measuring patterns of stimulus and response repetition. Performance costs are often observed when repeating a stimulus but alternating a response, since the previously integrated features overlap with the newly required binding. To disentangle these two confounded effects, we hypothesized that when a stimulus display is gradually changed between two trials, the alternated feature should look as if it were repeated. Thus, by employing concepts from object-based attention and multiple object tracking, we show that feature integration may better account for sequential Simon effects than for conflict adaptation.

(1025)

Is Voluntary Task Switching Influenced by Individual Differences in Executive Control? KARIN M. BUTLER & CHRISTINA WEYWADT, *University of New Mexico*, & CATHERINE M. ARRINGTON, *Lehigh University*—This study investigated the ability to switch between tasks in a voluntary task switching (VTS) procedure as it relates to performance on working memory capacity measures. VTS requires participants to initiate task choice rather than rely on an external cue, allowing for a measure of switch probability in addition to switch costs (Arrington & Logan, 2005). We examine relationships among switch probability, switch cost, and working memory capacity measures. The influence of internal control was assessed by manipulating the time available to instantiate the task set, and the influence of external information on task choice was manipulated by varying the onset times of possible targets. The effects of executive control abilities on task choice and switch costs will be discussed in relation to factors influencing task selection and performance in VTS.

(1026)

Inducing Exaggerated Proactive Interference With Transcranial Magnetic Stimulation. A. CRIS HAMILTON, ROY H. HAMILTON, H. BRANCH COSLETT, TAMARA BOCKOW, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Neuroimaging and neuropsychological data indicate that the left inferior frontal gyrus (LIFG) is important for the resolution of proactive interference (PI) in working memory. We used brief 300-msec trains of 10-Hz rTMS to demonstrate that disruption of LIFG is causally involved in resolving PI. Healthy subjects performed a probe recognition task (Monsell, 1978) that reliably elicits PI (measured by response time and accuracy). A list of three words was presented followed by a probe, and subjects indicated whether the probe appeared in the list. PI was elicited by manipulating the recency of probes. Consistent with previously reported TMS data using this task (Feredoes et al., 2006), we found greater effects of PI when TMS was applied to LIFG, and this effect was apparent only in subjects' accuracy. TMS did not influence accuracy on positive trials, suggesting that effects of TMS to LIFG were specific to trials that elicit PI.

(1027)

Task-Set Inhibition in Chunked Task Sequences. DARRYL W. SCHNEIDER, *Vanderbilt University* (sponsored by Gordon D. Logan)—Plans give structure to behavior by specifying whether and when different tasks must be performed. A task sequence is an example of a plan that can be represented at two levels: a sequence level and a task level. In the present study, the relationship between chunking (a sequence-level process) and task-set inhibition (a task-level process) was investigated to determine whether within-chunk facilitation reduces the $n-2$ repeti-

tion cost commonly attributed to task-set inhibition. An experiment is reported in which subjects were induced to chunk sequences such that $n-2$ repetitions occurred within or between chunks. Direct evidence of chunking was obtained and $n-2$ repetition cost was smaller when $n-2$ repetitions occurred within chunks than between chunks. These findings are consistent with the idea that the reduced $n-2$ repetition cost reflects priming of task goals rather than direct modulation of task-set inhibition.

(1028)

The Effect of Working Memory Load on Task Choice in Voluntary Task Switching. STARLA M. WEAVER & CATHERINE M. ARRINGTON, *Lehigh University* (sponsored by Catherine M. Arrington)—The voluntary task switching (VTS) paradigm allows subjects to choose the specific task to be performed on each trial. Subjects are instructed to perform each task equally often and in a random order; however, they tend to show a repetition bias, performing fewer switches than would be expected in a random sequence. Lack of executive resources was assessed as a contributor to this repetition bias. A memory load manipulation was used to limit the executive resources available during VTS. Simple memory storage tasks, which required only the maintenance of memory letters, had no impact on VTS performance. However, a working memory load, which required the active manipulation of memory letters during VTS, differentially reduced the proportion of switches such that greater repetition bias was found under greater working memory loads. The availability of executive resources at the time of task performance appears to influence task choice.

(1029)

Directed Inhibition of Previewed Distractors in a Stroop Task: Underlying Mechanism. HSUAN-FU CHAO, *Chung Yuan Christian University*—In a previous study, it has been demonstrated that Stroop interference could be reduced by pre-cueing the distracting word and asking participants to inhibit the previewed distractors in advance. This study aimed at investigating the underlying mechanism in this distractor previewing effect. Experiment 1 replicated the effect of distractor viewing when both incompatible and compatible trials were used. Experiments 2–4 demonstrated significant effects of distractor previewing when cues and distractors differed in forms. In Experiment 5, a cost was obtained for conflict trials in that the previewed item cued the target color rather than the distractor word. Finally, the cue validity was removed in Experiment 6, and no effect of distractor previewing was observed. These results ruled out the explanations in terms of response set, temporal segregation, and distractor facilitation. The intentional inhibition account can best explain these findings.

(1030)

What Happens to Attention When We Drink? GREGORY J. H. COLFLESH & JENNIFER WILEY, *University of Illinois, Chicago*—It is believed that alcohol use has a negative impact on attentional processes, but the affected cognitive mechanisms are not well understood. Clinical literature has advanced two theories describing how alcohol affects attention. According to the alcohol myopia theory, alcohol consumption decreases the focus of attention (Steele & Josephs, 1990). Salience theories suggest that increased exposure to alcohol, or alcohol consumption, increases the salience of alcohol-related stimuli (Jones, Jones, Smith, & Copley, 2003), which acts as a source of distraction from other stimuli. The current study attempts to identify the attentional processes that alcohol use affects by examining performance on a battery of selective and divided attention tasks, including inattention blindness, a modified Stroop task, and change blindness, while participants are intoxicated (BAC .075). Both neutral and alcohol-related stimuli are used to test the myopia and salience accounts. Additionally, interactions between individual differences in WMC and changes in performance under intoxication will be discussed.

(1031)

Separating Exogenous From Endogenous Factors in Attentional Capture. MATTHEW YANKO, *Simon Fraser University*, PAOLA

POIESE, *University of Trento*, & THOMAS M. SPALEK & VINCENT DI LOLLO, *Simon Fraser University*—Attentional capture occurs when a task-irrelevant stimulus involuntarily receives attentional priority. Two sources of capture have been proposed in the literature: exogenous (stimulus-bound) and endogenous (goal-oriented). Although the two sources have often been regarded as mutually exclusive, we show that both can act concurrently and can be decoupled within a single experiment. The displays consisted of RSVP streams of differently colored letters with a target letter defined by a specific color. In some conditions, irrelevant color singletons surrounded either one RSVP item (Experiment 1) or all items (Experiment 2). Experiment 1 provided evidence for both exogenous and endogenous sources of capture. Experiment 2 reduced or eliminated exogenous sources by eliminating the uniqueness of the sudden onset of the peripheral distractors. The novel contribution of this work is that it provides unambiguous evidence that attention can be captured exogenously as well as endogenously. The results are consistent with dual-pathway accounts of attentional control.

(1032)

Decomposing the Multisource Interference Task. HEATHER M. GILMORE & ELISE TEMPLE, *Cornell University* (sponsored by Grover C. Gilmore)—The multisource interference task (MSIT) combines different types of interference known to delay reaction time for the purpose of maximizing cognitive interference. Previous work has not addressed the separate influences of each source of interference. The present study was designed to decompose the sources of interference to determine their independent contributions. Participants were instructed to identify the number that was different in a three-digit array. Experiment 1 examined flanker interference, the combination of flanker and spatial interference, and the effect of a font cue. Additionally, blocked versus mixed design was compared. It was found that two types of interference were more difficult than one type of interference and that blocking of interference type yielded more potent effects. Experiment 2 replicated the results and additionally examined spatial interference. The results of the study can be used to design a maximally potent MSIT.

(1033)

Goal Activation or Inhibition? Disentangling Forms of Top-Down Control. MARY K. ASKREN & CINDY LUSTIG, *University of Michigan*—The role of goal activation in conflict resolution is well accepted, but inhibition's role is more controversial. We used a task-switching procedure to disentangle the effects of demands on goal activation versus inhibition. Goal activation demands were measured by rule-incompatibility costs: Poorer performance on trials for which the two task rules led to opposite responses as compared with trials where both rules led to the same response. These rule-incompatible trials required subjects to activate the correct goal in order to produce the correct response. The results ($n = 48$ young adults) indicate that rule incompatibility only led to slowing when it was confounded with bottom-up, Stroop-like conflict. This pattern suggests that even when participants have the correct goal activated, additional inhibitory processes are needed to suppress bottom-up, stimulus-driven conflict. A follow-up study examines which of these processes—goal activation or inhibition—shows larger differences between young and old adults.

• AUTOMATIC PROCESSING •

(1034)

Affect Priming Versus Sequential Affect Judgment. DEAN G. PURCELL, *Oakland University*, & ALAN L. STEWART, *Stevens Institute of Technology*—Sequences of two faces displaying facial affect were presented under conditions of affect priming and under conditions of sequential affect judgment (SAJ). The priming task required the observer to judge the affect of only the second of the two faces. Affect priming was found as well as an anger inferiority effect (AIE). The

affect of the second face more strongly determined this AIE than did the affect of the first face. The SAJ task required observers to compare first and second stimulus affect in order to determine whether they were congruent. As in the priming task, an AIE was found. However, unlike in the priming task, priming was not evident and the observed AIE was determined by the affect of the first face. This was so despite the active processing of both faces required in the SAJ task.

(1035)

Modulation of the Stroop Effect by Inhibition of Return. JONG MOON CHOI & YANG SEOK CHO, *Korea University*—In a visual orienting task, reaction times are longer when a target is presented at a cued location than at an uncued location about 1,000 msec after an exogenous cue flashed. This phenomenon is called inhibition of return (IOR). To examine whether the magnitude of the interference effect would be modulated by IOR in the Stroop task, a color carrier, a color word, or neither of them was presented at the cued location 800, 1,050, or 1,300 msec after an exogenous cue flashed. The Stroop effect was largest when nothing was presented at the cued location, intermediate when the color carrier was, and smallest when a color word was at 1,050-msec SOA. However, this interaction disappeared at 800-msec and 1,300-msec SOAs. This reduced Stroop effect is due to the stimulus not being processed efficiently because of IOR, which is supposed to provoke lack of attention.

(1036)

Biologically Significant Stimuli Produce Visual Prior Entry. GREG L. WEST, ADAM A. K. ANDERSON, & JAY PRATT, *University of Toronto* (sponsored by Jay Pratt)—It remains unclear whether biologically significant stimuli, such as neutral or threatening faces, receive attention prior in time to other contemporaneous stimuli. Visual prior entry, as measured by temporal order judgments (TOJs), rests on the premise that allocated attention accelerates perception; that is, attended stimuli are perceived before unattended stimuli, and thus this method is a sensitive and direct measure of attentional capture. We demonstrate, using a novel TOJ paradigm without cues, that schematic faces of both neutral and angry emotional valence show visual prior entry effects; that is, these stimuli are perceived prior in time in comparison with competing stimuli. We further extend these results by contrasting effects produced both by schematic and real face stimuli. This study provides direct evidence that biologically significant stimuli, in schematic or photographic form, bias the contents of awareness and thus are perceived prior in time.

(1037)

Learning to Flexibly Dual-Task: When Single-Task Automaticity Is and Is Not Enough. NICOLE M. HILL & WALTER S. SCHNEIDER, *University of Pittsburgh* (sponsored by James Voss)—Dual processing theory predicts that controlled but not automatically processed single-task performance will decline in a dual-task context. However, declines in a dual-task context occur regardless of processing mode. We posit that (1) single-task learning is necessary but not sufficient for automatic dual-task performance, (2) extensive dual-task practice develops dual-task automatic processing, and (3) automatic dual-tasks can be flexibly performed—that is, novel dual-task combinations (NDTC) and single-trained-only targets (STOT). Ninety stimuli/sec were presented in a display containing four distinct tasks. Single-to-dual transfer resulted in declining performance; training nearly attenuated this decline. The NDTC and STOT conditions produced a modest dual-task cost relative to untrained dual-tasking. This suggests that single-task (consistent) training retains a degree of controlled processing that was released by dual-task training; furthermore, performance became flexible and remained high-level despite task alterations.

(1038)

A Word Choice: The Effect of Emotion on Lexical Decision and Accuracy. JOSEPH M. BAKER & STEPHEN R. SCHMIDT, *Middle Tennessee State University* (sponsored by Stephen R. Schmidt)—Past

research has failed to show significant lexical decision reaction time differences between emotional and nonemotional words. It is possible that the relatively long stimulus presentations employed in earlier studies were responsible for these null effects. In order to investigate the role of stimulus durations in the lexical decision task, emotional, neutral, and nonwords were presented to participants randomly in one of four stimulus durations (e.g., 30, 50, 75, and 100 msec). Emotional words were responded to faster than neutral and nonwords. Also, participants were more accurate in identifying emotional words than neutral words within all presentation durations, with the largest difference occurring within the 30-msec presentation duration. These results suggest that lexical decision reaction time differences do exist between emotional and neutral words, as well as supporting findings that suggest that emotional words are attended to faster than neutral words.

(1039)

Deviations of Pointing Movements Toward the Irrelevant Stimulus Location in Vertical and Horizontal Simon Tasks. SIMONA BUETTI & DIRK KERZEL, *University of Geneva*—In the Simon effect (SE), responses to the color of a stimulus are faster when the irrelevant position of the colored stimulus is congruent with the response location. The SE decreases with increasing reaction times (RTs) for horizontal, but not for vertical, stimulus arrangements. Consistent with RTs, the lateralized readiness potential (LRP) shows an early deflection in incongruent trials of horizontal, but not vertical, Simon tasks. We observed that the trajectories of pointing movements were attracted by the irrelevant stimulus position. Furthermore, deviations toward the irrelevant stimulus decreased with increasing RT for both horizontal and vertical Simon tasks. Thus, the SE in movement parameters mirrored the time course in RTs for horizontal, but not vertical, stimulus arrangements. These results suggest that the early deflection in LRPs may underlie the time course of the SE in RTs, but not the SE in movement trajectories.

(1040)

A Task-Difficulty Artifact in Subliminal Priming. MICHAEL S. PRATTE & JEFFREY N. ROUDER, *University of Missouri, Columbia* (sponsored by Jeffrey N. Rouder)—Subliminal priming is said to occur when a subliminal prime influences the identification of a subsequent target. Most subliminal priming claims are based on separate target and prime identification tasks. We argue that because prime identification is difficult, participants' motivation wanes and, consequently, prime-identification performance suffers. Identification of weak stimuli may, therefore, appear at chance. To test this artifact, we increased the ease of the prime-identification task by intermixing easy (visible) primes with difficult (near liminal) ones. In Experiment 1, this strategy of intermixing easy primes is shown to raise identification of the difficult ones. In Experiment 2, prime duration was lowered such that prime identification was near chance in intermixed presentations. Under these conditions, we fail to observe any priming effects. Hence, previous demonstrations of subliminal priming may simply reflect a task difficulty artifact.

(1041)

Coding Strategies in Number Space. OLIVER LINDEMANN, *Radboud University*, JUAN M. ABOLAFIA, *Miguel Hernandez University*, JAY PRATT, *University of Toronto*, & HAROLD BEKKERING, *Radboud University Nijmegen* (sponsored by Harold Bekkering)—The present study investigates the impact of task demands on the association of spatial and numerical response codes (SNARC effect). Participants were instructed to memorize three simultaneously presented Arabic digits describing a left-to-right ascending number sequence, a descending sequence, or a disordered sequence. Afterward, participants indicated the parity status of a centrally presented digit. As the response latencies showed, SNARC effects in the parity task were mediated by the coding requirements of memory tasks. That is, SNARC effects were present only after memorizing ascending or disordered number sequences but disappeared after processing descend-

ing sequences. Interestingly, the impact of the memory task was only present if all sequences within one experimental block had the same type of order. Our findings are inconsistent with the notion of an automatic activation of the “mental number line” and suggest rather that spatial strategies might be responsible for the cognitive link between numbers and space.

• VISUAL ATTENTION •

(1042)

Methodological Considerations and Individual Differences in Visual Search. CHRISTOPHER K. BARRETT, *UCLA*, & ERIN C. ANDERSON, RUBEN R. ROMERO, DANIEL J. STAGGS, MOHAMMED KORBACHEH, & BARBARA J. CHERRY, *California State University, Fullerton*—The present study used a visual search paradigm adapted from Lupien et al. (1994) where participants were to respond “yes” or “no” to the presence of a target (a black “x”) amid varying distractors. Participants performed the task in two different sessions 1 to 2 weeks apart, once on a standard computer and once on a laptop computer to determine any differences due to type of computer. Self-report measures of depression and stress were also completed during session 1, since these have been reported to influence performance on selective attention tasks. We found shorter reaction times for the laptop versus standard computer, but no differences in accuracy. Higher levels of stress were associated with increased errors on the visual search task for female (but not male) participants. This was especially true when controlling for depression. Implications of these findings will be discussed.

(1043)

Attention Concentrates at the Centers of Stationary and Moving Objects in Multiple-Object Scenes. CARY S. FERIA, *Morehead State University*—When several moving objects are tracked, attention is concentrated at the center of each object (Alvarez & Scholl, *JEP:G*, 2005; Feria & Doyle, *VSS*, 2006). The present study aimed to investigate whether this center bias is caused by the tracking of motion, and to determine what types of motion produce the bias. Observers tracked several moving lines, while simultaneously detecting probes appearing on the centers and ends of lines. The presence and absence of rotational, translational, and size change components of object motion were manipulated in a factorial design. Probe detection was more accurate at centers than at ends of lines. This center advantage occurred with stationary objects, and its magnitude was not affected by different motion types. These results indicate that attention is biased toward centers of objects in multiple-object scenes, for both stationary and moving objects. The center bias is not caused by the tracking of object motion.

(1044)

Nonspatial Attentional Capture Cannot Be Eliminated Under Feature Search Mode. TOMOE INUKAI, *Chukyo University*, & JUN I. KAWAHARA & TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology*—Performance for identifying a visual target is impaired by a temporally preceding singleton distractor (attentional capture). Although it is known that attentional capture is eliminated by adopting the feature search mode, it is unclear whether this is the case for nonspatial attentional capture. We examined the effect of the search modes on attentional capture in spatial and nonspatial domains. Observers’ task was to search for a target letter defined by a specific tilt in an RSVP stream of nontarget letters containing a color singleton distractor. The results showed that the nonspatial singleton reduced target identification accuracy in both search modes, while the spatially displaced singleton reduced accuracy only when observers adopted the singleton detection mode. The finding that the efficiency of the feature search mode for ignoring the distractor is limited in nonspatial attentional capture suggests that different underlying mechanisms are involved in attentional capture in nonspatial and spatial domains.

(1045)

Voluntary Orienting Modulates Multiple Location Inhibition of Return. JANICE J. SNYDER, TROY A. W. VISSER, & ROBYN GORDON, *University of British Columbia, Okanagan*, & WALTER F. BISCHOF, *University of Alberta* (sponsored by Walter F. Bischof)—Inhibition of return (IOR) is thought to reflect processes that promote efficient search by biasing attention against returning to previously inspected locations. Consistent with this notion, IOR has been found at up to five consecutively cued locations and is larger for difficult search tasks. Here, we examine how the interplay of endogenous (voluntary) and exogenous (reflexive) orienting impacts the magnitude of IOR across multiple cued locations. An onset cue (exogenous orienting) signalled the location of an upcoming target with high or low probability (endogenous orienting). On half of the trials, a second cue presented at a different location signalled that the target would instead occur at the location of the new cue with high or low probability. Our results provide strong support for the idea that voluntary orienting modulates the magnitude of IOR at previously examined locations.

(1046)

It’s Alive! The Link Between Motion Onset and Behavioral Urgency. SHAWN E. CHRIST, *University of Missouri*—Prior research has shown that the introduction of motion to a previously static item (i.e., motion onset) captures attention in an automatic stimulus-driven fashion. It has been speculated that motion onset may be “behaviorally urgent” in that it plays an important role in the categorization of objects as living or nonliving, thereby helping to identify potential predators or prey. In the present study, we sought to provide empirical support for the notion that these cognitive phenomena are indeed linked. The results from a series of visual search experiments are reported that suggest an overlap in the cognitive processes underlying the categorization of living and nonliving objects and the attentional influence of motion onset. Findings are discussed within the context of our current understanding of visual attention, object recognition, and their underlying neurocognitive substrates.

(1047)

Limitations of Perceptual Segmentation on Spatial Context Effects in Visual Search. MARKUS CONCI, *LMU Munich*, & ADRIAN VON MÜHLENEN, *University of Warwick* (sponsored by Adrian von Mühlennen)—Invariant contextual information supplies an important source for behavioral orienting. For example, in the contextual cuing paradigm, repetitions of the spatial layout of a search display implicitly guide spatial attention to the target. The present study explored how the segmentation of the search items into distinct groups influences the contextual cuing effect. Experiment 1 demonstrated that if displays were grouped by color, the contextual cuing effect was reduced. Grouping by size led to an even larger reduction of the cuing effect (Experiment 2). Finally, a subsequent experiment showed that selectively attending to the relevant subgroup of search items preserved contextual learning. Taken together, our findings suggest that contextual cuing is modulated by perceptual grouping. This modulation is larger when spatial as opposed to surface features are varied. This is consistent with the view that contextual associations are primarily learned within the segmented group of items.

(1048)

An Object-Based Attentional Repulsion Effect. SARA A. STEVENS & JAY PRATT, *University of Toronto*—The attentional repulsion effect (ARE) is a spatial consequence of shifting attention to peripheral locations in the visual field. Previous research has shown that a brief peripheral cue produces a shift in the perceived location of a Vernier stimulus in the opposite direction to where the peripheral cue was located. The ARE is therefore known to affect dorsal stream processing; the influence of the ARE on the ventral stream, however, is unknown. The present study examines whether object-based ventral stream processing is affected by the ARE, using peripheral (Experiment 1) and central (Experiment 2) cues. Peripheral cues produced an

object-based ARE on a centrally located diamond-shaped object, consistent with the notion that the ARE originates early in perceptual processing. No object-based ARE was found with gaze cues. This suggests that these two forms of cues may have similar effects on temporal consequences of attention, but not on the spatial consequences.

• METAMEMORY •

(1049)

Dissociating Judgments of Learning From Memory Encoding: An Event-Related Potential Study. IDA-MARIA SKAVHAUG, *University of Stirling*, EDWARD L. WILDING, *Cardiff University*, & DAVID I. DONALDSON, *University of Stirling*—Little is known about the neural basis for judgments of learning (JOLs). Here, we use event-related potentials (ERPs) to compare the neural correlates of JOLs and memory encoding. We ask whether JOLs are simply the result of memory encoding or are mediated by processes that are separate from (or additional to) encoding. In the study phase, participants assigned JOLs to a number of word pairs; memory for the pairs was assessed in a subsequent test phase. Trials were sorted on the basis of JOL and memory performance, allowing ERP activity recorded at study to be examined separately for encoding and JOL effects. An early positive-going posterior ERP effect (a typical subsequent memory effect) was associated with both memory encoding and JOLs, whereas a later negative-going left central ERP effect was present for JOLs only. The ERP findings dissociate the processes mediating JOLs from memory encoding.

(1050)

Learning About the Spacing Effect: The Role of Experience and Feedback. ALAN D. CASTEL, *UCLA*, & JESSICA M. LOGAN, *Rice University*—Previous research suggests that participants give higher judgments of learning (JOLs) for items practiced under massed rather than spaced conditions. We examined how practice with multiple testing sessions and feedback influenced participants' JOLs for spaced and massed items. When participants made JOLs only after the second presentation of each item, JOLs did not differ for massed versus spaced items, despite memory performance favoring spaced rehearsal. When JOLs were made after each presentation and multiple study–test cycles were given, JOLs were strongly influenced by repetition, but did not differentiate between massed and spaced items. This occurred even when participants scored their own recall performance over multiple lists, suggesting that experience and self-directed feedback did not contribute to more accurate metacognitive judgments. Thus, although spaced rehearsal is a powerful learning technique, it appears that students underestimate the benefits of spaced repetition when learning.

(1051)

The Retrieval of Contextual Information Is Critical for Accurate Feeling of Knowing Predictions: An Aging Analysis. JOHN B. BULEVICH, *Rhode Island College*, AYANNA K. THOMAS, *Tufts University*, & STACEY J. DUBOIS, *Colby College*—In feeling of knowing (FOK) paradigms, participants are asked to predict subsequent recognition memory performance on items that were initially encoded, but that cannot presently be recalled. Research suggests that average FOK judgments may be influenced by the total amount of contextual information retrieved related to the unrecalled target (Koriat, 1993). We tested whether the episodic FOK deficit demonstrated by older adults relates to retrievability of partial contextual information. The effect of quantity and quality of partial information on average FOK judgments and prediction accuracy was compared in older and younger adults across three experiments. The results indicated that older adults required explicit retrieval of contextual information before making FOK judgments in order to make accurate FOK predictions. The results also demonstrated that quality of the retrieved partial information influenced both average FOK judgments and accuracy of FOK judgments in both older and younger adults.

(1052)

Failure to Adjust Prediction of Knowing Judgments in a Memory Task Under Alcohol. MARK VAN SELST, JAYSON GAWTHORPE, & MARILYN AMPUERO, *San Jose State University*, & DANIEL CAMARILLO, *University of Kentucky, Lexington*—In an examination of the cognitive impact of acute alcohol intoxication, 16 participants were dosed in each of three alcohol conditions (0.00, 0.45, and 0.65 g/kg) counterbalanced across 3 days of testing. On each day, participants received the memory test at 65 min postdose (i.e., at or after peak BAC). During the study phase, the participants rated each word on how well they thought they would remember it (1 = *not*, 10 = *definitely*). Free recall of the word list was tested 5 min after the study phase; a recognition test was given immediately after the recall test. Performance on both tests declined with alcohol. Predictive memory ratings were not impacted by alcohol, although the predictive memory ratings remained as effective predictors of task performance in each of the alcohol conditions for both types of memory test. The paradoxical effect of work frequency was not strongly present in the recall data.

(1053)

Processes Underlying Metamemory Judgments in Patients With Schizophrenia. Investigation of the Accessibility Model. ELISABETH BACON, *INSERM*, & MARIE IZAUTE, *Blaise Pascal University, Clermont-Ferrand*—Cognitive deficits and insight problems are core symptoms of schizophrenia. The metamemory judgments of patients differ from the controls, whereas their predictive accuracy (G) is preserved (Bacon et al., 2001, 2007). According to Koriat (1993, 1995), the computation of FOK relies on the accessibility of partial and/or contextual information. Our aim was to see whether patients also rely on the products of retrieval to monitor their awareness about what they know and what they don't know. The task was adapted from Koriat (1993). The material to be learned consisted of four-letter nonsense tetragrams, where each letter provided partial information with regard to the four-letter target. Patients showed global lower memory performances and metamemory ratings, but they showed remarkable consistencies between the retrieval of partial information and their metamemory ratings and accuracies. The accessibility hypothesis as a basis for metamemory judgments seems to be relatively preserved in patients with schizophrenia.

(1054)

Nicotine (2 mg), Attention, Memory, and Metacognition in Moderate Smokers. WILLIAM L. KELEMEN & ERIKA K. FULTON, *California State University, Long Beach*—Nicotine replacement therapies, including nicotine gum, can facilitate temporary abstinence in smokers, and thus support compliance with the increasing scope of smoke-free policies. This practice has been endorsed by the World Health Organization and adopted in businesses that require prolonged intervals of smoke-free activity, including some airlines and hospitals. We used a double-blind, within-subjects design to assess the cognitive effects (i.e., sustained attention, free recall, and metacognition) of 2 mg nicotine gum compared with a placebo (nicotine-free) gum. Moderate-to-heavy smokers were tested in both 8-h abstinent and non-abstinent states. They received one session of training followed by test sessions on consecutive days in four counterbalanced conditions: (1) abstinent with nicotine gum, (2) nonabstinent with nicotine gum, (3) abstinent with placebo gum, and (4) nonabstinent with placebo gum. Discussion will focus on methodological issues in nicotine research and whether nicotine produces cognitive benefits beyond relief of withdrawal in abstinent smokers.

(1055)

Adaptive Changes in Encoding Strategy With Experience: Evidence From the Test Expectancy Paradigm. JASON R. FINLEY & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—Efficient memory use requires that encoding decisions reflect future task demands. This experiment evaluated subjects' abilities to adaptively

modify encoding strategies. Across four study–test cycles, subjects were induced to expect either cued or free recall tests by studying lists of word pairs and receiving the same test format for each list. Tests required recall of target words, either in the presence (cued) or absence (free) of cue words. A fifth and final cycle included either the expected or the alternate, unexpected test format. On both cued and free final tests, subjects who had expected that format outperformed those who had not. Furthermore, cued-expecting subjects showed superior recognition of cue words and superior associative recognition of intact pairs. These results demonstrate that subjects were not merely modulating study effort based on anticipated test difficulty, but were adopting qualitatively different encoding strategies that were appropriate to the demands of the expected test.

(1056)

Effects of Schematic Knowledge on the Relationship Between Judgments of Learning (JOLs) and Memory for Items and Sources. AGNIESZKA E. KONOPKA & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign* (sponsored by Susan M. Garnsey)—Source monitoring judgments can reflect a combination of episodic recall and background knowledge. We investigated the extent to which metamnemonic judgments predict memory for items and memory for sources when schematic information is or is not provided at encoding. Participants gave judgments of learning (JOLs) to statements presented by two speakers, and were informed of the occupation of each speaker before or after the encoding session. Replicating earlier work, prior knowledge decreased the tendency to erroneously attribute statements to schematically consistent but episodically incorrect speakers. The origin of this effect can be understood by examining the relationship between JOLs and performance: In the absence of prior knowledge, JOLs were equally predictive of item and source memory, but were exclusively predictive of source memory when subjects knew of the relationship between speakers and statements during study. These results demonstrate meaningful influences of background knowledge on information that people solicit in service of metamnemonic judgments.

(1057)

Tip-of-the-Tongue States Interfere With Verbal Working Memory. BENNETT L. SCHWARTZ, *Florida International University*—Tip-of-the-tongue states (TOTs) are judgments of the likelihood of retrieval for items currently not recalled. Schwartz (in press) showed that a concurrent verbal working memory task (digit span) lowered the number of TOTs relative to a control condition. In the present experiment, I examined whether unresolved TOTs led to lower performance in a verbal working memory task. First, participants answered general-information questions. Second, for unrecalled items, participants made TOT judgments. Then, on half of the unrecalled trials, participants were shown seven digits and were immediately asked to recall them. Participants were then given a recognition test for the unrecalled general-information questions. During TOTs, working memory performance was worse than it was for non-TOT items, demonstrating that interference occurs between TOTs and working memory. These behavioral data concur with neuroimaging data, which suggest that TOTs and verbal working memory activate similar areas in the brain (e.g., Maril et al., 2005).

(1058)

Is Testing Critical to Changing How One Learns? PATRICIA A. DEWINSTANLEY, *Oberlin College*, & ELIZABETH LIGON BJORK, *UCLA*—We examined whether a memory test is critical for changing the way that learners encode information during a second learning event. Participants studied paragraphs presented one sentence at a time on computer screens. During study of the first paragraph, some critical items had to be produced from letter fragments, whereas others were presented intact in bold letters. After the first paragraph, participants were tested on their memory for the information, were asked to predict which items they thought they would remember, or were

given an unrelated filler task. Next, all groups studied a second paragraph with both fragmented and intact critical items. Our research question asked under which conditions would participants change the way they processed the items during study of the second paragraph. We apply our findings to the illusion-of-comprehension literature and suggest ways that students might be able to improve their knowledge of their own learning.

(1059)

Illusions of Familiarity in Recognition Memory: The Role of Response Reversals. MARIANNE E. LLOYD, *Seton Hall University*, & JEREMY K. MILLER, *Willamette University*—Four experiments are presented that investigate whether participants are able to correct illusions of memory using the response reversal paradigm (Van Zandt & Maldonado-Molina, 2004), in which participants make both a speeded and a non-speeded response to each recognition test item. The results of the study suggest that response reversals do not decrease rates of conjunction errors, even when participants employ encoding techniques that have been found to be effective in reducing conjunction errors (Lloyd, in press). In contrast, illusions due to artificial fluency (e.g., Jacoby & Whitehouse, 1989) can be reduced under limited circumstances. The results suggest that memory error rates and recognition sensitivity (which was improved for the second response in all conditions) are differently affected by opportunities to change one's responses on a recognition test.

• PROSPECTIVE MEMORY •

(1060)

Support for a Dual Process Model of Prospective Memory: Effects of Memory Load, Working Memory Capacity, and Asymmetrically Associated Lures. KEITH A. HUTCHISON, MARGARET T. FREUEN, & RYAN WORDEN, *Montana State University* (sponsored by Keith A. Hutchison)—Prospective memory (PM) performance was examined for target items (e.g., *stork*, *string*) using lexical decision as an ongoing task and varying memory load between 0, 2, and 6 items. In addition to PM target performance, responses were examined for critical forward-associated (e.g., *baby*) and backward-associated (e.g., *puppet*) lures in order to investigate presumed forward-acting active maintenance and backward-acting spontaneous retrieval processes, respectively. An *n*-back task was used to measure working memory capacity. Reaction times and errors for both PM targets and lexical decision filler words increased with memory load. As predicted by the dual process model, lure interference also increased with memory load, and this occurred exclusively for forward-related lures. Analysis of correlations further supported the dual process model in that backward interference correlated with PM performance only in the 2-item load, whereas forward interference and working memory capacity correlated with PM performance in the 6-item load.

(1061)

Reprioritizing Prospective Memory Intentions. ELAINE TAMEZ, SARAH C. MOYNAN, MARK A. McDANIEL, & MEREDITH E. MINEAR, *Washington University*—Reprioritizing prospective memory (PM) intentions refers to a change in the order or the importance of an intention relative to an ongoing task or another intention. Marsh et al. (1998) found, in an observational study, that over half of incomplete intentions were due to reprioritizing intentions rather than forgetting intentions. The present experiments examine how reprioritizing PM intentions influences PM performance in a laboratory-based task. Two groups of participants were compared: those with a stable intention and those with an intention reprioritized relative to an ongoing task or to a second intention. PM performance declined relative to a stable intention group when the intention was reprioritized relative to an ongoing task but not when reprioritized relative to a second intention. Reprioritization also influenced reaction time on the ongoing task and strategy use. Our results indicate that reprioritization does not always negatively impact PM performance.

(1062)

Evidence of Spontaneous Retrieval for Suspended but Not Completed Intentions. MICHAEL K. SCULLIN, *Washington University*, & GILLES O. EINSTEIN, *Furman University*—McDaniel and Einstein (2007) argue that prospective memories can be retrieved through spontaneous retrieval processes that respond to the presence of a target event. The present research investigated whether spontaneous retrieval processes continue to be activated after the completion of a prospective memory task. In two experiments, participants performed image-rating phases with a prospective memory task (press the “Q” key in presence of a target) embedded in one phase. Next, participants were told that their intention was either completed or suspended. Participants then performed a lexical decision task in which each target (and matched control) item appeared five times. Both experiments revealed slower response times to target items in comparison with control items when the intention was suspended but not when the intention was completed, thereby providing evidence for spontaneous retrieval only in the suspended condition. These initial results suggest that spontaneous retrieval processes are quickly deactivated following completion of an intention.

(1063)

Attentional Manipulations Affect Focal and Nonfocal Prospective Memory Cues Differently. GABRIEL I. COOK, *Claremont McKenna College*, J. THADEUS MEEKS & RICHARD L. MARSH, *University of Georgia*, & GILLES O. EINSTEIN, *Furman University*—Event-based prospective memories involve retrieving intentions in the presence of an environmental cue. Such cues vary in their specificity, and consequently, the degree to which they evoke retrieval of the previously established intention. According to the multiprocess view of prospective memory, very specific cues (i.e., focal cues) are detected relatively automatically, whereas less specific cues (i.e., nonfocal cues) require more attentional resources to be devoted to intention completion to achieve the same level of performance. Three experiments used three different manipulations of reducing the attention available for intention completion in order to demonstrate that in all three cases the detection of nonfocal cues was more severely impacted than the detection of focal cues. The manipulations included level of effort required to perform the task in which cues were embedded, a response signal procedure, and a random number divided attention task. Thus, not all event-based cues require the same resources to be detected.

(1064)

Effects of Very Long-Term Penetrating Head Injury on Laboratory Prospective Memory. LIA KVAVILASHVILI, *University of Hertfordshire*, & VANESSA RAYMONT & JORDAN GRAFMAN, *National Institute of Neurological Disorders and Stroke*—Research on patients with traumatic brain injury (TBI) has shown that they experience deficits in remembering both event- and time-based prospective memory tasks (remembering to do something in response to an event or at a particular time in the future, respectively). However, very long-term effects of TBI on prospective memory have not been examined. The present study assessed 199 Vietnam veterans with penetrating head injury (PHI) and 55 matched controls on three laboratory prospective memory tasks embedded within a general knowledge question answering task: a time-based task, and two event-based tasks with distinctive or nondistinctive target events. Performance of the control group on these tasks was not reliably better than that of the group with long-term PHI. Prospective memory performance will also be examined in relation to volume, hemisphere, and localization of the damage.

(1065)

Instructions to Complete or Forget an Intention Influence Stroop Performance. ANNA-LISA COHEN, *Yeshiva University*, & D. STEPHEN LINDSAY & JUSTIN KANTNER, *University of Victoria*—Research on the “intention superiority effect” (e.g., Goshke & Kuhl, 1993) revealed that material from scripts that are to be performed later by the participant are processed faster than is material

from a neutral script. Cohen, Dixon, and Lindsay (2005) demonstrated an “intention interference effect” for both young and older adults in which performance was slower for critical items belonging to an intention that participants intended to carry out versus critical items belonging to an intention that did not have to be executed. In a new line of studies, we examine the effect of critical item order. Because we used complex intentions that contained three critical items, we could examine how the superiority of the intention-related material builds across items. The results suggest that the first critical item acts as a reminder (showing no interference) and causes the remaining items to be retrieved reflexively, leading to Stroop interference.

(1066)

Effects of Delay and Type of Processing on Prospective Memory. KATHRYN A. HUDSON & DAWN M. McBRIDE, *Illinois State University*—Prospective memory (PM) has been defined as the process of remembering future events. Multiprocess theory (McDaniel & Einstein, 2000) proposes that PM performance can be more automatic when the PM and ongoing tasks are highly associated (i.e., focal PM cues are presented), but utilizes more controlled processes when the PM and ongoing tasks are not highly associated (i.e., nonfocal PM cues are presented). The present study examined how the delay between PM task instruction and PM cue presentation affects PM task performance with focal and nonfocal PM cues. As reported in previous studies (e.g., Einstein & McDaniel, 2005), responses to the ongoing task were faster in focal PM cue conditions than in nonfocal PM cue conditions. In addition, delay effects on PM task performance differed for focal and nonfocal conditions. The results of the present study support multiprocess theory descriptions of PM task performance.

• RECALL •

(1067)

Recalling the List Before the Last: Context Isolation, Context Retrieval, and Filtering Retrieved Memories. YOONHEE JANG & DAVID E. HUBER, *University of California, San Diego*—A series of experiments used the list before the last free recall paradigm, which manipulated the list length of both target and intervening lists to index the degree of interference from each list. Correct target list recall was only affected by the target list length when participants engaged in recall between the lists, whereas there was an effect of both list lengths with other activities. This suggests that the act of recalling drives context change, isolating the target list from interference. Incorrect recall of intervening list items was affected only by the length of the intervening list when recall occurred between the lists, but was otherwise affected by both list lengths. A multinomial model of sampling and recovery was implemented to assess the adequacy of this account. These results suggest a more nuanced account of retroactive interference that includes context isolation, context retrieval, and the ability to filter retrieved memories.

(1068)

Memory by Sampling. CAROLINE MORIN & GORDON D. A. BROWN, *University of Warwick*—According to temporal distinctiveness models of memory such as SIMPLE (Brown, Neath, & Chater, 2007), memory items’ temporal locations are represented as points on a temporal dimension in multidimensional psychological space. Such models do not provide a natural account of item presentation duration effects or rehearsal effects. Here, we explore predictions of a modified time-based model (memory by sampling) in which the temporal extension of items is explicitly represented. In Experiment 1, participants viewed lists of words whose presentation times followed either a U-shaped or an inverted U-shaped distribution. Participants overtly rehearsed each item during its presentation. In Experiment 2, presentation durations were random. Item recall increased systematically with item presentation time, especially in delayed free recall (Experiments 3 and 4). The results were as predicted by the memory by sampling model.

(1069)

Encoding Strategy and the Testing Effect in Free Recall. PETER P. J. L. VERKOEIJEN, *Erasmus University Rotterdam*, PETER F. DE-LANEY, *University of North Carolina, Greensboro*, & REMY M. J. P. RIKERS, *Erasmus University Rotterdam* (sponsored by Remy M. J. P. Rikers)—The *testing effect* refers to the phenomenon that taking an intermediate test benefits long-term retention more than restudying the material does. In the present study, we investigated the interaction between encoding strategy, retention interval, and testing effects. Participants studied a word list using a story strategy or a rehearsal strategy. Subsequently, they restudied the list or they received an intermediate free-recall test. Then, half of the participants received a final test after 5 min, whereas the other half received the final test after 1 week. When the final test was administered after 5 min, restudying yielded a better memory performance than testing. This held true for the story and the rehearsal strategy. Conversely, when the final test was given after 1 week, a testing effect was obtained in the story-strategy condition, whereas a reversed testing was found in the rehearsal-strategy condition. The theoretical and the practical implications of these findings are discussed.

(1070)

The Effects of Effort After Meaning on Recall. FRANKLIN M. ZAROMB & HENRY L. ROEDIGER III, *Washington University* (sponsored by Todd Braver)—Three experiments examined free recall of ambiguous sentences with and without corresponding cues to facilitate comprehension using Auble and Franks's (1977) paradigm. Sentences were either studied without cues, with cues provided immediately beforehand, or with cues following a 2- or 6-sec interval delay. When the conditions were manipulated within subjects, puzzling over the meaning of sentences for several seconds prior to receiving the cue to aid comprehension enhanced veridical recall and reduced false recall. The memorial advantage associated with increasing the sentence-cue delay did not occur when the cue presentation conditions were arranged in homogeneous sentence-blocks or manipulated between subjects. However, when instructions were changed to direct subjects to try to discern the meaning of sentences prior to receiving a cue, recall improved in both the between-subjects and blocked-sentence designs. Effort after meaning improves recall.

(1071)

Episodic Cuing: More Information Makes Worse Memory. ANDREA K. TAMPLIN & GABRIEL A. RADVANSKY, *University of Notre Dame* (sponsored by Gabriel A. Radvansky)—In three experiments, people were trained on general information, with accompanying unique episodic information, to choose an appropriate factory task or filing procedure. The learning task emphasized both the general and the episodic knowledge. After training, people were given task numbers/names, and were asked to recall the general information associated with these tasks. Findings suggest that while episodic cues aided memory in some cases, in others they made memory worse. Memory was generally improved with episodic cues when the traces were relatively weak, and harmed when memory traces were stronger. These results are interpreted in the context of theories of focused and competitive memory retrieval. Specifically, providing an episodic cue may misdirect retrieval processes away from portions of memory containing the needed information, and there may even be suppression of noncued information.

• WORKING MEMORY •

(1072)

Depth of Processing Differentially Affects Working Memory and Long-Term Memory. NATHAN S. ROSE, JOEL MYERSON, HENRY L. ROEDIGER III, & SANDRA HALE, *Washington University*—Two experiments compared the effects of depth of processing at encoding on working memory and long-term memory. Experiment 1 examined working memory performance on the levels-of-processing (LOP)

span task, a newly developed complex span procedure which involves processing to-be-remembered words on the basis of either their visual, phonological, or semantic characteristics. Using the LOP span task, Experiment 2 compared the effect of depth of processing at encoding on immediate serial recall with its effect on subsequent delayed recognition of the same items. Taken together, the results of the two experiments show that depth of processing has a minimal effect on working memory, but that even in the absence of an effect on immediate recall, there is a clear LOP effect on long-term memory for the same items. These results are consistent with previous findings showing that working memory and long-term memory are fundamentally separable systems and provide strong support for dual-store memory models.

(1073)

The Utilization of Domain Knowledge to Expand Working Memory Capacity. TRAVIS R. RICKS & JENNIFER WILEY, *University of Illinois, Chicago* (sponsored by Jennifer Wiley)—To investigate how expertise improves working memory capacity (WMC), we completed a set of studies that extended the Fincher-Kiefer et al. (1988) findings that domain knowledge increased scores on domain-related span tasks, which we replicate in our Experiment 1. In our subsequent studies, we isolated whether the storage or processing components of span tasks were related to baseball. In Experiment 2, processing was related, but storage items were not. No effects were seen due to domain knowledge. In Experiment 3, storage was related but processing was not. Again there was no effect for knowledge. Only Experiment 4, where the storage items were related to baseball, and participants were explicitly informed of the baseball theme, found an effect for knowledge. This suggests that experts expand their WMC by utilizing domain-related retrieval structures, but that they need to be aware of the relation between to-be-remembered items and their prior knowledge.

(1074)

The Negative Impact of Prior Reflective Selection is Sometimes Due to Target Enhancement. JULIE A. HIGGINS & MARCIA K. JOHNSON, *Yale University*—Briefly thinking of one item from an active set of semantically related items reduces accessibility of the non-selected items during subsequent processing. We test whether this reduced accessibility is due to target enhancement or to distractor suppression. Participants read aloud a word set containing three related category exemplars (one high, one medium, and one low associate). Then they either reread or thought of (refreshed) one of the words. Participants read the original set again before refreshing a second word from the set. Response times to refresh the second word were longer having just refreshed versus having just reread a word from the set. This increase was larger when the first word refreshed was a higher associate than when it was a lower associate. This pattern of results suggests that the negative impact of prior refreshing is due to enhanced activation of the refreshed item and not inhibition of the nonrefreshed items.

(1075)

Do Working Memories Decay? MARC G. BERMAN, JOHN JONIDES, LEE I. NEWMAN, & DEREK E. NEE, *University of Michigan* (sponsored by John Jonides)—We present data from a series of experiments exploring decay and interference in working memory. Utilizing an item-recognition task, we examined the degree to which previously seen stimuli interfered with item-recognition performance on current memoranda. The amount of time that separated previously seen items from current memoranda was manipulated from 2 to 14 sec to determine whether working memories do in fact decay with the sheer passage of time. In addition, the amount of proactive interference (PI) that was aggregated over the course of the experiment was varied between studies to determine whether the amount of aggregated PI interacted with the amount of time-based decay. Lastly, we analyzed how the number of intervening trials modulated the interfering ability of previously seen items. Our preliminary results

show a complex interaction between the aforementioned variables in determining whether decay exists in working memory.

(1076)

Concurrent Working Memory Load and Working Memory Span Effects on Visual Search. HEATHER D. MOTSINGER & DALE DAGENBACH, *Wake Forest University*—Recent research on working memory (WM) effects in visual search has produced conflicting results. Typically, studies manipulating WM capacity using a concurrent memory task have found WM effects under some conditions, but comparisons of high and low WM span groups have not. The present study compared search performance of high and low WM span groups under maintenance load and no load conditions in blocks with normal arrays, and in blocks in which a color singleton distractor was present on half of the trials. For visual search, WM span effects emerged only in the mixed blocks. WM load affected overall RT for both kinds of blocks, but not search rate. In the WM task, accuracy of high spans was significantly greater than that of low spans across all WM load types. The presence of the singleton impacted working memory performance for low spans, but not for high spans.

(1077)

Differential Effects of Articulatory Suppression on Spatial Location Memory. CANDICE C. MOREY, *University of Missouri, Columbia* (sponsored by Nelson Cowan)—Prabhakaran et al. (2000) and Baddeley (2000) proposed that cross-domain stimuli, such as spatially arranged letters, are maintained in a domain-general working memory (WM) store. If this is true and if this store is independent from domain-specific WM stores, then concurrent articulatory suppression should only affect the contents of a verbal WM store (e.g., letters). Participants viewed circled letters randomly scattered over an invisible grid. Some participants were tested on the binding between letters and spatial locations (bound probes), whereas some participants were tested with letters and spatial locations separately (separate probes). Articulatory suppression clearly impaired accurate responses to letter but not to location probes in the separate probe condition. However, in the bound probe condition articulatory suppression impaired ability to detect any type of change, including new letters, locations, and recombinations. These results suggest that WM for cross-domain stimuli may require integration of multiple WM components, not only a domain-general store.

(1078)

Indirect Assessment of Visual Working Memory for Simple and Complex Objects. TAL MAKOVSKI & YUHONG V. JIANG, *Harvard University*—Visual working memory (VWM) contents can influence subsequent visual search performance, even when they are irrelevant to the search task. For example, visual search is faster when the target, rather than a distractor, is surrounded by a shape currently held in VWM. This study uses this modulation of search by working memory as a means to investigate properties of VWM. Participants were asked to remember color or shape of simple and complex polygons, with complexity defined by Garner's R&R transformation rule. During the retention interval, participants searched for a tilted line among other lines embedded inside colored polygons. Search was faster when the target was enclosed by the remembered polygon, but the facilitation was greater for colors and diminished with increasing memory set size and complexity. A control experiment confirmed that the effects were not due to passive priming. We conclude that the search congruity effect can indirectly assess VWM.

• SKILL ACQUISITION •

(1079)

The Rich Get Richer: Emergence of Individual Differences in an Eye Movement Study of Storybook Reading. JIA GUO & GARY FENG, *Duke University*, & KEVIN F. MILLER, *University of Michigan* (sponsored by Kevin F. Miller)—Children who are initially better read-

ers tend to accelerate in reading development. This “Matthew effect” has been attributed to the increased exposure to print among young readers. This study explores the origin of this nonlinear development by investigating emerging readers' attention to pictures and texts during shared storybook reading. Six-year-old Chinese-speaking preschoolers' eye movements were monitored while an adult read two picture books to them. As expected, the amount of time children spent on texts versus pictures was strongly predicted by the number of words they could recognize. Whereas nonreaders virtually ignored the text altogether, children who could know at least some words spent more time on the text and thus benefited from increased print exposure. Adults' storytelling styles—interactive or verbatim—did not influence this pattern. Implications to word learning and reading acquisition are discussed.

(1080)

On the Multiple Routes to Skill Failure: Distraction, Over-Attention, and Task Demands. MARCI S. DECARO & ROBIN D. THOMAS, *Miami University*, & SIAN L. BEILOCK, *University of Chicago* (sponsored by Robin D. Thomas)—How do pressure-filled situations negatively impact performance? Distraction theories suggest that pressure-related worries co-opt attentional resources needed to perform the task at hand. Explicit monitoring theories suggest that pressure increases attention to the component steps of performance, disrupting proceduralized processes. We asked whether we could find evidence of both types of failure in the same domain—category learning. Individuals learned rule-based and information-integration categories under either a control condition, a pressure condition that elicited distracting thoughts (i.e., earning money for oneself and a partner), or a pressure condition that induced monitoring of step-by-step performance (i.e., surveillance by a video camera). Rule-based category learning, driven by attention-demanding hypothesis testing, was negatively impacted by distracting pressure, but unaffected by monitoring pressure. Information-integration category learning, reliant on procedural learning processes operating largely outside attention, showed the opposite pattern. There are multiple routes to failure that depend on pressure type and task demands.

(1081)

Strategies for Using Instructions in Assembly Tasks. ELSA EIRIKSDOTTIR & RICHARD CATRAMBONE, *Georgia Institute of Technology* (sponsored by Richard Catrambone)—This study examined which of two strategies were more effective for using and learning from instructions. An “instruction-based” strategy involves studying the instructions before attempting the task, whereas a “task-based” strategy involves attempting the task and referencing instructions as needed. Participants completed assembly tasks and performance during training, and transfer was assessed via task completion time, correctness, and subjective cognitive load. Participants using a task-based strategy took longer to complete the training task than did instruction-based participants, although there was no difference between these groups when repeating the task in a second session a week later. Control participants using their default strategy needed less time to complete the transfer tasks and reported less cognitive load on all the tasks than did the other participants. The results suggest that reading instructions fully before attempting a task helps initial performance but does not necessarily aid transfer performance relative to a person's “natural” strategy.

(1082)

Predicting Chess Skill Acquisition Throughout Time: A Linear Mixed Models Analysis. ANIQUE DE BRUIN, REMY M. RIKERS, & HENK G. SCHMIDT, *Erasmus University Rotterdam*—Studies on the development of expertise have identified a strong relation between accumulated hours of deliberate practice and expert performance. The present study examined whether this relation also holds for the early phases of skill development. Instead of a between-groups design, we used a within-group design to study the relation between deliberate

practice and performance. By means of a linear mixed models analysis, we showed that throughout chess players' careers, a strong relation was found between deliberate practice and chess ratings. Moreover, differences between persisters and later dropouts were the result of lower engagement in deliberate practice, from an early point on. This rejects the possibility that the relation between deliberate practice and performance only holds for those who eventually reach the top. Finally, the performance difference between males and females could mainly be attributed to less deliberate practice by females.

(1083)

Learning the Relations Between Multiple Inputs and Outputs: Integration Effects in a Diagnostic Task. JON TALL, ROBERT MATHEWS, SEAN LANE, & BILL SALLAS, *Louisiana State University*—In real-world situations, it is often difficult to figure out what “works.” We often have multiple behavioral options and multiple ways that we could measure the impact of our behavior. In three experiments, we modeled this complexity using a managerial task that involved learning the effect of multiple inputs (interventions) on multiple performance measures of employees. Participants “met” with each employee to improve their performance and to learn which interventions were most helpful overall. Later, on separate tests, they prescribed the best intervention for each participant and indicated the impact of each intervention on each performance measure. The critical manipulation was whether a key variable had a negative side effect or not. The major finding was that, although participants appeared to integrate their knowledge of the side effect into their decisions (by prescribing it less), they nevertheless did not indicate any knowledge of its impact when explicitly queried about it.

• IMAGERY AND SPATIAL COGNITION •

(1084)

Quantitative and Qualitative Gender Differences in Learning Large Spaces. ANN EKECHUKWU, *Vanderbilt University*, JULIA SLUZENSKI, *Richard Stockton College of New Jersey*, & TIMOTHY P. MCNAMARA, *Vanderbilt University* (sponsored by Timothy P. McNamara)—Males and females walked a straight path through a field while memorizing the locations of surrounding objects. About 10 min later they performed a computer task requiring them to recall the interobject angles. Males had lower angular error than females, suggesting that the earlier finding was not due to the context of the baseball field. Males were also less likely than females to use a verbal strategy during learning. In addition, we investigated whether performance on the field task was related to performance on nonnavigational spatial tasks and to verbal ability. For males, performance on the field task was generally related to other spatial abilities, whereas for females this finding was not as strong. In contrast to males, female performance was related to verbal ability. Collectively, these findings suggest that males rely more on quantitative spatial coding than do females, and that females rely more on verbal spatial coding than do males.

(1085)

Factors Affecting Object–Object Information in Spatial Representations II. JESSE SARGENT, STEPHEN C. DOPKINS, & JOHN W. PHILBECK, *George Washington University*—Human subjects learned the location of four objects around them in a room. However, visual access was restricted during preview such that a particular adjacent pair of the four objects (between-image pair) could never be seen together from the same point of view. Participants were then blindfolded and underwent passive whole-body rotations, pointing to the objects after each rotation. The error in locating one object relative to another was greater for the between-image pair than for the within-image pairs that could be viewed together during preview. Between- and within-image pairs were matched for angular separation. The results are interpreted as suggesting that in representations of detailed spatial information about remembered, immediate room-sized environments, certain objects “bind” together more tightly than others. Possible al-

locentric characteristics of such “bound” object representations and the role of visual imagery are considered.

(1086)

Similarity Between Room Layouts Causes Orientation-Specific Sensorimotor Interference in To-Be-Imagined Perspective Switches. BERNHARD E. RIECKE & TIMOTHY P. MCNAMARA, *Vanderbilt University*—May (2004) suggested that the difficulty of imagined perspective switches is partially caused by interference between the sensorimotor (actual) and to-be-imagined orientation. Here, we demonstrate a similar interference, even if participants are in a remote room and don't know their physical orientation with respect to the to-be-imagined orientation. Participants learned 15 target objects located in an office from one orientation (0°, 120°, or 240°). Participants were blindfolded and disoriented before being wheeled to an empty test room of similar geometry. Participants were seated facing 0°, 120°, or 240°, and were asked to perform judgments of relative direction (e.g., imagine facing “pen,” point to “phone”). Performance was facilitated when participants' to-be-imagined orientation in the learning room was aligned with the corresponding orientation in the test room. This suggests that merely being in an empty room of similar geometry can be sufficient to automatically reanchor one's representation and thus produce orientation-specific interference.

(1087)

Inferring Cross Sections: Benefits of Spatial Visualization Training. CHERYL A. COHEN & MARY HEGARTY, *University of California, Santa Barbara* (sponsored by Mary Hegarty)—We examined the benefits of training with virtual objects on a spatial visualization task that involves identifying the cross section of a geometric solid. In Experiment 1, a novel 30-item multiple choice test was developed to measure individual differences in this task. Performance was related to orientation of the cutting plane (orthogonal or oblique) and to spatial ability. Errors indicated that low-spatial participants often failed to shift mental perspective to the requisite view orientation of the cross section. In Experiments 2 and 3, low-spatial participants were trained by allowing them to pass a plane through a virtual object and observe the resulting cross section. This training led to large gains in performance of trained individuals in comparison with controls. Performance improved on the trained objects and transferred to novel objects. The results suggested that individuals learned to recognize specific cross sectional shapes and to assume the correct view orientation.

(1088)

Mitigating Effects of Spatial Ability on Mental and Manual Rotation. ANDREW T. STULL, MARY HEGARTY, & RICHARD E. MAYER, *University of California, Santa Barbara*—In two experiments, individuals of differing spatial ability were measured on response time, orientation matching, and path directness as they manipulated a virtual 3-D object in two conditions, with or without orientation references (ORs). In Experiment 1, participants attempted to quickly and accurately match 40 targets randomly rotated around 40 unique, non-canonical axes. In Experiment 2, participants attempted to match 44 targets systematically rotated around the three canonical axes or a noncanonical axis. In both experiments, the OR group responded significantly faster, more accurately, and more directly than the non-OR group. Performance was correlated with spatial ability, and effects of spatial ability were mitigated in the OR group. These results suggest that orientation references may help individuals mentally and manually manipulate complex objects. Furthermore, it may be possible to alleviate difficulties of low-spatial individuals by providing orientation references.

• SPATIAL MEMORY •

(1089)

Spatial Ability and Working Memory: Just and Carpenter (1985) Revisited. DALE KLOPFER, JEREMY ATHY, & LAURA LEVENTHAL,

Bowling Green State University—Just and Carpenter (1985) proposed that people with low spatial ability (lows) perform spatial tasks (e.g., mental rotation, cube comparison) less accurately than do highs because of individual differences in working memory. Miyake et al. (2001) found that different spatial ability measures tap into maintenance and executive components of working memory differentially. We developed an interactive version of Just and Carpenter's task where the participant decides whether two cubes with letters on their surfaces are the same. The interactive component allowed participants to rotate the cube rather than imagining it rotating. With the reduced demands on working memory that the interactive task affords, we expected lows to perform as well as highs on the task. Differences in accuracy were eliminated, but the two groups demonstrated differences in their understanding of rotational transformations, the amount of time spent planning, and whether they matched the letters on all the visible faces before responding.

(1090)

Hemovelocitv and Performance Demonstrate That Complexity Limits Visual Short-Term Memory. NATASHA A. BARRETT, *Georgia State University*, MICHAEL J. BERAN, *Language Research Center*, & DAVID A. WASHBURN, *Georgia State University* (sponsored by David A. Washburn)—Two theoretical models have been proposed to explain the capacity limit of visual short-term memory. The fixed slot model states that visual capacity is limited by the number of objects in a display. The flexible slot model states that visual capacity is limited by the complexity of the objects in the display. Previous researchers have focused on the spatial component of visual capacity instead of object memory. We instead examined object memory in a change detection task using random polygons that varied on the complexity of the image and the number of objects presented. In conjunction with recognition memory performance, we incorporated brain activity as revealed by hemovelocitv. Hemovelocitv was measured by transcranial Doppler sonography. Performance and brain activity varied as a function of object complexity. Capacity fell far below the level proposed by the fixed slot model. The results therefore favor the flexible slot model.

(1091)

The Intricacies of Encoding and Rehearsal in Spatial Memory. KATHERINE GUÉRARD & SÉBASTIEN TREMBLAY, *University of Laval*, & JEAN SAINT-AUBIN, *University of Moncton*—In spatial serial recall, performance increases as the distance between the consecutive stimuli locations decreases. This effect, known as the path length effect (Parmentier, Elford, & Maybery, 2005), was investigated in order to examine the mechanisms implicated in memory for spatial information. The participants had to recall the order in which spatial locations were presented. In half of the to-be-remembered sequences, the distance between consecutive dots was short, and in the other half, the distance was long. Moreover, participants had to perform visual suppression, an interfering task in which they had to incessantly move their eyes from one location to another during the delay (Experiment 1) or during item presentation (Experiment 2). Combined with the analysis of eye movements, the use of visual suppression suggested that the path length effect takes place at encoding, since the effect was reduced when the interfering task was carried out during item presentation, but not during the delay.

(1092)

Veridical Memory in Category-Based Spatial Distortions: A Retrieval Model. CRISTINA SAMPAIO, *Western Washington University*, & RANXIAO FRANCES WANG, *University of Illinois, Urbana-Champaign*—Studies showed that systematic categorical distortions occur in spatial memory recall. The present experiment investigated whether people have access to the veridical memory for a target's location. Each trial contained two separate tasks. The first task involved a standard location reproduction procedure after a brief view of a target within a blank circle. The second task involved a forced-choice

recognition procedure after a re-presentation of the same target within the circle. In this task, the foil item for each participant was the participant's own recalled location of the target recorded in the first task of the trial. The results for the reproduction task replicated the category bias effect. However, participants selected the original location of the target in approximately 77% of the trials in the recognition task. These findings indicate that people retain a veridical memory of the original location and are able to select that location after a delay.

(1093)

Working Memory in Developing and Applying Spatial Mental Models. TAD T. BRUNYE, *Tufts University & U.S. Army Research, Development, and Engineering Command*, & HOLLY A. TAYLOR, *Tufts University*—A series of four experiments examined working memory involvement during the construction and application of spatial mental models. Experiment 1 used a dual-task paradigm to examine visuospatial, articulatory, and central executive involvement during survey and route description learning. Converging evidence from inference and declarative memory tasks suggests articulatory involvement in text processing, and visuospatial and central executive involvement in spatial mental model development, particularly during route description learning. Experiment 2 applied the dual-task paradigm during the application of spatial mental models. An articulatory dual-task slowed the successful recognition of verbatim information, whereas visuospatial and central executive dual-tasks slowed inference verification; accuracy was not affected. Taken together, results suggest that spatial mental models develop and are successfully applied through interactions between multiple working memory systems. Furthermore, this involvement varies as a function of description perspective.

(1094)

Response Mode Differences in Perspective Taking: Differences in Interference or Differences in Strategy? JONATHAN W. KELLY & TIMOTHY P. McNAMARA, *Vanderbilt University*—Two experiments explored the effects of response mode on imagined perspective taking. Participants learned object locations and then, while blindfolded, pointed to and verbally described object locations from perspectives aligned or misaligned with their current facing direction. On the basis of May's (2004) sensorimotor interference theory, pointing responses, but not verbal responses, were expected to be hindered by a reference frame conflict for misaligned perspectives. Contrary to this hypothesis, a performance advantage for aligned as opposed to misaligned perspectives was found for both response types. To investigate the possibility that previously reported response type effects were due to differences in strategy and not differences in interference, participants were instructed to use a third-person strategy. This alternative strategy resulted in similar performance from aligned and misaligned perspectives for verbal labeling, but not for pointing. We propose that previous findings attributed to differences in sensorimotor interference could be due to differences in strategy.

• MUSIC COGNITION •

(1095)

Mechanisms of Melody Recognition. JOSH McDERMOTT & ANDREW J. OXENHAM, *University of Minnesota*—The pattern of upward and downward changes in pitch, known as the melodic contour, is thought to be a primary means by which humans recognize melodies. To probe the nature of the contour representation, we asked subjects to judge whether the contours of two successive melodies were the same or different. The first melody was always defined by variation in pitch, while the second varied along one of several different dimensions. We found that subjects could perform at high levels when the second stimulus varied in brightness, intensity, or pitch, but not when it varied in other attributes. However, subjects could only perform the task when brightness or intensity changes were mapped to pitch changes of the same sign—that is, when intensity/brightness

increases corresponded to pitch increases rather than decreases. The results are consistent with a mechanism not exclusive to pitch, perhaps operating on dimensions that evoke a vertical metaphor.

(1096)

Investigating the Psychological Representation of Tonality in Imagined Contexts. DOMINIQUE VUVAN & MARK A. SCHMUCKLER, *University of Toronto*—Musical imagery was examined by investigating musically trained listeners' abilities to image a major tonality when presented with a cue tone varying in its musical relatedness to the to-be-imagined key (e.g., "imagine this cue tone as the tonic or mediant or dominant of a major tonality"). Specifically, listeners heard a range of cue tones followed by a probe tone, and then rated how well the probe fit with the imagined tonality. Analyses of probe tone profiles revealed that listeners successfully imaged the requested tonality despite the varying musical relatedness of the cue, and also revealed that the implied tonality of the cue tone itself had an independent influence on listeners' ratings. Analyses of the time required to image a tonality revealed no influence of the musical relatedness of the cue tone, except when the cue tone was the tonic of the intended key, which produced significantly faster image times.

(1097)

Feature Binding and List Length in Memory for Musical Phrases. W. J. DOWLING, *University of Texas, Dallas*, & BARBARA TILLMANN, *CNRS-UMR 5020 Lyon*—We previously found that memory for musical phrases improves during the 15 sec following their presentation (*Music Perception*, 2001). This led us to hypothesize that the binding of features of musical phrases during memory encoding is a gradual process occurring while the listener continues to follow the music. This feature binding leads to reduced confusion in a recognition test between target items (T) and similar lures (S), a confusion engendered by shared individual features that dissipates when those features are correctly bound (for example, by the correct placement of a melody on its musical scale). This suggests that recognition performance should improve with coherent, connected lists of musical phrases as list length increases (in contrast to the decline found with disconnected lists of verbal materials). Pilot work with lengths of 2 and 4 items confirms the hypothesis, and we will report results for lists of 2, 3, 4, and 6 phrases.

(1098)

Nobody's Perfect: Neural Correlates of Performance Errors in Musicians. CLEMENS MAIDHOF, MARTINA RIEGER, STEFAN KOELSCH, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences* (sponsored by Wolfgang Prinz)—Playing a musical instrument at a professional level is a highly demanding task requiring the constant and precise monitoring of one's own actions to achieve correct performance. In the present experiment, we investigated the neurophysiological correlates of performance errors of pianists. 12 pianists were blindfolded and were asked to play fast sequences bimanually on a digital piano while the EEG was measured. Event-related potentials of self-made errors were computed and compared with those of correct notes. The results showed that electric brain responses differed between correct and erroneous performance already 100 msec before the onset of a wrong note. This implies that not all error-related mechanisms rely on auditory feedback, and that errors are neurally detected prior to the completion of an erroneous movement. Thus, it appears that musicians can detect errors already at an early planning stage, possibly by using internal forward models.

(1099)

Increasing Pitch Velocity Increases the Magnitude of the Auditory Kappa Effect. MOLLY J. HENRY & J. DEVIN MCAULEY, *Bowling Green State University*—Three experiments tested the hypothesis that implied pitch velocity modulates the strength of the auditory kappa effect. Participants judged the relative timing of the middle "target" tone in three-tone sequences, ignoring pitch. In Experiment 1, pitch

was held constant, but the temporal midpoint between the onsets of the first and third tones varied between subjects and took on one of three values (364 msec, 500 msec, 800 msec). In Experiments 2 and 3, tone sequences ascended or descended in pitch, respectively, and implied pitch velocity took on one of three values (4 ST/364 msec, 4 ST/500 msec, 4 ST/800 msec). Consistent with visual kappa findings, the auditory kappa effect was larger for sequences with a faster pitch velocity (e.g., 4 ST/364 msec) than for sequences with a slower pitch velocity (e.g., 4 ST/800 msec) for both ascending and descending sequences.

• VISUAL PERCEPTION •

(1100)

ART-E Theory: Perceived Depth and Width Is a Function of Visual Angle Ratio and Elevation. IGOR JURICEVIC, JOHN M. KENNEDY, & IZABELLA ABRAMOV, *University of Toronto, Scarborough* (sponsored by John M. Kennedy)—How does vision react when perceiving an object's aspect ratio (depth/width) in a perspective picture? ART theory (Juricevic & Kennedy, 2006) proposes that vision uses a visual angle ratio (ratio of the visual angles of the object's depth and width) and the object's angle-from-the-normal (direction of the object from the central vanishing point). We now propose ART-E theory, which substitutes angle of elevation for angle-from-the-normal. Consider two paths of square tiles, one directly in front (heading of 0°) and the other at a heading of 45° to the left. ART and ART-E theory make identical predictions for the changes in perceived aspect ratios of the tiles along the path directly ahead. However, they differ for the path at 45°. The predictions were tested with panoramic perspective pictures of three paths of square tiles differing in heading (0°, 30°, 45°). Subjects' judgments of the tiles in the paths support ART-E theory.

(1101)

Influencing the Strength of the Horizontal/Vertical Illusion. ALAN SEARLEMAN, *St. Lawrence University*, CLARE PORAC, *Pennsylvania State University, Erie*, & KENDRA HORTON & JENNELLE ALVIN, *St. Lawrence University*—The strongest version of the horizontal/vertical (HV) illusion is comprised of two intersecting lines of equal length: a vertical line bisecting a horizontal line, resembling an upside down "T." Most people perceive the vertical line as being longer. This study compared the effectiveness of two competing theories in predicting changes in the strength of the HV illusion. We attempted to alter the original illusion by adding black distractor dots at either 2 mm or 10 mm from the line endpoints in order to either maximize or minimize the illusion's typical strength. Functional fovea theory would predict that the 10-mm dots should be more effective, whereas the centroid extraction theory would expect the dots placed at 2 mm to be more effective. The results left no doubt that the 2-mm distractor dots (and hence centroid extraction theory) were the most effective in manipulating the strength of the HV.

(1102)

Effects of Prime Diagnosticity During Perceptual Identification: Strategies or Implicit Adaptation? CHRISTOPH T. WEIDEMANN, *University of Pennsylvania*, DAVIDE E. HUBER, *University of California, San Diego*, & RICHARD M. SHIFFRIN, *Indiana University*—Effects of prime diagnosticity in perceptual tasks are often claimed to stem from strategic responding, but this assumption is rarely tested. We manipulated prime duration and prime diagnosticity in a visual forced-choice perceptual identification task with repetition priming. The strength and direction of prime diagnosticity produced marked effects on choice accuracy, but those effects were resistant to subsequent changes of diagnosticity. In additional experiments, participants learned to associate different diagnosticities with primes of different durations, but not with primes presented in different colors. Regardless of prime diagnosticity, preference for a primed alternative covaried negatively with prime duration. These findings suggest that prime diagnosticity affects performance not through strategic responding,

but by altering the implicit discounting of evidence which remains important regardless of prime diagnosticity.

(1103)

Perception of Affordances for Standing Depends on Height of Center of Mass. TONY REGIA-CORTE & JEFFREY B. WAGMAN, *Illinois State University*—We investigated whether perceiver-actors are sensitive to how changes in the height of their center of mass influence their ability to stand on an inclined surface. Participants adjusted the angle of a surface until they felt that it was just barely possible for them to stand on that surface. Weights were attached to a backpack apparatus worn by participants so as to change the location of the participant's center of mass. Participants performed this task in each of three mass-placement conditions—raised mass, centered mass, and no mass. In addition, participants performed the task in each of two perceptual modalities—they perceived the surface by viewing it and by probing it with a handheld rod (while blindfolded). Perception of affordances for standing on the inclined surface depended on the height of the center of mass but did not depend on the perceptual modality by which the surface was perceived.

(1104)

Representing the Orientation of Objects: Evidence From Adults' Error Patterns. EMMA GREGORY & MICHAEL McCLOSKEY, *Johns Hopkins University*—Representing the orientation of objects in the visual field is essential for interacting with the world, yet little research has explored how the visual system represents object orientation. We present a theoretical framework conceiving of orientation as a relationship between reference frames. According to the theory, orientation representations map an object-centered reference frame onto a reference frame external to the object, with this mapping specified by several independent elements. The theory makes predictions about the error types that should occur in perceiving and remembering object orientation. In several experiments testing these predictions, pictures of objects were presented briefly, and participants reported the orientations of the objects. We argue that the observed errors support the two key assumptions of the theory: (1) Orientation representations have a componential structure, and (2) object-centered reference frames play a central role in orientation representation. We also argue that alternative hypotheses cannot account for our results.

(1105)

Exaggerated Leftward Bias for Faces in Mirror-View. YAMAYA SOSA-MACHADO & MARK E. McCOURT, *North Dakota State University* (sponsored by Mark E. McCourt)—Healthy dextral subjects ($N = 49$) performed tachistoscopic line-bisection (LB) and free-viewing chimeric-face (CF) emotional valence discrimination tasks when stimuli were viewed either directly or in obvious mirror reflection. Leftward biases typify performance of normal observers in both LB and CF tasks. We hypothesized that leftward bias would be reduced for stimuli viewed in mirrors. Single-sample t tests showed a significant egocentric leftward bias for both tasks in both direct-view and mirror-view conditions ($p < .01$). For LB, leftward bias did not differ in direct- versus mirror-viewing ($p = .315$). Leftward bias in the CF task was significantly greater ($p = .017$) in mirror- versus direct-view conditions (71.9% and 64.5%, respectively). The results indicate that mirror viewing selectively exaggerates the egocentric leftward bias associated with processing happy facial expressions.

(1106)

What's in a Name? Species of Redundancy in Visual Target Detection. BOAZ M. BEN-DAVID, *University of Toronto, Mississauga*, & DANIEL ALGOM, *Tel Aviv University* (sponsored by Daniel Algom)—We report a series of investigations into the effects of common names, physical similarity, and physical identity on signal detection time and capacity of the system processing the signals. Examined are target-distractor (single target), target-target (redundant targets), and distractor-distractor (no targets) displays in a redundant

signals design. Detection is impeded when the to-be-ignored distractor shares name or a physical feature with the target, but redundancy gain is larger and signal processing is of increased capacity under such conditions. Redundant targets coactivate detection in situations in which several different target-pairs exist; otherwise, there is a parallel race. Finally, physically identical targets and distractors precipitate the fastest reactions in all conditions. The enormous sensitivity of the human detector to subtle features of the situation is uncovered, and the guiding principles for a truly encompassing model are outlined.

• WORKING MEMORY •

(1107)

Working Memory Training in Older Adults. BARBARA CARRETTI, ERIKA BORELLA, CESARE CORNOLDI, & ROSSANA DE BENI, *University of Padua* (sponsored by Cesare Cornoldi)—It is well assessed that working memory (WM) has a limited capacity; nonetheless, few studies have investigated how this limitation is affected by practice and learning. Recently, some evidences have been collected about the possibility to enhance WM performance, but only in young adults. Across two studies, we examined whether two different memory trainings can improve WM performance in older adults. In a first experiment, participants were instructed to use a typical long-term memory strategy (mental imagery) during an immediate recall task, and the benefit of the use of this strategy on the performance in a WM task was assessed. In a second experiment, participants were trained with adaptive and demanding WM tasks to increase their WM performance. Both studies indicated a significant improvement in WM performance of the older experimental group in comparison with the older control group. The results will be discussed in term of cognitive transfer effects.

(1108)

A Deficit in Immediate Recall of Language in Older Adults. AMANDA L. GILCHRIST, NELSON COWAN, & MOSHE NAVEH-BENJAMIN, *University of Missouri*—We ask why older adults have poorer immediate recall of language than do young adults. One hypothesis is that older adults recall fewer units of information (chunks) and another is that they are poorer at binding related words together to form multiword chunks. These hypotheses were examined using 4 types of spoken materials for free recall: 4 short, simple sentences; 8 such sentences; 4 compound sentences, each comprising two of the shorter sentences in a meaningful combination; and shuffled sentences. By varying the length and number of separate units per trial, we could determine how chunk formation helped recall. We classified series of words recalled in the presented order without pause as coherent chunks. Older adults recalled fewer chunks than did young adults, with only small age differences in chunk size. However, older adults used a different strategy that worked well for 4 short sentences but was less successful for longer materials.

(1109)

Does Differential Strategy Use Account for Age-Related Differences in Working Memory Performance? HEATHER ROTH & JOHN DUNLOSKY, *Kent State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—In two experiments, we evaluated whether strategy use accounts for age-related differences in performance on working memory span tasks. In both experiments, participants completed the reading span task and the operation span task and reported strategies used for each set of to-be-remembered items. Age deficits in overall span performance were observed on both tasks, and individuals performed significantly better on trials for which they reported using effective strategies. Despite the overall age difference in span performance, young and older adults reported using the same proportion of effective strategies on both tasks. Thus, although strategy use does contribute to performance on span tasks, it does not account for the observed age-related deficit.

(1110)

Older Adults Search Working Memory As Efficiently As Younger Adults: Evidence From Four Different Memory Scanning Conditions. ELKE B. LANGE & PAUL VERHAEGHEN, *Georgia Institute of Technology* (sponsored by Paul Verhaeghen)—In two experiments, we compared performance of young and old adults in a serial recognition task. In this task the visual presentation of N digits at N locations was followed by N recognition probes ($N = 3, 4, 5$). Participants had to decide whether the probe digit occurred at the same location as in the encoding phase. We probed items predictably (forward, backward, a learned irregular pattern) and randomly. RT is independent of N only when the probe recognition order matches the encoding order; otherwise RT increased linearly with set size, with the learned irregular probing yielding the largest slope. After logarithmic transformation of the data and subtraction of sensorimotor RT, no age \times slope interactions were found, showing that the search efficiency of older adults is a simple multiplicative function of that of the young.

(1111)

Individual Differences in Working Memory Capacity and Other Cognitive Abilities Influence L2 Reading Comprehension With Missing Information. MICHAEL BUNTING, SCOTT A. WEEMS, DIMITRIOS K. DONAVOS, ELIZABETH ROGLER, & HENK J. HAARMANN, *University of Maryland*—Missing words (i.e., completeness) and missing background information (i.e., context) can adversely impact readability and comprehension, especially for readers with lower language proficiency. Our objective was to identify the role of individual differences in salient cognitive factors in L2 reading comprehension when completeness and context vary. L2 reading comprehension skills of 82 adult foreign-language professionals (L1: English; L2: Spanish acquired post-critical period; lower- to upper-intermediate L2 proficiency) were assessed in tests of narrative and conversation comprehension, inferential reading, and reading with spatial reasoning. Subjects made inferences about missing words, missing context, or the spatial arrangement of items, or avoided misleading inferences. L1 working memory (WM), L1 and L2 processing speeds, reasoning ability, L1 reading ability, creativity, and situation memory were assessed. Preliminary findings indicate that WM and L1 reading ability are the strongest correlates of L2 reading comprehension when drawing inferences is difficult.

(1112)

Domain-Specific Proactive Interference Effects Are Predicted by Impairments in Short-Term Memory Capacity. LAURA H. F. BARDE & MYRNA F. SCHWARTZ, *Moss Rehabilitation Research Institute*, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania* (sponsored by Myrna F. Schwartz)—To date, studies regarding mechanisms of proactive interference (PI) in working memory have focused primarily on the integrity of control processes (i.e., inhibition, selection). In a patient study, we took an alternative approach, wherein variation in domain-specific short-term memory (STM) capacity was correlated with resistance to semantic or phonological PI (sPI and pPI). Twelve patients with left hemisphere stroke performed a modified item-recognition task (Hamilton & Martin, 2006; Monsell, 1978) designed to elicit sPI or pPI from list items located one, two, or three trials back. Following a z -transformation of each patient's interference measure, referencing an age-matched control group ($n = 20$), we found domain-specific patterns of PI. That is, impairments in semantic STM were associated with sPI, but not with pPI. The reverse effect was found in patients with phonological maintenance deficits. We interpret the results with regard to extant models of STM impairment and accounts of PI resolution.

(1113)

Effects of Phonological Neighborhood Size and Biphone Frequency on Serial Recall of Words. LINDA MORTENSEN & RANDI C. MARTIN, *Rice University*—Immediate serial recall is more accurate for lists composed of nonwords with many than with few phonologi-

cal neighbors and for lists of nonwords with high than with low biphone frequency (Thorn & Frankish, 2005). We investigated the independent effects of phonological neighborhood size (Experiments 1 and 2) and biphone frequency (Experiments 3 and 4) on immediate serial recall of high- and low-frequency words. When the lists were sampled from a closed set of words, neighborhood size had no effect. When the lists were from an open set, a facilitatory effect was observed but only for low-frequency words. Biphone frequency facilitated recall of both high- and low-frequency words in both closed and open sets. These results confirm that phonological neighborhood effects on recall of words exist but suggest that the effect is confined to low-frequency words. The influence of lexical and sublexical phonological knowledge on short-term memory for words is discussed.

(1114)

Phonological and Orthographic Similarity Affects Verbal Short-Term Memory for Chinese Characters. CHE-YING LAI & DENISE H. WU, *National Central University*, & DAISY L. HUNG & OVID J.-L. TZENG, *National Yang-Ming University* (sponsored by Ovid J.-L. Tzeng)—Prominent theories of short-term memory (STM) emphasize the importance of phonology to retaining verbal materials, whereas orthography is only considered supplementary when phonology is not available or useful. However, when retaining Chinese characters, whose correspondence between phonology and orthography is relatively irregular in comparison with most alphabetic languages, orthographic contribution might be more likely to express. We manipulated the phonological and orthographic similarity between Chinese characters independently in three experiments. The contribution of phonology was consistently observed across three experiments, indicating the dominant role of this kind of information in verbal STM. More importantly, the contribution of orthography was also demonstrated in both phonologically dissimilar and similar characters after the strategy of focusing on other aspects of Chinese characters was prevented. Our findings suggest that orthography is also a crucial component of verbal STM for retaining Chinese characters, even when the phonological information is readily available.

• IMPLICIT LEARNING AND MEMORY •

(1115)

Memory Consolidation During Rapid Serial Visual Presentation. ANDREAS BREUER & MICHAEL E. J. MASSON, *University of Victoria*, ANNA-LISA COHEN, *Yeshiva University*, & D. STEPHEN LINDSAY, *University of Victoria* (sponsored by Michael E. J. Masson)—It has been claimed that for a briefly viewed object to be encoded into long-term memory, the viewing episode must undergo a process of memory consolidation beyond the initial processing needed to identify the object. Previous demonstrations have supported the conclusion that memory consolidation can take several hundred milliseconds. Contrary to this claim, we provide evidence that pictures shown for only 75 msec in a rapid serial visual presentation (RSVP) format with no motivation for processing beyond immediate identification do exhibit improved performance in an indirect test of memory (masked object identification), even when performance is at chance in a recognition memory test. We also determined that the memory episodes formed from the RSVP sequences were partly perceptual, as shown by better performance for exact replications of the studied picture relative to mirror reversals, and partly conceptual, as shown by cross-modal priming.

(1116)

The Role of Color in Object Memory. TOBY J. LLOYD-JONES & KAZUYO NAKABAYASHI, *University of Kent*—We examined the effects of repetition priming, object format (pictures vs. words), color format (color patches vs. words), and color transformation between study and test (from correctly colored to incorrectly colored and vice versa) on colored-object decision performance (i.e., deciding whether an object was correctly colored) using diagnostically colored objects

(where color is a cue to identity; e.g., *fire engine* or *banana*). The main findings were that transformation had no influence on repetition priming (i.e., priming was equivalent for transformed and untransformed objects), and that priming differed according to whether objects were correctly or incorrectly colored and whether the object was represented as a picture or object name. For correctly colored objects priming was observed only for pictures, whereas for incorrectly colored objects priming was observed for both pictures and object names. We discuss these findings in light of recent accounts of priming in binary decision tasks.

(1117)

Attention and Search Difficulty in Contextual Cuing: Implications for the Explicit–Implicit Memory Distinction. HEATHER H. MCINTYRE, *Georgia Institute of Technology* (sponsored by Daniel H. Spieler)—The role of attention in implicit learning was recently clarified in the contextual cuing paradigm. Specifically, Chun and Jiang (2001) showed that individuals become increasingly faster at locating a target within a search array when the spatial configuration of the target and subset of distractors sharing features with the target (i.e., color) are kept constant across multiple blocks, with no advantage to keeping the irrelevant distractors constant. Furthermore, the magnitude of contextual cuing is purported to be directly proportionate to the difficulty of the search as a result of an increase in perceptual load and a more precise focus of attention on relevant search items. However, data from 80 participants suggest that the extent to which contextual cuing emerges in increasingly difficult search tasks is a function of executive attention and working memory span. Implications for the explicit–implicit distinction in memory systems are discussed.

(1118)

Recognition and Categorization After Exposure to Equally and Unequally Distributed Training Stimuli, in AGL. FENNA H. POLETIEK & LARA WARMELINK, *Leiden University*, & NICK CHATER, *University College London*—Poletiek and Chater (2006) suggest that frequency distribution of a training sample of exemplars affects learning in artificial grammar learning. Exemplars with a high probability to be produced by the grammar—i.e., highly frequent in a random output—presumably are more typical for the structure than low probability exemplars. Inequalities in the distribution provide cues to the learner about differences between exemplars with regard to their prototypicality for the grammar. Oppositely, however, recollecting as many items as possible from a training sample should benefit from presenting each item equally often, as predicted by the power law of practice. This interaction between task goal and distributional char-

acteristics of exemplars of a grammar was tested experimentally. We explore first the implications of this effect for understanding the influence of distributional aspects of the input sample on grammar induction and memory processes. Additionally, the relation between recognition and classification processes is discussed.

(1119)

Associative Processes in Probabilistic Sequence Learning. JENNIFER P. PROVYN & MARC W. HOWARD, *Syracuse University* (sponsored by Marc W. Howard)—Temporally defined associations in episodic recall tasks exhibit a contiguity effect in both the forward and backward directions. Many researchers believe that episodic and implicit memory depend on different brain systems. We systematically traced out the functional form of temporally defined associations in a serial reaction time task. Stimuli were sampled probabilistically from a ring. On 70% of the trials, the stimulus presented was one step forward in the ring, corresponding to lag+1. Remote lags were uniformly sampled on 30% of the trials. We examined RT as a function of lag. Surprisingly, we observed graded contiguity effects in both forward and backward directions, as well as an associative asymmetry favoring forward associations. The striking similarity between the forms of temporally defined associations in explicit and implicit tasks suggests either that episodic recall and probabilistic sequence learning share an overlapping associative mechanism or that similar computational principles underlie temporally defined associations across domains.

(1120)

Statistical Learning Set: Emerging Biases in the Learning of an Artificial Grammar. RICK DALE, *University of Memphis*, & CHRISTOPHER M. CONWAY, *Indiana University*—Over a half-century ago, Harlow's experiments on "learning to learn" in macaques inspired awe, generated a rich experimental literature, then moved into relative obscurity. Harlow's original notions of learning set are closely related to recent investigations of learning biases in human statistical learning (e.g., Lany & Gomez, 2004; Thiessen & Saffran, 2007), but the link between these two research areas has not been previously explored in detail. In a series of experiments, we demonstrate that successive learning experiences by humans in an implicit statistical learning paradigm—requiring participants to map sequences of nonsense syllables to an artificial visual referent system—dramatically affect their subsequent acquisition of novel patterns in the same learning environment. We relate these findings to Harlow's original conceptions of learning set, and extend them to emergent learning biases in language acquisition.

POSTER SESSION II

Grand Ballroom, Convention Center, Friday Noon, 12:00–1:30

• SELECTIVE ATTENTION •

(2001)

A Diffusion Model Account of Threat Processing in Anxiety. COREY N. WHITE, ROGER RATCLIFF, MICHAEL W. VASEY, & GAIL MCKOON, *Ohio State University* (sponsored by Anjali Thapar)—In the present study, the diffusion model (Ratcliff, 1978) was used to assess anxiety-related differences in the processing of threatening information. Individuals with high trait anxiety have been shown to exhibit an attentional bias for threatening information, but this effect has been suggested to only occur in tasks involving competition for processing resources (Bradley & Mathews, 1991). The present study replicated this effect in a lexical decision task, challenging the claim that processing competition is necessary. The results from a recognition memory task suggest reduced rehearsal of threatening words for anxious individuals. This pattern of results is discussed in relation to current theories of anxiety. The processing components for individuals correlated strongly between the lexical decision and recognition tasks, suggesting relatively stable individual differences in processing. The results of this study support the use of the diffusion model as a preferred alternative to traditional analyses of accuracy or mean reaction times.

(2002)

Semantic and Perceptual Determinants of Within-Modality Distraction. JOHN E. MARSH, HELEN M. HODGETTS, & DYLAN M. JONES, *Cardiff University*—Using a free recall task (in which stimuli were exemplars drawn from semantic categories), we show that correct recall is disrupted by the semantic and perceptual similarity between the to-be-remembered (TBR) and to-be-ignored (TBI) items. This finding contrasts with previous research suggesting that only semantic properties of the TBR and TBI items disrupt correct recall in this setting (Marsh, Hodgetts, & Jones, 2007). In the present study, irrelevant exemplars were selected from either the same or different semantic category as TBR items and were either visually or auditorily presented. Perceptual similarity was manipulated by word presentation color (visual) or gender of voice (auditory). The degree of disruption to correct recall was amplified by the perceptual similarity manipulation but only when the irrelevant items were semantically similar to the TBR items. This finding suggests that perceptual and semantic factors interact to determine recall performance. The results are discussed in terms of source monitoring and semantic activation/inhibition theories.

(2003)

Associative Judgments Block Semantic Processing . . . ERIN BUCHANAN, WILLIAM S. MAKI, & MELISSA PATTON, *Texas Tech University*— . . . but not vice versa. Pairs of words were presented that varied with respect to both associative strength and semantic feature overlap. Some human subjects judged associative strength (likelihood of word B in response to word A), whereas other subjects judged semantic similarity (number of features shared by words A and B). Associative judgments were influenced by associative strength, but not affected by feature overlap. Semantic judgments, however, were influenced by both feature overlap and associative strength. How do associative judgments block semantic processing? We will report on experiments that use priming techniques to reveal the time course of the processes responsible for the attentional asymmetry.

(2004)

The Role of Valence and Frequency in Stroop Color Naming. TODD A. KAHAN & CHARLES D. HELY, *Bates College*—People are generally slower to name the color of emotional words relative to neutral words. However an analysis of this emotional Stroop effect (Larsen, Mercer, & Balota, 2006) indicates that the emotion words

used are often longer, have lower frequencies, and have smaller orthographic neighborhoods than the neutral words. This raises the possibility that the emotional Stroop effect is partly caused by lexical rather than emotional aspects of the stimuli, a conclusion supported by the finding that reaction times to name the color of low-frequency words are longer than those for high-frequency words (Burt, 2002). To examine the relative contributions of valence and frequency in Stroop color naming, 64 participants completed an experiment where each of these variables was manipulated in a 3×2 factorial design; length, orthographic neighborhood density, and arousal were equated. An interaction between valence and frequency indicates that the emotional Stroop effect depends on word frequency.

(2005)

Electrophysiological Evidence That Semantic Visual Word Processing Requires Spatial Attention. LOGAN CORNETT & MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & JOEL LACHTER, *NASA Ames Research Center*—Recent behavioral studies show that unattended words do not influence responses, suggesting that words are not identified without spatial attention. A viable alternative explanation, however, is that unattended words can be fully identified, but somehow fail to influence response processes. To test this hypothesis, we used a more direct measure of word identification: the N400 component of the event-related potential (ERP). The N400 effect is the difference in ERPs between words that match and mismatch the current semantic context. Only identified words can produce a significant N400 effect. This effect thus provides a highly specific, continuous index of semantic word processing, which is largely independent of subsequent response processes. We used a spatial cuing paradigm, in which cued (attended) words and noncued (nonattended) words could match or mismatch the semantic context. We found an N400 effect only for cued words, suggesting that visual word processing requires spatial attention.

(2006)

Weaker Interference Control for Words Than for Arrows in Low Perceptual Load Contexts. GREGORY J. DAVIS, ADAM T. BIGGS, BRADLEY A. DOBRZENSKI, & BRADLEY S. GIBSON, *University of Notre Dame*—Gibson and Scheutz (2006) have recently shown that interference control in low perceptual load contexts is stronger when symbolic cues are iconic and express deictic spatial relations (arrows) than when they are abstract and express projective spatial relations (spatial words). The present experiments advanced this line of investigation by showing (1) that the observed differences in interference control are not due to differences in the ability to disengage attention from these cues; (2) that the observed differences in interference control occur only in the presence of distraction, but not in simple detection tasks; and (3) that the weaker interference control associated with projective spatial relations can be observed in both the visual and auditory modalities. This modulation of visual selective attention has important theoretical implications because it appears to operate via different mechanisms than other well-known determinants of visual selective attention such as perceptual load and cognitive load.

(2007)

Examining the Automaticity of Symbolic Attentional Cues: Do Gaze Cues and Arrow Cues Enhance Perception? NASEEM AL-AIDROOS, SARA A. STEVENS, GREG L. WEST, & ULRICH W. WEGER, *University of Toronto*, JIM MCAULIFFE, *Nipissing University*, & JAY PRATT, *University of Toronto*—Traditionally, reflexive attentional orienting is thought to result from the appearance of peripheral stimuli that draw attention to their presented location. Recent evidence has emerged suggesting that two types of centrally presented symbolic cues may also produce reflexive orienting: eye-gaze and arrow cues. To test this argument, we used the criterion that the volitional deployment of attention facilitates response speed and perceptual accuracy, whereas reflexive attention only facilitates response

speed (Prinzmetal, McCool, & Park, 2005). Uninformative gaze cues (Experiment 1) and arrow cues (Experiment 2) were presented centrally to participants in a peripheral letter-discrimination task. For both cue types, compatible cues were found to facilitate reaction time but not error rate, demonstrating that gaze and arrow cues affect response speed but not perceptual accuracy. This dissociation between reaction time and error effects indicates that both gaze and arrow cues generate reflexive shifts of attention.

(2008)

Predicting Preference From Fixations. MACKENZIE G. GLAHOLT & EYAL M. REINGOLD, *University of Toronto, Mississauga*—We extended work by Shimojo, Simion, Shimojo, and Scheier (2003), and measured the strength of the association between fixation duration and preference. Participants selected the most attractive of eight stimuli arranged in a grid. Eye fixations correlated with selection, as well as with explicit attractiveness ratings, and also predicted selection on a trial-by-trial basis. By ranking features on the basis of fixation time, we were able to successfully predict participants' preferences for novel feature combinations in a two-alternative forced choice task. Theoretical and applied implications are discussed.

(2009)

Visual Marking of Emotionally Valenced Face Stimuli. ELISABETH BLAGROVE & DERRICK G. WATSON, *University of Warwick*—Visual marking (Watson & Humphreys, 1997) increases search efficiency for new items via deprioritization of old (previewed) items already in the field (the preview benefit). We examined whether a preview benefit arises with schematic face stimuli and the extent to which their emotional valence modulates these effects. Three experiments investigated the ability to ignore neutral, positive, or negative valenced faces. In all cases, a partial preview benefit was obtained and negative faces were detected more efficiently than positive faces. However, there was a trend for previewed negative faces to be less easily suppressed than were positive faces. The results extend our understanding of when preferential processing of negative valenced stimuli occurs and are interpreted in terms of the ecological properties and constraints of time-based visual selection.

• LANGUAGE PRODUCTION •

(2010)

Sentence Production in Monologue and Dialogue: The Scope of Planning. BENJAMIN SWETS, RICHARD J. GERRIG, MATTHEW E. JACOVINA, & WILLIAM G. WENZEL, *Stony Brook University* (sponsored by Richard J. Gerrig)—Little is known about the differences between planning speech in monologue (speech without an addressee) versus dialogue (speech with an addressee). Here, we test the hypothesis that the pressure on speakers to respond in a timely fashion should render high-level utterance planning more incremental (i.e., advanced planning should be less extensive) in dialogue than in monologue. In our study, participants produced brief utterances to describe visual displays. We complicated utterance planning by including tangram figures that prohibited easy lexicalization. Participants completed the task in circumstances of monologue or dialogue, and also under circumstances of natural or explicit time pressure. We examined the time course with which participants planned upcoming tangrams and proceeded with articulation as a function of addressee presence and time pressure. We suggest that speech production is quite adaptable to its circumstances, and that its resources are strategically deployed depending on the environment in which they are used.

(2011)

Assessing the Role of Morphological Marking in Subject–Verb Gender Agreement: Evidence From Hebrew. AVITAL DEUTSCH & MAYA DANK, *Hebrew University of Jerusalem*—The present study investigated the role of morphological markedness on the implementation of subject–predicate agreement in language production. This

study was conducted in Hebrew, using a sentence completion task, and focused on gender agreement. In Hebrew, masculine forms are usually morphologically unmarked, whereas feminine forms are morphologically marked. Although it is generally consistent, the system includes examples of feminine forms which are not inflected for feminine suffixes—that is, unmarked feminine forms. Furthermore, there are particular suffixes that denote masculine and feminine plurals. However, there are many examples of masculine plurals which are inflected irregularly, by a feminine suffix. We took advantage of these characteristics to manipulate morphological factors in the process of agreement production. The results suggest that gender agreement cannot be explained solely in terms of overt inflectional morphology; however, it is subjected to morphophonological influence. Furthermore, the results suggest the possible involvement of derivational morphology in syntactic agreement.

(2012)

Working Memory and Oral Fluency During Spontaneous Language Production. IRENA O'BRIEN & DEBRA A. TITONE, *McGill University*, DAVID MCFARLAND, *University of Montreal*, CAROLINE PALMER, *McGill University*, & NATALIE PHILLIPS, *Concordia University*—Models of spontaneous language production propose that speech planning occurs incrementally (Bock, 1982; Levelt, 1989). Within this conceptual framework, working memory would be crucial to appropriate speech planning. The present study investigated whether individual differences in working memory were related to various aspects of speech production. Working memory measures, using a modified listening span (Waters & Caplan, 1996) and backward digit span tasks, and spontaneous speech recordings were obtained from 44 native English speakers. In addition to final word recall, the listening span task also measured sentence judgment times. Multiple regression analyses revealed that speakers with higher backward digit span performance spoke with longer runs and shorter pauses. In addition, speakers with shorter sentence judgment times in the listening span task spoke faster and exhibited fewer hesitations. These results offer preliminary evidence that working memory may facilitate language production by allowing more efficient incremental planning.

(2013)

Working Memory and the Production of Metaphors. RUSSELL PIERCE, *University of California, Riverside*, & CANDACE STUTE, THERESA FRASER, MICHELLE RIFI, ELIZABETH UBIDES, & DAN CHIAPPE, *California State University, Long Beach*—We examined the role of working memory (WM) in metaphor production. We administered to participants the operation span, word span, and listening span tasks as measures of WM. 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. Difficulty of the items was manipulated by varying their conventionality (i.e., whether the properties are conventionally associated with a vehicle term) and aptness (i.e., whether the properties being attributed are a good fit with the topic). We recorded time to generate vehicles, and rated the quality of the vehicles. WM measures predicted the quality of metaphor vehicles produced regardless of difficulty, but did not predict time to generate those vehicles.

(2014)

The Phrase As a Minimal Planning Scope in Sentence Production. JASON E. CROWTHER & RANDI C. MARTIN, *Rice University*—In a sentence production study, subjects described the arrangement of three stationary pictures using sentences such as “The foot is above the candle and the faucet” or “The foot and the candle are above the faucet.” Complexity of the initial phrase (i.e., one vs. two nouns) and word frequency and name agreement for the first two nouns were manipulated. Onset latencies for each noun were measured. Replicating

Smith and Wheeldon (1999), sentence onset latencies were longer for sentences beginning with complex rather than simple phrases, consistent with a phrasal scope of planning. However, data from the name agreement and frequency manipulations indicated that planning beyond the initial phrase occurred when the nouns in the first phrase had high name agreement and high frequency. Thus, although the results are consistent with the phrase as a minimal scope, they indicate that scope may be extended when initial phrase words are easy to retrieve.

(2015)

Word Frequency Affects Subject–Verb Number Agreement. ERICA L. MIDDLETON & KATHRYN BOCK, *University of Illinois, Urbana-Champaign*—The traditional account of subject–verb number agreement (e.g., “The flag is/The flags are”) is that the grammatical number of the subject noun (e.g., singular “flag” or plural “flags”) dictates verb number. However, other factors have been found to influence agreement, including the number meanings of subject phrases and the plurality of nonsubject (local) nouns in the verb’s vicinity (e.g., “The flag near the ambassadors were colorful”), creating attraction. We investigated a third nongrammatical influence on agreement: the relative frequencies, or contrastiveness, of the singular and plural forms of local nouns. Participants heard and repeated preambles (e.g., “The flag near the ambassadors”), completing them as full sentences that included verbs. Verb number was sensitive to variations in contrastiveness, with plural attraction increasing as contrastiveness increased. This suggests that the implementation of agreement during language production is sensitive to competition among form or meaning related entries in the lexicon.

(2016)

Acoustic Analyses of the Sarcastic Tone of Voice. GINA M. CAUCCI, ROGER J. KREUZ, & EUGENE H. BUDER, *University of Memphis*—Sarcastic intent can be signaled by speakers in a variety of ways, such as by rolling one’s eyes. Other paralinguistic cues, such as tone of voice, can also cue listeners to a speaker’s sarcastic intentions (Cutler, 1974; Roberts & Kreuz, 1994). However, the exact parameters that define this tone of voice have been the subject of some dispute (e.g., Bryant & Fox Tree, 2005). This project investigated the acoustic properties of the sarcastic tone of voice. Participants were recorded in a conversational setting while engaged in tasks designed to naturally elicit sarcasm. The amount of common ground shared by conversational dyads was manipulated (friends vs. strangers). The pitch, duration, and amplitude for words intended sarcastically was measured, and compared with the same words when used literally. Preliminary data suggest that sarcastic statements differ from nonsarcastic statements on these acoustic parameters, and that shared common ground influences speakers’ use of sarcasm.

(2017)

Wernicke’s Aphasia: Exploring the Interface Between Language and Thought. PAUL D. McGEOCH, DAVID BRANG, & VILAYANUR S. RAMACHANDRAN, *University of California, San Diego*—We studied patients with Wernicke’s aphasia to explore whether covert language is required for thinking. We found that: (1) Speech had most aspects of syntactic structure but no recursiveness. Contrary to popular belief, Broca’s area is not sufficient for this ability; it clearly also requires the Wernicke’s area (semantics) and, indeed, may be an aspect of many brain functions, such as self-awareness. (2) They could lie non-verbally—implying a theory of other minds. (3) Additional evidence for Wernicke’s patients possessing a theory of other minds was given when one patient was shown a small cookie being placed in box A and a big one in box B. A and B were then hidden by a partition and a stooge was seen to go pick one of the cookies. The patient didn’t know which. The patient then chose box A, having inferred that the stooge must have (obviously) picked the large cookie.

(2018)

Online Writing Processes of Subject–Verb Agreement in Dutch–

English Bilinguals. JANET G. VAN HELL & MARIJKE MENSIES, *Radboud University Nijmegen* (sponsored by Janet G. van Hell)—We studied online processes of subject–verb agreement construction in written language production in bilinguals’ first and second language. Past research, studying errors in language production, shows that Dutch and English monolingual speakers differ in their sensitivity to the conceptual number of the sentential subject. We studied subject–verb agreement in Dutch–English bilinguals using a sentence fragment completion paradigm and contrasted conceptually multiple token fragments with single token fragments. The bilinguals wrote in their first (Dutch) or second (English) language. In addition to studying errors in language production (the dependent measure used in previous production studies), we examined online processes of writing using a digitizer tablet. Analyses of pause time patterns show longer pause durations after the head noun and before the verb in writing multiple token fragments in both languages. This suggests that conceptual information influences subject–verb agreement construction at an early stage, in first and second language writing.

(2019)

Orthographic Priming and Homophone Substitution Errors: Producing Similarly-Spelled Words Might Influence What You Right. KATHERINE K. WHITE, SAMANTHA M. GIBSON, & SARAH M. ZOLLER, *College of Charleston*, & LISE ABRAMS, *University of Florida*—Despite considerable research on language production errors involving speech, little research exists in the complementary domain of writing. Two experiments investigated the production of written homophone substitution errors, which occur when a contextually appropriate word (e.g., *beech*) is replaced with its homophone (e.g., *beach tree*). Participants wrote auditorily presented sentences that included a contextually appropriate dominant or subordinate homophone (e.g., *The teacher was most proud of the beech tree in his garden*). Each homophone was preceded by a prime or unrelated word. Primes overlapped in phonology and orthography (*teacher*) or in orthography only (*headmaster*) with the contextually inappropriate homophone (*beach*). More errors occurred when the context elicited a subordinate homophone relative to a dominant homophone. Furthermore, both types of primes increased errors relative to unrelated words. These results are discussed within dual route theories and suggest that recent exposure to shared graphemes, with or without shared phonology, increases homophone substitution errors.

(2020)

Lexical Influences on Nonword Spelling. TAMI J. PATTERSON & JOCELYN R. FOLK, *Kent State University*—Previous work has demonstrated that the processes dedicated to spelling familiar words (lexical process) and unfamiliar words (sublexical process) interact during spelling. We investigated two possible mechanisms underlying lexical influence on the sublexical system during nonword spelling: a dynamic and temporary reweighting of phoneme–grapheme probabilities in the sublexical system after exposure to a related word and residual activation of a previously heard word’s letters at the grapheme level. Participants listened to lists of intermixed words and nonwords and were required to spell only the nonwords. On a small percentage of trials the word preceding a target nonword rhymed with the nonword. We varied the interval between prime words and target nonwords (0 or 2 intervening items) and the neighborhood characteristics of the nonwords. We found evidence that both possible mechanisms contribute to lexical–sublexical interaction and that lexical neighbors influence nonword spelling. We discuss implications for models of the spelling system.

• DIVIDED ATTENTION •

(2021)

Dividing Attention Between Two Different Categories and Locations. JUN I. KAWAHARA, *National Institute of Advanced Industrial Science and Technology*, & YUKI YAMADA, *Kyushu University*—When two

targets are embedded in a rapid serial visual presentation stream of distractors, perception of the second target is impaired if the intertarget lag is less than 500 msec. This phenomenon, called the attentional blink, has been attributed to a temporal inability of attentional resources. Nevertheless, a recent study found that observers could monitor two streams concurrently for up to four items presented in close succession, suggesting a much larger visual capacity limit. However, such high-capacity performance could be obtained by a rapid attentional shift, rather than concurrent monitoring of multiple locations. Therefore, we examined these alternatives. The results indicate that observers can concurrently monitor two noncontiguous locations, even when targets and distractors are from different categories, such as digits, alphabet, Japanese, and pseudocharacters. These results can be explained in terms of a modified input-filtering model in which a multidimensional attentional set can be flexibly configured at different spatial locations.

(2022)

The Effects of Noise Reduction on Listening Effort. ANASTASIOS SARAMPALIS, *University of California, Berkeley*, SRIDHAR KALLURI & BRENT W. EDWARDS, *Starkey Hearing Research Center*, & ERVIN R. HAFTER, *University of California, Berkeley* (sponsored by William Prinzmetal)—Hearing-aid users frequently complain of difficulty understanding speech in the presence of noise. Signal processing algorithms attempt to improve the quality, ease of listening, and/or intelligibility of speech in noisy environments. Hearing-aid users often report that speech sounds easier to understand with a noise reduction (NR) algorithm, even though there are no documented intelligibility improvements, suggesting that NR may lead to a reduction in listening effort. We investigated this hypothesis using a dual-task paradigm with normal-hearing and hearing-impaired listeners. They were asked to repeat sentences or words presented in noise while performing either a memory or a reaction-time task. Our results showed that degrading speech by reducing the signal-to-noise ratio increased demand for cognitive resources, demonstrated as a drop in performance in the cognitive task. Use of an NR algorithm mitigated some of the deleterious effects of noise by reducing cognitive effort and improving performance in the competing task.

(2023)

Ideal Observer Analysis in Dual Attention Task. REIKO YAKUSHIJIN, *Aoyama Gakuin University*, & AKIRA ISHIGUCHI, *Ochanomizu University*—We applied ideal observer analysis to a dual-task situation in order to investigate directly how attentional resources are allocated. Two sets of component circles arrayed circularly were displayed side by side. The sets were different both in the size of components and in the size of circular configurations. Participants were asked in each trial to discriminate the size of components (local task) or the size of circular configurations (global task). The task required was in random order through trials. Priority of each task was manipulated across trial sequences. Gaussian noise was introduced to those sizes so that ideal performance could be calculated quantitatively on each task. The result showed that, although statistical efficiency was higher in the prior task, the efficiency summation of two tasks was constant irrespective of the priority manipulations. It suggests that the total amount of attentional resource was constant regardless of top-down allocation of attention.

(2024)

Working Memory Consolidation Causes the Attentional Blink. HIROYUKI TSUBOMI, *University of Tokyo*, & NAOYUKI OSAKA, *Kyoto University* (sponsored by Naoyuki Osaka)—In an RSVP stream, the first target interferes with the second if it is presented within a few hundred milliseconds. This phenomenon, called the attentional blink (AB), is often thought to reflect the temporal limit of visual working memory (VWM) consolidation. However, this relationship has been assumed rather than directly tested. We presented an array of 24 black or green Landolt C rings. After 3 sec, one of the green rings turned

red for 100 msec, followed by a 100-msec mask. Subsequently, a black ring turned red for 100 msec, followed by a 100-msec mask. The participants were instructed to report the gap direction of the two red rings. The AB for the second red ring occurred only when there were more than three green rings in the array. Using the same type of stimuli, VWM capacity was independently measured to three items. This indicates a clear connection between VWM and AB.

(2025)

Does the Response Criterion Affect Redundancy Gain in Simple RT? JEFF O. MILLER, *University of Otago*—In simple RT, responses are faster when two stimuli are presented than when one is—an example of “redundancy gain.” Models of redundancy gain typically assume that two stimuli cause faster accumulation of sensory evidence, thus satisfying a response criterion more rapidly when both are presented. That account predicts that, all other things being equal, redundancy gain should be larger when the response criterion is higher. We tested this prediction in two experiments manipulating the response criterion. One experiment compared blocks of trials with infrequent versus frequent catch trials, assuming that observers would set a higher criterion when catch trials were frequent. The other experiment compared blocks including no-stimulus catch trials against blocks including a distractor stimulus in catch trials, assuming that observers would set a higher criterion in the latter blocks to avoid incorrectly responding to distractors. The results have implications for models of redundancy gain.

(2026)

Dual-Task Performance With Consistent and Inconsistent Stimulus-Response Mappings. KIM-PHUONG L. VU, *California State University, Long Beach*, & ROBERT W. PROCTOR, *Purdue University*—This study examined benefits for consistent stimulus-response mappings for two tasks in a psychological-refractory-period paradigm. In Experiment 1, participants performed three-choice spatial tasks, using combinations of corresponding and mirror-opposite mappings. Both mappings showed a consistency benefit for stimuli in the two outer positions, for which the correct response differed across mappings, but only the corresponding mapping showed a consistency benefit for the center position, for which the middle response was always correct. Experiments 2 and 3 used four-choice spatial tasks. A consistency benefit was obtained for both mappings when the mapping for each task was completely corresponding or mirror opposite. However, a consistency benefit was not always obtained for a mixed mapping for which corresponding responses were made to two positions and opposite responses to two positions. These results suggest that the consistency benefit is mainly evident when the mappings for both tasks can be characterized by a single rule.

(2027)

Interhemispheric Collaboration for Matching Emotions Signified by Words and Faces. JOSEPH B. HELDIGE, URVI J. PATEL, JIYE KIM, & PATRICIA GEORGE, *University of Southern California*—Previous visual laterality studies indicate that benefits of dividing an information processing load across both cerebral hemispheres outweigh costs of interhemispheric transfer as the tasks become more difficult or complex. The present experiment indicates that this finding does not generalize to a complex task that requires matching emotions represented by two different visual formats whose perceptual processing involves different cortical areas: words (e.g., *sad*) and cartoon faces (e.g., a face with sad expression). Combined with other recent studies that mix stimulus formats (e.g., digits and dots to represent numeric quantity), the present results suggest that when stimuli are simultaneously presented in appropriately different visual formats, identification of those stimuli may take place in parallel, via different cortical access routes. Consequently, there is little interference, even when the stimuli are presented to a single cerebral hemisphere, so there is little or no benefit from spreading processing across both hemispheres.

(2028)

Retrieval Interference Effects: The Role of Discrete Versus Continuous Concurrent Tasks. ANA M. FRANCO-WATKINS, *Auburn University*, & HAL PASHLER & TIMOTHY C. RICKARD, *University of California, San Diego*—Previous research has demonstrated some degree of dual-task interference when a concurrent task is paired with a continuous memory-retrieval task; however, this interference appears modest in magnitude. Meanwhile, in PRP designs, there are indications that memory retrieval may be completely postponed by a concurrent task, implying a more extreme degree of interference (Carrier & Pashler, 1995). The present experiments sought to determine which features of the dual-task design produced memory retrieval interference and whether the interference was graded as opposed to total. Interference was assessed at both an aggregate level (e.g., total items recalled and overall concurrent task performance) and at a more microscopic level (e.g., examining the relative timing of the two tasks on individual trials) in order to shed light upon the factors modulating memory-retrieval interference.

(2029)

Word Frequency and the P3: Evidence That Visual Word Processing Requires Central Attention. SARAH HULSE, *Oregon State University*, PHIL A. ALLEN, *University of Akron*, ERIC RUTHRUFF, *University of New Mexico*, & MEI-CHING LIEN, *Oregon State University*—Some behavioral studies have suggested that visual word processing cannot proceed when central attention is devoted to another task, whereas other studies suggest otherwise. To address this issue, we used the P3 component of the event-related potential (ERP), known to be sensitive to stimulus probability. Participants performed a lexical decision Task 2 while performing a tone discrimination Task 1. The critical manipulation was Task 2 word frequency. Previous single-task ERP studies have shown a larger P3 for high-frequency than for low-frequency words, suggesting that low-frequency words require more processing capacity (e.g., Polich & Donchin, 1988). Critically, the P3 difference between high and low frequency indicates that the word was read successfully. We found that the P3 difference was much smaller when Task 2 words were presented simultaneously with Task 1, suggesting that word processing is not fully automatic, but rather requires central attention.

• PSYCHOLINGUISTICS •

(2030)

Iconicity in American Sign Language: Word Processing Effects. ROBIN L. THOMPSON, DAVID P. VINSON, & GABRIELLA VIGLIOCCO, *University College London* (sponsored by Gabriella Vigliocco)—We investigated the potential language processing advantage of iconicity (the transparent relationship between meaning and form) for American Sign Language (ASL) signers. ASL signers were asked whether a picture (e.g., a bird) and a sign (e.g., “bird” produced with thumb and forefinger, representing a bird’s beak) refer to the same object. In one condition, the iconic property/feature of the sign was salient (a picture of a bird, beak well in view) while in the second the iconic property was not salient (a picture of a bird flying). Analysis of response latencies revealed a benefit for ASL signers in comparison with English-speaking controls; signers responded faster when the iconic property was made salient in the picture. Furthermore, both near-native and late L2 signers showed no difference in this facilitation effect, providing evidence that signers are sensitive to iconicity as a cue for lexical retrieval regardless of the age at which ASL is acquired.

(2031)

New Methods for Studying Syntactic Acquisition. MALATHI THOTHATHIRI & JESSE SNEDEKER, *Harvard University* (sponsored by Elizabeth S. Spelke)—There is a lively debate in language acquisition about the characterization of young children’s linguistic knowledge. Is it based on item-specific templates or on a more ab-

stract grammar? Most research to date has asked whether children generalize grammatical knowledge to novel verbs. But this paradigm places children in unnatural situations, and meanings of verbs are hard to learn. We combined structural priming and eye-tracking to investigate children’s online comprehension of known verbs in a naturalistic task. Does a syntactic structure with one verb influence children’s interpretation of subsequent sentences with other verbs? By varying the syntactic and semantic overlap between prime and target sentences, we determined that 4-year-olds expect verb-general mappings between semantic roles and syntactic positions (*Load the truck with the hay primes Pass the monkey the hat; Load the hay on the truck primes Pass the money to the bear*). Studies under way ask whether 2-year-olds employ similar generalizations.

(2032)

Linguistic and Nonlinguistic Strategies in Artificial Language Learning. SARA FINLEY & WILLIAM BADECKER, *Johns Hopkins University*—The artificial language learning paradigm has successfully addressed questions about learnability and linguistic representations. We present results that expose a potential problem for this paradigm: The task may not differentiate linguistic and nonlinguistic learning strategies. In natural language, vowel harmony is determined either by a dominant feature or by direction, but never by “majority rules” (e.g., spread round only if the majority of input vowels are round). In one experiment, participants were trained on a harmony process in which three single-syllable words (e.g., [bi], [do], [gu]) combined to form a three-syllable word conforming to round harmony (e.g., [bidegi]/[budogu]). At test, participants exhibited a strong “majority rules” preference, which suggests that they employed a nonlinguistic strategy to determine the best harmonic concatenation. Follow-up experiments examine whether more language-like training inputs (e.g., training with pairs of morphologically related words with harmonizing affixes) had an effect on participants’ learning strategies.

(2033)

Sentence Comprehension and Bimanual Coordination: Implications for Embodied Cognition. ANNIE J. OLMSTEAD, NAVIN VISWANATHAN, KAREN AICHER, & CAROL A. FOWLER, *University of Connecticut and Hasbans Laboratories* (sponsored by Carol A. Fowler)—Much of the embodied cognition literature exploits stimulus-response compatibility (e.g., Glenberg & Kaschak, 2002; Zwaan & Taylor, 2006) to expose the recruitment of the motor system in language understanding. Typically, response times indicate a facilitatory consequence of language input and motor response compatibility. Insights into the nature of the motor-language coupling may be gained by investigating how language comprehension affects motor control variables more generally. We investigated the effects of sentence judgments on continuous motor variables in a bimanual pendulum swinging paradigm (Kugler & Turvey, 1987). Stimulus-response compatibility was not manipulated; rather, participants performed an unrelated activity (swinging pendulums about the wrist) while they made verbal judgments about the sensibility of sentences having different semantic characteristics. Preliminary results suggest that relative phase shift is differentially affected by different sentence types. The results are discussed and an evaluation of the methodology is provided.

(2034)

BOLD Signal Correlations With Plausibility in Sentence Comprehension. LOUISE A. STANCZAK, *Boston University*, DAVID N. CAPLAN, *Massachusetts General Hospital*, GINA R. KUPERBERG, *Tufts University and Massachusetts General Hospital*, GLORIA S. WATERS, *Boston University*, LAURA BABBITT, *Massachusetts General Hospital*, & NEAL J. PEARLMUTTER, *Northeastern University*—Most neuroimaging studies examining pragmatic or semantic meaning properties in sentence comprehension compare an entirely acceptable condition with a clearly anomalous condition using subtraction, with a comprehension task requiring an overt acceptabil-

ity judgment. To avoid some of the confounds in such designs, we compared a yes/no comprehension question-answering task (Experiment 1) with an overt acceptability judgment task (Experiment 2), measuring BOLD signal change in event-related fMRI. Both experiments used the same stimuli, consisting of sentence triples in which the matrix verb's direct object varied in separately rated plausibility, as in "Vanessa threw the javelin/feather/situation but did not win the competition." Comparing across three plausibility levels permitted isolation of a single left frontal cortical region sensitive to differences among all conditions, and this region's response interacted with task. Additional correlational analyses revealed differential plausibility sensitivity of this region within different plausibility levels.

(2035)

Frequency and Context Cues in Ambiguity Resolution As a Function of Working Memory Capacity. LOUISE A. STANCZAK & GLORIA S. WATERS, *Boston University*, NEAL J. PEARLMUTTER, *Northeastern University*, & DAVID N. CAPLAN, *Massachusetts General Hospital* (sponsored by Gloria S. Waters)—Previous studies have investigated the contributions of frequency and context information during sentence comprehension to resolve ambiguities. The interpretation of a homograph (*bank*) can be affected by the frequency of the meaning and the preceding sentential context. Parsing the direct object (DO)/sentential complement (SC) ambiguity (*She acknowledged the shirt was dirty*) can be affected by the frequency with which a DO/SC follows a particular verb and the plausibility of the noun following the verb. Some working memory theories postulate that high-span participants resolve lexical/syntactic ambiguities more efficiently than do low-span participants, while other theories do not. Differences may lie within frequency and/or context cues during offline and/or online processing. We found no offline differences in sensitivity to frequency cues (homograph and verb bias) or context cues (preceding context and plausibility ratings) as a function of working memory.

(2036)

Rules, Heuristics, and Language Working Memory During Sentence Processing. MANUEL MARTIN-LOECHES, *Center UCM-ISCIH for Human Evolution and Behavior*, RASHA ABDEL-RAHMAN, *Humboldt University, Berlin*, PILAR CASADO & ANNETTE HOHLFELD, *Center UCM-ISCIH for Human Evolution and Behavior*, & ANNEKATHRIN SCHACHT & WERNER SOMMER, *Humboldt University, Berlin*—How information contained in a second task affects semantic and syntactic processing during sentence comprehension in a primary task was studied using event-related potentials in 32 participants. In one condition, material in the second task could be semantically congruent or incongruent relative to the adjective in the sentence, the latter being either semantically correct or incorrect relative to the sentence. Homologous syntactic (gender) manipulations were performed in another condition. Whereas syntactic processing appeared blind to the syntactic content of the second task, semantically incongruous material of the second task induced fluctuations typically associated with the detection of within-sentence semantic anomalies (N400) even in semantically correct sentence adjectives. Semantically incongruous material also influenced later stages of the processing of incorrect adjectives. The data add to recent discussions on an algorithmic semantic subsystem relevant for the syntactic structure, and support independent working memory systems for semantic and syntactic information separately.

(2037)

The Effect of Distractive Elaboration on the Long-Term Memory of Predictive Inferences. SYREETA A. JONES & QUN GUAN, *Florida State University* (sponsored by Wanjin Meng)—The study is supported by the grant of the second author. The research question was: What are the effects of text elaboration and text predictability on the online activation and long-term memory of the predictive inference (PI)? The text elaboration is distractive in nature, suppressing the activation of

the primary PI. Participants include 39 English-native-speaking college students. A 2 (high- vs. low-elaboration) \times 2 (inference vs. control) repeated measure design was conducted. The online PI activation was assessed by naming task. Long-term PI was assessed by cued recall task. The results showed that PIs represented by quicker (within 500 msec) naming latencies were recalled better than those represented by longer (beyond 500 msec) naming latencies. The higher the level of distractive elaboration in the text, the lower the level of online activation of PI, but the higher the probability of the offline long-term recall of PI. The results were interpreted in terms of the constructivist view of text comprehension.

(2038)

Representing Political Concepts in High-Dimensional Semantic Space. CURT BURGESS, CHAD MURPHY, MARTIN JOHNSON, & SHAUN BOWLER, *University of California, Riverside*, & CATHERINE H. DECKER, *Chaffey College*—Political science and cognitive science share a long history and interest in the empirical study of meaning. The field of cognitive science has seen a dramatic increase in the ability to computationally model meaning in memory and language over the last 15 years. A substantial difference between the concepts of interest between the two fields is that political semantics tend to be more abstract and related to cultural and social influences. We describe a research program that applies the HAL model to political relationships related to persuasion, characteristics of campaigns, ambiguity in language, and ideological and cultural differences. It is argued that the high-dimensional theoretical approach to modeling meaning integrates political, cognitive, and social phenomena into a unifying framework.

• CATEGORY LEARNING •

(2039)

Prior Knowledge and Nonminimal Category Learning: Experimental and Modeling Results. HARLAN D. HARRIS, *New York University*, AARON B. HOFFMAN, *University of Texas, Austin*, & GREGORY L. MURPHY, *New York University*—Minimal-learning models of category learning predict that subjects learning categories with many stimulus dimensions should either learn a few dimensions well or all dimensions moderately. We performed a study of the combined influence of dimensionality and prior knowledge on category learning. Subjects learned structures with varying numbers of redundant dimensions, and with either knowledge-related or knowledge-unrelated features. Despite similar learning rates and reaction times, subjects learned more dimensions when more were present, and prior knowledge further increased what was learned. A second experiment confirmed that the participants did in fact learn the additional features rather than simply inferring the correct answer at test. Computational modeling showed how top-down resonance of activation in the KRES model of category learning (Rehder & Murphy, 2003) can account for the results, whereas models that assume independent contributions from each dimension cannot. We conclude that both high dimensionality and prior knowledge yield nonminimal learning.

(2040)

Similarity Detection in Incidental Category Learning. JOHN P. CLAPPER, *California State University, San Bernardino*—A major limitation of failure-driven or contrast-based models of incidental category learning is that they can only discover new categories in response to stimuli that fall outside the boundaries of existing categories. Thus, they cannot identify clusters of similar objects within an existing category and use them to create new subcategories. Here, members of a category with several overlapping properties were presented in an immediate-memory task with an equal number of stimuli composed of random feature combinations. In the diagnostic-label condition, members shared a common label; in the nondiagnostic condition, they did not. Participants were more likely to discover the category and learn its consistent features in the diagnostic condition. Im-

portantly, this facilitation could only have occurred if people noticed the shared label, an example of category discovery via “similarity detection” as opposed to contrast or “difference detection.” This ability might compensate for the limitations of a purely failure-driven approach.

(2041)

Motivational Focus Interacts With Reward Structure in Category Learning. RUBY T. NADLER, JOHN PAUL MINDA, & LILY PEI-SHIUAN LIN, *University of Western Ontario*—Recent research suggests that categories are learned by multiple brain systems, and that situations that allow for greater cognitive flexibility will lead to better performance on rule-described categories that depend on an explicit system. We examined the effects of motivational focus (e.g., promotion or prevention) and task reward structure (e.g., gain or loss) on participants’ ability to learn suboptimal or optimal rules. Two conditions featured a motivational focus that matched the reward structure of the task (promotion/gain and prevention/loss). Two conditions featured a motivation structure that did not match the reward structure of the task (promotion/loss and prevention/gain). We found that performance was generally better in the matching conditions than in the mismatching conditions and that participants in the matching conditions were more likely to learn complex, optimal rules. These results suggest that the matching conditions allow for greater cognitive flexibility and support a multiple-systems account of category learning.

(2042)

The Incidental Learning of Within-Category Attribute Correlations in a One-Attribute Rule Visual Search Classification Paradigm. GUY L. LACROIX, *Carleton University*, GYSLAIN GIGUÈRE, *University of Quebec, Montreal*, GLEN HOWELL, *Carleton University*, & SERGE LAROCHELLE, *University of Montreal*—Giguère, Lacroix, and Larochelle (2007) showed that participants could incidentally learn within-category attribute correlations in a one-attribute rule classification task. Nevertheless, learning was limited. In this study, participants categorized stimuli in a one-attribute rule visual search classification paradigm. We hypothesized that the search component would increase learning. Two experiments were conducted. Both involved a classification training phase of 640 trials. The stimuli were six-shape displays that included a rule attribute and five diagnostic attributes. In Experiment 1, the rule attribute (and up to two other attributes) were removed at transfer. The results showed that several attributes (color, texture, and size) of varying diagnosticity were used to correctly classify the stimuli. In Experiment 2, attribute values were changed at transfer. Slower RTs were obtained when attribute values from conflicting categories were used. These experiments provide evidence that within-category attribute correlations can be learned in a classification task without inference learning instructions.

(2043)

New Category Representations Are Biased by Implicit Perceptions. MICHAEL E. ROBERTS & ROBERT L. GOLDSTONE, *Indiana University*—Our study examines the effects of implicit perceptual representations when a participant first learns a category. Participants sequentially viewed pictures of two category members for familiar categories (e.g., *dog*, *cow*, *airplane*, etc.) and novel categories (artificial stimuli), and the second, primed member was followed by either a relevant or irrelevant story. After training on all categories in a set, participants completed a delayed matching test that showed a category label and then a picture of a category member or a member from another category. Participants responded significantly faster and more accurately for trials involving familiar categories, and we attribute this enhancement to well-learned category representations. However, for the novel category set, participants responded significantly faster to primed members that had been followed by relevant stories. This result suggests that participants perceptually invoked the primed member representation while reading the story, and that these automatic invocations biased the new category representation.

(2044)

Contribution of the Declarative Memory System to Probabilistic Category Learning. JULIE SPICER, *Columbia University*, MURRAY GROSSMAN, *University of Pennsylvania*, & EDWARD E. SMITH, *Columbia University*—The multiple memory systems approach posits that different forms of knowledge are acquired and stored in qualitatively different ways. Evidence has suggested that probabilistic category learning, as assessed with the weather prediction (WP) task, can be supported by two systems: a system that acquires nondeclarative habit knowledge and a system that acquires declarative flexible knowledge. One focus of recent research has been to characterize the mechanisms through which each system contributes to behavior as information is acquired in parallel. In the present study, we have further characterized the contribution of the declarative system to WP learning. We show that individual differences in working memory relate positively to categorization accuracy and that patients with Alzheimer’s Disease do not reach an above-chance level of categorization accuracy, supporting a strong role for declarative learning in the WP task. Implications for the role of nondeclarative learning are also discussed.

(2045)

Category Learning, Binding, and the Medial Temporal Lobe: Evidence From Early Alzheimer’s Patients. JARED X. VAN SNELLENBERG & JANET METCALFE, *Columbia University*, MURRAY GROSSMAN, *University of Pennsylvania*, & EDWARD E. SMITH, *Columbia University* (sponsored by Edward E. Smith)—Despite considerable impairments in explicit memory, patients with medial temporal lobe (MTL) lesions and patients with Alzheimer’s disease (AD) have been shown to have intact learning in a number of implicit learning paradigms, including category learning. Some recent evidence, however, suggests that “explicitness” per se may not determine the integrity of learning in individuals with a compromised MTL. One alternative is that a “binding” process, in which distinct elements of a stimulus or event become associated in memory, is critically mediated by MTL. In a test of this hypothesis, we showed that AD patients are at chance performance, and significantly worse than control participants, on an implicit two-category learning task that requires binding for successful performance.

(2046)

Modeling Process Differences in Implicit and Explicit Category Learning: A Symbolic-Connectionist Approach. LEONIDAS A. A. DOUMAS, *Indiana University*, & ROBERT G. MORRISON, *Northwestern University*—Much experimental evidence suggests both implicit (i.e., feature-based) and explicit (i.e., rule-based) mechanisms for learning categories, and these systems may compete and/or interact in different circumstances. However, most computational attempts to capture these processes typically rely on very different representational assumptions. For instance, models of implicit category learning are typically based on connectionist architectures consisting of networks of distributed units. In contrast, models of explicit category learning typically employ some type of symbolic architecture allowing for the flexibility characteristic of categories learned via rules. We present a model of category learning, DORA, that uses different learning mechanisms on a single distributed representation, allowing us to account for both implicit and explicit learning from a visual category learning task (Maddox, Ashby, & Bohil, 2003). We also successfully simulate differential working memory effects on implicit and explicit versions of this task as reported by Zeithamova and Maddox (2006).

• ANIMAL COGNITION •

(2047)

Rats’ Memory for Event Duration: Effect of Postsample Cues to Remember and Forget. ANGELO SANTI, NEIL McMILLAN, & PATRICK VAN ROOYEN, *Wilfrid Laurier University*—Rats were trained to discriminate 2 sec versus 8 sec of magazine light illumination by responding to either a stationary lever or a moving lever. Dur-

ing training, the comparison response alternatives were always presented following remember (R) cues, but never presented following forget (F) cues. During testing, accuracy was significantly poorer on F-cued trials than on R-cued trials. A choose-short bias was observed at extended delays on both R-cued and F-cued trials. However, increasing the duration of the R cues and F cues produced a choose-long bias, indicating that rats responded to comparisons on the basis of the combined duration of the sample and the postsample cue. This is the first demonstration of a directed forgetting effect for event duration memory in rats.

(2048)

Can Big Brown Bats Integrate Their Visual and Echoic Sensory Systems? CAROLINE M. DELONG & JAMES A. SIMMONS, *Brown University*—Big brown bats echolocate by emitting wideband frequency-modulated sonar sounds and processing the echoes that return to their ears. Little is known about their ability to integrate their echolocation system with their visual system during object discrimination tasks. In this experiment, bats were presented with a two-alternative forced choice task in which the stimuli were a one-cylinder monopole target (negative stimulus) and a two-cylinder dipole target (positive stimulus). In the training phase, the stimuli were painted white and the task was done in dim light so that the bats could use both echolocation and vision. In the testing phase, the stimuli were presented in two unimodal conditions (echolocation only and vision only) and one bimodal condition in which one cylinder of the dipole target was presented visually and the other echoically. If the bats succeed in the bimodal condition, it implies that they can integrate these two sensory systems.

(2049)

Ultrasonic Vocalizations With Dorsal Stimulation in Rat Pups. CHRISTOPHER WILSON, JEFFREY S. ANASTASI, KRISTINA NUNGARAY, YU KUBOTA, & MANUELA GARZA, *Sam Houston State University*—Three experiments were performed to investigate production of ultrasonic vocalizations (USVs) in rat pups in response to transport response elicitation with dorsal stimulation, using both quantitative and qualitative measures. In Experiment 1, USVs were recorded with tonic (holding) or phasic (gently waving) stimulation with phasic producing increases in USV rate. In Experiment 2, USVs were recorded with the pup passively held, suspended to induce the dorsal immobility response, and suspended so as to induce a transport response. Transport response elicitation increased number of USVs above both dorsal immobility and passive handling. In Experiment 3, USVs were recorded just prior to the mother's retrieving the pup and during retrieval. Actual retrieval increased both number and duration of USVs, producing both quantitative and qualitative differences, over preretrieval. The results are discussed with respect to the nature of the pups' responses, input of maternal stimulation, and possible mechanisms for these differences.

(2050)

Refining the Visual Cortical Priming Hypothesis in Category Learning by Humans and Rhesus Monkeys (*Macaca mulatta*). MARIANA V. C. COUTINHO, JUSTIN J. COUCHMAN, JOSHUA S. REDFORD, & J. DAVID SMITH, *University at Buffalo* (sponsored by J. David Smith)—Humans show prototype-enhancement effects and steep typicality gradients in dot-distortion categorization tasks. These effects have been ascribed to visual cortical priming. To challenge and refine this hypothesis, we compared performance by humans and monkeys on two dot-distortion category tasks in which (1) the stimuli were size invariant and (2) the stimuli varied greatly in size. Prototype effects and typicality gradients were substantially the same in the two tasks, for humans and monkeys. This constrains the visual cortical priming hypothesis, because low-level visual-priming effects would not show this robustness of performance to size change. There may be higher level priming mechanisms involved in dot-distortion categorization, or prototype-abstraction processes may not actually be solely priming based.

(2051)

Comparing Implicit and Explicit Categorization Strategies in Humans and Rhesus Macaques (*Macaca mulatta*). JUSTIN J. COUCHMAN, MARIANA V. C. COUTINHO, & J. DAVID SMITH, *University at Buffalo*—In an early dissociation between implicit and explicit categorization, Kemler Nelson (1984) gave participants an optional categorization task that could be performed by responding either to overall family resemblance or to a single-dimensional criterial rule. Explicit human learners often adopted the rule-based strategy; incidental human learners often adopted the family-resemblance strategy. In the present study, we replicated Kemler Nelson's human experiment and found the same dissociation. In addition, we extended her paradigm to rhesus monkeys, asking whether they also have an explicit, category-learning system that can be responsive to analytic rules. Macaques heavily favored the family-resemblance strategy. Even after many sessions and thousands of trials in the task, they seemed to have little appreciation that a simple rule, based on one stimulus dimension, could produce perfect categorization.

(2052)

Transfer Testing Provides Little Evidence of Commonality Between Matching-to-Duration Tasks Involving Keylight and Food Presentations. DOUGLAS S. GRANT, *University of Alberta*—Pigeons were trained to discriminate between 2- and 8-sec durations of keylight and food presentations. Different comparison stimuli were presented following keylight and food durations (colors for one task and lines for the other task). Following acquisition, the birds experienced two successive transfer tasks in which the comparisons trained with one set of durations were presented on trials involving the alternate set of durations. In each transfer test, the duration-to-comparison mapping was either consistent (i.e., both short samples associated with one comparison and both long samples associated with the other comparison) or inconsistent (i.e., one short and one long sample associated with one comparison, and the other short and long sample associated with the other comparison). Whether transfer involved a consistent or inconsistent sample-to-comparison mapping had little effect on either initial accuracy or rate of acquisition. Hence, duration tasks using keylight and food durations are not functionally equivalent.

(2053)

Timing With Opportunity Costs: Concurrent Schedules Improve Accuracy of Peak Timing. FEDERICO SANABRIA, *Arizona State University*, ERIC A. THRAILKILL, *Utah State University*, & PETER R. KILLEEN, *Arizona State University*—The temporal generalization gradient produced by the peak procedure conflates detectability and bias. We instituted concurrent ratio and interval schedules to manipulate the opportunity cost of false alarms (early and late peak responses). Concurrent tasks brought peak start and stop times closer to the target time. The shifts were greatest for start times, which not only moved closer to the target time, but whose coefficients of variation decreased. The changes were inconsistent with several basic models of timing.

• DECISION MAKING •

(2054)

Melioration Versus Maximization: Feedback- and Strategy-Driven Models of Adaptive Behavior. HANSJOERG NETH, CHRIS R. SIMS, & WAYNE D. GRAY, *Rensselaer Polytechnic Institute* (sponsored by Wayne D. Gray)—Environments that confront cognitive agents with a choice between local and global gains often evoke a behavioral pattern known as melioration—a preference for immediate rewards over higher long-term gains (Herrnstein, 1997; Tunney & Shanks, 2002). We previously presented evidence that global feedback about expected and optimal gains does not enable decision makers to reliably overcome melioration in favor of maximization in a probabilistic binary-choice paradigm (Neth, Sims, & Gray, 2006). Treating the dilemma between melioration and maximization as a representational

problem, we present a range of reinforcement learning models that explore how slight shifts in attended dimensions and reinforced units of behavior can result in different allocation strategies. Beyond mimicking aggregate human data, our models explain how sequential decision making can be understood as a combination of feedback- and strategy-driven processes, effectively reconceptualizing probability matching as representational learning.

(2055)

Exploring the Supraliminal Mere Exposure Effect. MARC G. BERMAN, RICHARD GONZALEZ, & MICHAEL S. FRANKLIN, *University of Michigan*—The mere exposure effect is a phenomenon where participants prefer stimuli that have been repeatedly presented as opposed to stimuli that have not been presented. The stimuli in most mere exposure studies are neutral and novel to the participant, therefore eliminating preexisting valence. Here, we explored how the supraliminal mere exposure effect was affected by differently valenced stimuli (as determined by independent raters). In addition, we explored potential factors accounting for the observed heterogeneity whereby some participants show the mere exposure effect and others do not. Furthermore, we present a statistical method for analyzing mere exposure data using ordinal regression that is more sensitive than previously utilized techniques and permits modeling the heterogeneity. Preliminary findings suggest that subjects who do show the effect are not influenced by stimulus valence and utilize recognition to determine stimulus preference. Therefore, it appears that recognition overrides initial stimulus valence in supraliminal mere exposure preference judgments.

(2056)

A Comparison of Reaction-Time Models of Multiple-Choice Decisions. FABIO LEITE & ROGER RATCLIFF, *Ohio State University* (sponsored by Roger Ratcliff)—Several sequential sampling models for multiple-choice decisions were evaluated. These models used various racing diffusion processes (e.g., Usher & McClelland's, 2001, leaky competing accumulator model). The structures of the models differed on a number of dimensions, including starting point of competing accumulators, lateral inhibition, and constraints on accumulation rates (e.g., accumulators only allowed to take nonnegative values). Data were collected from a letter-discrimination experiment in which stimulus difficulty or probability of the response alternatives was varied along with number of response alternatives. Performance of the models was addressed by testing them against empirical data, including issues of psychological plausibility of parameter estimates and mimicry among models.

(2057)

Effects of Caffeine on Deck Selection in Two Gambling Tasks. PATRICK A. RAMIREZ & DANIEL S. LEVINE, *University of Texas, Arlington*—Participants were given two different gambling tasks: the Iowa Gambling Task (IGT) due to Bechara et al., and a variant of the modified IGT due to Peters and Slovic, in either order, with 100 trials in each. On the second task, the participants were given either a caffeinated drink (treatment), a decaffeinated drink (placebo), or water (control). It was found that caffeine significantly increased the tendency to choose advantageous decks, but only on the Bechara task and not on the Peters task. The advantage of caffeine on the Bechara task was manifest even on the first 20 deck selections. This led us to conjecture that the effect of caffeine could be primarily an enhancement of attention, with the Bechara task being the more subject to inattention because the Peters task has more variability in its outcomes.

(2058)

Human and Optimal Valuation in a Sequential Decision-Making Task With Uncertainty. KYLER M. EASTMAN, BRIAN J. STANKIEWICZ, & ALEX C. HUK, *University of Texas, Austin*—Many sequential sampling models suggest that decisions rely on the accumulation of evidence over time until reaching a particular threshold.

These models can often account for variations of speed and accuracy in perceptual tasks by manipulation of this threshold. But how does this threshold get determined in real-world decisions? It has been hypothesized that the threshold maximizes some reward function, possibly incorporating measurements of both speed and accuracy (Gold & Shadlen, 2003). This approach has produced a family of models that accurately describes behavior for two-alternative forced choice (2AFC) tasks. (Bogacz et al., 2006) However, it has been unclear what the optimal threshold becomes when additional perceptual information can be obtained at a cost. We present a model of optimal sequential decision making in a task that extends the traditional 2AFC by adding the option of additional information. In the task, the observer receives a sample from two overlapping distributions.

• JUDGMENT •

(2059)

Associations Between Absent Events in Contingency Judgment. LEYRE CASTRO, FABIÁN A. SOTO, & EDWARD A. WASSERMAN, *University of Iowa*—Studies of contingency judgment have shown that cue–outcome associations can be strengthened or weakened even when the cues are absent (e.g., retrospective reevaluation effects). But, there is no evidence in the mainstream contingency judgment literature for the formation of new associations between an absent cue and an absent outcome. Interestingly, research with human infants (Cuevas, Rovee-Collier, & Learmonth, 2006) and nonhuman animals (Dwyer, Mackintosh, & Boakes, 1998) has disclosed that new associations between cues and outcomes can be formed when neither of them is presented. In our own contingency judgment experiments, we have found evidence for the formation of new associations between cues and outcomes that are absent, but that are associatively activated. Our results raise difficult problems for cognitive or inferential accounts (e.g., De Houwer, Beckers, & Vandorpe, 2005), but they can be readily explained by associative learning models (e.g., Dickinson & Burke, 1996; Van Hamme & Wasserman, 1994).

(2060)

The Effect of Race on Guilty Verdicts: Order Matters. LESLIE N. KNUYCKY, HEATHER M. KLEIDER, & ASHLEY MYERS, *Georgia State University* (sponsored by Stephen D. Goldinger)—Factors other than case evidence (i.e., available cognitive capacity, judgment instructions) influence juror verdicts (Goldinger et al., 2003). Racial bias, one factor shown to affect jury judgments (Jones & Kaplan, 2003), is posited as an automatic response often difficult to intentionally control. We examined whether attempts to inhibit bias may “backfire” when race is made especially salient. In two experiments, case presentation order (varying position of black or white defendants) and instructions to ignore race impacted jury decisions. The results showed that with no instruction, black defendants received harsher judgments when presenting white- before black-defendant cases. This order effect was negated in Experiment 2 with instruction to disregard race, as guilty verdicts increased overall for black defendants. This suggests that when race is “noticeable” via presentation order or instruction, racially biased decisions result. Such decisions lead to more severe verdicts for black defendants than when race goes “undetected.”

(2061)

Judgments of Randomness: Is There a Bias Toward High Alternation? FIONA E. J. McDONALD & BEN R. NEWELL, *University of New South Wales* (sponsored by Ben R. Newell)—Extensive research has documented that people are poor generators of random sequences. A key feature of human generated sequences is a tendency for excessive alternation of outcomes. The research on judgments of randomness is not as extensive but it has been found that when judging sequences, there is also a tendency to judge those with excessive alternation as most random. We challenge this notion, finding through a series of experiments only minimal bias in judgments of random-

ness. In addition, we report that judgments are influenced by working memory, the number of sequences judged per set, as well as whether the data are presented as a series of discrete outcomes or in a graphical format. We conclude that when judging sequences, people are not as biased as has been previously reported.

(2062)

Object Familiarity Can Be Altered in the Presence of Other Objects. ALAN S. BROWN, *Southern Methodist University*, & ELIZABETH J. MARSH, *Duke University*—Does the familiarity of an object depend on the context in which it is judged? To answer this, abstract symbols were judged alone or in the context of another symbol. The flanker symbol was either very familiar or very unfamiliar, as established in a pilot study. Experiment 1 used two brief presentation conditions: 100 or 1,000 msec. In both conditions, unfamiliar flankers decreased rated target familiarity, while familiar flankers increased rated target familiarity, relative to the no-flanker control. In Experiment 2, symbols remained in view until rated. Familiar flankers continued to inflate the familiarity of the target, but there was no effect of unfamiliar flankers (relative to the no-flanker control). Irrelevant stimuli can change how familiar a target feels, especially when the nontarget is very familiar.

(2063)

Implicit Figural–Semantic Association in Chinese Characters. MIN-JU LIAO, HAN-JU TASI, & CHING-FAN SHEU, *National Cheng Kung University*—Research has shown a figural–semantic association in Chinese where the orthographic signs are used to designate concepts. The present study investigated an implicit/automatic process of this association. Our hypothesis was that figural attributes of positive meaning characters will automatically prompt positive perceptual evaluations. Perceptual judgment and recognition tasks were employed in the present experiment. In the perceptual judgment task, participants noncognate of Chinese were presented with a pair of Chinese characters designed with either antonymic or neutral concepts and were to choose one character that was perceptually more preferable. In the recognition task, participants' recognition performance for characters presented in the first task was examined. Preliminary data revealed that when presented with two antonymic characters, participants tended to evaluate positive meaning characters as more preferable. The recognition rates for individual characters from antonymic or neutral concept pairs did not show any difference.

(2064)

The Effect of Forecasts From Sources Differing in Forecast Extremity and Diagnosticity. YARON SHLOMI & THOMAS S. WALLSTEN, *University of Maryland*—An important issue concerns how consumers of forecasts learn to utilize the information provided to them. We created advisors that varied in forecast extremity (e.g., probability forecasts that were low [60%] vs. high [90%]) and diagnosticity (e.g., conditional hit rate, .60 vs. .90) and provided participants an opportunity to learn about the forecasts' characteristics over many trials. The data suggest that the two dimensions have independent effects on the extremity of the participants' judgments. We developed a mathematical model to account for participants' learning in this task. Applying the model at the level of individual respondents, the estimated parameters suggest that forecast extremity was overweighted and forecast diagnosticity was underweighted. Our results are useful on both theoretical and practical grounds. In addition, the experimental procedure developed here may be adapted for investigating effects of properties related to the producer of the forecasts, such as trustworthiness.

• RETRIEVAL PROCESSES •

(2065)

Detecting Semantic Versus Episodic Memory Retrieval via fMRI Pattern Classification. PER B. SEDERBERG & KENNETH A. NORMAN, *Princeton University*—Behavioral studies have demon-

strated that humans rely on both semantic and episodic associations to cue memory retrieval; however, with few exceptions, imaging studies of memory retrieval have focused on the neural correlates of semantic and episodic memory independently. In order to understand the interplay between semantic and episodic associations during memory retrieval, it is first necessary to track subjects' retrieval states during memory search. To this end, we collected fMRI data while subjects performed both semantic and episodic paired-associate stem completion tasks. We were able to distinguish between semantic and episodic cue states in all subjects by means of a back-propagation neural-network pattern classifier. In a subset of the subjects, the output of the neural classifier also correlated with behavioral performance in the tasks. These results indicate that subjects modulate their retrieval state during memory search and that pattern classification techniques can dissociate between episodic and semantic states during memory retrieval.

(2066)

Memory Retrieval As an Encoding Event: The Role of Attention. NICOLE M. DUDUKOVIC & ANTHONY D. WAGNER, *Stanford University*—When you remember an event, the act of memory retrieval serves to reencode the experience, ultimately influencing whether you will remember it in the future. We investigated whether dividing attention during retrieval reduces the power of retrieval as an encoding event. Participants studied object pictures under two different semantic encoding tasks. They then engaged in a recognition and source memory test, sometimes while simultaneously performing an auditory discrimination task. Two days later they returned for a second recognition and source memory test. Recognition and source memory were better for items that had been retrieved under full as opposed to divided attention. More importantly, items that were correctly recognized on the first test were more likely to be subsequently recognized on the second test if they had initially been retrieved under full attention. The same held true for correct source memories. Thus, attention may be critical for retrieval benefits.

(2067)

Distributed Retrieval Practice: How Much Is Enough? MARY A. PYC & KATHERINE A. RAWSON, *Kent State University*—Previous research has established that distributed retrieval practice promotes memory. However, students necessarily have a finite amount of time to spend studying, and thus examining the efficiency of practice schedules is also important. In two experiments, we compared various schedules of distributed retrieval practice to examine the minimum number of times an item needs to be correctly recalled during practice to maximize final test performance. The results showed that correctly recalling an item only once during practice led to lower final test performance than correctly recalling an item more than once during practice. However, we observed diminishing returns of further practice, until a point was reached where correctly recalling an item more times during practice provided no further benefit to final test performance. The results also showed that the level of practice at which asymptotic final test performance was reached depended on the retention interval between practice and final test.

(2068)

Phonological and Visual Imagery Mediation Processes in Vocabulary Retrieval. ROBERT J. CRUTCHER & JENNIFER M. SHEA, *University of Dayton*—Two experiments investigated retrieval processes of vocabulary pairs learned using keyword mediators by independently manipulating the phonological or visual imagery properties of the mediators. We measured accuracy and latency of retrieving Indonesian–English vocabulary pairs (vocabulary task), as well as of retrieving keywords from Indonesian words (keyword subtask) and English translations from keywords (English subtask). Manipulating the phonological similarity of the keyword mediator to the Indonesian word impacted vocabulary retrieval such that greater phonological similarity of keyword mediators to Indonesian words enhanced re-

trieval of the Indonesian–English pair and enhanced retrieval of only the keyword subtask. However, higher imagery value keywords influenced both the keyword and English retrieval subtasks while making little or no difference in overall vocabulary retrieval performance. This unexpected but interesting pattern of results is discussed and potentially explained.

(2069)

Constrained Retrieval in Recognition Memory? JUSTIN KANTNER & D. STEPHEN LINDSAY, *University of Victoria* (sponsored by D. Stephen Lindsay)—Some prominent theories of recognition memory hold that recognition judgments are based on the degree of match between test probes and all previously encountered exemplars. Jacoby and his colleagues, by contrast, have recently argued that recognition judgments may be supported in part by a process of “constrained retrieval” whereby individuals selectively search memory for items from a particular contextual source. We critique Jacoby’s evidence for this claim and report new experiments designed to detect constrained retrieval in a recognition task. The results indicate that subjects can indeed constrain retrieval in response to test probes under some conditions, but not under others. We discuss the implications of this pattern of significant and null effects for theories of recognition memory.

(2070)

Pattern Classification of fMRI Retrieval States During Recognition Memory. JOEL R. QUAMME & KENNETH A. NORMAN, *Princeton University*—Pattern classification algorithms have been used in fMRI to examine distributed activity patterns in the brain associated with different cognitive states. In this study, subjects studied singular and plural words, and performed recognition memory tasks in the scanner. We trained a simple neural network classifier to distinguish between subjects’ fMRI brain patterns when paying attention to recollected details about a previously studied item, and when paying attention to general feelings of item familiarity. Then, in a second phase, subjects made old–new judgments to studied, nonstudied, and switched-plural versions of studied words (e.g., study *fleas*, test *flea*). After training the classifier on the first phase, we tested it on brain activity from the second phase to obtain the classifier’s “best guess” concerning the subject’s retrieval state during old, new, and switched-plural trials. We report on the relationship between the classifier’s output and subjects’ behavioral responses in this task.

(2071)

Neuroimaging and Electromyographic Evidence for Response Conflict in Recognition Tasks. TRAVIS L. SEYMOUR, *University of California, Santa Cruz*, & ERIC H. SCHUMACHER, *Georgia Institute of Technology*—How do memory retrieval processes lead to overt responses in strategic recognition tasks? The Jacoby model proposes that the influences of both familiarity and recollection processes combine to select appropriate recognition responses, but does not account for response times (RTs). An extended model designed to account for accuracy and RT (Seymour, 2001) suggests that parallel familiarity and recollection-based task-sets can lead to response conflict that must be resolved by control processes. We tested this prediction by using brain activation and electromyographic measures during an exclude recognition task. In Experiment 1, we measured brain activation from cortical regions sensitive to response conflict and found greater activity for conflict than for filler trials. Experiment 2 used electromyographic evidence to replicate this finding with a measure incontrovertibly related to motor execution. These results are consistent with the parallel task-set model’s assumption that recognition, motor, and conflict monitoring processes interact in strategic retrieval tasks.

(2072)

Retrieval Process of Autobiographical Memory and Oldness of Episode. TAKASHI HORIUCHI, *Okayama University*—The purpose of this study was to examine how the difference of oldness of episode

affected the retrieval process of an autobiographical memory. Sixteen university students participated in the experiment. In each trial, the participant was assigned to either the university or the junior high school period condition. In both conditions, the participant was asked to retrieve an episode associated with each cue word, and reported “remember,” “know,” or “no.” Estimates derived from an independent remember–know procedure (Jacoby, 1998) showed that the university period condition was higher in both the intentional and the automatic process than was the junior high school period condition.

• METACOGNITION •

(2073)

Exploring Undetected Errors in Skilled Cognitive Activity. LESLIE A. ADERHOLD & RICHARD A. CARLSON, *Pennsylvania State University*—Increased skill typically leads to faster performance and fewer errors. These improvements result in part from more concise mental representations. However, more concise representations may sometimes contribute to characteristic errors and failures of monitoring at high levels of skill. For example, even skilled writers may find it difficult to proofread their own work. Participants in several studies practiced a rule-application task, checking for rule violations and reporting confidence in their responses. Some error types persisted at high levels of skill, even when speed–accuracy trade-offs were ruled out. Furthermore, participants often reported very high confidence in error responses, persisted in those errors, and continued to report high confidence when provided the opportunity to recheck their work. We consider possible explanations in terms of motivation, implicit monitoring on the basis of fluency, and representational constraints on metacognition. Understanding failures of error monitoring in high-performance skills may have important practical implications.

(2074)

Metacomprehension of Statistical Concepts. RUTH H. MAKI, CURTIS CRAIG, J. L. RUDINE, & ELIZABETH A. MURRAY, *Texas Tech University*—We investigated transfer appropriate monitoring (TAM) in metacomprehension of statistical concepts. During learning, participants either calculated answers to problems or read the answers. Learning was tested with multiple-choice and calculation tests. TAM suggests that calculating during learning would lead to more accurate judgments on the calculation test, and reading during learning would lead to more accurate judgments on the multiple-choice tests. The learning activity \times test interaction was not significant with metacomprehension accuracy, but it did occur with bias. Calculating during learning produced overconfidence on the multiple-choice test, but it had no effect on the calculation test. Overall, relative prediction accuracy was higher for participants who had previously taken a statistics course and for participants who did not calculate during learning. These results suggest that calculation during learning interferes with students’ abilities to judge how well they are learning, and it may lead to overconfidence.

(2075)

Study Strategies—Do Deaf College Students Do It Differently? MARY DIANE CLARK & LASHAUN A. WILLIAMS, *Gallaudet University*—Looking at the literature on test-taking strategies, underachieving groups tended to show less preparation when studying for tests and developed fewer strategies for the behavior, and those strategies tended to be ineffective (Bornhold, 2002; Ellis & Ryan, 2003). In addition, Ellis and Ryan found that these students had lower levels of test-taking self-efficacy. More specifically for deaf test-takers, Chaliff and Toranzo (2000) found that the test construction also impacted their students’ results on these kinds of tests. The English syntax of the questions as well as the question format caused deaf test-takers difficulty in demonstrating their knowledge. Chaliff and Toranzo related these difficulties to poor reading strategies. The current study elicited strategies from a group of deaf college students. Content analysis shows more superficial strategies that appear to re-

flect metacognitive weaknesses. The results reflect communication issues as well as a lack of deep processes on the part of the students.

(2076)

The Contribution of Mental Effort to the Perception of Agency. DANIELLE LABOSSIERE, JADY WONG, & JASON P. LEOBE, *University of Manitoba*—To date, few studies have been conducted on the cognitive roots of the perception of agency (Metcalfe & Greene, in press). We suspect an association between mental effort and the perception of agency over completion of a task. To test this idea, participants studied a series of words and, during a test phase, were presented with a word-fragment completion task consisting of fragments constructed from both studied and unstudied words. We manipulated difficulty in solving word fragments by presenting fragments with either one or three letters missing (Lindsay & Kelley, 1996). After completing each word fragment, participants judged whether they were responsible for solving the fragment or whether prior exposure to the word was responsible for providing the solution. If an association exists between mental effort and the perception of agency, we expected that participants would be more likely to judge themselves as responsible for solving difficult word fragments.

(2077)

Confusing Past Intentions With Past Actions. EKATERINA DOBRYAKOVA & GÜNTHER KNOBLICH, *Rutgers University*—Two experiments investigated whether people confuse having planned an object-directed action with actually having performed it (think of the difference between having planned to put the passport in your bag or actually having put it there). Participants formed intentions for a number of objects they viewed on a screen. They then performed only half of the actions with real objects. One week later they viewed objects they had performed actions on (25%), objects they had planned actions with (25%), and new objects (50%). They reported for each object whether they had performed an action with it. Participants were significantly more accurate for new objects and objects with which they had performed an action than for objects with which they had planned actions. Experiment 2 replicated this finding, ruling out some trivial explanations. The tendency to confuse actions and intentions could result from a partial simulation of the action during planning.

(2078)

Benefits of Instructions and Incentives for Older Adults' Retrieval Reluctance in a Novel Computation Task. DAYNA R. TOURON, *University of North Carolina, Greensboro*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—Previous research using a noun-pair lookup task indicates that older adults delay strategy shift from visual scanning to memory retrieval despite adequate learning, and that this “retrieval reluctance” is related to subjective choice factors. The present experiment extended these outcomes to a novel arithmetic task and tested the flexibility of response criteria and strategy preferences. Old and young participants were trained on the pound arithmetic task, which involves a strategy shift from performing a complex novel arithmetic algorithm to responding via associative recognition of equation–solution pairings. Task instruction conditions equally focused on speed and accuracy, encouraged retrieval use as a method toward fast responding, or offered monetary incentives for fast retrieval-based performance. Strategy shift was determined at least in part by metacognitive and volitional factors, since participants who received explicit retrieval instructions, and particularly monetary incentives for retrieval, shifted strategy more rapidly than those without such instructions or incentives.

(2079)

The Role of Inconsistency Cues in the Development of False Childhood Memories. KIMBERLEY A. WADE, *University of Warwick*, & MARYANNE GARRY, *Victoria University of Wellington*—Garry and Wade (2005) showed that narratives are more likely to elicit false childhood memories than are doctored photographs. The experi-

menters offered a fluency-based account and suggested that narratives encourage confabulation more than photographs do. We tested this prediction by exposing adults to fake photographs and fake narratives of a childhood event and manipulating the order in which participants viewed the mediums. The photo-constraining hypothesis predicts that photographs should provide details that conflict with participants' internally generated images of the false event. Yet such a blocking mechanism would only obstruct false memory development if participants were first given a verbal suggestion and left to conjure up images before viewing a photo. Contrary to the photo-constraining hypothesis, narrative > photo participants were more likely to report false memories than were photo > narrative participants. Our results suggest that photos do not constrain memory construction, presumably because people fail to use inconsistency cues when making source judgments.

(2080)

Cranial Nerve Mnemonics: Comparing the Effectiveness of Formal Versus Informal. SHARLENE D. WALBAUM, JILLIAN BIANCO, & MEGHAN NOWAKOWSKI, *Quinnipiac University*—Sophomore ($N = 50$) and junior ($N = 37$) Health Sciences majors described the cranial nerve mnemonic they were taught and recalled the order and names of the cranial nerves. A factorial ANOVA yielded a significant main effect of year in school on cranial nerve recall in the expected direction [$F(1,87) = 22.27, p = .001$] and a significant interaction [$F(1,87) = 3.88, p = .05$] between type of mnemonic and year in school on accurate recall. Sophomores recalled significantly more ($M = 6, SD = .83$ vs. $M = 4.21, SD = .85$) when using a mnemonic taught by a professor, while juniors recalled significantly more when they reported learning the mnemonic outside of class ($M = 10.14, SD = .7$ vs. $M = 8.43, SD = .88$). The results are explained in terms of the effectiveness of active learning.

• MEMORY AND INSTRUCTION •

(2081)

Failed Tests Can Enhance Learning. NATE KORNELL, MATTHEW J. HAYS, & ROBERT A. BJORK, *UCLA*—Taking tests is an effective way to learn. But what happens when one cannot answer a test question? Does the unsuccessful effort impede future learning, or enhance it? Participants studied trivia questions in two conditions: a read-only condition, in which the question and answer were presented simultaneously, and a test condition, in which the question was presented alone, prior to the answer being provided. Half of the questions (Berger, Hall, & Bahrick, 1999) simulated general-knowledge questions, but in fact were fictional (e.g., Who was the East African Goddess of love and power?—Nefaru). Such items ensured a failure to answer when initially presented, but nonetheless such unsuccessful responding enhanced subsequent learning of the answer, versus read-only items. Thus, testing appears to enhance future encoding, and successful tests alone cannot explain the testing effect. At a practical level, taking challenging tests—instead of avoiding errors—may be one key to effective learning.

(2082)

Unsuccessful Tests Enhance Future Learning. LINDSEY E. RICHLAND, *University of California, Irvine*, NATE KORNELL, *UCLA*, & SEAN KAO, *University of California, Irvine*—The testing effect is the phenomenon in which testing enhances memory for previously studied content. Memory is particularly enhanced for items successfully retrieved during testing. Three experiments investigated the effects of testing before studying—a time when participants were unlikely to successfully retrieve content. Participants read excerpts from an essay on vision. Either they were asked about embedded concepts before reading the passage (test condition) or they read the passage for a longer time (read condition). In both conditions, the tested concepts were highlighted (presented in bold letters or italics) to distinguish the effects of testing from directing attention. Although participants

failed on initial tests, memory performance on a final posttest including tested and novel items was better in the tested condition in all experiments. Retrieving the correct answer from memory does not appear to be the only reason for the testing effect—simply being asked seems to enhance learning.

(2083)

Test-Enhanced Learning in the Classroom: The Columbia Middle School Project. HENRY L. ROEDIGER III, MARK A. McDANIEL, KATHLEEN B. McDERMOTT, & POOJA K. AGARWAL, *Washington University* (sponsored by Janet Duchek)—The testing effect refers to enhanced learning of information that has been previously tested. We implemented and experimentally evaluated a test-enhanced learning program in 6th-grade social studies classes. Experiment 1 involved within-subjects manipulation of whether target facts from daily lessons were quizzed or not. Multiple-choice quizzes were administered prior to the class lesson, at the end of the class lesson, and as a review several days after the class lesson. Across four multiple-choice chapter examinations, a significantly higher proportion of previously tested facts were answered correctly than nontested facts. Experiment 2 added a condition in which some facts were presented for rereading. Chapter examination performance on facts presented for rereading was higher than for nontested facts but still significantly lower than for tested facts. Thus, the testing effect was not a mere exposure effect. Testing significantly enhanced learning of target information in 6th-grade social studies classes.

(2084)

Testing Insulates Against Build-Up of Proactive Interference. KARL K. SZPUNAR, KATHLEEN B. McDERMOTT, & HENRY L. ROEDIGER III, *Washington University* (sponsored by Kathleen B. McDermott)—Cramming for an examination is a ubiquitous learning strategy that has received little attention in the laboratory. Verbal learning experiments, which require participants to learn large sets of materials in a short amount of time, are well suited to inform our understanding of this common study strategy. In three experiments, we show that although previous learning impairs the learning of later information in the study sequence (proactive interference), interpolating tests during the study sequence appears to insulate against this negative influence. Our findings highlight a unique benefit of testing, when administered during the course of study, and have important implications for students' study strategies.

(2085)

The Benefit of Generative Study Activities Depends on the Nature of the Criterial Test. ANDREW C. BUTLER, PATRICK S. FLANAGAN, HENRY L. ROEDIGER III, & MARK A. McDANIEL, *Washington University* (sponsored by David G. Elmes)—Generative study activities can enhance retention of text-based material. Two experiments investigated how the nature of the criterial test influences the benefits derived from two types of generative study. Specifically, we manipulated the type of initial study activity (letter reinsertion, paragraph sorting, reading) as well as the question type (tapping item-specific or relational information) and test format (multiple-choice or cued recall) on a delayed criterial test. Subjects performed one of the three study activities on a set of prose passages. Two days later, they were tested with questions about both item-specific and relational information from the passages, and these questions were presented in multiple-choice or cued recall test format. The benefit of generative activities depended critically on whether the type of processing produced by the activity matched the type of processing required during the criterial test. This pattern of transfer appropriate processing held across both types of test format.

(2086)

Using the 3Rs: Study Strategies and Learning From Educational Texts. DANIEL C. HOWARD & MARK A. McDANIEL, *Washington University*, & GILLES O. EINSTEIN, *Furman University* (sponsored by Mark A. McDaniel)—Two experiments with young adults investi-

gated the effectiveness of study strategies for learning from educational texts. Of particular interest was the “3R” strategy, in which participants read a text once, recited everything that they could remember from the text, and then reread the text a second time. This strategy has potent theoretical benefits because the recitation phase serves as an immediate free recall test, which aids later recall of the information (a phenomenon known as the “testing effect”) and may help guide processing of the text during the rereading phase. The 3R strategy was compared with a note-taking study strategy and a read-twice control group in two experiments with information of varying complexity. Learning was assessed with free recall, multiple-choice, and short answer inference questions. The 3R group showed improvements over control on all three types of criterial test.

(2087)

Determinants of Learning From Text: The Roles of Reader and Text Characteristics. NICOLE MOON, DAVID Z. HAMBRICK, & ERIK M. ALTMANN, *Michigan State University*—The current study investigated the roles of reader-related and text-related characteristics in passage learning. The questions of interest were the following: (1) whether the inclusion of an organizer in the form of an embedded analogy would interact with working memory (WM) and prior knowledge (PK) in passage learning, and (2) whether there was a relationship between WM and PK in passage learning. Participants in both the control and the organizer conditions were given WM tasks, PK tests, a passage, and tests of passage learning. A hierarchical regression revealed that supplying learners with an embedded analogy improved recall of information related to main concepts. In addition, this analysis indicated that although WM and PK contributed positively to passage learning performance, no evidence was found that organizers are able to compensate for WM or PK.

(2088)

Criterion Shifts As a Function of Probe Strength: Rereading and Text Retrieval. MURRAY SINGER, *University of Manitoba*—This study scrutinized criterion shifts as a function of probe strength in text retrieval. People apply more liberal criteria to temporally remote than to recent intermixed recognition probes, in both text and category recognition (Singer & Wixted, *Memory & Cognition*, 2006). However, there is no criterion shift in response to conspicuous probe-strength differences (Stretch & Wixted, *JEP:LMC*, 1998). Here, people read 10 stories once or twice each. Reading repetitions were either consecutive (Experiment 1) or at intervals of over four stories (Experiment 2). Later, the participants recognized probes from story pairs, one weak (one reading) and one strong. Criterion was independent of strength (as in Stretch & Wixted) in spaced rereading; but in consecutive rereading, there was a distinct criterion shift. Consecutive rereading may enhance the perceptual representations of text encoding. This could impact the probe's familiarity, the memory process that is closely associated with the strength variable of signal detection. Conspicuous familiarity differences may regulate criterion shifts.

(2089)

High-Tech Textbooks: Do Dynamic Visual Displays and Interactivity Increase Learning? KEITH B. LYLE, *University of Louisville*, MARK A. McDANIEL, *Washington University*, ANDREA S. YOUNG, *Duke University*, & ROBIN J. HEYDEN, *Educational Multimedia Consultant*—New textbooks may incorporate dynamic visual displays, which furthermore may be interactive and require the reader to generate responses. Visual representations and self-generation increase memory for simple laboratory stimuli, but little is known about how these factors affect learning and memory for complex, real-world material such as that in textbooks. In the present studies, undergraduate subjects read one of three versions of a lesson from a real biology textbook. The versions differed in whether they did or did not include dynamic visual displays, and whether subjects passively viewed the displays or interactively responded to them. Learning was assessed using a variety of test types (e.g., multiple-choice, short answer) and

subjects rated the lesson on several subjective measures. Subjects were most enthusiastic about lessons that included visuals and interactivity, but those features may or may not actually increase learning, depending on whether they promote processing that transfers to particular test types.

(2090)

A Testing Effect With Multimedia Learning. CHERYL I. JOHNSON & RICHARD E. MAYER, *University of California, Santa Barbara* (sponsored by Richard E. Mayer)—In Experiment 1, participants viewed a short, narrated animation about lightning formation, and then either watched the animation again (study–study group) or took a retention test (study–retention test group), before taking an immediate or delayed retention test. In Experiment 2, in addition to the study–study and study–retention test conditions, a third condition took an intervening transfer test (study–transfer test group), and all groups took an immediate or delayed retention test followed by a transfer test. Across both experiments, the study–retention group outperformed the study–study group on the delayed retention test but not on the immediate retention, thus replicating the testing effect obtained with word lists. In Experiment 2, taking an initial retention test benefited final retention test performance but not final transfer test performance, whereas taking an initial transfer test benefited performance on both the final retention and transfer tests, as predicted by levels-of-processing theory.

• IMPLICIT COGNITION •

(2091)

Semantic Organization: Possible Individual Differences Based on Handedness. VARALAKSHMI SONTAM & STEPHEN D. CHRISTMAN, *University of Toledo* (sponsored by Stephen D. Christman)—Previous research indicates that there are handedness differences in semantic switching flexibility. That is, in comparison with strong-handers, mixed-handers switch between different subcategories within a semantic tree more readily. The present study hypothesizes that these handedness differences are due to differences in semantic organization based on differential link-strengths between the concepts, which in turn affects the spread of activation. Specifically, it is proposed that for mixed-handers, the strength of links connecting the concepts belonging to different subcategories (relatively less relevant concepts) is very close to the strength of the links connecting the concepts within a subcategory (more relevant concepts). This idea was tested using ambiguous words (e.g., *bank*), which are related to other concepts via dominant (e.g., *money*) or subordinate (e.g., *river*) meanings. Consistent with the hypothesis, in a controlled priming task, mixed-handers demonstrated equal facilitation for both dominant and subordinate associates, whereas strong-handers showed facilitation only for the dominant associates.

(2092)

Evidence of Cross-Modal Grammar Learning. JASON J. JONES & HAROLDE E. PASHLER, *University of California, San Diego* (sponsored by Harold E. Pashler)—Many researchers have argued that the mechanisms of statistical learning are modality specific. We present data from an artificial grammar learning experiment demonstrating that subjects learn statistical relationships between auditory and visual stimuli. We argue this is evidence for a form of statistical learning occurring at a level of cognition at which modality information has already been abstracted away.

(2093)

The Implicit Learning of Concurrent Spatial Sequences. JACQUELINE C. SHIN, *Indiana State University*—Can implicit learning occur for concurrent sequences in two spatial dimensions? In a serial reaction time task, a visual stimulus was presented in one of three sets of four horizontal positions, each set in a different region of the visual display. The location of the stimulus within these localized (horizon-

tal position) and macroscopic (region) spatial levels was manipulated independently. Response selection was based on the localized information, but the macroscopic information was incidental. In different conditions, the two types of spatial information followed same-length sequences that were phase matched or followed different-length sequences. In the same-length condition, the two sequences were integrated into a common sequence representation. Although the individual sequences were learned simultaneously in both conditions, learning for the macroscopic spatial sequence was greater in the different- than in the same-length condition. The pattern of results suggests an interactive relationship between integrative and independent sequence learning in the visuospatial modality.

(2094)

Monitoring Not Versus Not-Monitoring in Automatic Memory for Context. YAAKOV HOFFMAN, *Bar Ilan University & Ben Gurion University*, & JOSEPH TZELGOV, *Ben Gurion University* (sponsored by Joseph Tzelgov)—Automatic (AA) memory is monitored neither at encoding nor at retrieval. Direct measurement of AA memory is examined with a recognition context paradigm, where larger gray (perceptually nonsalient) words appear behind smaller black (salient) words. Context was manipulated by instructions telling participants to remember either a gray (gray = target, black = context) or a black (black = target, gray = context) word. Although significant AA memory was obtained for both contexts, the result pattern differed. Shorter lists, deeper encoding, and full attention enhanced memory for nonsalient context, yet impaired memory for salient context. Longer lists, shallower encoding, and divided attention, which typically weaken memory, enhanced AA memory for salient context. It implies that nonsalient context is not triggered by task requirement and is thus not monitored. However, salient context interferes with target monitoring and has to be intentionally ignored.

(2095)

Interaction Between Spatial Context Learning and Learning Strategy. NOBUTAKA ENDO, *Hiroshima Shudo University*, WALTER R. BOOT, ALEJANDRO LLERAS, & ARTHUR F. KRAMER, *Beckman Institute, University of Illinois, Urbana-Champaign*, & TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology*—Visual search performance is improved when participants repeatedly experience the same spatial layout (contextual cuing). Contextual cuing suggests that the spatial layout is implicitly learned, and can guide spatial attention to the target location (Chun & Jiang, 1998). Recently, Lleras and von Mühlén (2004) manipulated participants' search strategy (active or passive between participants) and showed that contextual cuing occurred only when participants with passive strategy conducted the search task. Moreover, Endo, Boot, Kramer, Lleras, and Kumada (2006) replicated the results of Lleras and von Mühlén's study even when participants used each strategy in the different session of the experiment. However, it was unclear whether search strategy affected context learning or use of the learned context because they used the different set of stimuli in each session. In the present study, we controlled the set of stimuli between the sessions, and examined the interaction between context learning and search strategy.

(2096)

Accommodating "Backward" Repetition Priming Effects in a Transfer Appropriate Processing Model. WENDY S. FRANCIS, EDGAR GRANILLO, MARTHA G. OROZCO, & VICTORIA ALEXANDER, *University of Texas, El Paso*—Word comprehension and word production involve access to common mental representations, but the associated flow of information goes in opposite directions. Two experiments with Spanish–English bilinguals measured the long-term effects of forward and backward process repetition on response times in picture naming and word translation. Experiment 1 ($N = 84$) used picture naming, translation, and semantic classification as encoding tasks for later translation. Experiment 2 ($N = 84$) used picture nam-

ing, translation, and word naming as encoding tasks for later picture naming and translation. Comprehension processes benefited from prior production in the same language, and production processes benefited from prior comprehension. However, these response time reductions were smaller than with identical process repetition, suggesting some degree of process directionality. Error rate reductions followed a different pattern, with comprehension at encoding eliciting the largest benefit in production. Possible methods of incorporating backward processes into a quantitative transfer-appropriate processing model are examined.

(2097)

Picture Priming in a Successive Two-Choice Discrimination Task in Pigeons. SUZETTE L. ASTLEY, HOLLY LATTERELL, & SASHA BURNETT, *Cornell College*—In a study of picture priming, pigeons were first trained to respond differentially in a two-key choice task in the presence of 1 of 20 pictures of cars or people to a criterion of 80% correct. In test sessions, target pictures were presented relatively briefly, and were preceded 60 sec earlier by a 10-sec presentation of either the same picture (e.g., Person 1 → 60-sec ISI → briefly presented Person 1) or a picture from the other category (e.g., Car 1 → 60-sec ISI → briefly presented Person 2). The results showed that seeing the same picture 60 sec earlier facilitated performance in some of the birds.

(2098)

Intuitive Gestalt Perception Rests on the Unconscious Activation of Semantic Concepts. ANNETTE BOLTE, *Braunschweig University of Technology*, & THOMAS GOSCHKE, *TU Dresden*—Intuition denotes the ability to judge stimulus properties better than chance levels without being able to express the basis of the judgments verbally. Here, we show that intuitive judgments in a gestalt perception task are based on the unconscious activation of conceptual object representations. Participants were presented fragmented line drawings which depicted meaningful objects (coherent fragments) or contained randomly displaced line segments (incoherent fragments). In three experiments, participants discriminated coherent and incoherent fragments at better than chance levels even if they did not recognize the objects. Moreover, object names produced faster lexical decision latencies when they were preceded by coherent rather than by incoherent fragments. Coherent fragments producing larger priming in the lexical decision task (indicating stronger activation of object representations) were more frequently judged as coherent. The results indicate that intuitive gestalt judgments rest on the activation of semantic object representations, which bias conscious decisions without being consciously retrieved.

• TOUCH •

(2099)

Haptic Memory Capacity. TOMOHIRO NABETA & TAKASHI KUSUMI, *Kyoto University*—The present study examined the capacity of the haptic memory and its modality specificity. The experiment consisted of the haptic study and the recognition test phases. In the haptic study phase, 100 or 500 objects were presented with the haptic modality. In the recognition test phase, the studied and distractor objects were presented with the haptic or visual modality. We obtained four main results: (1) Hit rate was very high after studying 500 objects as well as after studying 100 objects. (2) Hit rates in the haptic test and in the visual test were almost identical. (3) False alarm in the haptic test was lower than in the visual test. (4) The difference in the false alarm between the haptic and visual modalities after studying 100 objects was comparable with the difference after studying 500 objects. The results suggest that the capacity of the haptic memory depends on the modality specific system.

(2100)

The Haptic Horizontal–Vertical Curvature Illusion. MORTON A. HELLER, ANNE D. McCLURE, MICHELLE E. KERR, STEPHANIE

KIBBLE, KRISTEN RUSSLER, & ANDREANA BASSO, *Eastern Illinois University*—Blindfolded subjects used their index fingers to trace tangible convex curved lines with heights equal to their widths at the base. A generalized overestimation of height in comparison with width was found, showing a horizontal–vertical illusion with tangible curves. Overestimation of height and underestimation of width also occurred with stimuli in the frontal plane as well as flat on the table top. The illusion was obtained with curves that were closed as well as open. Finally, an experiment manipulating stimulus rotation showed evidence of radial–tangential scanning effects. The theoretical and practical implications of the results will be discussed.

(2101)

Haptic Stiffness Identification and Information Transfer. STEVEN A. CHOLEWIAK & HONG Z. TAN, *Purdue University* (sponsored by Hong Z. Tan)—This experiment investigated static information transfer (IT) in a stiffness identification experiment. Past research on stiffness perception has only measured the Weber fractions. In many applications where haptic virtual environments are used for data perceptualization, both the ability to discriminate stiffness (Weber fraction) and the number of correctly identifiable stiffness levels (2^{IT}) are important for selecting rendering parameters. Ten participants were asked to tap a virtual surface vertically using a custom-designed haptic force-feedback device and identify the stiffness level. Five stiffness values in the range 0.2 to 3.0N/mm were used. The virtual surface was modeled as a linear elastic spring and exerted an upward resistive force equaling the product of stiffness and penetration depth whenever it was penetrated. A total of 250 trials were collected per participant. The average static IT was 1.57 bits, indicating that participants were able to correctly identify about three stiffness levels.

(2102)

Haptically Guided Grasping and the Perceptual Effects of the Tactual Sander Illusion. ALAN C. SCOTT & RANDOLPH D. EASTON, *Boston College* (sponsored by Randolph D. Easton)—The Sander illusion has been used to demonstrate the lack of an effect on grip aperture during visually guided grasping despite the presence of a perceptual illusion which produces differentiable estimates of the lengths of the two equal diagonals (Stöttinger & Perner, 2006). With plans to investigate the possibility of differentiable effects of illusions on haptic perception and haptically guided grasping, two studies were conducted. Without the aid of vision, 20 participants attempted to reach out and grasp items of various lengths and orientations using left-handed exploration and right-handed grasping (Experiment 1). Haptically guided grasping did produce differences in grip aperture which were dependent on differences in stimulus length as small as 0.35 cm. In Experiment 2, 28 participants made judgments under blindfold about the length of various stimuli (including Sander's parallelogram) using simultaneous right-handed exploration and left-handed adjustments of a haptic ruler. Müller-Lyer and Sander stimuli both produced perceptual illusions of length.

(2103)

Discriminating Smooth From Grooved Surfaces: The Role of Skin Conformance. GREGORY O. GIBSON & JAMES C. CRAIG, *Indiana University*—The role of skin conformance and penetration on discriminating a smooth from a grooved surface (the smooth–grooved task, SM/GR) was examined at two locations (fingerpad and fingerbase). To establish a baseline, the penetration produced by a 100-g force was determined for each subject. One psychometric function was generated using a constant level of penetration (the baseline level). A second psychometric function was generated using five different penetrations (baseline, $\pm 1,000$, and ± 500 μm of penetration); these were achieved by varying force. The results indicate that randomly varying penetration of the contactor into the skin had no significant effect on SM/GR performance. If subjects had based their decision of smooth versus grooved on overall intensity, thresholds should have increased substantially in the variable penetration condition. Greater confor-

mance does, however, lead to better sensitivity. Overall, conformance accounts for 85% of the variance across both locations.

(2104)

Multiple Somatosensory Frames of Reference: Evidence From the Simon Effect. JARED MEDINA, *University of Pennsylvania*, & BRENDA RAPP, *Johns Hopkins University*—Individuals respond more slowly even in nonspatial tasks when the stimulus and response are on different sides of space—this is known as the Simon effect (Simon & Small, 1969). Explanations assume that spatial codes are automatically generated for both stimulus and response within specific spatial reference frames. We present the results of a novel application of the “Simon effect paradigm” to examine tactile reference frames. We report evidence of multiple tactile reference frames. Specifically, when participants’ arms are uncrossed, we find that allocentric, object-relative tactile stimulus codes are generated. However, when participants’ arms are crossed, an egocentric, somatotopic reference frame is engaged (e.g., the left hand is encoded as left regardless of hand position). We discuss these findings within a tactile processing framework that includes somatotopic and nonsomatotopic stages of spatial representation and processing.

• SPATIAL REPRESENTATIONS •

(2105)

Selecting a Reference Object. LAURA A. CARLSON, MARK R. WILLIAMS, & PATRICK L. HILL, *University of Notre Dame*—Spatial descriptions such as “The stapler is behind the binder” specify the location of a target (stapler) by spatially relating it to a reference object (binder) whose location is assumed to be easily found due to its salience relative to other surrounding objects. Using line drawings and real object displays, we assessed the importance of three candidate dimensions for defining salience: spatial, perceptual, and conceptual. Participants described the location of a target within displays containing multiple candidate reference objects. For spatial salience, candidate objects were placed in more preferred or less preferred spatial relations to the target. For perceptual salience, one candidate reference object was uniquely colored. For conceptual salience, one candidate reference object was the criterion object in a prior categorization task. The results indicate a strong preference to select reference objects on the basis of their spatial relation to the target, with perceptual attributes having a stronger influence than conceptual attributes.

(2106)

Perspective in Spatial Memory and Descriptions: Transforming Representations for Communication. SARAH KRIZ, *Naval Research Laboratory*, & MARY HEGARTY, *University of California, Santa Barbara*—This study evaluated how spatial perspective is mentally represented and the extent to which limits in representational flexibility affect linguistic communication. In three experiments, participants learned an environment through direct navigation or map viewing. Later, they were asked to describe the environment from a perspective that matched or mismatched their learned perspective. Descriptions were analyzed to test three representational models: (1) spatial representations are perspective-free, (2) spatial representations encode multiple perspectives, and (3) spatial representations encode the learned perspective, and are transformed to access the other perspective when required by the communicative situation. Data from the three experiments were best explained by the transformation model, and the results suggest that transformations of spatial representations to an unlearned perspective are subject to cognitive limitations.

(2107)

Cue Effects on Memory for Location When Navigating Spatial Displays. SYLVIA FITTING, DOUGLAS H. WEDELL, & GARY L. ALLEN, *University of South Carolina* (sponsored by David E. Clement)—Participants maneuvered a mouse icon smoothly through a circular region on the computer screen to find a hidden platform in a

procedure that blended aspects of the Morris water maze task and the dot location task. Predictions for effects of varying number of surrounding cues (1, 2, or 3) were generated from a model of cue-based memory error and bias (Fitting, Wedell, & Allen, in press). The pattern of biases and errors was consistent with those predictions. Memory performance decreased with decrease in number of cues, as measured by number of moves to reach the target location and absolute heading error. As memory performance declined, bias effects increased, as measured by heading bias in the first 10 navigational steps and positional bias in the last 10 steps. Remembered locations were biased toward the nearest cue, and error decreased as a function of proximity to cue locations.

(2108)

To Go in Circles or Forge Straight Ahead: Depicting Cyclical Processes. ANGELA KESSELL, *Stanford University*, & BARBARA TVERSKY, *Columbia University and Stanford University*—Schematic forms in depictions, such as lines, boxes, and arrows, can convey meanings about concepts and relations that are readily understood in context. Here, we investigate production and comprehension of depictions of cyclical processes such as cell division and washing clothes. When restricted to a circular display, people tend to put a natural first step in the 12 o’clock position, with subsequent steps clockwise; they also interpret the 12 o’clock step as the first one unless there is a natural first step elsewhere. When not restricted to a circular display, people tend to depict cyclical processes linearly.

(2109)

Learning the Layout of a New Building: A Longitudinal, Real-World Study. DREW DARA-ABRAMS & MARY HEGARTY, *University of California, Santa Barbara* (sponsored by Jack M. Loomis)—Over the course of an academic year, we followed faculty members and graduate students as they learned the layout of a new addition to the psychology building at the University of California, Santa Barbara. At three times during the year, participants generated route directions between locations in the new and old buildings, which are connected by catwalks spanning a courtyard. As each of the three floors in both buildings has a different layout, route directions appeared to follow one of three strategies: first head in the destination’s direction, first head to the destination’s floor, or first go to the ground floor. Route efficiency was evaluated based on path length, and floor plans were used to compute a visibility graph, which indicated which routes were the most visually integrated and contained the fewest turns. We will report the effects of both visibility and learning on strategy choice.

(2110)

Inducing Hierarchical Representations: Consequences for Spatial Heuristics. SIMON J. BUECHNER & CHRISTOPH HOELSCHER, *University of Freiburg* (sponsored by Daniel R. Montello)—Two experiments investigated people’s mental representation of a regularly shaped building and related path choice heuristics. Experiment 1 applied a structure mapping task, indicating that people spontaneously group landmarks within their mental representation according to structural characteristics of the environment (horizontally/vertically). We also showed that the selection of a path choice heuristic was directly related to the representation’s structure. Experiment 2 induced one of the two major groupings in the mental representation by leading the participants through the building either horizontally or vertically. Participants performed verification and production tasks with landmarks along an imagined path. Reaction times in within-group tasks were faster than those in across-group tasks, showing that participants organized their representation according to the way they were exposed to the building. The experiments provide evidence that a person’s mental representation is sensitive to both the environment’s structure as well as to the way it is experienced.

(2111)

Learning of Absolute and Relative Distance and Direction by Pigeons. BRADLEY R. STURZ, *Armstrong Atlantic State University*,

& JEFFREY S. KATZ, *Auburn University* (sponsored by Jeffrey S. Katz)—In an open-field search task, pigeons searched for a goal located at the midpoint of the hypothetical line connecting two landmarks. In Experiment 1, global orienting cues were absent. After reaching criteria, pigeons were tested with novel interlandmark distances. Search error and location on test trials suggested that pigeons learned relative distance. In Experiment 2, a global orienting cue was present. After reaching criteria, pigeons were again tested with novel interlandmark distances. The results suggested that pigeons learned absolute distance. In Experiment 3, pigeons searched at the midpoint of rotated arrays in both the presence and the absence of a global orienting cue, indicating learning of relative direction. In Experiment 4, pigeons searched in the appropriate goal direction when presented a single landmark in the presence but not in the absence of a global orienting cue, indicating learning of absolute direction. The results suggested that pigeons learned both absolute and relative distance and direction from discrete visual landmarks.

• WORKING MEMORY •

(2112)

Visuospatial Working Memory and Warnings Modulate Object Location Memory. PAULA J. WADDILL, RISA IKEMOTO, & ELISE WIGGINTON, *Murray State University*—Postma and DeHaan (1996) have proposed that object location memory utilizes separate processes related to memory for locations and to assignment of objects to locations, and that verbal mediation may be important for the latter but not the former process. In this study, we investigated the degree to which individual differences in both visuospatial and verbal working memory correlated with memory for locations of object pairs. We also evaluated the degree to which warnings to avoid inaccurate placement of the pairs affected location memory. Warnings significantly reduced mean displacement distance for both real objects and nonsense shapes and significantly decreased mislocations of real objects. Correlations of location memory with visual span, spatial span, and executive functioning measures were modulated by type of object and warning condition. Measures of verbal working memory did not correlate with object location accuracy. Implications for models of object location memory are discussed.

(2113)

Encoding, Representation, and General Fluid Intelligence in Visuospatial Working Memory. LISA M. DURRANCE & BENJAMIN A. CLEGG, *Colorado State University*—Two experiments examined processing in visuospatial working memory (VSWM). These investigated encoding and representation processes, and their relationship to general cognitive ability. It has been suggested that information in VSWM is represented in a hierarchical global configuration. However, prior research has also found encoding differences between simultaneous and sequential presentation formats. The present experiments examined whether effects of presentation are mirrored by changes in organization. Simultaneous versus sequential presentations were employed at study, with participants tested using four different spatial configurations to examine the type of representation operating in each condition. The results support a global spatial configuration in VSWM following both sequential and simultaneous displays. Additionally, significant correlations between gF and visuospatial performance in the sequential condition, but not in the simultaneous conditions, implicate greater involvement of general cognitive abilities in processing spatial sequential information. These results will be discussed in terms of the VSWM model.

(2114)

The Effect of Spatial and Nonspatial Contextual Information on Object Visual Memory. HSIN-MEI SUN & ROBERT D. GORDON, *North Dakota State University*—Recent research has found that object memory is stored as part of a larger scene representation rather than independently of scene context. The present study examined how spatial and nonspatial contextual information contribute to visual short-

term memory. We tested participants' visual memory by using a change detection task in which a target object's orientation was either the same as it appeared during initial viewing or changed. In addition, we examined the effect of spatial and nonspatial contextual manipulations on change detection performance. The results revealed that change detection performance was reduced when either spatial or nonspatial contextual information changed in the test image. Thus, object memory is stored as part of a more comprehensive scene representation, and both spatial and nonspatial contextual changes impair memory for target properties (e.g., orientation).

(2115)

Perceptual Expertise Enhances the Resolution but Not the Number of Representations in Working Memory. MIRANDA SCOLARI, EDWARD K. VOGEL, & EDWARD AWH, *University of Oregon* (sponsored by Edward Awh)—Despite its central role in cognition, capacity in visual working memory is restricted to about three or four items. Curby and Gauthier (in press) examined whether perceptual expertise can help to overcome this limit by enabling more efficient coding of visual information. In line with this, they observed higher capacity estimates for upright than for inverted faces, suggesting that perceptual expertise enhances visual working memory. The present work examined whether the improved capacity estimates for upright faces indicates an increased number of "slots" in working memory, or improved resolution within the existing slots. Our results suggest that perceptual expertise enhances the resolution but not the number of representations that can be held in working memory. These results clarify the effects of perceptual expertise in working memory, and support recent suggestions that number and resolution represent distinct facets of working memory ability.

(2116)

The Capacity and Constraint in Color–Shape Integration Across Time. Y.-Y. YEH, *National Taiwan University*—Working memory plays an important role in the control processes involved in integration. In four experiments, we investigated the capacity and constraint in the integration of information held in working memory with the current percept. In all experiments, an array of colors and shapes were sequentially presented at the same location for integration. The results suggested that integration in working memory is limited in capacity and the newly bound representation is unstable after a retention interval of 1 sec. Participants were able to integrate only 1–2 representations even when stimulus duration was long at 1 sec. Once the two features were integrated, shape recognition was worse when the embodied color in a test probe was inaccurate. In contrast, color recognition was not affected by the inaccurate shape in the probe. The implications on information integration and feature processing of a bound representation are discussed.

(2117)

Olfactory Single-Probe Serial Position Recall: Cross-Modal Equivalence. ANDREW J. JOHNSON & CHRISTOPHER MILES, *Cardiff University* (sponsored by Dylan M. Jones)—Four experiments explored the serial position functions produced following single-probe serial recall of olfactory, visual, and auditory sequences. Experiment 1 demonstrated that participants were capable of encoding absolute positional information of odors for sequences of 4, 5, and 6 odors. An absence of serial position effects was produced across sequence lengths. Application of unfamiliar faces to the same paradigm (Experiment 2) produced recency and some primacy across sequence lengths, whereas sequences of pure tones generated a function with recency only (Experiment 3). Articulatory suppression revealed that the presence of primacy following unfamiliar-face sequences was facilitated, although not uniquely reliant upon verbal labeling (Experiment 4). The findings question the proposal of Ward, Avons, and Melling (2005) that the serial position function is task rather than modality dependent, with qualitatively different function produced for different modalities despite employment of an equivalent task.

(2118)

Severe Departure From Weber's Law With Comparisons in the Sensory Trace Mode. ERVIN R. HAFTER & ANNE-MARIE BONNEL, *University of California, Berkeley* (sponsored by Donald A. Riley)—Increment detection is studied with trials presenting a brief reminder stimulus, (I), followed by a test stimulus, either (I) or (I + ΔI). Using this paradigm in an auditory/visual dual task, we have found that the cost of sharing depends on the memory used for stimulus comparison. Evidence shows that with I fixed within a block, test stimuli are compared with standards in long-term memory, and there is a cost of shared attention indicative of a single, shared attentional resource. Conversely, when trial-by-trial roving of I forces comparisons in the sensory trace mode, there is no such cost. The focus here is on the psychophysics of roving. Unlike in the case of fixed levels, where Weber's law holds true, roving produces a severe departure from Weber's law that penalizes smaller Is. This indication of a constant additive noise reflects a cost of holding and comparing stimuli in the trace mode.

(2119)

The Role of the Hippocampus and LIFGs in Working Memory Retrieval. ILKE ÖZTEKIN, BRIAN McELREE, BERNHARD P. STARESINA, & LILA DAVACHI, *New York University*—Event-related functional magnetic resonance imaging (fMRI) was used to isolate regions involved in retrieval from working memory (WM) by contrasting access to representations maintained in focal attention with those that required retrieval. Neural activity was measured in two WM paradigms: a probe recognition task, requiring access to item in-

formation, and a judgment of recency (JOR) task, requiring access to temporal order information. In both tasks, a common pattern of activity emerged in the hippocampus and left inferior frontal gyrus (LIFG): Activity showed a sharp drop for the most recent item in comparison with all other items in the list. These results demonstrate the role of hippocampus and LIFG in WM retrieval. They converge with timecourse measures in indicating that only the most recently processed item is maintained in focal attention, and that, unlike other items in WM, access to this item does not require a retrieval operation.

(2120)

On the Structure of Working Memory. ANDREW R. A. CONWAY, *Princeton University*, & JASON M. CHEIN, *Temple University*—We used fMRI to explore the relative engagement of the brain's cognitive control system by verbal and spatial working memory (WM) and short-term memory (STM) span tasks. Subjects performed verbal and spatial WM span, and STM span, tasks that were developed for compatibility with fMRI. Each WM span task consisted of a processing and storage component. Verbal storage was letter memory; verbal processing was lexical decision; spatial storage was Corsi blocks; and spatial processing was symmetry judgment. Subjects performed each component alone, as well as in combination (i.e., as a WM span task). Brain regions typically associated with cognitive control, including prefrontal, anterior cingulate, and parietal areas, were most strongly engaged during the WM span conditions. This pattern was generally consistent across verbal and spatial tasks. The findings support the view that frontal lobe function and cognitive control mechanisms mediate the relationship between WM span and measures of higher cognition.

POSTER SESSION III

Grand Ballroom, Convention Center, Friday Evening, 5:30–7:00

• METACOGNITION •

(3001)

What Age Differences? Feelings-of-Knowing Reflect an Illusion of Recognition for Both Younger and Older Adults. DEBORAH K. EAKIN, *Mississippi State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—We evaluated age differences in feeling-of-knowing judgments (FOKs) for targets, given cues varying in associative set size. Data from Eakin and Hertzog (2006) were used which produced cue-set-size effects for recall for both younger and older adults, but were eliminated (1) in the intralist cuing condition for younger adults and (2) in recognition for both cuing conditions for both age groups. FOKs evidenced illusions about predicted recognition that were driven by the pattern of recall outcomes. FOK sensitivity did not reflect the relatively high probability of recognition for unrecalled items under extralist cuing, nor did it track the cue-set-size reversal for intralist cuing. Moreover, FOK accuracy was near chance for both age groups, producing no reliable age differences in FOK accuracy.

(3002)

Knowing We Know Before We Know: EEG Correlates of Initial Feeling-of-Knowing. CHRISTOPHER A. PAYNTER, PAUL D. KIEF-FABER, & LYNNE M. REDER, *Carnegie Mellon University* (sponsored by Lynne M. Reder)—In a replication of Reder and Ritter (1992) that also collected EEG recordings, subjects performed a feeling-of-knowing task in which they had to rapidly determine whether the answer to a math problem was known or whether the answer had to be calculated. Previously unfamiliar math problems were repeatedly tested over the course of the experiment and the feeling of knowing or not-knowing judgment had to be completed in 850 msec (much less time than needed to retrieve the answer itself). ERP analyses uncovered waveform differences between accurate retrieve versus calculate trials as early as 200 msec following onset of the problem. Accurate retrieve trials showed activation primarily in the right hemisphere following problem onset, whereas calculate trials and inaccurate retrieve trials showed activation primarily in the left hemisphere. Theoretical implications are discussed.

(3004)

The Influence of Framing on Children's Metacognitive Judgments. BRIDGID FINN, *Columbia University*, & LISA K. SON, *Barnard College*—Recent evidence suggests that metacognition can be influenced by framing (Finn & Metcalfe, 2007; Koriat, Bjork, Sheffer, & Bar, 2004). Judgments of learning (JOLs) show a diminished overconfidence bias (Finn & Metcalfe, 2007), and are sensitive to varying retention intervals (Koriat et al., 2004) when made within a forget frame rather than a remember frame. Thus far these results have been limited to adults. In this study, children studied synonym pairs and made JOLs within either a remember or a forget frame. They then predicted their performance on a test coming up in either 10 min or in 1 week. The results showed that forget judgments were lower than remember judgments at both the 10-min and 1-week prediction intervals. While remember judgments did not differentiate between the retention intervals, forget judgments were higher for the 10-min prediction than for the 1-week prediction.

(3005)

The Relationship Between Cue Diagnosticity and Judgment Accuracy for Judgments of Text Learning. JULIE M. C. BAKER & JOHN DUNLOSKY, *Kent State University* (sponsored by John Dunlosky)—One explanation for the poor predictive accuracy for judgments of text learning is that the cues that people use to make these judgments are not diagnostic; that is, the cues do not predict criterion test performance. We conducted an experiment to test the hypothesis that cue diagnosticity drives judgment accuracy. Cue diagnosticity was manipulated by varying the similarity between momentary ac-

cessibility and the criterion test. In particular, the criterion tests were either a multiple-choice recognition test or a speeded recall test—the latter most resembled the cue of momentary access. As expected, cue diagnosticity and judgment accuracy were higher for the speeded recall test than for the recognition test.

(3006)

Does Test Expectancy Influence Metacomprehension Accuracy? KEITH W. THIEDE, *Boise State University*, & JENNIFER WILEY & THOMAS T. GRIFFIN, *University of Illinois, Chicago*—In our previous research, we have improved metacomprehension accuracy by providing contexts that get readers focused on their situation model when judging comprehension. We have not, however, examined whether readers can achieve this focus on the situation model on their own, if informed via instructions and practice tests that that is what they should do. To evaluate this possibility, we conducted a study using the standard test-expectancy paradigm. The results showed that metacomprehension accuracy was influenced by test expectancy. Participants who expected an inference test more accurately monitored their performance on the inference tests than did the group that had expected a memory test (memory of details). These findings confirm that readers can focus on the kind of test items that tap the situation model and improve metacomprehension accuracy, if they know what type of tests to expect.

(3007)

Metacognitive Control and Strategy Selection: Deciding to Practice Retrieval During Learning. JEFFREY D. KARPICKE, *Purdue University* (sponsored by David B. Pisoni)—Practicing retrieval is a potent technique for enhancing learning, but do students use retrieval practice when they regulate their learning on their own? Four experiments addressed this question. Subjects learned foreign language word pairs in a multitrial learning task, and long-term retention was assessed on a 1-week delayed test. When learning condition was experimentally manipulated by assigning pairs to be repeatedly tested, repeatedly studied, or removed from practice, repeated testing produced powerful effects on learning and retention. However, when subjects were given control over their own learning and could choose to test, study, or remove pairs, they chose to remove the majority of pairs rather than to practice retrieval, leading to poor retention. The experiments demonstrate an illusion that occurs during self-regulated learning: Fluent processing promotes confidence in one's own learning and leads individuals to terminate practice rather than to self-test, a strategy choice that ultimately results in poor retention.

• DISCOURSE PROCESSES •

(3008)

Memorial Influences on the Fluency of Text Processing. MATTHEW COLLINS & BETTY ANN LEVY, *McMaster University*—Numerous studies have shown that repeated reading of the same text leads to faster and more accurate reading. Known as the text repetition effect, this effect is attributable to a memory representation of the text recruited to facilitate processing upon rereading. However, there is a great deal of debate regarding the nature of the text memory representation. Recently, Raney (2003) has proposed a model suggesting that overlap at the three levels of text representation can account for processing fluency between passages. Consistent with this account, we found that the magnitude of the repetition effect decreased when there was less overlap between passages at the level of the situation model. These results suggest that text representations cannot be described as either strictly abstract or strictly episodic. Rather, it appears that the degree of overlap at each level of representation will determine how much of a repetition benefit there is between passages.

(3009)

Amazing Stories: Does Fictionality Matter in Learning From Text? DANIEL SLATEN, DAVID N. RAPP, & WILLIAM S. HORTON,

Northwestern University (sponsored by David N. Rapp)—Research has demonstrated that readers rely upon fictional stories as sources of information (Marsh, Meade, & Roediger, 2003). Fiction, though, can vary in the degree to which it describes settings, characters, and events that conform with the real world. We investigated the ways in which unrealistic fiction might influence readers' reliance on information embedded in stories, and their attributions of the source of any resulting knowledge. Stories were modified so contexts were far-fetched and fantastical, to examine whether contexts might dissuade readers from relying on information in the stories. Participants completed a test of general world knowledge containing questions about embedded facts; some of these facts were entirely inaccurate or unfamiliar. Despite the contexts, participants' responses suggested that they learned from the texts. Additionally, participants frequently attributed facts that they learned, including misinformation, to their prior knowledge, replicating Marsh et al. This demonstrates the strength with which readers rely on stories as sources of information.

(3010)

Anticipatory Processes During Comprehension of Poetry. JIM L. WOEHRLE & JOSEPH P. MAGLIANO, *Northern Illinois University*, & DAVID N. RAPP, *Northwestern University* (sponsored by Joseph P. Magliano)—Recent research suggests that comprehenders use phonological, semantic, and pragmatic information to anticipate upcoming lexical items in discourse. This experiment examined anticipatory processes during comprehension of rhymed quatrains with fixed rhyme structures (ABAB). Participants read rhymed quatrains that were presented without the final word or without the final one or two lines. Participants had to predict the poem-final word. When participants were presented with the first several lines of the poem, phonological constraints (e.g., number of rhyme possibilities) were the primary determinants of prediction accuracy. However, when presented with the entire poem (missing the final word), both phonological and discourse-level constraints (e.g., semantic overlap of the poem-final word with prior context) influenced prediction accuracy. These results suggest that while anticipatory processes in poetry comprehension can be influenced by both surface-level text properties and discourse-level information, surface-level properties may be of initial import until further discourse is available to the comprehender.

(3011)

How Nonnative Speakers Make Phonetic Adjustments to Partners in Dialogue. JIWON HWANG, SUSAN E. BRENNAN, & MARIE K. HUFFMAN, *Stony Brook University*—Ambiguities arise when nonnative speakers fail to make phonetic contrasts that are absent in their native language. Korean speakers lack the voicing contrast b/p ("mob" vs. "mop") and the vowel contrast ae/E ("pat" vs. "pet"), leading to ambiguous pronunciation of English words. In two referential communication experiments, Korean speakers of English spontaneously pronounced target words (e.g., "mob"). A confederate partner either primed the target words (e.g., asking "What is below 'hob'?" or not, or needed to be able to pragmatically distinguish two contrasting words ("mob" adjacent to "mop" in the array) or not. Korean speakers produced more English-like phonetic targets in both the priming and pragmatic conditions (vowel duration was used to signal both contrasts). Moreover, Korean speakers were primed to make the disambiguating contrast when interacting with an English speaker but not with another Korean speaker of English. Implications for audience design and adaptation in dialogue are discussed.

(3012)

Can Giraffes Go Without Water Longer Than Zhiraffes? The Influence of Accent on Truth Judgment. SHIRI LEV-ARI & BOAZ KEYSAR, *University of Chicago*—Studies have shown that people infer various aspects of stimuli from their relative ease of processing. For instance, stimuli that are easier to process are judged as more familiar, clear, and truthful. Foreign-accented speech is harder to process than unaccented speech. Therefore, we investigated whether it is per-

ceived as less truthful than unaccented speech. Participants rated the truthfulness of trivia statements, such as *Giraffes can go without water longer than camels can*, read by native speakers of American English and nonnative speakers with a mild or a heavy accent. Participants were informed that the speakers read statements that the experimenter provided. Statements were rated as less truthful when read by nonnative as opposed to native speakers. Furthermore, the effect depended on participants' expectations regarding the difficulty of processing accents and the heaviness of the speakers' accents. These results demonstrate that accent has wide implications for the interaction between native and nonnative speakers.

(3013)

Individual Differences in Comprehension Monitoring. YASUHIRO OZURU, CHRISTOPHER A. KURBY, & DANIELLE S. McNAMARA, *University of Memphis*—This experiment investigated whether and how readers monitor expository text comprehension. Participants read a 62-sentence passage on brain functions 1 sentence at a time in three different conditions: judgment of learning, judgment of sentence difficulty, or no judgment. Participants' reading time of each sentence was measured. After reading the passage, participants answered 59 multiple choice questions about the passage content based on memory. The results indicated: (1) high-skill readers' reading time is correlated with objective measures of sentence difficulty; (2) high-skill readers' judgments (learning and difficulty) were correlated with their reading time; (3) readers' judgments do not correspond to actual performance on multiple choice questions based on that sentence; and (4) performing overt metacognitive judgment tasks did not increase accuracy on comprehension questions in comparison with a no-judgment group. The results suggest that comprehension monitoring is a skilled process, but may not contribute to better comprehension in itself.

(3014)

Reading Comprehension: The Relative Contributions of Four Sources of Individual Differences. BRENDA A. M. HANNON, *University of Texas, San Antonio*—Although there has been considerable research demonstrating the separate contributions of lower level processes, higher level processes, working memory, and learning strategies/metacognitive skills to reading performance, at present, no study has compared all four sources simultaneously. As a result, we know little about how these four sources interact (see, e.g., Cornoldi, Beni, & Pazzaglia, 1996; Perfetti, Landi, & Oakhill, 2005) or whether one or all of the sources make separate and important contributions to reading (e.g., Cornoldi et al., 1996; Perfetti, Marron, & Foltz, 1996). The present study begins to address this issue. The results replicated a number of previous findings; however, they also revealed some interesting relationships, such as a negative relationship between repetition and higher level processes. The results also showed that although three of the sources made unique contributions to reading performance, lower level and higher level processes are the most important contributors.

(3015)

The Impact of Visual Availability on Referential Communication in Younger and Older Adults. KATYA A. OTIS & WILLIAM S. HORTON, *Northwestern University*—In referential communication tasks, partners work together to negotiate shared perspectives on task referents. Moreover, prior work has shown that older adults require more negotiation to achieve successful reference than do young adults (Horton & Spieler, in press). Typically, however, partners are prevented from seeing each other, even though eye gaze, head nods, and facial expressions may be important sources of information about understanding, particularly for older adults. We tested the impact of visual availability on communication by manipulating, for separate blocks of trials, whether pairs of younger and older adults could see each other as they matched sets of cards containing both abstract tangrams and caricatures of human faces. Lack of visual availability im-

paired communicative efficiency more for interactions involving tangrams than for those involving caricatures. For older adults, the effect of seeing the partner was particularly pronounced. Direct evidence for the use of visual availability was obtained by examining patterns of mutual gaze.

• SEMANTIC PROCESSING OF WORDS •

(3016)

Measuring Semantic Satiation With a Categorical Matching Task. XING TIAN, *University of Maryland, College Park*, & DAVID E. HUBER, *University of California, San Diego* (sponsored by David E. Huber)—In the subjective experience of semantic satiation, the sense of meaning for a repeated word is progressively lost. However, semantic satiation has proven difficult to measure empirically. Using a category–exemplar speeded matching task, we developed a technique that reliably demonstrates an initial speed-up, followed by a later slow-down when responding to repeated occurrences of the same category label (e.g., MAMMAL), which was paired with novel exemplars from trial to trial (e.g., HORSE for match or APPLE for mismatch). This was achieved within a mixed list of 20 trials that contained 10 repetitions of the same category label and 10 trials with other category labels. The transition from faster to slower responding occurred both for match and mismatch trials. Two follow-up experiments used the same design but with exemplar–exemplar and word–word matching to determine how much of this effect is due to repetitions of meaning versus repetitions of orthography.

(3017)

Multiple, Multiple Primes and the Elimination and/or Reversal of Repetition Priming. JENNIFER H. COANE & DAVID A. BALOTA, *Washington University* (sponsored by David A. Balota)—In two experiments, we explored the functional relationship between the number and type of related primes and lexical activation of targets. On each trial, embedded within a 12-item list, 0 to 12 semantically/associatively and/or orthographically/phonologically related primes preceded (250 msec/item) a single target for speeded pronunciation. On half of the trials, the target was embedded among the primes to assess repetition priming. Facilitatory repetition priming occurred when all other primes were unrelated. An interaction between repetition and semantic priming indicated that repetition priming was eliminated when six or more related primes preceded the target. Form priming and repetition priming yielded interactive, albeit inhibitory, effects: Repetition suppression was obtained for phonologically related lists. These results indicate that semantically related primes can produce asymptotic levels of activation (thereby eliminating the standard repetition priming effect), and form-related and repetition primes synergistically produce inhibition (thereby reversing the standard repetition priming effect).

(3018)

Decay of Automatic Semantic Priming From Visible Unidentifiable Primes in an RSVP Task. PATRICK A. O'CONNOR, JAMES H. NEELY, & JIAH PEARSON-LEARY, *University at Albany*—There is little direct evidence supporting the commonly held belief that semantic activation decays within 500–700 msec. In three RSVP experiments in which visible primes, which were not to be reported, occurred either 80, 240, 720, or 1,360 msec before the to-be-reported target's onset, semantic priming was consistently significant at the 80- and 240-msec delays and never significant at the 1,360-msec delay. Thus, automatic activation may last 720 msec but decays to non-significant levels by 1,320 msec.

(3019)

Examining the Coarse Coding Hypothesis: Evidence From Summation Priming of Lexically Ambiguous and Unambiguous Targets. PADMAPRIYA KANDHADAI & KARA D. FEDERMEIER, *University of Illinois, Urbana-Champaign*—The coarse coding hypothe-

sis postulates that meaning activation is focused in the left hemisphere (LH) but broad and weak in the right (RH). Consistent with coarse coding, some studies report an RH benefit for activating multiple meanings of lexically ambiguous words; however, others have failed to find an RH benefit for processing distantly linked unambiguous words. To address this issue, the present study employed a summation-priming paradigm: Two primes converged onto an unambiguous, lexically associated target (LION–STRIPES–TIGER) or diverged onto different meanings of an ambiguous target (KIDNEY–PIANO–ORGAN). Participants made lexical decisions to targets or made a semantic relatedness judgment between primes and targets. In both tasks, for both triplet types, we found equivalent behavioral priming strengths and patterns across the two visual fields, counter to the predictions of coarse coding. Follow-up ERP studies also fail to support coarse coding, while pointing to other types of hemispheric differences in word processing.

(3020)

The Impact of Target Neighbors in Semantic Priming. YASUSHI HINO, YUU KUSUNOSE, & RURIKA NAKASHIMA, *Waseda University*, & STEPHEN J. LUPKER, *University of Western Ontario*—Recent results suggest that, when reading a word, the meanings of its orthographic neighbors are activated. For example, Bourassa and Besner (1998) reported a priming effect in lexical decision when an orthographic neighbor of a masked nonword prime was related to the target. In our experiments, we investigated the impact of the meanings of the target's neighbors in lexical decision tasks with masked and unmasked primes. Lexical decision performance for katakana word targets was compared in two conditions: when a target neighbor (e.g., *rocket*) was related to the prime (e.g., *missile*–POCKET) and when no target neighbors were related to the prime (e.g., *school*–POCKET). In addition, in order to evaluate the locus of the effect, we also manipulated the relatedness proportion. The results support the conclusions that the meanings of target neighbors are activated and the impact of this activation can be affected by relatedness proportion.

(3021)

The Effects of Cross-Language Activation on Bilingual Lexical Disambiguation. ANA I. SCHWARTZ & LI-HAO YEH, *University of Texas, El Paso*—The present study examined whether cross-language activation influences bilinguals' processing of lexical ambiguity. Highly proficient Spanish–English bilinguals performed a semantic verification task in which sentence frames were followed by the presentation of the final word of the sentence (the prime word). Participants then decided whether a follow-up target word was related to the meaning of the sentence. On critical trials, the sentences ended in a semantically ambiguous word that was either a cognate with Spanish (e.g., *novel*) or a noncognate control (e.g., *fast*). The preceding sentence context biased the subordinate meaning, and targets were related to the irrelevant, dominant meaning (e.g., BOOK; SPEED). Mean reaction times and error rates were greater when the prime words were ambiguous cognates, suggesting that the semantic representations from the native language were coactivated and increased the competition from the shared, dominant meaning. Implications for current models of reading are discussed.

• SPEECH PERCEPTION •

(3022)

The Time Course and Nature of Listeners' Sensitivity to Indexical Information During Word Recognition. MOLLY ROBINSON & BOB McMURRAY, *University of Iowa* (sponsored by Shaun P. Vecera)—Word recognition is sensitive to noncontrastive acoustic detail such as speaker identity. Episodic models explain this with lexical entries defined by exemplars that include speaker-specific and phonetic codes. Alternatively, such effects could arise from a purely phonetic lexicon if recognition was calibrated to voices (normalization). These models were distinguished in a series of visual world experiments. The pri-

mary experiment used cohort pairs (*windmill/window*), familiarizing only one member in a given voice. Then eye movements were monitored while subjects identified words from a screen containing target, cohort, and unrelated pictures. When hearing the familiar voice, normalization models predict heightened early activation for target and cohort, since experience with *wind-* applies to both. Episodic models predict bias only to words previously heard. The fixations roughly followed an episodic pattern, but only after the disambiguation point (*/m/* in *windmill*). Thus, unlike both models, indexical information may facilitate perception of sublexical units (not words).

(3023)

Prosodic Influences on Segmental Context Effects: An Analysis of Neural Dynamics. DAVID W. GOW, JR. & JENNIFER A. SEGAWA, *Massachusetts General Hospital*—The structure of spoken language is organized around a hierarchy of units ranging from feature cues to words, phrases, sentences, and discourses. Gow's (2003) feature cue parsing theory suggests that perceptual grouping or unitization processes produce progressive and regressive perceptual context effects in the perception of assimilated speech. In the present work, we explore the role of higher order prosodic boundaries in this unitization process. We examined the neural dynamics that produce or block assimilation context effects, using a multimodal imaging strategy involving fMRI, MEG, EEG, and anatomical MRI data and analyses of gamma phase locking and Granger causation. These analysis tools allowed us to identify activation dependencies between ROIs making up a large distributed cell assembly responsible for different elements of spoken language processing. The results are discussed in the context of the general problems of unitization and the integration of multiple representations in speech perception.

(3024)

The Role of Orthography in Spoken Word Recognition. LARISSA J. RANBOM & CYNTHIA M. CONNINE, *Binghamton University* (sponsored by Cynthia M. Connine)—Two experiments investigated the role of orthography in the representation and processing of spoken words. The experiments capitalized on English spelling conventions, which can include letters that are not pronounced in the spoken form (i.e., the *t* in *castle*). Processing of silent-letter words pronounced with and without the silent letter (e.g., *castle* pronounced with or without a */t/*) was compared with control words with no silent letter (e.g., *hassle* pronounced with or without a */t/*). In Experiment 1, a same/different task for words pronounced correctly or with the inserted phoneme showed greater confusability for the silent-letter words (e.g., when the inserted phoneme matched the orthography) than for the controls. In Experiment 2, equivalent priming effects were found for the correct and segment-added pronunciation only for silent-letter words. We suggest that phonological representations computed from an orthographic form are represented in the lexicon and are active during spoken word recognition.

(3025)

Years of Exposure to English Predicts Perception and Production of /r/ and /l/ by Native Speakers of Japanese. ERIN M. INGVALSON, *Carnegie Mellon University*, JAMES L. McCLELLAND, *Stanford University*, & LORI L. HOLT, *Carnegie Mellon University*—Length of residency (LOR) in a second language (L2) environment is a reliable predictor of overall L2 proficiency. We examined whether LOR in an English-speaking society would predict native Japanese (NJ) speakers' proficiency with English /r/ and /l/, notoriously difficult sounds for NJ speakers. NJ participants with under 2, 2–5, or 10+ years of residency were assessed on perception and production of /r/ and /l/ plus other proficiency and exposure variables. Of interest was onset frequency of the third formant (*F3*), the most reliable cue differentiating English /r/ and /l/ but one that is very difficult for native Japanese. Longer LOR was associated with greater reliance on *F3*, and *F3* weighting was correlated with rated English-like production. Reliance on *F3* approached native levels for some in the longest

LOR group, suggesting that adult plasticity extends to some of the most difficult aspects of L2 proficiency.

(3026)

Apparent Lexical Compensation for Coarticulation Effects Are Due to Experimentally Induced Biases. ALEXANDRA JESSE & JAMES M. McQUEEN, *Max Planck Institute for Psycholinguistics*, & DENNIS NORRIS, *MRC Cognition and Brain Sciences Unit*—An empirical pillar of the interactive view of speech perception (McClelland et al., 2006) is the evidence of apparent top-down influence of lexical knowledge on compensation for coarticulation. Magnuson et al. (2003), for example, showed that lexical knowledge about an ambiguous fricative (“sh” not “s” forms a word in “bru?”) appeared to change perception of a following ambiguous plosive (more “t” responses in “bru?-?apes”), like hearing an unambiguous fricative would. A series of phonetic-categorization experiments with the Magnuson et al. materials show that their result was due to experimentally induced response biases rather than lexical knowledge. The direction of the effect varied as a function of the probability of word (*bliss/brush*) and nonword (*blish/bruss*) trials during practice. With these probabilities equated, no lexical compensation for coarticulation effect was found. These findings suggest that speech perception is not interactive, and that listeners are sensitive to biases created by only 16 practice trials.

(3027)

Gradient Sensitivity to Continuous Acoustic Detail: Avoiding the Lexical Garden-Path. BOB McMURRAY, *University of Iowa*, & RICHARD N. ASLIN & MICHAEL K. TANENHAUS, *University of Rochester* (sponsored by Richard N. Aslin)—Spoken word recognition is gradiently sensitive to cues like voice onset time (VOT; McMurray, Tanenhaus, & Aslin, 2002). We ask how long such detail is retained and whether it facilitates recognition. A lexical garden-path paradigm used pairs such as *barricade/parakeet*. If voicing were ambiguous, the system must wait considerable time to identify the referent. VOT was varied from the target (*barricade*) to a garden-path inducing nonword (*parricade*). If VOT is retained, it could facilitate reactivation at the point-of-disambiguation (POD). However, if it was lost, there should be no effect of VOT on disambiguation. Using eyetracking, we examined cases where listeners overtly committed (fixated) the competitor prior to the POD. Recovery time was linearly related to VOT. This replicated when the screen did not contain the competitor. Thus, sensitivity to continuous acoustic detail persists and can facilitate online recognition. TRACE can only model this under restricted parameter sets, suggesting important constraints on this model.

(3028)

Word Segmentation in the “Real World” of Conversational Speech. JOSEPH D. W. STEPHENS & MARK A. PITT, *Ohio State University*—Language comprehension requires segmentation of continuous speech into discrete words. An understanding of the problems faced by the perceptual system during segmentation can be gained from analyses of corpora of spontaneous speech. Analyses of phonetic transcriptions of the Buckeye Corpus were used to define the problem in detail. The results revealed that in some high-frequency environments (e.g., following schwa), acoustic and phonetic information was ambiguous in the location of word boundaries. Experiments were then performed to investigate how listeners resolve these ambiguities. In line with the work of Mattys et al. (2005), the results suggest that contextual information drives segmentation because strong acoustic cues to word boundaries are often absent.

(3029)

Effects of Nonspeech Contexts on Speech Categorization: A Critical Examination. NAVIN VISWANATHAN, JAMES S. MAGNUSON, & CAROL A. FOWLER, *University of Connecticut and Haskins Laboratories*—On the general auditory account of speech perception, compensation for coarticulation results from spectral contrast rather than

from true phonetic compensation (Diehl, Lotto, & Holt, 2004). Numerous findings showing that speech and analogous nonspeech contexts produce similar effects on following speech support this claim (Lotto & Kluender, 1998). However, the nonspeech precursors differ from their speech counterparts in three crucial ways. First, their intensity is matched to syllable intensity rather than the (lower) intensity of the formant they are meant to represent; second, they typically reflect the final state of the formant rather than its trajectory (but see Lotto & Kluender, 1998); third, they are presented in isolation, rather than in the context of other formants present in speech. In our experiments, as we incrementally match tones to natural speech along these dimensions, context effects diminish. This suggests that conditions for spectral contrast may not always be present in natural speech.

(3030)

Individual Differences in Foreign-Language Phoneme Perception and Production. VERA KEMPE, *University of Stirling and University of Abertay*, JOHN C. THORESEN, *University of Durham*, & PATRICIA J. BROOKS, *City University of New York*—This study explores individual differences in perception and production of nonnative phoneme contrasts by adults. In Experiment 1 ($N = 79$), American English speakers performed same–different judgments on pairs of Norwegian words differing only with respect to tone, and Russian words differing in palatalization. The results showed that males outperformed females in sensitivity to tonemes, but not to palatalization. Experiment 2 ($N = 64$) replicated the task with Scottish English speakers, and measured phoneme production accuracy, which was correlated with perception measures. Regression analyses indicated that the strongest predictor of Norwegian toneme sensitivity was need for cognition (a measure of cognitive motivation), whereas the strongest predictor for the Russian palatalization sensitivity was verbal working memory capacity. Crucially, the gender difference in perception was replicated. Given that Norwegian tonemes differ in pitch contours, our findings are consistent with research documenting superior binaural perception of nonlinguistic pitch contours in males (McRoberts & Sanders, 1992).

• PSYCHOLINGUISTICS •

(3031)

The Lexical Semantics of Hitting and Breaking. JESSICA LOVE & GAIL MCKOON, *Ohio State University* (sponsored by Gail McKoon)—The lexical semantics of two types of verbs is examined in four psycholinguistic experiments. Verbs of hitting/touching are compared with verbs of externally caused change of state (e.g., *break*). The comprehension times are collected for these verbs in three different constructions: in acceptable transitive sentences, in acceptable intransitive sentences, and in unacceptable transitive sentences. We also present these verbs in a lexical decision experiment. The data are interpreted in terms of event templates—that is, semantic representations of the type of event a verb can denote. We find that the verbs of hitting/touching, with their simple activity template, are processed more quickly than the verbs of externally caused change of state in all constructions, as well as in lexical decision.

(3032)

Verb Semantics and a Reversed ACE. XU XU & MEGAN TAYLOR, *Pennsylvania State University, Harrisburg*—Recent studies demonstrated an action-sentence compatibility effect (ACE). Participants made sensibility judgments on sentences describing simple actions. When the depicted action was in the same direction as the arm movement required for making the judgments, they responded faster. ACE suggests that language processing involves sensorimotor simulation of the events being described. These studies mainly manipulated the syntactical role of “you” to depict actions toward/away from participants (e.g., *Diane threw you the pen/You threw Diane the pen*). This experiment further investigated the process of sensorimotor simulation by exploiting verb semantics but controlling syntax (e.g., *You*

threw the ball/You caught the ball). A reversed ACE was found: Participants responded faster when the depicted action was in the opposite direction of the action required to respond. The finding may suggest different timing of constructing simulations when processing these sentences from those in previous studies. The timing may be established during the tasks.

(3033)

Verb Aspect, Event Structure, and Pronoun Interpretation: An ERP Investigation. TODD R. FERRETTI, *Wilfrid Laurier University*, HANNAH ROHDE, *University of California, San Diego*, MELANIE CRUTCHLEY, *Wilfrid Laurier University*, & ANDREW KEHLER, *University of California, San Diego*—We investigated the interpretation of pronouns following sentences containing transfer-of-possession verbs marked with either imperfective or perfective aspect (e.g., *Amanda was shifting/had shifted some poker chips to Scott. He/She counted the stack*). The second sentence described a plausible subsequent event. Following perfective sentences, pronouns with a *source* referent elicited brain potentials that were more negative at left anterior locations than pronouns with a *goal* referent, and such pronouns also elicited more positive amplitudes at posterior locations (consistent with a P600 or “SPS”). Following imperfective verbs, *source* pronouns elicited greater anterior negativity than *goal* pronouns, but this effect had broader distribution and a later onset than in the perfective condition. These results are consistent with recent research showing that pronouns are preferentially interpreted to refer to the *goal* when *occasion* coherence relations are used, and that this bias is greater for perfective than imperfective aspect.

(3034)

Classifier Use by Adult Speakers of Mandarin Chinese, Hmong, and Japanese. MARIA D. SERA, DINGCHENG LI, NOBUKO DAVIS, JUDY FULLER, JAMES STEVENS, & CHRIS BATTEEN, *University of Minnesota*—Classifier languages divide nouns into groups, thus offering a vantage point from which to better understand human categorization. However, virtually no experimental evidence exists on the use of classifiers. In this study, 36 adult speakers of Mandarin Chinese, Hmong, and Japanese provided classifiers for the 136 most common English nouns. We found differences among the language groups in the number and structure of the noun classes formed. In Chinese and Japanese, 9–12 different classifiers were used with most nouns, whereas in Hmong only 2 classifiers were used. The classes also differed. For example, Chinese speakers used one classifier for animates and a different one for humans, Hmong speakers used one classifier for both animals and humans, and Japanese speakers used three different classifiers for animals. The results offer reference points from which to study the relation between language and categorization across speakers of different classifier languages.

(3035)

ERP Correlates of Reference Resolution in Discourse. VEENA A. NAIR, AMIT ALMOR, & JENNIFER M. C. VENDEMIA, *University of South Carolina* (sponsored by Amit Almor)—The repeated name penalty (RNP) is the slower reading of repeated proper name anaphors when referring to the most salient antecedent in the discourse relative to less salient antecedents. Most current theories of anaphor processing attribute the RNP to integrative discourse processes that are involved in the generation and updating of discourse representations. Several recent ERP studies (e.g., Ledoux et al., in press; Swaab et al., 2004) have found that reading a repeated proper name anaphor elicits a larger N400 when the antecedent is salient than when it is not. This suggests that the integrative processes underlying the RNP are initiated immediately. However, the implications of these findings are not entirely clear because these studies only looked at anaphoric relations within sentences. The experiment we report here aimed to extend this research by examining whether similar ERP responses are elicited by reading anaphors whose antecedents are in a previous sentence.

(3036)

Perception of Speakers Using Nonliteral Language in Conversation. KAREN A. HUSSEY & ALBERT N. KATZ, *University of Western Ontario*—We produced a set of conversations between two people and then altered them such that only one member of each dyad used either nonliteral language (conventional or unconventional) or communicated literally. A new sample of participants read portions of these conversations and, after each, rated them along a set of dimensions (e.g., direct–indirect, succinct–elaborative) and made confidence judgments about the gender of the speakers and whether the interlocutors were friends or strangers. When using unconventional nonliteral language, one is perceived as more likely to be male and speaking to a friend, and to communicate in an elaborate and self-focused manner. A second study with only literal speakers identified by strong gender-linked names indicated that the effects were based on nonliteral language use and not just perceptions of gendered-language production. These findings provide support for nonliteral language as distinct from literal language on the basis of discourse and situation goals.

(3037)

Detection of Plausibility Violations Inside and Outside of Theta Relations. TESSA WARREN, AMANDA VIRBITSKY, & KERRY MCCONNELL, *University of Pittsburgh*—Recent investigations into plausibility violation detection have increased our understanding of the role and timing of availability of different kinds of information during language comprehension (e.g., Hagoort, Hald, Bastiaansen, & Petersson, 2004; Nieuwland & Van Berkum, 2006; Warren & McConnell, in press). The present eyetracking study used plausibility violations to investigate whether the structural/semantic relationships between words in a sentence influence the speed with which they are integrated into a semantic interpretation. Integration may be faster between words that establish the basic semantic who-did-what-to-whom in an event (i.e., participate in theta-assignment, like a verb and its object) than between words that do not (e.g., two participants in the same event). The results suggested that similarly severe plausibility violations were detected along the same time course regardless of whether they occurred within a theta-assigning relation or not, suggesting that semantic interpretation is not faster within theta-assigning relations.

(3038)

Evaluating the Evidence for Recursion in Animals. CURT BURGESS & ALLISON KAUFMAN, *University of California, Riverside*—Hauser, Chomsky, and Fitch (2002, *Science*, hereafter HCF) propose “a faculty of language in the broad sense” (FLB) and “a faculty of language in the narrow sense” (FLN). They claim that the FLN, which consists of the ability to understand recursive grammatical structures, is the current defining characteristic of human language. HCF have brought the issue to the forefront of the language debate. However, HCF’s discussion of recursion neglects several research programs that have demonstrated evidence for recursion in several animal species (e.g., Byrne & Byrne, 1993; Pepperberg, 1992; Savage-Rumbaugh et al., 1993). We contend that these studies, along with another published later (Gentner et al., 2006), provide evidence that falsifies HCF’s hypothesis. We will discuss these studies, possibilities for recursion in other published studies, and our efforts in uncovering recursion in our own research program, which involves high-dimensional linguistic modeling of marine mammal vocalizations.

(3039)

Comparing the Online Interpretation Processes of Metaphors and Similes. CARLOS RONCERO, *Concordia University*, JOHN M. KENNEDY & RON SMYTH, *University of Toronto*, & ROBERTO DE ALMEIDA, *Concordia University* (sponsored by John M. Kennedy)—Metaphors take the form “topic *x* is vehicle *y*” (e.g., “life is a journey”). Similes add “like” (e.g., “life is like a journey”). Metaphors are preferred to similes when the comparison seems apt (Chiappe et al., 2003). A reading experiment (self-paced moving-window paradigm) tested online interpretation of metaphors and similes followed by explana-

tions—for example, “John says life is (is like) a journey because it has many directions.” Vehicles were read faster in metaphors than in similes. Explanations (“it has many directions”) were slower in similes than in metaphors. The results suggest that participants expect metaphors to be apt (thus not requiring careful reading of an explanation), but similes will require an evaluation of the conditions under which the topic is compared to the vehicle.

(3040)

Number Attraction and the Mismatch Asymmetry: Reaction Time Evidence for Competition. ADRIAN STAUB, *University of Massachusetts, Amherst* (sponsored by Charles Clifton)—Speakers frequently make number attraction errors in which a verb agrees in number with a local noun (Bock & Miller, 1991). The present research tested Haskell and MacDonald’s (2003) proposal that such errors arise from mutually inhibitory competition between verb forms. In two experiments, participants made a speeded choice of a verb form after reading a subject phrase. There was a significant number attraction effect, and replicating previous research, this effect was larger with a plural local noun (the mismatch asymmetry). An attracting local noun also slowed responses, with more slowing when this local noun was plural. None of the effects depended on the adjacency of the local noun and the verb. These results support a competition account of the production of number agreement. They also argue against accounts of the mismatch asymmetry that propose qualitative differences in the representation of singular and plural number (e.g., Eberhard, 1997).

• TASK SWITCHING •

(3041)

Understanding the “Task” in Task Switching. SUSAN M. RAVIZZA, *University of California, Davis*—Task switching abilities are assessed in a variety of ways across studies with little regard to what types of representations or processes are being switched. These experiments provide evidence for two dissociable types of switches—shifts of visuospatial attention (perceptual switches) and shifts in task-relevant information (contextual switches). Contextual switches incur a shift cost even in the absence of a competing task set, and shift cost can be completely abolished with enough preparation time. In contrast, perceptual shift costs are entirely driven by effects of the competing stimulus set, and a shift cost remains even with ample time to prepare. Taken together, these experiments suggest that task switching is not simply one cognitive process, but that behavioral effects depend on the type of shift that is performed.

(3042)

The Electrophysiological Study of Different Types of Task Switching. SHULAN HSIEH, RODERIK GERRITSEN, HANJUNG LIU, & CHI-CHIH CHANG, *National Chung Cheng University*—This study aimed to examine whether different types of task switching would modulate different components of event-related potential (ERP). The present study recorded ERPs while participants switched either between different stimulus dimensions or between different judgments. Each participant performed four sessions with each of two types of tasks: two sessions where the judgment was held constant and the relevant stimulus dimension could switch, and two sessions where the stimulus dimension was held constant and the type of judgment could switch. The behavioral data showed that mean reaction time for switch trials was slower than for repeat trials and the difference (switch cost) was larger for judgment than for stimulus dimension switch. The electrophysiological data showed that whereas stimulus dimension switch modulated an earlier component of ERPs, judgment switch, conversely, modulated a later component of ERPs. The results of the present study thus suggest that there may be different mechanisms involved in task switching.

(3043)

Instruction Effects in Task Switching. IRING KOCH, *RWTH Aachen University*—The aim of the present study was to examine the effect of

instructions on sequential task preparation in task switching. To this end, a three-task cuing paradigm was devised in which both switches and repetitions were predictable. Experiment 1 manipulated predictability (predictable vs. random) while preparation time (i.e., cue–stimulus interval, CSI) remained constantly short. Experiment 2 manipulated CSI in predictable sequential transitions. Both experiments showed clear instruction effects, but these were restricted to task repetitions, for which sequential predictability determined the identity of the upcoming task. Predictability effects were small in task switches, and they were not modulated by instruction, suggesting that preparation is mainly task-specific rather than switch-specific. Together, the experiments suggest that intentional processes contribute to predictability benefits in task repetitions, probably by enhancing the monitoring of sequential task transitions in working memory in order to maintain task activation in task repetitions.

(3044)

Advance Reconfiguration Prior to Probe Onsets in Voluntary Task Switching. BAPTIST LIEFOOGHE, EVELYNE LAGROU, FREDERICK VERBRUGGEN, ANDRÉ VANDIERENDONCK, & ROBERT HARTSUIKER, *Ghent University* (sponsored by Robert Hartsuiker)—In the voluntary task-switching paradigm, Arrington and Logan (2005) introduced a procedure in which participants selected a task when a probe was presented, prior to the stimulus onset. They observed preparation effects prior to stimulus onsets which suggest the presence of advance task-set reconfiguration. The present study investigated when participants started such reconfiguration by focusing on preparation effects prior to probe onsets. More specifically, we tested whether participants engaged advance reconfiguration when sufficient time was provided between the response on a previous trial and the probe onset. Preparation effects prior to probe onsets were observed for predictable probe onsets (Experiment 2) but not for unpredictable probe onsets (Experiment 1). These findings are consistent with the hypothesis that advance reconfiguration prior to probe onsets is possible, albeit under certain conditions. We suggest that advance reconfiguration prior to probe onsets does not occur with unpredictable probe onsets as a result of the high demands associated with advance reconfiguration under such conditions.

(3045)

Stimulus–Task Associations and Response Competition in Task Switching. SUSAN LAGRONE & DANIEL H. SPIELER, *Georgia Institute of Technology*—Task switch costs may be influenced by prior stimulus–task associations (Rogers & Monsell, 1995). Using picture-word stimuli, we replicated the finding that prior stimulus–task associations influence switch costs (Waszak, Hommel, & Allport, 2003). In a second experiment, we used a task that did not have the significant response competition component present in processing picture-word stimuli. We manipulated prior stimulus–task associations by having participants make two possible semantic judgments (animacy and size) on word stimuli. In this case, stimulus–task associations had no influence on task switch costs. These results suggest that prior stimulus–task associations may exert an influence on task switching performance primarily in situations with significant response competition.

(3046)

Task Preparation and Transition Frequency: Characterizing Preparation Through Previous Trial Control Demands. ANITA D. BARBER & WALTER S. SCHNEIDER, *University of Pittsburgh and Center for the Neural Basis of Cognition* (sponsored by Christian Schunn)—Recent studies have found that the preparatory switch cost is reduced when switch frequency is high relative to repeat frequency (Logan & Schneider, 2006; Monsell & Mizon, 2006). However, other studies have found that switch frequency does not affect the switch cost, but instead causes a general increase in RT on all trials (Reynolds, Brown, & Braver, in press; Schneider & Logan, 2007). Presently, two experiments manipulated switch frequency to determine whether switch preparation is selectively influenced or whether general task preparation is affected. Task frequency was also manip-

ulated to examine whether previous trial switching affects frequent and infrequent trials similarly. It was found that a previous trial task switch increased RT for the current trial regardless of whether the current trial was a switch or repeat. For infrequent trials, the previous switch type had little effect on task preparation. A model of switch frequency effects on task preparation is presented.

(3047)

Exploring the Characteristics of Tool-Associated Transformation Rules in a Tool-Switching Paradigm. MIRIAM LEPPER, CRISTINA MASSEN, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—In tool use, we have to realize the tool-specific transformation rule that transforms our bodily movement (action) into the desired tool movement (effect). Our participants had to switch between tool-use actions: They had to open or to close tools. Depending on the tool structure, the tool-associated transformation rule was either compatible (bodily movement = tool movement) or incompatible (bodily movement ≠ tool movement). For the compatible transformation rule, we found rule priming effects that were independent from movement repetitions/switches. For the incompatible transformation rule, however, the benefit of rule priming was present only for movement repetitions. We argue that the compatible transformation rule is represented as a default set of natural action–effect associations. Priming of this default set leads to a benefit on action. For the incompatible transformation rule, action–effect associations are artificial and have to be computed anew in each trial. Therefore, only priming of concrete action–effect associations is beneficial.

• SELECTIVE ATTENTION •

(3048)

When You're Not Sure What You're Looking For: Visual Search Under Conditions of Uncertainty. MONICA S. CASTELHANO, *Queen's University*, & ALEXANDER POLLATSEK & KYLE R. CAVE, *University of Massachusetts, Amherst*—What if you're looking for something, but don't know what it looks like? Participants search for an object when shown either the target's picture or name (basic-level category). Targets were either a typical or an atypical category member. There was no typicality effect when searching for a picture target. For named targets, there was a modest gain in the latency to fixate the target for typical items. However, the bulk of the typicality effect for named targets was in "verification time": After initially fixating the target, there were more fixations to distractors and longer gaze durations on atypical target items. Thus, most of the effect of object typicality on the search is in verifying that the target matches the category label, not in the original selection of target candidates.

(3049)

Shifts of Attention Between Two Objects During Spatial Relationship Judgments. STEVEN L. FRANCONERI, *Northwestern University*—The ability to judge spatial relationships among objects in the world is a fundamental part of visual processing. Although these judgments can be attentionally demanding, as demonstrated by inefficient visual search for targets defined by a spatial relationship, there is little evidence of why. We asked participants to report whether displays contained a red square on the left of fixation and a green square on the right, or the opposite arrangement. Using ERP, we measured a high temporal resolution trace of horizontal shifts of attention, by examining the difference over time between left and right electrode sites over visual cortex. Each participant shifted attention between objects starting 150 msec after display onset, and the order and timing of shifts differed among subjects. Despite the feeling that we apprehend spatial relationships between two objects by attending to both at once, these results suggest that these judgments have a serial component.

(3050)

Asymmetric Flanker Compatibility Effects Become Symmetric Across Space. JEFFREY R. W. MOUNTS, *SUNY, Geneseo*, JASON S.

MCCARLEY, *University of Illinois, Urbana-Champaign*, & CLAIRE E. LITTLEFIELD, YUSUKE YAMANI, CHRISTINE M. KEMP, & JEFFREY L. THOMSON, *SUNY, Geneseo*—Certain pairs of stimuli yield asymmetric RT patterns in visual search. Specifically, targets defined by the presence of a unique feature (e.g., a Q among Os) are found more efficiently than targets defined by the absence of a feature (e.g., an O among Qs). Horstmann et al. (2006) showed similar asymmetries in flanker tasks, with targets defined by the presence of a feature yielding weaker flanker compatibility effects than targets defined by the absence of a feature. To examine the basis of this asymmetry, we manipulated the separation between color-cued target and flanker items embedded among gray filler items. Data showed that asymmetrical compatibility effects were most pronounced at small target-flanker separations, and further analyses suggested that the asymmetry was the result of spatially mediated competitive interactions between the target and flanker. Specifically, flankers possessing the defining feature compete more strongly for spatially localized attentional resources, thus producing stronger interference.

(3051)

Attentional Mechanisms in Simple Visual Detection. CHARLES C. LIU & PHILIP L. SMITH, *University of Melbourne* (sponsored by Philip L. Smith)—Recent spatial cuing studies suggest that detection sensitivity can be enhanced by the allocation of attention. These results are ambiguous, however, because cuing effects could be due to uncertainty reduction rather than signal enhancement. In displays with no uncertainty, cuing effects are observed only if the target is backwardly masked—a phenomenon known as the mask-dependent cuing effect. We investigated this effect in four experiments using the response signal paradigm. When targets were unmasked, cues failed to improve detection accuracy when uncertainty was eliminated (Experiment 1), but large cuing effects were obtained when uncertainty was present (Experiment 2). When targets were masked, stronger cuing effects were obtained with a backward pattern mask (Experiment 3) than with a simultaneous noise mask (Experiment 4). Despite some individual differences, the mask-dependent cuing effects were not due solely to an external noise exclusion mechanism.

(3052)

How Reward Changes Visual Search. CLAYTON HICKEY & JAN THEEUWES, *Vrije Universiteit Amsterdam* (sponsored by Jan Theeuwes)—Human behavior is guided by environmental feedback; when we find that our performance results in a positive outcome, we are likely to continue to act in a similar manner. In this poster, we present results suggesting that this conditioning plays an important role in guiding attention in visual search. Participants completed a task based on the additional singleton paradigm. Each correctly performed trial was followed by either a large or a small reward. When a trial was followed by a high reward, the attentional set established for that trial appeared to be reinforced, as evidenced by fast responses in the next trial when the same attentional set was required. No such reinforcement was found following low-reward trials, with some subjects showing a propensity to abandon the set that resulted in less reward. These results suggest that reinforcement plays a critical role in the establishment and maintenance of attentional set.

(3053)

Control of Spatial Shifts of Attention in the Auditory Modality. JESSICA J. GREEN & JOHN J. McDONALD, *Simon Fraser University* (sponsored by John J. McDonald)—Recently, we reconstructed the timing and anatomical sources of brain activity associated with attentional control in vision. Occipital, parietal, and frontal cortices were activated in succession within 500 msec of a signal to shift attention. Parietal and occipital areas were then reactivated in succession prior to the appearance of a visual target. Here, we investigated whether an analogous sequence of activations would occur during shifts of attention in the auditory modality. An auditory cue was used

to direct attention to the likely location of an impending auditory target. We examined beamformer sources of low-frequency electroencephalographic activity during the cue-target interval. Attentional control was associated with the same sequence of parietal and frontal activations found in vision, except that anticipatory biasing was seen in auditory, rather than visual, cortex. These results suggest that a single cortical system mediates voluntary control of spatial attention in the auditory and visual modalities.

(3054)

Attention Capture in the Face of Changing Attentional Control Settings. MEI-CHING LIEN, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & JAMES C. JOHNSTON, *NASA Ames Research Center*—Studies have shown that the involuntary capture of spatial attention by objects is contingent on whether their properties match what a person is looking for (top-down control). Even salient objects often fail to capture attention when they do not match top-down attentional control settings. In most previous studies, however, control settings were fixed. What happens in the real-world case where settings change moment by moment? Does the current setting determine what captures attention, or is there hysteresis for the previously used setting? Do changes in control settings make the attentional system more vulnerable to capture by salient objects? New experiments, using color as the top-down control property, showed that attentional capture is contingent primarily on the current attentional settings. Attention was captured neither by abrupt onsets nor by boxes in the nontarget color relevant on the very last trial. People have a remarkable ability to flexibly adjust attentional control settings.

(3055)

Attentional Preference in Selective Reaching: Location Versus Response Efficiency. TIM WELSH, *University of Calgary*, & MICHELE ZBINDEN, *ETH*—Tipper, Lortie, and Baylis (1992) found that distractors between the home position and the target caused more interference in a selective reaching movement than distractors farther from the home position. Based largely on this “proximity-to-hand” effect, Tipper et al. proposed that attention can be distributed in an action-centered framework such that the interference caused by a specific stimulus is dependent on the to-be-performed action. The purpose of the present experiment was to determine whether there is an attentional preference for stimuli close to the starting position of the reach (“proximity-to-hand” effect) or for stimuli that afford more efficiently executed actions regardless of location. The results support an attentional preference for the most efficient response, since the largest interference effect was observed when the distractor afforded an action with a lower index of difficulty than the target, even though that distractor was farther from the home position than was the target.

• AUTOMATIC PROCESSING •

(3056)

Within- and Between-Hands Simon Effects for Object Locations and Graspable Components. DONGBIN CHO & ROBERT W. PROCTOR, *Purdue University* (sponsored by Robert W. Proctor)—Three experiments examined the Simon effect for stimulus locations and graspable object components as a function of whether responses were made with fingers on the same or different hands. When the relevant dimension was stimulus color, the Simon effects for irrelevant dimensions of stimulus location and side of a frying pan handle were of similar size for the within- and between-hands response conditions. However, the between-hands Simon effect was larger than the within-hands effect when upright-inverted orientation judgments were made for the frying pan. This difference was not evident when the handle was disembodied, or separated, from the body of the frying pan. These results suggest that both relative position of the object part and a grasping affordance contribute to performance when responses to an object property are made by different hands.

(3057)

Influence of Intermixed Emotion-Relevant Trials on the Affective Simon Effect. YANMIN ZHANG & ROBERT W. PROCTOR, *Purdue University* (sponsored by E. J. Capaldi)—“Good” and “bad” responses are faster when an irrelevant emotional stimulus feature corresponds with the response than when it does not (the affective Simon effect). Two experiments investigated how this effect is influenced by an intermixed emotion-relevant task. In Experiment 1, four schematic faces (friendly, happy, hostile, sad) were used for the affective Simon task and four different images (bird, heart, gun, ghost) for the emotion-relevant task, whereas in Experiment 2 the schematic faces were used for both. Mixed compatible emotion-relevant trials increased the affective Simon effect in both experiments, but mixed incompatible emotion-relevant trials did not influence it. This result differs from that obtained when location-relevant and location-irrelevant tasks are mixed. It suggests that the enhancement of the affective Simon effect observed when the Simon task is mixed with a compatible emotion-relevant task is due specifically to correspondence of stimulus affect with response affect.

(3058)

Top-Down Control in Pop-Out Search: ERPs Indicate Dimension-Based Top-Down Selection. ANNA SCHUBÖ, *LMU Munich*, CRISTINA MEINECKE, *University of Erlangen*, ERICH SCHRÖGER, *University of Leipzig*, & HERMANN J. MÜLLER, *LMU Munich*—Salient pop-out elements are thought to be detected automatically, yet there is a debate on the role of top-down processes in pop-out selection. We investigated such top-down influences in a search task in which observers had to detect a pop-out target in a specific dimension (e.g., orientation) while ignoring a pop-out nontarget in another dimension (e.g., color; assignment balanced). Event-related potentials were recorded separately for pop-out targets and nontargets and for target-absent trials. We observed an enhanced N2p, indicative of pop-out selection, for targets, but no difference between nontarget and blank trials, indicating similar processing in the latter conditions. However, when observers had to search for a specific target feature (e.g., green) rather than a dimension, some N2p enhancement was also observed for a nontarget feature in the same dimension. These results argue in favor of a strong top-down influence on pop-out selection that operates on dimensions rather than on features.

(3059)

Playing Chess Unconsciously: Only Experts Reveal Subliminal Priming of Conjunction Stimuli. ANDREA KIESEL & CARSTEN POHL, *University of Würzburg*, WILFRIED KUNDE, *University of Dortmund*, & MICHAEL P. BERNER & JOACHIM HOFFMANN, *University of Würzburg*—Experts in a field process task-relevant information more efficiently than do novices (Reingold et al., 2001). Here, we demonstrate that chess experts detect unconsciously whether a briefly presented chess situation entails a checking configuration. Thereby, two features—identity and location—of the chess figures had to be integrated. In a subliminal priming experiment, chess experts but not novices revealed unconscious priming effects. For novices, conscious awareness seems to be a prerequisite for more complex visual processing. However, contrary to current views (Engel & Singer, 2001), experts revealed priming effects for unconsciously presented conjunction stimuli if these stimuli were well-trained chess configurations. We conjecture that experts acquired templates—that is, visual memory episodes—for chess configurations in which the respective features are already bound. These templates enable complex visual processing outside of conscious awareness.

(3060)

The Persistence of Automatic Vigilance for Negative Stimuli. SABRINA SIMMONS & ZACHARY ESTES, *University of Warwick* (sponsored by Zachary Estes)—Negative stimuli hold attention longer than other stimuli (automatic vigilance). Because negative stimuli draw attention to their valence, other stimulus properties are processed more slowly. Therefore, negative stimuli elicit slower re-

sponses on a range of cognitive tasks. We tested whether negative vigilance is truly automatic. If so, then it should persist across repeated presentations of the same stimulus. In Experiment 1, negative words elicited slower lexical decisions than positive words on each of three repeated presentations. However, response times did not asymptote by the third block. In Experiment 2, response times asymptoted by the tenth stimulus repetition, with the negative asymptote significantly slower than the positive asymptote. In Experiment 3, we presented a single negative word (“spider”) and a single positive word (“kitten”) 100 times each. After 100 presentations, the negative word elicited slower responses than the positive word. Thus, the vigilance for negative stimuli does appear to be automatic.

• MOTOR CONTROL •

(3061)

Movement Coding Processes Are Task Dependent. LORE THALER & JAMES T. TODD, *Ohio State University* (sponsored by James T. Todd)—To execute a movement, observers have to code their movement plan into motor commands. It has been suggested that the coded control parameter is either the end-state of the effector (endpoint coding) or the displacement of the effector from its current position (vector coding). The question, whether observers employ endpoint or vector coding, has been under debate for 20 years. The experiments reported here were designed to test whether observers employ both endpoint and vector coding, but that the relative contribution of either process depends on the task. Observers performed successive reaches either to visual target locations or over visually specified target distances and directions. The latter condition implied, but did not visually mark, target locations. To assess which coding observers employ in each condition, observer-generated data were compared to model-generated data. The results suggest that endpoint coding dominates when visual target locations are provided. Vector coding dominates otherwise.

(3062)

Effect Anticipation Modulates Deviance Processing. ARVID HERWIG, *Max Planck Institute for Human Cognitive and Brain Sciences*, & FLORIAN WASZAK, *CNRS and Université René Descartes*—Perceptually deviant stimuli elicit a larger oddball-P3 for stimuli triggered by participants’ voluntary buttonpresses than for stimuli presented automatically (Nittono, 2006). This result may indicate that the context to which a stimulus is compared is partially defined by the anticipated consequence of the triggering action. To test this assumption, we ran an experiment comprising two phases. First, subjects underwent an acquisition phase, in which self-selected keypresses were always followed by a certain tone (S1: later used as standard stimulus vs. S2: later used as deviant stimulus). In the second phase, self-selected keypresses randomly triggered a standard, deviant, or target stimulus. The P3a in response to deviant stimuli was larger for actions that previously produced the standard stimulus than for actions that previously produced the deviant stimulus. This finding suggests that anticipated action effects constitute an integral part of the context to which a sensory event is compared, when checked for deviance.

(3063)

Attentional and Conceptual Factors in the Simon Effect. IAN P. RASMUSSEN, DANIEL I. BROOKS, ELIOT HAZELTINE, & SHAUN P. VECERA, *University of Iowa* (sponsored by Eliot Hazeltine)—The Simon effect is usually explained as an attentional effect. However, the Simon effect can also be explained in terms of a conceptual priming effect. We attempted to test these rival accounts. In Experiment 1, two potentially task-relevant stimuli were maintained in working memory and the critical stimulus was subsequently indicated by a central cue. Despite the fact that the locus of attention spanned two response locations and the stimuli are no longer visible at response, the Simon effect was present. In Experiment 2, we independently manipulated the direction of attentional shifts and the stimulus locations, allowing us to see whether lateral shifts of attention provide the spatial

codes that drive the Simon effect. Our results show that the Simon effect was determined by the location of the stimulus, regardless of attentional shift. These results challenge the previously upheld belief that attention alone mediates Simon effects.

(3064)

Compatibility for Pure and Mixed Mappings of Discrete and Continuous Stimuli and Responses. MOTONORI YAMAGUCHI & ROBERT W. PROCTOR, *Purdue University*—The present research examined effects of perceptual similarity on the magnitude of stimulus–response compatibility (SRC) effects with mixed mappings. Two experiments tested the SRC effect with pure and mixed mappings for factorial pairings of discrete location and continuous rotation stimuli with discrete buttonpress and continuous yoke-turn responses. The results showed that, with pure mappings, the yoke-turns yielded a larger SRC effect with the continuous stimuli than with the discrete stimuli, whereas the buttonpresses yielded a larger SRC effect with the discrete stimuli than with the continuous stimuli. These outcomes suggest that the degree of set-level compatibility is higher when discrete-continuous characteristics of stimulus and response sets match than when they do not. However, reductions of SRC effects with mixed mappings were little affected by perceptual similarity between stimulus and response sets.

(3065)

Response-Locked LRPs From the Complication Procedure: Evidence Against Pure Insertion. J. TOBY MORDKOFF, *University of Iowa*, LESLIE A. ADERHOLD, *Pennsylvania State University*, PEGGY CHEN, *Kessler Institute for Rehabilitation*, BRIE SULLIVAN & REBECCA VON DER HEIDE, *Pennsylvania State University*, & ROSE HALTERMAN, *University of Iowa*—When using the complication procedure, performance is compared across simple-RT, go/no-go, and forced-choice tasks. In order to interpret the differences in response time as estimates of the durations of component stages, it must be assumed that components may be inserted (or deleted) without causing changes in the remaining components. We tested whether the assumption of pure insertion applies to late, motor processes by examining the response-locked, lateralized readiness potential (LRP). We found evidence against pure insertion, as well as further evidence concerning the functional significance of the LRP.

(3066)

The STOP Signal That Makes the Eyes GO: Evidence for an Exogenous Effect on Countermanding Saccades. RICHARD GODIEN & ARTHUR F. KRAMER, *Beckman Institute, University of Illinois* (sponsored by Arthur F. Kramer)—Performance in the stop-signal paradigm is typically described as a race between independent GO and STOP processes. However, competitive integration models of oculomotor control predict that a visual stop signal should interact with oculomotor programming to a target location. In a series of experiments, participants were instructed to execute an endogenous saccade, but to stop the saccade if a visual stop signal was presented. To test the idea that visual stop signals interact with the endogenous oculomotor program, we manipulated the location of the stop signal. The results revealed that stopping performance was impaired when the stop signal was presented near the endogenous saccade goal relative to when it was presented elsewhere. The results indicate that the presentation of the stop signal exogenously activates the oculomotor system and interacts with the endogenous saccade program, providing evidence for competitive integration models of oculomotor control.

(3067)

Emotion Potentiates Response Activation and Inhibition in Masked Motor Priming. BRUNO R. BOCANEGRA & RENÉ ZEELENBERG, *Erasmus University Rotterdam* (sponsored by Ingmar H. Franken)—Emotional or arousing stimuli are known to enhance the allocation of visual attention and to improve early perceptual processing. In the present study, we examined whether emotional stimuli also potentiate the activation and inhibition of automatic motor responses. We inves-

tigated whether peripherally presented fearful faces influence the response times to foveally presented target stimuli that were preceded by masked prime stimuli. Primes and targets elicited either left- or right-hand responses, at stimulus onset asynchronies (SOAs) of 20 or 170 msec. We show that both early facilitative (SOA: 20 msec) as well as late inhibitory (SOA: 170 msec) RT effects due to prime–target compatibility are enhanced through the presence of peripheral fearful faces. In sum, our combined findings suggest that emotion causes both a response-channel-specific enhancement of motor inhibition and a response-channel-independent enhancement of motor activation.

• DECISION MAKING •

(3068)

Aggressive Shooting Behavior: The Influence of Span, Personality, and Threat on Shoot Decisions. HEATHER M. KLEIDER & DOMINIC PARROTT, *Georgia State University*—We examined whether individual differences in personality and cognitive processing ability influenced shoot decisions in a simulated shooting task. Specifically, we tested, for trait-aggressive people, whether cognitive processing ability (i.e., working memory) influenced their decision to shoot when they were feeling threatened. The results showed that although high cognitive control (high-span) people are skilled at suppressing extraneous information, compared with their low-span counterparts, and maintained superior performance (accurate shooting of armed suspects) when in the no-threat condition, their shooting behavior was markedly more aggressive (shooting unarmed suspects) when threatened. These findings suggest that the cognitive processing ability that trait-aggressive high-span persons rely on to control aggressive behavior is reduced when they are threatened, resulting in aggressive shooting behavior. Implications for in-field police officers are discussed.

(3069)

Regulatory Fit Effects in a Gambling Task. DARRELL A. WORTHY, W. TODD MADDOX, & ARTHUR B. MARKMAN, *University of Texas, Austin* (sponsored by W. Todd Maddox)—We examined the interface between motivation and choice. In category learning, a regulatory fit has been shown to increase exploration of alternative response strategies even when exploration is suboptimal. In the current study, promotion and prevention focus subjects performed a gambling task that required them to choose from one of two decks on each trial. They either gained or lost points with each draw. In Experiment 1, optimal performance required an exploratory response pattern that entailed sampling from a deck that initially appeared disadvantageous but ultimately became advantageous. In Experiment 2, optimal performance required an exploitative response pattern. A softmax reinforcement learning model that includes an exploitation parameter was applied to the data and revealed greater exploration of alternative strategies for people with a regulatory fit. This response strategy was optimal in Experiment 1 and led to superior performance, but was suboptimal in Experiment 2 and led to inferior performance.

(3070)

Actual Versus Hypothetical Decision Making. KATHLEEN M. GALOTTI & LAURA R. NATHAN, *Carleton College*—Parents of kindergarteners ($n = 243$) participated in a short-term longitudinal study, as they made a decision for educational placement (from among 7–8 available options) for their child for the following year. A second sample of undergraduates ($n = 45$) were also asked to pretend to make this decision for their hypothetical child, and the responses were compared. Analyses will focus on similarities and differences in the responses of these two groups, one of whom is making an actual decision, and the other, a simulated one. Measures examined include the number of options and criteria under active consideration, the number and type of information sources consulted, the number and type of goals the decision-maker listed, and the decision-making style the decision-maker reported using in making this and other important decisions.

(3071)

A Signal Detection Model of Moral Decision Making. JASPER JANCIK & DALE J. COHEN, *University of North Carolina, Wilmington*—Kohlberg (1981) and Rest's (1979, 1986) research dominate our current understanding of moral decision making. Rest states that moral decision making is composed of four semiautonomous components: moral sensitivity, moral judgment, moral motivation, and moral character. Unfortunately, models of moral decision making based on these components are ill defined. We propose a multidimensional signal detection model of moral decision making that unites these four components in a single mathematically specified model. We present three experiments that provide validation of our model, investigate Haidt's (2001) claims regarding the role of emotion in moral decision making, and demonstrate the multidimensional and flexible nature of moral sensitivity.

(3072)

Moral Reasoning Under Uncertainty. KATHERINE V. KORTENKAMP & COLLEEN F. MOORE, *University of Wisconsin, Madison* (sponsored by Colleen F. Moore)—A number of recent papers on moral decision making have examined people's responses to dilemmas used by moral philosophers as "thought experiments." These dilemmas allow for very clear-cut examinations of moral reasoning—to examine when people reason as consequentialists or as deontologists. One problem with these dilemmas is that they do not include uncertainty. Few situations in the real world are entirely certain, and ethical theories do not adequately address how one should respond when moral dilemmas contain uncertainty. We presented 80 undergraduates with both standard moral dilemmas and dilemmas containing uncertainty to examine how uncertainty impacts moral reasoning. We hypothesized that uncertainty would lead to more deontological and less consequentialist reasoning.

(3073)

Discounting of Delayed and Probabilistic Food Rewards by Pigeons. LEONARD GREEN, JOEL MYERSON, & AMANDA L. CALVERT, *Washington University*, & SARA J. ESTLE & DANIEL D. HOLT, *University of Wisconsin, Eau Claire*—Discounting of delayed and probabilistic food rewards was studied using an adjusting-amount procedure. In one condition, pigeons chose between an adjusting number of food pellets contingent on a single peck and an alternative in which 20 pellets were contingent upon completion of a variable-ratio (VR) schedule. In a second condition, pigeons chose between an adjusting number of pellets available immediately and 20 pellets received after a delay. Indifference points (adjusting amounts approximately equivalent in value to the fixed amount) from the delayed-reward condition were plotted as a function of time until receipt of the delayed reward, and indifference points from the probabilistic-reward condition were plotted as a function of the harmonic mean of times until completion of each VR value. Data from both conditions were well described by a single hyperbolic discounting function, supporting the hypothesis that pigeons' discounting of probabilistic rewards is controlled by average time until a win.

• JUDGMENT •

(3074)

A Multidimensional Scaling Approach to Verbal Probability Expression. KUNINORI NAKAMURA & KIMIHICO YAMAGISHI, *Tokyo Institute of Technology* (sponsored by Kimihiko Yamagishi)—Most verbal probability phrases are either positive ("slight possibility") or negative ("impossible"), in that they encourage one to think of reasons why the target event will or will not occur. This feature of verbal probability phrases is referred to as directionality (e.g., Teigen & Brun, 1999). Previous studies (e.g., Budescu, Karelitz, & Wallsten, 2003) have tried to quantify the directionality by fuzzy measurement where the direction is quantified by membership function. In this study, we apply multiple dimensional scaling (MDS) to the domain of verbal probability phrases to uncover the underlying semantic structure of the directionality. Throughout our studies, participants estimated probabilities denoted by the verbal probability statements with

percentage, and we analyzed correlations of the estimated probability between the verbal probability phrases by MDS. The derived structure shows that similarity among the verbal probability phrases can be mapped into two dimensions, and suggests that one of these two dimensions can be interpreted as dimension of directionality.

(3075)

When Do People Rely on Fluency in Inferential Judgments? JULIAN N. MAREWSKI & LAEL J. SCHOOLER, *Max Planck Institute for Human Development* (sponsored by Lael J. Schooler)—Schooler and Hertwig (2005) implemented the fluency heuristic (e.g., Whittlesea, 1993) as strategy for judgments about the value of objects (e.g., cities) on quantitative criteria (e.g., city size) in the cognitive architecture ACT-R. It predicts higher values for objects for which a record can be retrieved faster from memory. In ACT-R, a record's retrieval speed is largely determined by a person's past exposure to the respective object. Exposure frequency to different objects in turn depends on how frequently they occur in the world. It is unknown which mechanisms determine when people rely on the fluency heuristic as opposed to on strategies that base judgments on knowledge about objects (e.g., knowledge about cities). In four experiments and analyses of the frequency of objects in the world, we show how the statistical structure of our world results in the fluency heuristic being most applicable and relied upon when a person cannot retrieve knowledge.

(3076)

Bayesian Principles and Causal Judgment: A Process Tracing Approach. AMANDA M. KELLEY, RICHARD B. ANDERSON, & MICHAEL E. DOHERTY, *Bowling Green State University*—Recently, Bayesian principles have been brought to bear in explaining causal and correlational judgment. In the present study, participants saw samples in which the correlation between two dichotomous variables—the presence or absence of a causal candidate, and the presence or absence of an effect—was positive, negative, zero, or mathematically indeterminate (because the cause was either always present or always absent). Additionally, in the case of indeterminate correlations, the ratio of effect-present to effect-absent data was varied across samples. Participants' task was to rank the various kinds of samples with respect to the likelihood that the sample indicated a positive causal relationship between the variables. Judgments tended to be sensitive to the objective probability that a sample had been randomly drawn from a correlated versus an uncorrelated population (though there were notable exceptions). Thus, the results support the hypothesis that people take an inferential statistical approach to causal judgment.

(3077)

The Mapping Model: A Cognitive Theory of Quantitative Estimation. BETTINA VON HELVERSEN & JÖRG RIESKAMP, *Max Planck Institute for Human Development* (sponsored by Jörg Rieskamp)—How do people estimate quantities such as the performance of a student or the risk of a medical treatment? Traditionally, models such as linear regression have been employed to answer this question, implicating that people weigh and integrate multiple sources of information. Alternatively, we propose a new model for quantitative estimation, the mapping model (von Helversen & Rieskamp, in press; *JEP:G*), that does not assume a differential weighting process. In three experiments, we tested the mapping model under varying environmental conditions against two established models of estimation: a linear regression model and an exemplar model (Juslin, Olsson, & Olsson, 2003, *JEP:G*). Overall, the mapping model predicted participants' judgments best. In particular, if the criterion distribution was J-shaped or the cue-criterion relation was nonlinear, the mapping model clearly outperformed the other models. However, linear regression predicted participants' estimations best, if the cue-criterion relation was linear.

(3078)

Identifying Mock Suspects in Simultaneous and Sequential Mock Lineups. ARNE WEIGOLD, *Texas Tech University*, & DIRK WEN-

TURA, *University of the Saarland* (sponsored by Ruth H. Maki)—In a police lineup, the psychological state of the suspects differs from that of the foils, in that the suspects face a situation that can potentially lead to personal loss if they are identified. Weigold and Wentura (2004) showed that being a suspect can result in detectable behavioral cues. Mock suspects were randomly selected and were promised money for not being found by mock eyewitnesses. They were filmed before (control condition) and after (experimental condition) their selection. The probability of identification of the mock suspects was significantly higher in the experimental than in the control condition. It was speculated that eyewitnesses used comparisons between lineup members to find the member that was “different” from the others. Since this might be remedied by using a sequential lineup procedure, the original study was replicated with a simultaneous versus sequential condition. The results indicate that sequential lineups decrease identification of mock suspects.

• MEMORY FOR FACES AND SCENES •

(3079)

Face Recognition for Own-Age and Own-Race Faces. JEFFREY S. ANASTASI & JASON L. RANDALL, *Sam Houston State University*, & MATTHEW G. RHODES, *Colorado State University*—Previous studies have demonstrated that individuals are better at recognizing in-group compared with out-group faces. We report two experiments in which participants studied same- and other-race faces that came from their own or other age groups. Specifically, white and black participants were shown white and black faces that were from the same or different age range as the participants. Participants exhibited superior memory for faces from their own race compared with other-race faces (i.e., an own-race bias). Additionally, participants exhibited superior recognition of faces from their own age group (i.e., own-age bias) but only for faces from their own race. No such own-age bias was apparent for other-race faces. The results are discussed with regard to Sporer’s in-group/out-group model (IOM).

(3080)

Computer-Generated Faces Are Not Processed Like Real Faces. CURT A. CARLSON & SCOTT D. GRONLUND, *University of Oklahoma*—We conducted three experiments to test whether computer-generated (CG) faces (FACES 4.0) are processed like real faces, either perceptually or memorially. Experiments 1 and 2 replicated the face inversion effect for real faces (Yin, 1969), but inversion had no effect on accuracy for CG faces. The results from Experiment 3 showed that increased encoding time (1 sec vs. 3 sec) had no effect on recognition memory performance or response time for real faces, but for the CG faces, accuracy and response time increased as study time increased. Application of the EZ-Diffusion model (Wagenmakers et al., 2007) provided insights into processing differences between CG faces and real faces. CG faces are processed less configurally than are real faces, which has implications for their use as stimuli in experiments exploring the cognitive processes underlying various applied memory phenomena.

(3081)

Influence of Peripheral Distinctive Features: Body Hair and Facial Recognition. JENNIFER THIBODEAUX & JAMES B. WORTHEN, *Southeastern Louisiana University*—The influence of a distinctive noncentral trait on recognition for faces was investigated in a single experiment. At encoding, participants were presented with a mixed list of waist-up photographs of women. Half of the photographs depicted women with visible armpit hair and half depicted the Western cultural norm of shaved armpits. After a 48-h retention interval, participants were given an old/new recognition test using photographs of faces only. The results of a multiple regression analysis indicated an interaction between hirsutism and attractiveness such that faces of attractive hirsute women were recognized better than faces in all other conditions. The results suggest that distinctiveness of a noncentral

feature can enhance memory for target stimuli. The relevance of the results for current theories of distinctiveness is discussed.

(3082)

Individual Differences in Face Processing: Behavioral and Psychophysiological Indicators. GRIT HERZMANN, OLGA KUNINA, OLIVER WILHELM, & WERNER SOMMER, *Humboldt University, Berlin* (sponsored by Werner Sommer)—Functional and neuro-anatomical models predict, and empirical evidence confirms, that event-related potentials (ERPs) are associated with distinguishable aspects of face processing and might serve as indicators of individual differences in face processing abilities. We investigated the extent to which such individual differences can be captured in the following ERP components: N170, difference due to memory, early and late repetition effects, and the old/new effect. 209 participants underwent intensive behavioral testing. 86 of them were randomly selected to take part in two EEG sessions where faces were learned and after 1 week were tested for recognition. All ERP components exhibited high internal consistencies, and confirmatory factor analysis showed them to be unidimensional. Latent factors for the behavioral measures of face processing correlated moderately with the repetition effects, the old/new effect, and the N170 latency. Thus, individuals with faster structural encoding and higher activation during recognition showed better face recognition performance.

(3083)

Children’s Identification From Lineups Matching Suspects, Descriptions, or Composites. IN-KYEONG KIM, CLARISSA NAMBIAR, ANASTACIA RODRIGUEZ, MARCELLO RUVALCABA, SAIDA L. SOLIS, & MELISSA VEGA, *La Sierra University*—This study investigated the selection of distractors for identification lineups based on suspect-matched, description-matched, and composite-matched procedures. Composite-matched procedure was newly developed and had components of visual description. Twelve 9- to 11-year-old children participated in verbally describing the perpetrator or making facial composites (using *Identi-Kit v.6*) with mock police officers immediately after viewing a crime scene video. Lineups were then produced on the basis of the similarity to the suspect picture, to the verbal description, and to the composites by 6 mock police officers. An additional 30 9- to 11-year-old children participated in the identification of the perpetrator 2 days after viewing the video. The results showed that the identification from the description-matched lineups was more accurate than the other two in the perpetrator-absent condition. Participants’ confidence in their answers was higher in the perpetrator-present condition than in the perpetrator-absent condition. The same experiment with 30 adult participants showed no significant differences among three lineup procedures.

(3084)

Typicality Congruency of Misinformation. MEHGEN DELANEY, ROBERT F. BELLI, & AYAKO MASUDA, *University of Nebraska, Lincoln* (sponsored by Robert F. Belli)—The present study investigated schema consistency on the suggestibility of memory for real-world common scenes. Participants were shown still photographs of scenes, which included either only typical or some atypical items. They were later exposed to narratives containing additive misinformation of atypical and typical items, and then were asked to reflect on their phenomenological experience of remembering by giving remember/know responses to misinformation items in a cued recall test. The results replicate the findings of Nemeth and Belli (2006) with participants providing significantly more remember and know responses to atypical misinformation, but only when shown scenes with atypical items. When shown typical items, significantly more remember responses were provided for the typical misinformation items. The results demonstrate a congruent misinformation effect in that false memories for suggested items, as measured by remember responses, are more likely to occur when there is a match between the typicality of shown and suggested items.

(3085)

Impairment of Scene Recall Due to Part-Set Cuing. DANIEL R. KIMBALL, WILLIAM A. COKER, & JAMES R. ERICKSON, *University of Texas, Arlington*—Recall impairment due to part-set cuing has been studied extensively using verbal stimuli, but to date there has been no evidence reporting applicability of the phenomenon to more ecologically valid stimuli, such as everyday scenes (kitchen, office, etc.). We found reliable part-set cue-induced impairment of recall for objects in such scenes when the cues were the names of schematically consistent objects, whether or not such cues had appeared in the scene. However, the effect of cue number varied depending on whether the cues had or had not appeared in the scene: When the cues had appeared, such impairment increased as a function of the number of cues, as with word list recall. When the cues had not appeared in the scene, impairment did not differ with cue number, unlike with word lists. These results have practical ramifications for eyewitness memory and present a challenge to part-set cuing theories.

• LEARNING AND MEMORY •

(3086)

Feedback Timing in Semantic Learning: Spacing and the Delay-Retention Effect. TROY A. SMITH, DANIEL R. KIMBALL, & MARTHA MANN, *University of Texas, Arlington*—The empirical findings to date regarding the effects of delaying feedback on learning and long-term retention are unclear: Some studies have found an advantage for delayed feedback, some an advantage for immediate feedback, and some no difference. In three experiments involving new semantic learning of trivia facts, we tested the extent to which spacing and lag effects can account for the seemingly contradictory findings in the literature. Experiment 1 compared the effects of varying the timing of repeated study trials, repeated test trials, and feedback trials. Experiments 2 and 3 examined the effects of restudy and retest opportunities following immediate and delayed feedback trials, and the impact of varying the lag between initial study and feedback. The results support the spacing hypothesis and challenge competing theories of feedback timing. We compare the results to predictions of the new theory of disuse (Bjork & Bjork, 1992).

(3087)

Contribution of Prior Semantic Knowledge to New Episodic Learning in Amnesia. IRENE P. KAN & MIEKE VERFAELLIE, *Boston VA Healthcare System*—We evaluated whether prior semantic knowledge would enhance episodic learning in amnesia. Subjects studied prices that are either congruent (i.e., market value) or incongruent (i.e., four times higher) with prior price knowledge for household and grocery items and then performed a forced choice recognition test for the studied prices. Consistent with a previous report, healthy controls' performance was enhanced by price knowledge congruency; however, only a subset of amnesic patients experienced the same benefit. Whereas patients with damage restricted to the medial temporal lobes experienced a significant congruency benefit, patients with damage also including the lateral temporal lobes did not experience a congruency benefit. Moreover, the extent to which patients experienced a congruency benefit was positively correlated with their prior price knowledge. Our findings are consistent with the idea that episodic memory is enhanced when the to-be-remembered information can be anchored to prior knowledge.

(3088)

Early Encoding Impairment in Schizophrenia. MARIE-LAURE GRILLON & CAROLINE HURON, *INSERM*—Investigations of memory impairment in schizophrenia have frequently revealed a strategic processing deficit at encoding. The present experiment was designed to investigate an early encoding process, refreshing (i.e., the process of thinking of a stimulus that has just been seen). Twenty-five patients with schizophrenia and 25 control subjects read words out aloud as they appeared on a screen. Critical words were read, re-

freshed, or repeated, following presentation of a column of three words or a single word in the top, middle, or bottom position of the screen. As a surprise test, participants were asked to recognize the words seen previously and to give remember, know, or guess responses. The results showed that patients were disproportionately slower or less accurate in the refresh condition. Nor, in contrast to controls, did they derive the beneficial effect of refreshing on conscious recollection. These results provide evidence that schizophrenia impairs an early encoding process.

(3089)

Ironic Effects of Censorship: Generating Censored Lyrics Enhances Memory. MATTHEW R. KELLEY, *Lake Forest College*, JAMES E. BRIGGS, *University of Wisconsin, Milwaukee*, JAMES C. CHAMBERS, *Wheaton College*, EMILY BLEGEN & DUSTIN KOCH, *Lake Forest College*, & JOANNA C. BOVEE, *University of Illinois, Chicago*—Two experiments explored the generation effect—mnemonic advantage for self-generated information—in the applied setting of lyrical censorship. Participants listened to an original song in which a subset of nouns were either partially or completely censored and then completed a recognition memory test consisting of heard, censored, and distractor items. Overall, recognition accuracy did not differ for censored and heard items, despite the fact that the censored items were never presented. More importantly, when the data were made conditional upon successful generation of the censored item during encoding, the standard generation effect was observed—recognition accuracy was significantly higher for the generated censored items compared with the heard items. Additionally, when asked to judge the source of the recognized words, participants routinely erred and indicated that they remembered “hearing” these nonpresented words. These results suggest that, by omitting certain words from songs, censors might actually make those words more memorable!

(3090)

What Form of Memory Underlies Novelty Preferences? KELLY A. SNYDER, *University of Denver*, & MICHAEL P. BLANK & CHAD J. MARSOLEK, *University of Minnesota* (sponsored by Chad J. Marsolek)—Novelty preferences (longer fixations on new stimuli than on previously presented stimuli) are widely used to assess memory in nonverbal populations such as human infants and experimental animals, yet important questions remain about the nature of the processes that underlie them. We used a classical conditioning paradigm to test whether novelty preferences reflect a stimulus-driven bias toward novelty in visual selective attention or explicit memory for old stimuli. The results indicated that conditioning affected adults' looking behavior in the visual paired comparison task but not their recognition memory judgments. Furthermore, the typically observed novelty preference occurred only when a bias toward novelty had no competition from a bias toward salience due to conditioning. These results suggest that novelty preferences may reflect attentional processes and implicit memory to a greater degree than explicit memory, a finding with important implications for understanding memory in nonverbal populations and the development of memory in humans.

(3091)

Individual Differences in Intentional Versus Incidental Learning: Effects of Handedness and Interhemispheric Interaction. STEPHEN D. CHRISTMAN & MICHAEL BUTLER, *University of Toledo*—Research indicates a robust episodic memory advantage for mixed-, relative to strong right-, handers, arising from increased interaction between left hemisphere-based encoding and right hemisphere-based retrieval processes in mixed-handers. Most of this research has employed intentional learning. The purpose of the present study was to investigate possible handedness differences under conditions of incidental learning, using the procedure developed by Craik and Tulving (1975) in which subjects make either structural, phonemic, or semantic judgments about words, followed by a surprise memory test. A fourth group studied words under intentional learning instructions. Repli-

cating past research, a mixed-handed advantage was found for the intentional learning condition. A mixed-handed advantage was also obtained for the deep semantic condition, but not for the two shallower processing conditions. These results suggest that mixed-handed advantages in episodic memory arise at the retrieval stage, with mixed-handers exhibiting greater access to multiple retrieval paths laid down at encoding.

(3092)

Differences in Associative Memory Errors As a Function of Handedness. DONNA J. LAVOIE, EMILY TAYLOR, ELLEN HINKEL, & JENNIFER SMITH, *St. Louis University*—Research examining hemispheric processing differences during associative memory tasks indicates that relatively restricted associative activation occurs in the left hemisphere, whereas more diffuse associative activation occurs in the right hemisphere. Research on handedness has established that left-handed individuals have a larger right hemisphere than right-handed individuals, while right-handed individuals have a larger left hemisphere. Left-handed individuals, then, may engage in more global, gist-based processing of stimuli than do right-handers. These potential handedness-related hemispheric differences in memory processing suggest that memory accuracy may differ between left- and right-handed persons, with left-handers being more susceptible to gist-based, or associative, memory errors. Right- and left-handed individuals' associative memory errors were assessed using the DRM paradigm. The results indicated that left-handed individuals had reliably higher false recognition of critical lures than did right-handed participants. The implications of these findings regarding both the cognitive and potential neurological mechanisms driving associative false recognition are discussed.

(3093)

Motor Interference on Memory Tests. MARTIN BINK, *U.S. Army Research Institute*, & BRANDY JOHNSON & BRYAN HALL, *Western Kentucky University*—Recent evidence suggests that the cognitive and motor-perceptual systems are more closely dependent than traditional conceptions of cognition suggest. If this is true, then concurrent motor activity should interfere with memory processing in a manner similar to effects found with verbal processing. In this study, people engaged in digit monitoring or finger tapping while studying lists of nouns or verbs. The results showed that the finger tapping manipulation reduced the memory for verbs relative to control and that the finger tapping condition was the only condition that produced a difference between nouns and verbs.

(3094)

Dual-Task Studies: Interaction of Motor Activity and Memory for Movement. SUSAN R. OLD & MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia* (sponsored by Moshe Naveh-Benjamin)—The theory of event coding (TEC; Hommel, Müsseler, Aschersleben, & Prinz, 2001) holds that perceived events and action planning share a common representational domain. It has been shown that planning and performing an action can interfere with the perception of action-compatible stimuli. The present experiments were conducted in order to determine whether performance of actions also interferes with memory for action-compatible stimuli. Participants studied various forms of stimuli, some of which included vertically or horizontally oriented motions. During study, participants also took part in a variation of a concurrent task, which may or may not have required hand movement. Memory for the presented stimuli was then tested. The results are discussed in relation to the TEC, as well as in terms of possible dual-task interference that may be inadvertently produced in divided attention memory tasks.

(3095)

The Influence of Misleading Information on Memory for the Taste of Organic and Nonorganic Apples. LAURA A. GILLESPIE & KRISTEN A. DILIBERTO-MACALUSO, *Berry College*, & JEFFREY

S. ANASTASI, *Sam Houston State University*—This study examined whether misleading visual and verbal information alters memory for the taste of organic and nonorganic apples. Participants were either verbally instructed before, after, or not at all (control) that they were sampling two different apples, one of which was labeled organic. In reality, two thirds of the participants sampled the same apple (i.e., both organic or both nonorganic). Participants rated each sample on several dimensions and indicated their taste preference. Participants then completed a food choice, food attitudes, and background information survey. We found that participants who received misleading information and tasted the same apples were more likely to prefer the apple labeled “organic.” Their preference was correlated with their food choices and attitudes toward food.

(3096)

Adaptive Memory: Does Survival Value Matter? DAVID A. CEO & JAMES S. NAIRNE, *Purdue University* (sponsored by James S. Nairne)—Our experiments attempted to determine whether there is an intrinsic property of words, survival value, that makes them more memorable. Norms were collected to ascertain how useful items might be in a survival context. Stimuli rated as high or low on usefulness (s-value) were selected while controlling for other factors known to influence recall. First, high s-value words were compared with low s-value words using an intentional free recall task. No difference was found, suggesting that s-value is not an important mnemonic property of words. These stimuli were then compared using an incidental task in which words were rated either for their relevance to a survival scenario or for pleasantness. A large effect of s-value was found in the survival task, suggesting that thinking about highly useful items in relation to their survival value especially aids retention.

(3097)

Planning for Survival Versus Planning a Burglary: The Mnemonic Advantage of Processing Fitness-Relevant Information. SEAN H. K. KANG, KATHLEEN B. McDERMOTT, & SOPHIE M. COHEN, *Washington University*—Nairne, Thompson, and Pandeirada (2007, *JEP:LMC*) propose that our memory systems serve an adaptive function, and have evolved to help us remember fitness-relevant information. In a series of experiments, they demonstrated that processing words according to their survival relevance resulted in better retention, relative to rating them for pleasantness, personal relevance, or relevance to moving house. The aim of the present study was to examine whether the advantage of survival processing could be replicated, using a control condition that we felt better matched the survival processing task in arousal, engagement, and schema coherence: relevance to planning a bank heist. We found that survival processing nonetheless yielded better retention on both a recall and a recognition test. Our findings provide additional evidence that the mnemonic benefit of survival processing is a robust phenomenon, and support the utility of adopting a functional perspective in investigating memory.

(3098)

When Two Is Less Than One: The Role of Others in Prospective Remembering. DONATELLA FERRANTE, LARA PELIZZON, & FRANCESCO MARCATTO, *University of Trieste*, & MARIA A. BRANDIMONTE, *Università Suor Orsola Benincasa* (sponsored by Walter Gerbino)—The aim of the present work was to investigate the influence of social interaction on prospective memory. In three experiments, we manipulated the kind of social interaction (pure presence of others vs. shared responsibility), the length of interaction (no interaction, only at encoding, only at retrieval, full interaction), the kind of prospective task (activity-based vs. event-based), and the length of the ongoing task (random vs. ability determined). The results showed effects of social facilitation and inhibition in the pure presence of others condition and effects of motivation reduction in the shared responsibility conditions. Contrary to common beliefs, we found a decrement in the likelihood of executing the prospective task in the shared responsibility conditions in comparison with the no-

interaction condition. The finding that a couple is less likely than a single individual to execute a task may have important theoretical and practical implications.

• **MULTISENSORY INTEGRATION** •

(3099)

Intermodal Event Files: Integrating Features Across Audition, Vision, and Action. SHARON ZMIGROD & BERNHARD HOMMEL, *Leiden University*—People bind features of visual events into event files, often together with action features. Recently, we found evidence that auditory features (pitch, loudness, and location) are integrated the same way. Here, we investigate whether visual and auditory features are bound across modalities both with each other and with the action they accompany. The results of two experiments reveal the predicted interactions between feature-repetition effects for visual color and auditory pitch: Repeating one feature without repeating the other strongly impairs performance. Hence, spontaneous intermodal binding is observed and it survives short onset asynchronies between visual and auditory features. Feature repetition also interacts with response repetition, suggesting stimulus–response binding. We conclude that event files are multimodal, integrating information from all sorts of stimulus and response dimensions.

(3100)

Time–Space Synesthesia: An Event-Related Brain Potential (ERP) Study. URSINA TEUSCHER, DAVID BRANG, LEE EDWARDS, MARGUERITE McQUIRE, VILAYANUR S. RAMACHANDRAN, & SEANA COULSON, *University of California, San Diego*—In one type of synesthesia, people report that they associate time events, such as months of the year, with specific spatial locations. The present study investigated these synesthetic time–space associations via a symbolic cuing paradigm. Cues consisted of arrows pointing left or right, and the names of months that were on either the left or the right side of the synesthete’s mental calendar. After each cue, a target stimulus appeared in the correctly cued location 75% of the time. ERPs were recorded from 12 time–space synesthetes and 12 age-matched control subjects during this target detection task. Our results suggest that, relative to controls, time–space synesthetes more effectively utilized words referring to temporal events to direct their attention in space. However, attentional cuing that occurred with month terms differed from that afforded by arrows. Our data suggest that time–space synesthesia affected stimulus categorization and response generation rather than visual processing.

(3101)

Examining Auditory–Tactile Temporal Ventriloquism. MIRJAM KEETELS & JEAN VROOMEN, *Tilburg University* (sponsored by Jean Vroomen)—We examined whether auditory stimuli capture the onset of tactile stimuli (i.e., auditory–tactile temporal ventriloquism). Participants were presented two vibro-tactile stimuli with variable temporal onset to the left and right index finger, and had to judge which of the two came first (i.e., tactile TOJ task). To induce auditory–tactile (AT) temporal ventriloquism, a capturing sound was, as in the audiovisual (AV) case, presented before the first tactile stimulus and after the second with auditory–tactile intervals of 0, 100, 200, 300, or 400 msec. JNDs were highest (i.e., lowest sensitivity) when sounds came simultaneously with the vibrations, while there was no difference between the 100-, 200-, 300-, and 400-msec AT intervals. The interfering effect of simultaneous sounds became less when the distance between the fingers increased. These results are unlike previous reports on AV temporal ventriloquism where sensitivity improved at 100-msec intervals, and thus indicate that sound does not capture touch.

(3102)

Sound Enhances Tactile Perception. TONY RO, JOHANAN HSU, & NAFI YASAR, *Rice University*, & L. CAITLIN ELLMORE &

MICHAEL BEAUCHAMP, *University of Texas Health Sciences Center, Houston*—Certain sounds, such as fingernails screeching down a chalkboard, have a strong association with somatosensory percepts. To assess the influences of audition on touch perception, four experiments measured how task-irrelevant auditory stimuli alter detection rates for near-threshold tactile stimuli. In Experiment 1, we showed that a simultaneous auditory stimulus increases sensitivity, but not response biases, to the detection of an electrical cutaneous stimulus delivered to the hand. Experiment 2 demonstrated that this enhancement of touch perception is spatially specific—only monaural sounds on the same side as the touch increased detection. Experiments 3 and 4 revealed that the effects of audition on touch are also frequency dependent—only sounds with the same frequency as the vibrotactile frequency enhanced tactile detection. These results indicate that auditory information influences touch perception in highly systematic ways and suggest that similar neural mechanisms may underlie the processing of information from these different sensory modalities.

(3103)

Novel Visual Methods Evoke Phantom Sensations and Treat Phantom Limb Pain. DAVID H. PETERZELL, *VA San Diego Healthcare System and University of California, San Diego*, ROBERTA E. CONE & CHRISTIAN CARTER, *VA San Diego Healthcare System and Alliant International University, San Diego*, ALEXANDREA HARMELL, *VA San Diego Healthcare System and University of California, San Diego*, & JUDY ORTEGA & DEBORAH VELEZ, *VA San Diego Healthcare System*—It is widely reported that a simple mirror reflection can cause phantom sensations in normal observers and reduce phantom limb pain in amputees. We created three unusual optical conditions that intensify these effects, and sometimes reduce phantom pain when the simple mirror is ineffective. The first uses three vertical, hinged mirrors oriented so that observers see side views of themselves. The triple-reflected side view is left/right reversed. A second uses two mirrors to provide multiple angles for lower-limb amputees. The third (“phantom pulse”) uses a real-time video image of the observer that flickers between a normal image and a mirror-reversed image at rates varying from 0.5 to 2 cycles/sec (with a .2-sec delay). For all three, movement of one limb causes phantom sensations in the opposite limb, leading to permanent pain reduction in some amputees. We speculate that “mirror neurons” with transient temporal properties contribute to these profound effects.

(3104)

Synesthesia Speeds Judgments of Numerical Representation in Simple Arithmetic Equations. THOMAS G. GHIRARDELLI, MALLORY A. CLARK, & MERIDITH B. HURD, *Goucher College*—S.E. is a 21-year-old synesthete who experiences colored images for digits. We presented her with a computerized task requiring the classification of simple arithmetic equations of the form $A + B = C$ as correct or incorrect. The digits were presented in colors that matched S.E.’s color–digit photisms, colors that did not match her photisms, and in black. In one experiment, we manipulated the color of the answer and in another experiment, we manipulated the color of the two addends. In both experiments, the remaining digits were presented in black. S.E.’s response time was significantly faster to equations with digits that matched her photisms, but only when the colored digits were the answer and not when they were the addends. We conclude that this result is due to concurrent activation of the numerical representation from both the addends and the colored answer.

(3105)

Tactile Textures Evoke Specific Emotions: A New Form of Synesthesia. DAVID BRANG & VILAYANUR S. RAMACHANDRAN, *University of California, San Diego* (sponsored by Vilayanur S. Ramachandran)—We studied two subjects, A.W. and H.S., in whom highly specific textures (e.g., denim, wax, corduroy, sandpaper, silk, etc.) evoked equally specific emotions (e.g., depression, embarrassment, confusion, relief, and contentment), respectively. The test/retest

consistency after 6 months was 100%. Skin conductance responses (SCRs) were monitored while we left each subject alone in a room so they wouldn't need to "fake" specific emotional expressions to convince us of their authenticity. A hidden camera videotaped their expressions evoked by different textures and the tapes were subsequently analyzed by blinded researchers to rule out confabulation. Evaluators' ratings significantly correlated with the valency of synesthetes' subjective reports, and SCR was significantly enhanced for negative synesthetic emotions. We suggest that this effect arises from increased cross-activation between S2 somatosensory cortex and insula for "basic" emotions and fronto-limbic hyperactivation for more subtle ones.

(3106)

Cross-Modal Comparisons of Time Intervals Presented or Not Presented in Sequences. SIMON GRONDIN, *University of Laval*, & J. DEVIN MCAULEY, *Bowling Green State University*—In four experiments, participants were presented with two sequences, each consisting of 1 or 4 intervals (marked by 2 or 5 signals), and were asked to indicate whether the interval(s) of the second sequence was (were) shorter or longer than the interval(s) of the first. On each trial, the standard sequence, which could occur first or second, delineated a fixed 500-msec interval, whereas the comparison sequence delineated a variable interval that was $500 \pm 15, 45, 75, \text{ or } 105$ msec. Markers in Sequence 1 and Sequence 2 were, respectively, sounds and flashes (Experiment 1), flashes and sounds (Experiment 2), both flashes (Experiment 3), and both sounds (Experiment 4). In general, the results showed that discrimination was better (1) when four intervals were presented, rather than one (especially in Sequence 2); (2) when the standard interval(s) was (were) presented before the comparison interval(s); and (3) when sequences were marked by sounds, rather than by flashes.

• SPATIAL UPDATING •

(3107)

Path Integration and Spatial Updating in Humans: Behavioral Principles and Underlying Neural Mechanisms. THOMAS WOLBERS & MARY HEGARTY, *University of California, Santa Barbara*, CHRISTIAN BUECHEL, *University Medical Center, Hamburg-Eppendorf*, & JACK LOOMIS, *University of California, Santa Barbara*—Path integration, the sensing of self-motion for keeping track of changes in orientation and position, constitutes a fundamental mechanism of spatial navigation. Here, we show that humans can reliably estimate self-motion from optic flow in virtual space, which relied upon the dynamic interplay of self-motion processing in area MST, higher-level spatial processes in the hippocampus, and spatial working memory in medial prefrontal cortex. A subsequent eye movement study revealed that when the positions of external objects have to be updated simultaneously, humans do not simply track remembered locations by means of saccadic eye movements. Instead, incoming self-motion cues are integrated with stored representations in the precuneus to enable online computation of changing object coordinates and to generate motor plans for potential actions in dorsal premotor cortex. These results will be discussed in the context of an emerging theoretical model of navigational learning.

(3108)

Where Am I? Updating Nested Spatial Memory Learned From Different Sources. A. REYYAN BILGE & HOLLY A. TAYLOR, *Tufts University*—People mentally update environment locations relative to their own position as they move, a process called spatial updating. Wang and Brockmole (2003) found that when learning nested environments from direct experience, the more immediate (or proximal) surrounding (room) received updating priority, whereas the remote one (i.e., campus) required more effortful updating. The present work examined nested updating after map learning. Participants learned locations within a room nested within a campus either through direct experience or via maps. After learning both environments, they updated

their location with respect to one of the environments and then completed tasks assessing knowledge of both environments. The results suggested that learning format selectively favors different levels of a nested environment. People more accurately represented the proximal environment (room) following navigation, whereas they more accurately represented the remote environment (campus) after map learning. These results have implications for best practice in representing environments on different scales.

(3109)

Knowledge Updating on the Basis of Learning From Spatial Actions and Spatial Language. ALEXANDRA PETERS & MARK MAY, *Helmut Schmidt University* (sponsored by Mark May)—Do spatial actions and spatial language lead to functionally equivalent or to functionally distinct types of spatial representation? In two experiments, we used real and imagined perspective switches to examine this question. Blindfolded participants were asked to learn object locations, either by exploring the locations with a cane (spatial action) or by hearing verbal descriptions (spatial language). In Experiment 1 with bodily switches (i.e., self-rotations between 0° and 180°), pointing latencies were longer after language than after action learning, especially for the more difficult testing perspectives (45° and 135°). In Experiment 2 with imagined switches to the same perspectives, spatial disparity between real and imagined perspective had a significant effect on latencies, both learning conditions being similarly affected. Implications of these findings for single- versus dual-code conceptions of the underlying spatial representations and processes are discussed.

(3110)

The Effect of Active Selection in Path Integration. XIAOANG WAN, RANXIAO FRANCES WANG, & JAMES A. CROWELL, *University of Illinois, Urbana-Champaign* (sponsored by Ranxiao Frances Wang)—Many species can integrate information of self-motion to estimate their current position and orientation relative to the origin, a phenomenon known as path integration. We used a homing task in virtual hallway mazes to investigate the effect of active selection/planning in path integration. Participants traveled along hallways and attempted to directly return to the origin upon seeing a golden apple. Half of the participants freely decided the direction and distance of each hallway by themselves (completely free selection condition). The other half followed the identical outbound pathways selected by their counterparts (passive following condition). The two groups received the same perceptual and motor information but differed in the voluntary selection of the path structure. We found no overall facilitation effect of active selection on homing performance, possibly due to the trade-off between the advantage of planning and the cost of increased working memory load and task complexity in the active selection condition.

(3111)

Intrinsic Reference Direction in Sequentially Learning a Layout. XIANYUN LIU & WEIMIN MOU, *Chinese Academy of Sciences*, & TIMOTHY P. MCNAMARA, *Vanderbilt University* (sponsored by Weimin Mou)—Mou, Liu, and McNamara (2007) showed that preferred directions in pointing judgments (e.g., "Imagine you are standing at X, facing Y, please point to Z") were consistent with the sequence that participants used to learn locations of objects, suggesting that the learning sequence may determine the spatial reference direction in memory. In this project, participants learned a layout of 7 objects with a symmetric axis different from the learning view. In Experiment 1, the objects' locations were illustrated by circular disks that were always presented during learning, and the objects were presented sequentially in a random order. In Experiment 2, the disks were removed and the objects were presented sequentially along the symmetric axis. The results showed that the preferred heading was determined by the symmetric axis in Experiment 1 but by the learning direction in Experiment 2. These results suggest that spatial reference directions are established before learning sequence.

(3112)

Capacity Limits of Spatial Updating: Online and Offline Updating. ERIC HODGSON & DAVID WALLER, *Miami University* (sponsored by Leonard S. Mark)—Keeping track of changing self-to-object spatial relations is generally considered to be capacity limited. However, the limits of updating seem to depend on whether objects are updated online (i.e., in real time) or offline (i.e., reconstructed after movement). Previous results (Hodgson & Waller, 2006) indicate that spatial updating through a 135° rotation involves offline processing and is unaffected by the number of targets. In contrast, participants in the present experiment were required to keep track of the locations of between 1 and 10 objects through a smaller, 45° rotation (putatively requiring only online processing). Set size effects were found in both error and latency, indicating a capacity limit of online updating around 6 items. An additional experiment showed that updating capacity depends both on the number of updated objects and on the magnitude of the movement, such that the further one rotates, the fewer objects one can update online.

(3113)

Can People Determine Parallel and Perpendicular Paths in Active Navigation? ELIZABETH R. CHRASIL & WILLIAM H. WARREN, JR., *Brown University*—Theories of path integration and cognitive map construction often assume that metric information about distances and angles is acquired during walking. Moreover, a map with Euclidean or affine structure must preserve parallelism. In the present study, we test whether traversed angles can be used to determine parallel and perpendicular paths in an ambulatory virtual environment. Participants performed a shortcut task in which they walked down a main path, took a 90° turn onto a side path, then a variable angle turn, and finally were asked to walk perpendicular or parallel to the main path. Participants were expected to exhibit large variable errors and a 90° bias, over-turning acute angles and under-turning obtuse angles. This task dissociates angle from distance, which are confounded in triangle completion tasks. The results can be used to predict path integration performance and have implications for the accuracy and geometric structure of cognitive maps.

(3114)

Route Angularity Effects on Distance Estimation in a Virtual Environment. ADAM T. HUTCHESON, DOUGLAS H. WEDELL, & DAVID E. CLEMENT, *University of South Carolina*—Research has shown that increasing the number of turns a route takes through the environment increases estimates of distance, known as the route angularity effect. Two studies examined mental processes responsible for the occurrence of the route angularity effect in virtual settings. Study 1 tested the plausibility of a scaling explanation of the route angularity effect using a paradigm that has produced the effect in the past. The route angularity effect was found, but the data did not support the scaling hypothesis. Study 2 examined the role of memory in the route angularity effect, with memory load manipulated at encoding or interference manipulated prior to retrieval. The results demonstrated that the route angularity effect was significantly increased by a memory load at encoding but that it was unaffected by the inference task prior to retrieval. Both studies show a greater magnitude of underestimation as the actual path length increases.

• WORKING MEMORY •

(3115)

The Impact of Perception–Action Incompatibility on Auditory Serial Recall. ROBERT W. HUGHES, JOHN E. MARSH, & DYLAN M. JONES, *Cardiff University* (sponsored by Fabrice Parmentier)—The talker-variability effect in serial recall—the impairment of auditory-verbal serial recall when successive to-be-remembered items are spoken in different voices—is typically explained by recourse to item loss through decay within a bespoke short-term store. We provide evidence that the effect can be reattributed to the incompatibility between the

automatic auditory perception of order and the action requirement to reproduce the veridical order of the to-be-remembered items: Factors that promote the automatic perceptual encoding of order by voice rather than according to the true temporal order of the items exacerbates the effect. Moreover, whereas tasks that require memory for order (serial recall and probe tasks) are susceptible, tasks that call only for item memory (missing-item task) are not. We suggest that the talker variability effect can be added to a growing list of short-term “memory” phenomena that may be reconstructed as reflecting the constraints on perceptual and gestural-planning processes.

(3116)

Phonological Similarity Effects in Verbal Working Memory and Language Production Tasks. DANIEL J. ACHESON & MARYELLEN C. MACDONALD, *University of Wisconsin, Madison*—Similar patterns of errors have been observed in language production and verbal working memory (WM) tasks under conditions of phonological similarity (Ellis, 1980). Such errors have been attributed to item-ordering processes in the WM literature but to phoneme ordering processes in language production. The nature of serial ordering mechanisms was investigated with a tongue-twister (TT) paradigm. Lists were composed of four nonwords, with ±TT status varying only through nonword ordering (e.g., TT list: *tiff deeve diff teeve*; non-TT list: *tiff teeve diff deeve*). Memory demands varied across four levels: simple reading (Experiment 1), immediate serial recall, immediate serial typing, and serial recognition (Experiments 2, 3 and 4, respectively). Robust effects of TT ordering were observed despite constant phonological overlap across items. Relative to item serial-position analyses, phoneme error analyses provided insight into the serial ordering process shared by language production and verbal WM. Implications for theories of WM are discussed.

(3117)

Improving Strategy Choice in Individuals With Low Working Memory Capacity. MELANIE CARY, *University of Wisconsin, La Crosse*, & MARSHA C. LOVETT, *Carnegie Mellon University*—How do individuals with low versus high working memory capacity differ in their strategy choices? Prior research (Cary & Lovett, 2004) examined this question for an income-calculation task where the two primary solution strategies were both viable but differed in working memory demands. The results showed that high-capacity individuals were more likely to adapt their choices toward the less-demanding strategy, whereas low-capacity individuals were more likely to stick with their initial strategy, even when it was the more demanding one. In the present study, two experiments explored alternative approaches to improving the strategy choices made by low-capacity individuals. One experiment examined the impact of providing low-capacity participants with a subtle instructional bias toward the less-demanding strategy. The other experiment examined the impact of providing low-capacity and high-capacity participants with example problems to illustrate the use of both strategies. Our analyses focus on participants’ strategy choice and adaptation in each case.

(3118)

Individual Differences in Interference From Auditory Distractors: The Role of Working Memory Capacity. EMILY M. ELLIOTT, JILL A. SHELTON, & SHARON D. LYNN, *Louisiana State University*, & CANDICE C. MOREY, *University of Missouri, Columbia*—Irrelevant sounds are pervasive, and can disrupt cognitive performance. The goals of the present study were to investigate individual differences in performance in the presence of auditory distractors and to assess the relationship of these differences with multiple indices of working memory capacity. Our findings suggest that goal maintenance and the ability to avoid distraction from irrelevant sounds were both important in determining the relationship between working memory and performance in a cross-modal version of the Stroop task. We found that out of three working memory measures, only operation span, a storage-plus-processing task emphasizing attentional control, showed

significant correlations with the cross-modal Stroop task, which measures resistance to interference. This relationship highlights the role of attentional control both in avoiding distraction from irrelevant sounds and in avoiding the interference effects of conflicting stimuli in this Stroop task.

(3119)

Does Metacognitive Monitoring Influence Age Differences in Working Memory Performance? DAYNA R. TOURON, *University of North Carolina, Greensboro*, NATALIE ORANSKY & MATTHEW E. MEIER, *Appalachian State University*, & JARROD C. HINES, *Georgia Institute of Technology* (sponsored by Dayna R. Touron)—A growing body of research indicates that age differences in cognitive performance can be influenced by metacognitive factors. Whereas most metacognitive aging research focuses on simple memory tasks, profound age-related deficits appear to exist in working memory (WM) abilities. Furthermore, recent research suggests that WM performance can be influenced by strategic behavior, suggesting metacognitive influences. The present research examines age differences in the monitoring of WM performance. Older adult and younger adult participants completed 4 blocks of training on a computerized operation span task in conditions which either required or did not require cognitive monitoring reports. Participants in the monitoring condition predicted and postdicted global performance level for each training block, and also rated their responses following each trial within a

training block. Outcomes demonstrate age-related declines in some areas of WM monitoring. Furthermore, WM task performance related to indices of monitoring accuracy, particularly for older adults.

(3120)

Memory Binding Deficits in College Students With Trauma Histories. MARIA S. ZARAGOZA, JUSTIN BLANCHE, & QUIN CHROBAK, *Kent State University*, KAREN J. MITCHELL, *Yale University*, & PATRICK PALMIERI, *Center for the Treatment and Study of Traumatic Stress*—A working memory task (Mitchell et al., 2006) assessed whether, relative to matched controls, individuals with significant trauma histories and PTSD symptoms show disproportionately large memory binding deficits for negatively arousing stimuli. On each trial, participants saw four negatively arousing or four neutral pictures presented sequentially, each in a different one of six locations. In different sets of trials, participants were asked to remember either (1) only the pictures or (2) the pictures plus their locations (which requires memory binding). Relative to memory for pictures only, control participants showed a significant disruption in memory binding for negative pictures only (replicating past research). Trauma participants, on the other hand, showed poor memory binding for both neutral and negative pictures, even controlling for depression. The results suggest that trauma may be associated with generalized memory binding deficits, at least when the task context includes negatively arousing stimuli.

POSTER SESSION IV
Grand Ballroom, Convention Center
Saturday Noon, 12:00–1:30

• PHONOLOGICAL PROCESSING •

(4001)

Processing Phonological Features During Visual Word Recognition: Evidence From Eye Movements and ERPs. JANE ASHBY & JOHN KINGSTON, *University of Massachusetts, Amherst*—Three experiments investigated whether skilled readers use phonological features (e.g., voicing) in visual word recognition. Two eye movement experiments measured lexical decision times to single words preceded by parafoveal previews that either agreed in voicing (e.g., *fak-fat* and *faz-fad*) or disagreed (e.g., *faz-fat* and *fak-fad*). An EEG experiment with the same materials presented 45-msec foveal primes in a masked-priming paradigm. The eye movement data sets indicated slower LDTs to voiced than to unvoiced targets. These data also exhibited the slowest LDTs when voiced targets were preceded by unvoiced previews (*fak-fad*). The ERP waveforms indicated a reduced N1 for both agreeing conditions (*faz-fad* and *fak-fat*), in comparison with their disagreeing counterparts. However, differences between voiced and unvoiced targets did appear around 600 msec posttarget. In combination, these data suggest that readers use marked and unmarked phonological features during visual word recognition.

(4002)

Pseudohomophone Processing in Lexical Decision and Phonological Lexical Decision Tasks. PAUL D. SIAKALUK, *University of Northern British Columbia*, PENNY M. PEXMAN, *University of Calgary*, & LINDA KERSWELL & WILLIAM J. OWEN, *University of Northern British Columbia*—There is considerable debate regarding the effects of phonology and semantics on the processing of pseudohomophones (e.g., *brane*) in the lexical decision task (LDT). Using multiple regression, we examined whether phonological and semantic variables accounted for unique pseudohomophone response latency and error variability in LDT and phonological LDT (does the item sound like a real word?). Our results indicated that phonology (as measured by phonological neighborhood size) accounted for unique variability in LDT, whereas semantics (as measured by imageability and number of associates) did not account for unique variability in either task. Interestingly, the status of the pseudohomophone word body (extant vs. novel) accounted for unique variability, such that in LDT responses were slower for pseudohomophones with extant word bodies, whereas in PLDT responses were faster to these items. We discuss how our results shed light on the relevance of task demands on pseudohomophone processing in visual word recognition.

(4003)

Within- and Cross-Alphabet Repetition Priming in Serbian. JELENA HAVELKA, *University of Kent*, & KATHLEEN RASTLE, *Royal Holloway University of London*—Masked repetition priming effects in Serbian were investigated in two experiments. Experiment 1 used a reading-aloud task to investigate the effect of within-alphabet (WA) priming (prime and target share the same orthography and phonology) and cross-alphabet (CA) priming (prime and target share the same phonology but differ in orthography). Primes were always words that could be uniquely identified as Cyrillic (CA) or Roman (WA), and targets were always words that could be uniquely identified as Roman. The results revealed robust repetition priming effects that were equivalent across WA and CA conditions. Experiment 2 was similar, except that CA primes were bivalent words consisting of letters sharing orthographic representations across alphabets but having different phonological representations in each. The results revealed that the robust CA priming effect observed in Experiment 1 vanished under these conditions, suggesting that masked repetition priming in Serbian is influenced by the rapid generation of multiple phonological codes.

(4004)

There Is a Missing-Phoneme Effect in Aural Prose Comprehension and It Mimics the Missing-Letter Effect in Reading. JEAN SAINT-AUBIN, *University of Moncton*, RAYMOND M. KLEIN, *Dalhousie University*, DAVID W. GOW, JR., *Massachusetts General Hospital*, & MIREILLE BABINEAU, *University of Moncton*—When participants search for a target letter while reading, they make more omissions if the target letter is embedded in a frequent function word than in less frequent content words. This phenomenon, called the *missing-letter effect*, is considered a window on the cognitive processes involved in reading. Here, 96 subjects either read two texts for comprehension while searching for a target letter, or listened to the narration of the same two texts while searching for its corresponding target phoneme. The results revealed more omissions of the target letter while reading and target phoneme while listening when they were embedded in a frequent function word than in less frequent content words. Item-based correlations between the letter and the phoneme detection tasks were high ($r = .60$ and $r = .74$ for the two passages). It is concluded that both procedures reflect those cognitive processes that reading and listening have in common.

(4005)

The Role of Phonology in the Activation of Word Meaning: Evidence From Event-Related Brain Potentials. RANDY LYNN NEWMAN, *Acadia University*, & DEBRA JARED & CORINNE HAIGH, *University of Western Ontario*—We used event-related potentials to clarify the role of phonology in activating the meanings of high-frequency words when skilled readers read sentences silently. Low- or high-frequency homophones in sentences such as “The zookeeper treated the sick bear with an antibiotic” were replaced on some trials by either their high-frequency homophone mate or a spelling control word (*bare/beer*). Our analyses focused on the N400, a response observed to violations in meaning, with the rationale being that a smaller N400 to homophone errors relative to spelling controls would indicate that phonology activated the meanings of both homophone members. We observed an attenuated N400 to homophone errors relative to spelling controls, but only when the unseen correct homophones were low in frequency. These results suggest that skilled readers activate the meanings of high-frequency words using both the orthographic–semantic and orthographic–phonological–semantic routes, and that there is a semantic–orthographic feedback process or spell-check that is less effective when unseen correct homophones are low in frequency.

(4006)

Lexical Priming of Nonword Spelling: Sound-To-Spelling Contingency and Spelling Similarity of Primes. DAISY H. MARTIN, *University of Essex*, ROBERT A. JOHNSTON, *University of Kent*, & CHRIS BARRY, *University of Essex*—The task of spelling nonwords to dictation necessarily requires the operation of some sublexical sound-to-spelling conversion process. Two experiments found clear lexical priming effects on nonword spelling; for example, /vi:m/ was spelled as VEAM more often following the prime word “dream” and was spelled as VEME more often following the prime word “theme.” The priming effects (1) were larger for low-contingency (or lexically low probability) than for high-contingency spellings, (2) diminished when a filler word intervened between the prime word and target nonword, and (3) were only slightly increased when two priming words contained the same (e.g., “scheme, theme”) rather than different (e.g., “dream, theme”) spellings. These results support a model of spelling production in which lexical and assembled spelling processes interact and also inform a more detailed account of the operation of assembled spelling.

• WORD PROCESSING •

(4007)

Age of Acquisition Effects in Chinese Word Processing. BRENDAN S. WEEKES, *University of Sussex*, YOUYI LIU & SHU HUA, *Beijing*

Normal University, & PING LI, *University of Richmond*—Zevin and Seidenberg (2002) suggested that there may be a lasting advantage for early learned words in Chinese because of the more arbitrary nature of the script. We investigated age of acquisition (AoA) effects with behavioral, electrophysiological, and brain imaging methods on Chinese single-character lexical decision. Experiment 1 used a factorial manipulation and found AoA effects when other variables were controlled. Experiment 2 confirmed these results using multiple regression methods. In Experiment 3, EEG data confirmed wave amplitude differences between early and late acquired items. In Experiment 4, event-related fMRI revealed that early and late acquired items activated different brain regions including frontal and precuneus cortices. We argue that AoA effects exist in the recognition of characters in Chinese, which is compatible with the arbitrary mapping hypothesis.

(4008)

Late Semantic Age of Acquisition Effects in Reading: Evidence From Eye Movements. BARBARA J. JUHASZ, *Wesleyan University*, & MARGARET GULLICK, *Dartmouth College*—Words that are acquired early in life are recognized faster than words acquired later in life. Previous studies have observed age of acquisition (AoA) effects on fixation durations during reading (Juhasz & Rayner, 2003, 2006). The present study explored the locus of this AoA effect. Balanced ambiguous words (*tick*) were selected for which both meanings of the word (*clock sound, insect*) were equally frequent, but one meaning was rated as being acquired earlier. These ambiguous words were embedded in sentence contexts that disambiguated the meaning of the ambiguous word; readers' eye movements were then recorded. Meaning AoA affected late processing measures on the ambiguous word, including second-pass reading time. The effect of meaning AoA also spilled over onto the posttarget region. A comparison of these late semantic AoA effects with previous studies suggests that AoA affects multiple stages in the lexical processing system. Implications for models of word recognition will be discussed.

(4009)

Hemispheric Differences in Processing Early and Late AoA Words for Left- and Right-Handed Adults. J. MICHAEL BOWERS & SHELIA M. KENNISON, *Oklahoma State University* (sponsored by Shelia M. Kennison)—The research extended prior studies showing that there are hemispheric differences in the processing of words learned early in childhood (early AoA) versus words learned later in life (late AoA) (Bowers & Kennison, 2007). These prior studies showed that there is greater right hemisphere involvement in the processing of early AoA words than of late AoA words. The present research compared the hemispheric differences in the processing of early and late AoA words for right-handed and left-handed adults. Three groups of participants were compared: (1) left-handed adults; (2) right-handed adults with only right-handed biological relatives; and (3) right-handed adults with some left-handed biological relatives. Participants viewed early and late AoA words presented briefly to either the left or the right visual field and carried out a lexical decision task. The results showed that there were significant hemispheric differences in the processing of late AoA words by left- and right-handed adults.

(4010)

There Are Many Ways to Be Rich: Effects of Three Measures of Semantic Richness on Visual Word Recognition. PENNY M. PEXMAN & IAN S. HARGREAVES, *University of Calgary*, PAUL D. SIAKALUK, *University of Northern British Columbia*, & GLEN E. BODNER & JAMIE POPE, *University of Calgary*—Previous studies have reported facilitatory effects of semantic richness on word recognition (e.g., Buchanan et al., 2001; Pexman et al., 2003). We compared the ability of three richness measures to account for reaction time (RT) and error variance in lexical decision and semantic categorization tasks. The measures were: (1) number of semantic neighbors (NSN; the number of words appearing in similar linguistic contexts), (2) number of features (NoF; the number of attributes listed for a

word's referent), and (3) contextual dispersion (CD; the distribution of a word's occurrences across contexts). NoF and CD accounted for unique variance in both tasks, whereas NSN accounted for unique variance only in the lexical decision task. Moreover, each measure showed a different pattern of relative contribution across the tasks. Our results provide new clues about how words are represented, and favor word recognition models that incorporate both lexical-semantic and episodic influences.

(4011)

Multiple Semantic Associates for a Single Individual With Free Association. LANCE W. HAHN, *Western Kentucky University*—Traditionally, free association tasks have acquired a single response for each cue word across several participants, and the results have been treated as a set of weighted associations for an idealized participant. One disadvantage of this approach is that it obscures individual differences. Monte Carlo simulations suggest a second disadvantage: Collecting single responses may undersample secondary associations. The presence of a strong associate can diminish the likelihood of a second moderate associate being produced in a single-response free association task. Single-response and multiple-response free association tasks were used to create a set of associations. The results suggest that the multiple-response task produces larger association strengths than does the single-response task for secondary associations. Additionally, the multiple-response task can be used to measure individual and group differences in semantic associations.

(4012)

Does Prior Knowledge Affect Distraction? The Effects of Aging and Music Expertise. ELIZABETH R. GRAHAM & GABRIELLE OSBORNE, *Claremont Graduate University*, & DEBORAH M. BURKE, *Pomona College*—Visual distractors semantically related to a text slow reading time more for older than young adults. We investigated whether these effects reflect generic age-related inhibition deficits or older adults' enriched semantic network. Young and older adults with low or high knowledge about music read passages about music or a control topic; passages contained related, unrelated, or no distractors. Older adults' reading times were slowed more by distractors than were young adults'. Reading times for music passages with related distractors were slower for related than for unrelated distractors for older adults but only for high-knowledge young adults. Recognition memory was better for targets than for distractors, with a larger effect for young than for older adults for the control passage. For music passages, however, superior recognition of targets occurred for low- but not for high-knowledge participants across age. Thus, prior knowledge modifies age differences in distraction, suggesting the importance of richer semantic networks for performance.

(4013)

Behavioral and Anatomical Correlates of Corpus Callosum Size. CHRISTINE CHIARELLO & SUZANNE E. WELCOME, *University of California, Riverside*, LAURA K. HALDERMAN, *University of Pittsburgh*, STEPHEN TOWLER, *University of Florida, Gainesville*, RONALD OTTO, *Riverside Imaging LLC*, & CHRISTIANA M. LEONARD, *University of Florida, Gainesville*—The corpus callosum varies widely in size and shape across individuals. We investigated anatomical and behavioral correlates of this variation in 200 young adults. Size of the total corpus callosum and seven subregions was measured from structural MRI scans, and the participants were tested in seven divided visual field lexical tasks. Contrary to prior findings with smaller samples, there was no relationship between corpus callosum size and either behavioral or anatomical asymmetries. There were no overall sex differences in corpus callosum anatomy. However, we did obtain a sex \times handedness interaction in a subsample of matched left- and right-handers: The splenium and isthmus were larger in left-handers than in right-handers, only for males. Variations in corpus callosum anatomy may not be associated with simple measures of structural or behavioral asymmetries.

• PROCESSING LETTER POSITIONS •

(4014)

Transposition Priming Effects Explained With Absolute Letter Position Coding. WENDY DE MOOR, WOUTER DUYCK, & TOM VERGUTS, *University of Ghent* (sponsored by Tom Verguts)—A basic problem that must be addressed by any word recognition model is how letter position information within a word is coded. The fact that we can distinguish between, for instance, GARDEN and GRADEN has led to the idea of absolute letter position coding—that is, one set of detectors to code for the first letter, one set for the second letter, and so on (e.g., McClelland & Rumelhart, 1981). On the other hand, transposition priming studies have demonstrated priming from, for instance, GRADEN to GARDEN, leading to word recognition models based on relative rather than absolute letter position coding (e.g., Peressotti & Grainger, 1999). In this study, we present a computational model that demonstrates that transposition priming can also be explained with absolute position coding if some uncertainty (fuzziness) is introduced in the coding positions. We also present new empirical data on transposition priming that support the computational model.

(4015)

The Quiet Clam Is Quite Calm: Transposed-Letter Neighborhood Effects in Reading. REBECCA L. JOHNSON, *Skidmore College*—Response time tasks have found inhibitory neighborhood effects for word pairs that differ in a transposition of two adjacent letters (e.g., *clam/calm*). Here, two eyetracking experiments were conducted to explore transposed-letter (TL) neighborhood effects within the context of normal silent reading. In Experiment 1, sentences contained a target word that either has a TL neighbor (e.g., *angel*) or does not (e.g., *alien*). In Experiment 2, the context was manipulated to explore whether semantic constraints attenuate neighborhood effects. Readers took longer to process words that have a TL neighbor than control words, but only when either member of the TL pair was likely. Furthermore, this interference effect occurred late in processing and was not affected by relative word frequency. These interference effects can be explained either by the spreading of activation from the target word to its TL neighbor or by the misidentification of target words for their TL neighbors.

(4016)

The Representation of Letter Position in Orthographic Representation. SIMON J. FISCHER-BAUM, BRENDA C. RAPP, & MICHAEL MCCLOSKEY, *Johns Hopkins University* (sponsored by Brenda C. Rapp)—The orthographic representations used when reading and spelling encode not only the letters that are in the word, but also their positions. How is letter position represented? Is the G in DOG represented as the third letter, the first letter to the right of a midline, the last letter, or the coda of an orthographic syllable? We present evidence from two individuals with acquired dysgraphia (subsequent to a stroke) who perseverate single letters when spelling. That is, letters from previous responses intrude into subsequent ones. Perseverated letters appeared more often than would be expected by chance in the same position of an error response and the source response. We contrasted the predictions of different hypotheses regarding the representation of letter position: syllabically defined position, left, right, or center alignment and right+left edge alignment. The analyses provide evidence for both syllabic and right+left edge alignment.

(4017)

Letter Position Encoding and Morphology. MANUEL PEREA, *University of València*, JON A. DUÑABEITIA, *University of La Laguna*, JOANA ACHA, *University of València*, & MANUEL CARREIRAS, *University of La Laguna* (sponsored by Manuel Perea)—Duñabeitia, Perea, and Carreiras (2007) found that masked transposed-letter priming effects tended to vanish when the adjacent letter transposition crossed a morpheme boundary (*walekr*–WALKER vs. *walibr*–WALKER). They suggested that morphological decomposition operates at an early stage of visual-word recognition. Recent evidence has also

shown that pseudoaffixed words (CORNER) can also be decomposed early in word processing (Rastle et al., 2004). In the present lexical decision experiments, we examined the magnitude of the transposed-letter priming effect for suffixed words, pseudosuffixed words, and nonaffixed words. We did so for adjacent and nonadjacent letter transpositions across the morpheme boundaries. The results showed that, for adjacent transpositions, the transposed-letter priming effect was greater for nonaffixed words than for affixed/pseudoaffixed words. However, for nonadjacent transpositions, the transposed-letter priming effect was unaffected by morphology. We examine the implications of these findings for models of letter position encoding and morphological processing.

(4018)

Fast and Furious False Recognitions: Jumbled Words and Semantic Associations. KARA D. DESOUZA, SARA HABER, & WILLIAM P. WALLACE, *University of Nevada, Reno*—Jumbled nonwords, in which the first and last letter of a word remain the same but interior letters are rearranged, have been shown to be easily readable (Grainger & Whitney, 2004). This might be due to the nonword being recoded into the original word (Perea & Lupker, 2003), a process which may suffer with fast stimulus presentation rates. This experiment investigated the jumbled word effect in conjunction with false recognitions of critical items related to semantic associate lists. Four presentation speed conditions (110 msec, 160 msec, 330 msec, 880 msec) were used to determine whether false recognitions of jumbled nonwords can be reduced through short presentation times. False recognition occurred for neither words nor nonwords at the fastest rate, but did occur for both at slower speeds. It appears that for nonwords, a significantly longer presentation time is required than for words, in order for semantically related false recognitions to occur.

(4019)

Deconstructing the Neighborhood: 1-Gram Effects and Orthographic Neighborhoods. CHRIS F. WESTBURY, *University of Alberta*—A word's orthographic neighborhood (ON) is defined as the number of words that differ from it by a single letter. We have examined the effect on lexical decision RTs of the number and frequency of words at different positions in a word, using a new frequency dictionary drawn from a very large new corpus, new nonlinear correlation tools, and both standard and novel techniques. One finding is that ON-modulating frequency effects extend much lower in the frequency range than is usually taken into account. We find strong positional effects in ON. A few positional effects wash out the effect of ON itself in linear and nonlinear regression analysis. We demonstrate that the positional effects can be nonlinear, and much stronger than linear analysis suggests. More complex and subtle measures of orthographic typicality than ON may be helpful for understanding how word typicality impinges on lexical access.

(4020)

The Influence of Sentence Context on Orthographic Neighborhood Effects in Reading. BRIAN M. FRIEL, *Delaware State University*—Two experiments—one involving a lexical decision task (LDT) and the other employing a self-paced sentence reading task—investigated the impact of sentence context on orthographic neighborhood effects in word recognition. In both experiments, the same 24 target words were used. Half of the targets had many orthographic neighbors (defined by Coltheart's N). The LDT results revealed that words with many neighbors (large N words) yielded faster response times than words with few neighbors (small N words). In the reading experiment, the targets in each neighborhood size condition were embedded in sentences. These sentences differed in terms of the degree to which context constrained the plausibility of the target's neighbors. Large N targets were read faster than small N targets, and sentence constraint facilitated target recognition. A comparison of reaction times for items between tasks revealed that the sentence context manipulation only affected recognition of large N targets.

(4021)

Neighbor Frequency Effects in English: Parallels With Lexical Ambiguity Resolution? TIMOTHY J. SLATTERY, KEITH RAYNER, & ALEXANDER POLLATSEK, *University of Massachusetts, Amherst*—Two eye movement experiments were conducted to investigate whether the processing of a word can be affected by the word's higher frequency neighbor. In Experiment 1, target words with (*birch*) or without (*spruce*) higher frequency neighbors were embedded into two types of sentence frames: one in which the higher frequency neighbor (*birth*) could fit given the prior sentence context and one in which it could not. Experiment 2 used the same design with target words that were both neighbors and homonyms (*beech*, *beach*) to investigate the role of phonology. The results suggest that sentence context can affect the processing of word neighbors in much the same way it affects lexical ambiguity resolution. The separate meanings of a lexically ambiguous word, then, may be thought of as extreme forms of word neighbors (word roommates). Implications for models of word recognition and lexical ambiguity resolution will be discussed.

• COGNITIVE CONTROL •

(4022)

Error Repetitions and Attention: Examination Within the Older Adults Group. ETSUKO T. HARADA, *Hosei University*, & SATORU SUTO, *Chuo University*—The phenomenon of error repetition—that elder users of IT-based equipment often show continual repetitions of the same erroneous operations in daily lives and the usability testing labs—was investigated with a simple kanji selection task, and we found that it was related to attention, especially the function of maintaining multiple goals in both age groups, younger and older adults (Harada & Suto, 2006). In this study, we examined this hypothesis further within the older adults group, by adding another simple task-switching task, the figure selection task. Both of the following results supported the hypothesis: (1) reexamination of preceding experimental results about the relation between the kanji selection task and the figure selection task, and (2) the experiment in which good and poor older groups divided with the figure selection task were compared directly in terms of error repetition frequency. The implication of this hypothesis to human-error research will be also discussed.

(4023)

The Source of Enhanced Cognitive Control in Bilinguals: Evidence From Bimodal-Bilinguals. GIGI LUK, *York University*, JENNIE E. PYERS, *Wellesley College*, KAREN EMMOREY, *San Diego State University*, & ELLEN BIALYSTOK, *York University*—Bilinguals often outperform monolinguals on nonverbal tasks that require resolving conflict from competing alternatives. The regular need to select a target language is argued to enhance cognitive control. To investigate whether this enhancement stems from a general effect of bilingualism (the representation of two languages) or from an articulatory constraint that forces language selection, we compared the performance of 12 bimodal-bilinguals (fluent in a signed and spoken language, and hence free from articulatory conflict) with that of 15 monolinguals and 15 unimodal-bilinguals on a computerized cognitive control task (a flanker paradigm). There was no difference between the groups in accuracy, but unimodal-bilinguals were faster in response time than the other groups; bimodal-bilinguals did not differ from monolinguals. These results trace the bilingual advantage in cognitive control to the unimodal-bilingual experience where the production demand on a single output system creates an ongoing conflict that must be resolved through attention and selection.

(4024)

Effects of Bilingualism and Aging in Multitasking. MYTHILI VISWANATHAN & ELLEN BIALYSTOK, *York University*—Previous research has shown that bilingualism offsets age-related losses in executive processes (Bialystok et al., 2004). The present study investigated the role of bilingualism and aging in a dual-task classification para-

digm. Younger (30–40) and older (60–80) monolinguals and bilinguals performed a visual classification task in which they designated pictures to one of two categories by a manual response at the same time as performing an auditory classification task with a verbal response. Younger adults and bilinguals (in both age groups) were faster in responding to both tasks, but older monolinguals often stopped performing the auditory task because of processing overload. The RT difference between responding to each task was calculated to determine how responses were executed. Bilinguals were more likely to respond to both tasks simultaneously, whereas monolinguals were more likely to switch back and forth. These data point to differences in executive control in a multitasking context for bilinguals.

(4025)

Does Musical Expertise Enhance Executive Functioning? ANNE-MARIE DEPAPE & ELLEN BIALYSTOK, *York University*, & TAKAKO FUJIOKA & FERGUS I. M. CRAIK, *Rotman Research Institute* (sponsored by Ellen Bialystok)—Following evidence for bilingual advantages in cognitive control tasks, the purpose of this study was to determine whether musical expertise provided parallel benefits in executive functioning. The sample included 95 young adults (24 years) who were identified by self-report as being monolingual speakers, bilingual speakers, monolingual instrumentalists, or monolingual singers. Participants completed two executive control tasks in which they resolved visual (Simon arrows task) or auditory (auditory Stroop task) conflict. In the Simon arrows task, the bilinguals and both musician groups outperformed the monolinguals, with no differences between the first three groups. In the auditory Stroop task, both musician groups outperformed the monolinguals and bilinguals in the pitch condition, whereas no differences were found between these groups in the word condition. The findings indicate that extensive musical training can promote enhanced executive functioning, both for domain general (visual Simon task) and domain specific (auditory Stroop task) performance.

(4026)

Cross-Task Correspondence Effects in Driving. JOCHEN MÜSSELER, *RWTH Aachen University*, & GISA ASCHERSLEBEN & KATRIN ARNING, *University of the Saarland*—In a previous study, we demonstrated cross-task correspondence effects between response location in a primary task and the location at which stimuli are presented in a secondary task. In the present experiments, this cross-task effect is examined in a critical driving situation: The secondary task required listening to the spoken message of the navigation system (“turn left [right]”), whereas the primary task required reacting with a left or right steering wheel response to a pedestrian suddenly entering the street. Findings denoted that when the pedestrian enters from the right (left) side, a right (left) message from the navigation system impairs performance as it conflicts with the left (right) steering wheel response to avoid hitting the pedestrian. In other words, superior performance is observed when spoken message and direction of the steering wheel response correspond than when they do not.

(4027)

Influence of Age and Expertise on Cross-Task Compatibility in Driving. KATRIN ARNING & GISA ASCHERSLEBEN, *University of the Saarland*, & JOCHEN MÜSSELER, *RWTH Aachen University* (sponsored by Jochen Müsseler)—Dual-task conditions impose high demands on older drivers, especially in critical traffic situations. Factors influencing driving performance such as dual-task demands, cross-task compatibility, age, and driving expertise (nonprofessional vs. professional drivers) were analyzed. Participants performed a driving task (primary task), in which a collision with a pedestrian suddenly entering the street from the side (from the left/right) had to be avoided with a steering wheel response (to the left/right). The secondary task was to listen to the spoken message (“turn left [right]”) of a navigation system. The results showed superior driving performance in nonprofessional drivers when the directions of the steering wheel response and the spo-

ken message of the navigation system corresponded. Moreover, inferior performance was found in older drivers but no stronger age-related compatibility effects. The compatibility effect completely vanished in older professional drivers, indicating that expertise reduces age-related compatibility effects in critical driving situations.

(4028)

Cognitive Control in Sense of Time. MARIA GRAZIA CARELLI & TIMO MÄNTYLÄ, *University of Umeå*—A number of patient studies suggest that impairments in executive/frontal functions are associated with disorders in temporal information processing. One implication of these findings is that subjective experience of time should be related to executive functions regardless of etiology. We examined sense of time in relation to components of executive functioning in healthy children and adults. Sense of time was based on tasks of varying complexity, including a time reproduction task in which participants completed discrete stimulus durations and a multitiming task in which participants reported observed temporal patterns with different onset and offset times. Individual differences in executive functioning were related to multitiming performance, rather than to time reproduction performance, in healthy participants. These findings suggest that the psychophysical paradigms of interval timing are not easily translated to complex goal-directed tasks, and that clinical assessment of temporal processing should reflect complexities of everyday cognition.

(4029)

Measures of Working Memory Capacity That Work. JAMES M. BROADWAY & RANDALL W. ENGLE, *Georgia Institute of Technology*—We administered three types of immediate memory test (complex span, running span, and simple span) to assess their differential prediction of general fluid (gF) abilities. We also manipulated rate of presentation in running span, producing fast and slow versions, since previous researchers have proposed that fast and slow running span reflect different processes. The results indicated that the majority of predicted variance in gF was due to variance shared among the three span measures, with running and complex spans each making unique incremental contributions to prediction and simple span making little. Additionally, there was little support for the notion that fast and slow running span tap distinct psychological constructs or abilities that are differentially related to gF. We propose that running span is a useful and valid measure of working memory capacity because it requires subjects to cope with information overload and to discriminate among internally generated retrieval cues.

• PSYCHOLINGUISTICS •

(4030)

Does Lexical Activation Flow From Word Meanings to Word Sounds During Spoken Word Recognition? EILING YEE & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—During spoken word recognition, lexical activation flows from word sounds to word meanings, whereas during production, activation flows in the opposite direction. If the production and comprehension systems share the same architecture, then during comprehension, some amount of activation might also flow from meaning to sound. We investigate this question by monitoring eye movements during spoken word recognition. Participants heard a word while viewing a four-object array. In critical trials, the name of one of the objects sounded similar to a word related in meaning to the heard word (e.g., for the heard word “key,” there was a picture of “logs,” because “logs” is related in sound to “lock,” which is related in meaning to “key”). We found that participants preferentially fixate on the object whose name sounds similar to a word related in meaning to the heard word, suggesting that information flows from meaning to sound during comprehension.

(4031)

Subliminal Speech Priming for Words and Nonwords: Evidence From Eyetracking. LARA TAGLIAPIETRA & HOLGER MITTERER,

Max Planck Institute for Psycholinguistics (sponsored by James M. McQueen)—Kouider and Dupoux (2005) obtained masked auditory repetition priming for words, but not for nonwords, in lexical decision. We tested whether this pattern is task specific. Participants heard unmasked word and nonword targets, which were preceded (with either a 0- or a 400-msec delay) by identical or unrelated masked primes. Eye movements were tracked as participants looked at a display of four printed letter strings (2 words and 2 nonwords), which included the target to be clicked on and the unrelated prime. Looks to both word and nonword targets occurred earlier after identical primes than after unrelated primes. Unrelated primes also triggered looks to their visual counterparts. This effect occurred for words and nonwords when target presentation was delayed by 400 msec, but only for words when targets immediately followed the primes. These results demonstrate masked auditory priming for nonwords and suggest that lexicality effects appear under particular experimental circumstances.

(4032)

Directed Imitation in Conversational Interaction. JENNIFER S. PARDO & ISABEL CAJORI JAY, *Barnard College*, & ALEXANDRA C. SUPPES & ROBERT M. KRAUSS, *Columbia University*—Previous research found that paired talkers converged in acoustic-phonetic forms over the course of a single conversational interaction. However, convergence was subtle and asymmetrical, leading to the conclusion that speech perception does not reflexively elicit imitation in speech production. In the present study, one member of a pair of talkers was explicitly instructed to try to imitate his/her partner in a paired conversational task. Twenty-four talkers provided speech before, during, and after task performance. Repeated phrases from the corpus comprised materials for AXB similarity tests performed by separate listeners. The listeners judged similarity in pronunciation of consonants and vowels, similarity in vowels alone, and imitation. Overall, talkers became more similar in phonetic forms, and the degree of similarity/imitation was influenced by imitation instruction, task role, and the talker’s sex. These findings demonstrate the importance of nonlinguistic factors in speech production and perception.

(4033)

The Time Course of Pragmatic Context Integration in Homophone Ambiguity Resolution. DANIEL MIRMAN, JAMES S. MAGNUSON, TED STRAUSS, & JAMES A. DIXON, *University of Connecticut* (sponsored by James A. Dixon)—Syntactic, thematic, pragmatic, and visual contexts all help listeners recognize ambiguous words, such as homophones. In interactive theories, context is integrated continuously, but in autonomous theories, there is an initial, encapsulated stage of processing protected from context. We examined whether a strong pragmatic expectation for concrete nouns could mediate ambiguity resolution. We tracked eye movements as subjects saw displays of four images of concrete objects and selected one that was named in a spoken instruction. The entire time course of processing showed greater activation of semantic associates of contextually appropriate (i.e., noun) meanings than contextually inappropriate (i.e., verb) meanings. The early, continuous, and graded pattern of context effects and the consequent effect on semantic associates rule out decision-level integration accounts of these results. Rather, these results indicate that context acts directly as a graded constraint on meaning activation.

(4034)

Does Orthography Matter in Auditory Word Recognition? Converging Evidence From Different Tasks. RONALD PEEREMAN & IMANE BENBOUSSELHAM, *University of Bourgogne*, SOPHIE DUFOUR, *University of Geneva*, & PATRICK BONIN, *LAPSCO/CNRS and Université Blaise Pascal*—Although many studies indicate that phonology shapes visual word recognition, it is currently unclear whether reciprocal influences of orthography occur during auditory word recognition. Previous data indicate that the consistency of the mappings between phonological and orthographic units modulates per-

formance in auditory lexical decision, but whether its influence extends to other tasks such as shadowing remains controversial. In a first experiment, we show that the emergence of the consistency effect depends on the degree of lexical involvement in shadowing auditory words. Consistency effects also emerged in two additional experiments using the semantic and the gender categorization tasks. A last shadowing experiment indicates that the magnitude of the orthographic effects reduces when words are embedded in sentence contexts. Simulation works lead us to propose that orthography does not necessarily mediate lexical access, but that learning to read and write might cause phonological representations to reflect the orthographic properties of words.

(4035)

Additional Evidence for Role of Focus Prosody in Silent Reading. JENNIFER GROSS, *Grand Valley State University*, BRIAN BARTEK, *University of Michigan*, & SAMANTHA RIECK & KYLE HAMPTON BREDELL, *Grand Valley State University*—The implicit prosody hypothesis (Fodor, 2002) contends that silent readers have a prosodic “inner voice.” To test this, participants read short paragraphs, in which select words were capitalized. For example, in the sentence, “Sam fell out of the canoe,” either “SAM” or “FELL” appeared in caps. The paragraph in which this sentence appeared manipulated whether “Sam” or “fell” was new information (not previously mentioned), and therefore in prosodic focus, or old information furnished in the story. Participants judged (on a 5-point scale) the helpfulness of capped words, under the ruse of helping an editor determine intentional from nonintentional caps (caused by a computer virus). Experimental conditions—capitalized words and congruency of context—were fully crossed. Replicating and extending our previous work, participants rated the “capped” words as more helpful, only when these target words were “new” (i.e., prosodically focused) rather than “given,” consistent with Selkirk’s (1995) theory of focus projection.

• DISCOURSE PROCESSES •

(4036)

An Electrophysiological Examination of Temporal Cue Use During Discourse Comprehension. TALITZMAN & PHILLIP J. HOLCOMB, *Tufts University*, & GINA R. KUPERBERG, *Tufts University and MGH* (sponsored by Phillip J. Holcomb)—To examine the time course for the integration of temporal information into readers’ situation models, the present study recorded event-related brain potentials (ERPs) as participants read short scenarios with temporal continuities (after one second), small shifts (after one minute), or large shifts (after one year). Difficulty integrating temporal shifts into the present model was examined by N400 amplitude at the point of the shift (second/minute/year). Difficulty accessing information preceding the shift was examined by N400 amplitude to a repeated noun-phrase anaphor immediately following the shift. This type of anaphor is not preferred as a referent for a salient antecedent. The results demonstrated that participants had increased difficulty integrating large temporal shifts into the preceding discourse model as evidenced by the largest amplitude N400. Processing large temporal shifts also decreased the accessibility of preceding information, making it appropriate to employ a repeated noun-phrase anaphor, as evidenced by the smallest amplitude N400.

(4037)

Before We Begin: The Consequences of Introductions on Processing of Explanations. MICHAEL MENSINK, *University of Minnesota*, DAVID N. RAPP, *Northwestern University*, PANAYIOTA KENDEOU, *McGill University*, & R. BROOKE LEA, *Macalester College*—Topics can be introduced in a variety of ways, but do particular introductions influence how individuals process those topics? We assessed the influence of introductions on participants’ reading of brief scientific explanations. Participants read sixteen texts describing basic scientific processes (e.g., mitosis, reflexes). Texts included 3-sentence introductions that (1) provided an engaging narrative in

which a character needed to provide the explanation or (2) described a technical rationale for why the explanation is worth reading about. These manipulations were intended to emulate the engaging introductions or technical remarks that often preface explanatory materials. Participants took longer to read technical in comparison with narrative introductions as they unfolded. However, participants took longer to begin reading explanatory material following narrative in comparison with technical introductions. Introductory content did not differentially influence participants’ expectations as to their understanding of the texts. Introductions may influence reader attention to explanatory material without concomitant awareness of their effects.

(4038)

Three Information Functions of Headings. ROBERT F. LORCH, JR., *University of Kentucky*, JULIE LEMARIE, *University of Toulouse, Le Mirail*, & WHITNEY C. O’ROURKE & SHAWN CANTY, *University of Kentucky*—A recent theory of signaling distinguishes six “information functions” performed by signaling devices. Signals may: (1) demarcate structural boundaries in a text; (2) emphasize content; (3) establish the function of a text subsection; (4) identify the topic of a subsection; (5) provide a label for a subsection; and/or (6) communicate organizational information. Three experiments isolated and tested three of the hypothesized information functions using a simple text search task. In Experiment 1, search times to locate target sentences were faster if the text contained topic-identifying headings than if the headings did not identify topics. In Experiment 2, search times were faster if the questions identified the subsections in which the targets were located. In Experiment 3, search times were faster if the questions identified the numbers of the relevant subsections. Thus, the experiments validate the information functions of topic identification, labeling, and organization.

(4039)

The Influence of Reading Goals on Text Recall. JONATHAN SCHUSTER & RUTHANN ATCHLEY, *University of Kansas*—This research examined the manner in which reading goals and organizational signals might act independently or interact with each other while reading to influence text recall. Participants read texts, which contained no signals, half signals, or full signals, and were assigned the goal of either reading for school or reading for pleasure. Significant reading goal differences were found, and there was a significant interaction that involved organizational signals and reading goal for overall recall. School goal participants recalled more information overall when signals were present than did pleasure goal participants; both groups were similar when signals were absent. Subsequently, we have also investigated the possible relationship between reading goals and working memory span to determine whether working memory span impacts what reading goals are available and how they are utilized.

(4040)

Monitoring Situational Content and Continuity While Reading. SARA GILLIAM & PETER W. FOLTZ, *New Mexico State University*, & JOSEPH P. MAGLIANO, *Northern Illinois University* (sponsored by Peter W. Foltz)—According to Zwaan, Langston, and Graesser’s (1995) event-indexing model, readers monitor changes in a series of critical dimensions: space, time, protagonist, causality, and goal. However, before readers can monitor for continuities across dimensions, they have to extract the situation model information that is present. The goal of this study was to explore the extent to which readers monitor both situational content and continuities while reading naturalistic discourse. Participants read four naturalistic texts, and sentence reading times were recorded. Discourse analyses were developed to determine the situational content and continuity of each sentence for characters, time, space, causality, and goals. The results suggest that reading times are influenced more by situational continuity than by content. Furthermore, consistent with prior research, causality is the dimension that is most closely monitored. Although readers may build representations based on situational content, mon-

itoring changes in continuity is critical for the construction of these representations.

(4041)

Unfamiliarity and Belief Change: Manipulating Gender in Fictional Narratives. MIJA M. VAN DER WEGE, *Carleton College*—Research has shown that people alter their beliefs when reading fictional narratives (e.g., Prentice, Gerrig, & Bailis, 1997) and even learn information from fictional sources (e.g., Marsh, Meade, & Roediger, 2003). One cognitive explanation for this is that familiarity with the story setting frees cognitive resources to evaluate factual claims in the fictional context, and previous research has found limited support for this theory by manipulating the familiarity of the setting of the story (Prentice, Gerrig, & Bailis, 1997). The present study found additional support for the familiarity hypothesis by manipulating the alignment of the reader's and protagonist's genders. When reading stories with a female protagonist, female readers experience less belief change than when reading stories with a male protagonist, with male readers showing the reverse pattern. However, this pattern was observed in first-person stories, but not in third-person stories.

(4042)

How Readers' Mood and the Valence of Story Endings Structure Readers' Experiences of Narratives. GIOVANNA EGIDI, *University of Chicago*, & RICHARD J. GERRIG, *Stony Brook University*—Do readers attend differently to story endings as a function of their positive or negative valence? Does the valence of readers' mood—positive or negative—influence the way in which they process such outcomes? To address these questions, we wrote stories that could have a positive or negative ending, and induced participants to experience a positive or negative mood prior to reading the stories. Independent of their mood, participants read negative endings more slowly than positive endings and remembered them better. However, readers in a negative mood judged as more surprising positive endings, and readers in a positive mood judged as more surprising negative endings. This research illustrates that ending valence has strong influence on moment-by-moment reading, but readers' mood influences readers' expectations for story outcomes once they have formed a complete representation of the story.

(4043)

Simple Addition and Subtraction Calculations While Reading a Narrative. PAUL J. SCHROEDER & DAVID E. COPELAND, *University of Nevada, Las Vegas*—Research with word problems has shown that adults can make arithmetic calculations from text when asked to do so. However, do adults make calculations while reading a text if they are not explicitly asked to do it? The present study examined the extent to which readers make arithmetic calculations while reading a narrative under normal reading instructions and conditions. Specifically, this study considered whether readers track precise values for simple addition or subtraction while reading or whether general approximations were acceptable. Participants read short stories that presented two separate quantities (i.e., a starting amount and either an addition or a loss). Arithmetic calculation was examined by comparing reading times for inconsistent versus consistent statements regarding the sum or difference value. Surprisingly, initial results show that readers are more likely to detect inconsistent values for subtraction than for addition.

• PERCEPTION •

(4044)

The Role of Familiarity and Reproducibility in Auditory Distance Perception. PATCHOULY N. BANKS, BARBARA A. CHURCH, & EDUARDO MERCADO III, *University at Buffalo*—Humans are poor at judging the distance to a sound source. They typically underestimate the distance when sounds have traveled far, and overestimate the distance when sources are nearby. Several acoustic cues contribute to

auditory distance estimation, most notably intensity. Nonacoustic cues, including familiarity, may also play a role (Zahorik, Brungart, & Bronkhorst, 2005). For example, previous research suggests that distance judgments are easier for forward versus backward speech (McGregor, Horn, and Todd, 1985). One limitation of this prior study is that it confounded familiarity with reproducibility. We attempted to control these factors. Participants categorized different types of sounds, recorded at different distances, as coming from either near or far sources. The sounds varied orthogonally in familiarity and reproducibility. The results do not support the idea that distance judgments are always easier for familiar sounds, but do suggest that nonacoustic features of sounds can influence auditory distance estimation in interesting ways.

(4045)

Interpreting Asymmetrical Correlations Between Perceived Changes in Pitch and Loudness. ESTELLA H. LIU, BARBARA A. CHURCH, & EDUARDO MERCADO III, *University at Buffalo*—Perception of loudness and pitch interact during the processing of multidimensional sounds. For example, listeners overestimate changes in pitch when loudness increases, suggesting a perceptual bias for sounds with rising intensity. We examined whether listeners show this bias when asked to classify the direction of dynamic changes in pitch and loudness. Listeners categorized pitch and loudness as rising or falling when the correspondence between the two dimensions varied. Listeners were more likely to incorrectly categorize both pitch and loudness changes as rising/falling when the other dimension was also rising/falling. They were also faster to correctly judge change direction for both when the other dimension changed in the same way. As in previous studies, perceptual bias in pitch judgments appeared to be strongest when sounds increased in loudness. However, reaction time data suggested a speed–accuracy trade-off. Implications of these results for previous interpretations of asymmetrical biases are discussed.

(4046)

Acoustic and Semantic Effects on Change Deafness and Auditory Object Encoding. MELISSA K. GREGG & ARTHUR G. SAMUEL, *Stony Brook University*—Although change blindness has been frequently demonstrated, detection of auditory change has been far less studied; little is known about change deafness. We explored change deafness by measuring both change detection and auditory object encoding. Considerable change deafness occurred, even when auditory objects were well encoded. We found that the pitch and periodicity of sounds provided important cues for change detection, but not for object encoding. In contrast, manipulation of the semantic relationships between objects affected both change detection and object encoding: Listeners committed more errors on both tasks when targets were semantically related than when they were not. This finding suggests that auditory objects are semantically encoded and that listeners sometimes rely more on semantic information than on physical detail. Potential mechanisms responsible for change deafness are discussed.

(4047)

Investigating Acoustic Property Cue Use for Complex Natural Sound Structures. JESSE D. FLINT, RICHARD E. PASTORE, & JEREMY R. GASTON, *Binghamton University* (sponsored by Richard E. Pastore)—Many investigations of natural sound perception assume a crisp relationship between source and sound properties, with perception reflecting all listeners' evaluating the relevant and ignoring the irrelevant sound properties. However, each individual acoustic property often reflects a number of different aspects of the source event, resulting in fuzzy relationships between sound properties and specific aspects of the source event. In addition, perception of individual listeners reflects the evaluation of a limited subset of available acoustic information, with the specific subset differing across listeners. The present research investigates sound property utilization of individual listeners by manipulating experience with, and knowledge about, the relevance of specific sound properties. The results indicate

that, although listeners tend to not ignore salient irrelevant properties, experience and knowledge both have an effect on the use of specific relevant properties. The results will be discussed in terms of the degree to which individual properties can be altered.

(4048)

Brief Meditation Training and Its Effects on Pain Perception. FADEL Z. ZEIDAN, NAKIA S. GORDON, & PAULA GOOLKASIAN, *University of North Carolina, Charlotte*—Long-term meditation practice attenuates responses to experimental pain (Kaikigi et al., 2005). Meditation may reduce pain perception by serving as a distraction; inducing a relaxation response (Lazar et al., 2000); or enhancing ability to cognitively shift attention from pain (Orme-Johnson et al., 2006). These issues have been explored largely in adept meditators (Kabat-Zinn et al., 1985). We examined the effects of 3 consecutive days of 20-min mindfulness meditation training on pain perception to electrical stimulation. A comparison group tested under relaxation and arithmetic distraction conditions was also included. The results demonstrated that brief meditation intervention significantly reduced pain perception in comparison with relaxation and distraction. These findings suggest that pain perception can be attenuated after only 60 min of meditation instruction. The cognitive aspect of meditation practice may play a role in this effect.

(4049)

Presentation Order of Comparison and Standard Stimulus Affects the Difference Threshold. EINAT LAPID & ROLF ULRICH, *University of Tübingen*, & THOMAS RAMMSAYER, *University of Bern*—In determining the difference threshold (i.e., the just noticeable difference) in temporal discrimination tasks, subjects are typically asked to compare a constant standard stimulus with a variable comparison stimulus. This task allows one to establish a psychometric function from which the difference threshold is calculated. The psychophysical results of our experiments showed that the presentation order of the comparison and the standard could strongly influence the size of this threshold. A mathematical model can account for this order effect. It assumes that subjects average stimulus information across trials to establish a stable internal representation of the standard. This model also accounts for our finding that difference thresholds determined by a two-alternative forced-choice task are larger than thresholds determined by the classical method of constant stimuli.

(4050)

Does Norwich's Entropy Theory of Perception Actually Generate the Stevens' and Weber–Fechner Laws? IFTIKHAR R. NIZAMI—Norwich's "entropy equation," supposedly derived from information theory, relates sensation strength to stimulus strength. At "low" strengths, the relation is approximately logarithmic—"the Weber–Fechner law"—and at "high" strengths, approximately a power function—"Stevens' law." "Low" and "high" must be established through curve fitting, because the entropy equation has three unknowns, including a power exponent (y), allegedly "Stevens' exponent" (x). To test whether $y = x$, the logarithmic forms of the entropy equation and Stevens' Law were regression-fitted to 64 published plots of logarithm(magnitude-estimate) versus logarithm(stimulus-strength). y versus x is broadly scattered; 62/64 times, $y > x$. In theory, the fitted entropy equation allows calculation of the transmitted information. Constraining the fit to yield 2.5 bits/stimulus narrows the scatterplot so that, roughly, $y = 1.7x$. Neither the Weber–Fechner nor the Stevens approximations fully describe any examined sensation-growth plot. Quantification of sensation growth by "physical entropy" (Norwich, *Acta Biotheoretica*, 2005) repeats these errors.

• EVENT COGNITION •

(4051)

Cognitive Biases in Estimating the Similarity of Environmental Sounds. BRUNO L. GIORDANO, STEPHEN McADAMS, & JOHN

MCDONNELL, *McGill University*—Relevant auditory features for the perception of sound events are often studied using similarity ratings. Acoustical features for perception are inferred from the association between similarities and acoustical parameters. This approach might lead to mistaken conclusions if participants are influenced by the similarity of the knowledge structures activated by the recognition of the sound source (e.g., train whistling, train wheels). The comparative relevance of acoustical and conceptual information to the estimation of the similarity of animate and inanimate environmental sounds was measured. Similarities were measured using the agglomerative hierarchical sorting technique. Participants judged either identification labels, or the acoustical properties of the sounds, or the sounds without further specification of the response criteria (conceptual, acoustical, and unbiased conditions, respectively). Unbiased estimation of the similarity of animate and inanimate sound events resembled more closely conceptual and acoustical similarities, respectively. Methodological and theoretical consequences are discussed.

(4052)

Using Autobiographical Memory Questionnaires As a Form of Exposure Therapy for Stressful Events. LISA M. HATHAWAY & ADRIEL BOALS, *University of North Texas*—The present study investigated whether completing the autobiographical memory questionnaire (AMQ) for a stressful event results in a reduction in the emotionality and vividness of the event. At Time 1, 190 participants nominated a negative event from their lives. Participants in the experimental group completed the AMQ in reference to their nominated event, whereas the control group nominated six other events. Six weeks later, participants in both groups completed the AMQ in regards to the negative event nominated at Time 1. Participants in the experimental group reported significantly less emotional intensity and vividness of the event at Time 2, in comparison with the control group. No such pattern of group differences was observed for a second nominated stressful event also completed during Time 2. These results suggest that completing the AMQ for a stressful memory results in a decrease in the emotional intensity and vividness of the event.

(4053)

Actor Similarity and Binding Errors in Event Memory. JULIE L. EARLES, ALAN W. KERSTEN, EILEEN S. CURTAYNE, & JONATHAN G. PERLE, *Florida Atlantic University*—Mistakes in eyewitness identification can occur when an eyewitness incorrectly associates a familiar actor with the actions of another person. The present research demonstrates that actors do not need to be similar in appearance for such binding errors to occur. The actors can in fact be very different in appearance, even different sexes. Participants attempted to remember a series of brief events, each involving an actor performing a simple action. Participants were tested one week later on their recognition memory for the events. Increases in actor similarity led to increases in binding errors, in which participants falsely recognized a familiar actor performing a familiar action that had actually been performed by someone else. Binding errors often occurred even when the familiar actor was of a different sex than the original actor, however, providing strong evidence that these binding errors are not due solely to actor similarity.

(4054)

Freshman Flashbulbs: Exploring Flashbulb Memory Mechanisms in a Collegiate Sample. JENNIFER M. TALARICO, *Lafayette College*—Pilot data from the class of 2010 suggests that memories of distinctive, emotional, and personally significant events concerning the transition to college (e.g., meeting one's roommate or attending one's first collegiate class) satisfy the criteria for "flashbulb memory" status; participants remembered where they were, what they were doing, and had vivid visual images for these memories. In addition, they were quite confident that the event occurred as they remembered it. This allows for the exploration of potential mechanisms for the flashbulb

memory phenomenon such as rehearsal. Preliminary results suggest that vividness increased after overt rehearsal but decreased after covert rehearsal, and that this difference was greater in the short term versus the long term. There was little to no change in confidence ratings over time for either overt or covert conditions. Additional data from the class of 2011 will help clarify the role of rehearsal in the development of flashbulb memories.

(4055)

Intergenerational Contact and Physiological Aging Cues Influence Perceived Credibility of Older Witnesses. KATRIN MUELLER-JOHNSON, *University of Cambridge*, MICHAEL P. TOGLIA, *SUNY Cortland*, & CHARLOTTE D. SWEENEY & STEPHEN J. CECI, *Cornell University*—In the main experiment, 180 undergraduates rated court testimony of older eyewitnesses for credibility characteristics (e.g., convincingness, competence, confidence, accuracy, suggestibility). Testimony, concerning a car accident, was introduced by the witness's photo. Witness age (69, 79, 89) and sex were varied with one of 3 photos representing each age–sex combination. Separately, the 18 photos (from Hummert et al., 1997) were normed for perceived age. Reanalysis of the experiment revealed that convincingness, competence, memory, accuracy, and cognitive functioning were predicted by participants' everyday exposure to older adults, which was modified by an interaction involving perceived age of the witness in the photo. When perceived witness age was young relative to real age, participants who reported more contact with older adults rated witnesses more positively than did participants with less contact. With increasing perceived age of the photographed person, this difference decreased. Discussion will focus on the forensic relevance of witness credibility.

(4056)

Electrophysiological Correlates of the Segmentation of Simple Events. RICHARD M. SHARP, *University of Edinburgh*, JEFFERY M. ZACKS, *Washington University*, & DAVID I. DONALDSON, *University of Stirling* (sponsored by Jeffery M. Zacks)—Functional MRI studies have identified a network of brain regions sensitive to perceptually salient boundaries between events. We investigated the neural correlates of event segmentation using scalp-recorded event-related potentials. Participants viewed simple animations of randomly moving geometric objects. Top-down expectations were manipulated by instruction: Participants were told either that the objects were moving randomly or that they were performing a goal-directed activity (e.g., one object chasing the other). Participants viewed the movies passively, then segmented them into meaningful units at both a fine and a coarse temporal grain. During passive viewing, significant EEG responses were observed at points that participants later identified as event boundaries. Responses over frontal and parietal cortex were larger for coarse-grained boundaries than for fine-grained boundaries, consistent with the proposal that perceivers group smaller events into larger units. Responses to coarse-grained boundaries were affected more by top-down expectations, suggesting that grouping events depends differentially on top-down mechanisms.

(4057)

Maintaining an Action Plan Through Articulatory Rehearsal Is Not Necessary for Compatibility Interference. LISA R. FOURNIER, PAUL S. MATTSO, JOY KIRKWOOD, THEIBOT HERZOG, & JACKIE BALATABAT, *Washington State University* (sponsored by Lisa R. Fournier)—Planning and withholding an action to one visual stimulus (A) can delay a response to a latter occurring, second visual stimulus (B) if A and B share similar action codes (response hands). We examined whether this compatibility interference (CI) is limited to action plans held in working memory that are maintained by articulatory rehearsal. Participants planned and withheld a response to A, and then they either repeated a task-unrelated phrase or sat passively for ~3 sec until B appeared. Participants responded immediately to B and then to A. The results showed that recall accuracy of response A was

lower for the repetition versus the passive trials; however, CI occurred only for repetition trials. Thus, articulatory rehearsal of an action plan is not necessary for CI. Furthermore, a relatively long interval between the planned action A and intervening action B may eliminate CI unless one is actively engaged in another task during this interval.

(4058)

Cognitive Code Overlap Between Actions Stored in Memory and Actions Requiring Immediate Execution. LISA R. FOURNIER, RYAN McMEANS, & MATTHEW WIEDIGER, *Washington State University*—Withholding actions to one visual stimulus (A) can delay responses to a second visual stimulus (B) if A and B share similar actions (same response hand). We examined whether this compatibility interference (CI) was due to action code or cognitive code similarity between the stimuli. Participants saw two stimuli (A and B) that occurred in sequence. A manual left- or right-hand response was planned and withheld to A. Then B occurred, which required an immediate vocal response of “left” or “right.” Vocal responses were based on an object color (Experiment 1), a written word (Experiment 2), or the antonym of a written word (Experiment 3). Only Experiment 1 showed a delay in vocal responses to B when its verbal description (“left”) was compatible with the response hand (“left”) required for A. Thus, cognitive code similarity is sufficient for CI. Moreover, CI may be limited to responses that require access to stored cognitive representations in working memory.

(4059)

Can the Embodied Nature of Attitudes Be Used to Increase Persuasion? ERIC C. FIELDS, KEVIN D. MARTIN, & WILLIAM LANGSTON, *Middle Tennessee State University*—Increasingly, evidence from across the subdisciplines of psychology supports an embodied view of cognition. If this is the case, it should be possible to use the knowledge of how an attitude is embodied to increase persuasion away from (or toward) that attitude. Previous research has shown the elderly stereotype to be embodied in slow movement. In study 1, participants listened to messages that were either consistent with or inconsistent with the elderly stereotype. While listening, they moved either fast or slow. They then completed implicit and explicit measures of the elderly stereotype. The results suggested that the movement used might not be effective. To investigate whether particular movements are required to achieve embodiment effects in this area, for study 2 we used Mussweiler's (2006) protocol but substituted the arm movement used in our study for leg movement. It's possible that arm movements will not produce the same embodiment priming effects.

• REASONING •

(4060)

The Time Course of Hypothesis Activation During Diagnostic Reasoning. MARTIN BAUMANN, KATJA MEHLHORN, FRANZISKA BOCKLISCH, GEORG JAHN, & JOSEF F. KREMS, *Chemnitz University of Technology* (sponsored by Josef F. Krems)—Diagnostic reasoning may be seen as a process of sequential understanding that integrates new observations into a developing mental representation. This situation model represents the current best explanation of the observations. We assume that constructing situation models involves automatic knowledge activation as well as deliberate reasoning processes. Automatic activation determines the availability of hypotheses for the deliberate reasoning processes. In the reported experiment, the time course of hypothesis activation during the reasoning process was examined. Hypothesis activation was measured by combining a reasoning task with a concurrent probe reaction task with probes being strongly related to the explanations. Hence, response times to the probes indicated the degree of activation of the associated hypotheses. We found that hypotheses representing currently plausible explanations for a set of observations were more activated than were irrelevant or rejected hypotheses. We found no evidence for an inhibition of rejected hypotheses.

(4061)

Reasoning Over Isomorphic and Nonisomorphic Logic Structures.

JOHN BEST, *Eastern Illinois University*—A variety of dual-process theories claim that reasoning is usually accomplished by a heuristic system that may at times be overridden by a deductively competent analytic system. One alternative states that all reasoning is accomplished by one system whose representations are strengthened with experience. In this study, subjects solved 16 conditional reasoning problems and then 3 “logic table” problems that either were isomorphs of each other, or did not share an underlying logic structure. Crossed with this condition, half of the participants were given instructions and an answer grid that emphasized the role of the analytic system. Contrary to the predictions of dual-process but consistent with single-process alternatives, the subjects in each condition solved the third logic table problem much more quickly than they did the first (mean reduction = 38%), with no corresponding fall-off in deductive accuracy for any of the four groups.

(4062)

Cross-Cultural Cognitive Differences in Analogical Reasoning: A Computational Account.

ROBERT G. MORRISON, *Northwestern University*, LEONIDAS A. A. DOUMAS, *Indiana University*, & LINDSEY E. RICHLAND, *University of California, Irvine*—We previously reported that when children can identify the critical relations in a scene analogy problem, development of their ability to reason analogically interacts with both relational complexity and featural distraction (Richland, Morrison, & Holyoak, 2006). Here, we report that unlike 3- to 4-year-old American children, Hong Kong children are sensitive to featural distraction, but not to relational complexity. Differences in the linguistic structure of Chinese and English task versions suggest that this result is driven by variations in children’s knowledge representations. Performance differences are eliminated when Hong Kong children perform under a working memory dual task. We present computer simulations in LISA (Hummel & Holyoak, 1997, 2003) explaining these results as trade-offs between inhibition in working memory and the sophistication of relational knowledge representations. Specifically, we show that changes in inhibition can best explain the overall developmental progression; however, differences in knowledge representation best account for cultural differences.

(4063)

Can Domain Knowledge Improve Causal Reasoning?

MICHELLE R. ELLEFSON & CHRISTIAN D. SCHUNN, *University of Pittsburgh*—Grasping scientific phenomena includes more than the mere memorization of scientific facts. It requires the creation of appropriate models of the relations among important aspects of scientific phenomena. Many of these relations are causal. The present study explored students’ ability to reason about simple and complex causes, both within and outside of the scientific domain that they were studying. The participants were urban high school students in biology, chemistry, and physics courses ($n = 99$). Overall, the results suggest that reasoning about interactions among two or more causal variables is more difficult than reasoning about the main effect of one causal variable. Students did not achieve higher accuracy for reasoning questions in the domain that they were studying. Therefore, because the complexity of the questions influenced performance more than domain knowledge did, the results suggest that domain knowledge is neither necessary nor sufficient for complex reasoning in introductory science courses.

(4064)

Thinking Dispositions, Metacognition, and Syllogistic Reasoning.

JAMIE A. PROWSE TURNER, ERIN L. BEATTY, & VALERIE A. THOMPSON, *University of Saskatchewan*—We studied the relationship between three measures of thinking dispositions and (1) metacognitive ability and (2) reasoning performance on a syllogistic reasoning task. The measures of thinking dispositions included the general decision-making style instrument (GDMS; Scott & Bruce, 1995), the

actively open-minded thinking scale (AOT; Stanovich & West, in press), and the cognitive reflection test (CRT; Frederick, 2005). We measured metacognitive accuracy in a number of ways, including asking for item-by-item estimates of performance and several posttask estimates of performance. Regression equations established that different sets of variables predicted accuracy on the reasoning task, the item-by-item estimates, and the posttask estimates of performance. These findings are consistent with the hypothesis that item-by-item estimates and posttask estimates tap different processes (Stankov, 2000). We plan a follow-up study that includes measures of cognitive ability and performance on belief-biased materials.

(4066)

Premise Versus Conclusion Believability in Categorical Reasoning.

SHARON LEE ARMSTRONG, *La Salle University*—Previous studies have shown that neutral content produces superior performance over emotional or abstract content in evaluating conditional arguments and categorical syllogisms. Furthermore, consistent with theories of motivated reasoning, it is often suggested that it is prior beliefs about conclusions that drive validity judgments. However, my previous research found that it was the believability of the first premise, rather than the believability of the conclusion, that played the primary role in predicting correct validity judgments in conditional reasoning tasks. To determine whether this finding is peculiar to conditional reasoning, the present study investigated the role of the believability of different argument statements in the evaluation of categorical syllogisms. Comparisons of the patterns of validity judgments across the two types of logic problems are discussed with regard to current theories of reasoning.

(4067)

The Acquisition of Causal Variables.

NOAH D. GOODMAN & JOSHUA B. TENENBAUM, *MIT*—Standard theories of causal learning identify causal relations between preexisting variables, such as the nodes in a Bayesian network. But how are these variables acquired? How does the continuous flux of perception become symbolically coded in variables that support appropriate causal relations? We argue that whereas some variables are innate, others must be learned, in ways that depend on both bottom-up perceptual coherence and the functional role that variables play in the learner’s causal model of the world. We present a Bayesian framework for explaining how causal variables and relations can be learned simultaneously, in the form of a grounded causal model: a system of event concepts connected by causal relations and explicitly grounded in perception. We also present empirical studies showing that participants can learn grounded causal models from dynamic perceptual evidence. Several factors modulate learning difficulty as predicted by the Bayesian model, including perceptual distinctiveness and causal contrast.

(4068)

Similarity Falls Out of a Model of Analogy.

ERIC G. TAYLOR & JOHN E. HUMMEL, *University of Illinois, Urbana-Champaign* (sponsored by John E. Hummel)—The concept of “similarity” plays a central role in cognition. Existing models of similarity capture either “featural” or “structural” aspects of similarity, but typically not both. We attempted to capture both by fitting similarity judgment data with the LISA model of relational reasoning (Hummel & Holyoak, 1997, 2003). LISA simulates both structural effects on similarity, such as violations of the metric axioms and the dominance of alignable over nonalignable differences in similarity judgments, and the relation between structural and featural aspects as embodied by the combined effects of MIPs and MOPs (featural matches “in” or “out of place”; Goldstone, 1994) on similarity judgments. LISA’s ability to capture both featural and structural aspects of similarity derives from its knowledge representations, which are simultaneously symbolic, by virtue of dynamically binding relational roles to their arguments, and semantically rich, by virtue of their distributed representations of those roles and arguments.

• INHIBITION IN MEMORY •

(4069)

Arousal Reduces the Directed Forgetting of Words. MICHAEL MINNEMA & BARBARA J. KNOWLTON, *UCLA*—We measured the effect of performing an arousing task on subsequent directed forgetting. Subjects counted backward from 100 either by sevens (arousing) or by ones (nonarousing). Subjects then received a list of words that they were told to remember. In each arousal condition, subjects were either given a “forget” cue after the first list and were told that the list was just for practice and that they should try to forget it, or they were given a “remember” cue and were told that they should try to remember the list. All subjects were then told that they would receive a second list and that they should try to remember it. When later asked to recall all words, subjects in the arousal group showed significantly less forgetting of list 1 after the “forget” cue, with no difference after the “remember” cue. Arousal may deplete attentional resources needed for inhibition of to-be-forgotten information.

(4070)

Directed Forgetting or Directed Remembering? A Comparison of Remember, Forget, and Incidental Learning Instructions. MARK A. OAKES, PENNY L. YEE, AVERY RIZIO, JENNIFER SADOWSKY, TIERNEY BOISVERT, & CECILIA M. MAEYAMA, *Hamilton College*—Directed forgetting (DF) cost is observed when a person is instructed to forget stimuli that have been presented. Previous work on list method DF has attributed observations of cost to one of two mechanisms: increased remembering processes (increased rehearsal of R-items) or forgetting processes (episodic inhibition of F-items). In contrast, we examine the relative contributions of both types of processes to the observation of DF cost by comparing performance between remember and forget instructions with conditions in which participants receive an incidental memory instruction. The degree to which performance in the remember condition exceeds performance in the incidental condition will reflect the contribution of rehearsal processes, whereas the degree to which performance in the forget condition falls below the incidental condition will reflect the contribution of inhibition processes. The magnitude of these effects was also compared with measures of working memory capacity.

(4071)

Retrieval-Induced Forgetting: Inhibition or Interference? ANDREA D. HUGHES, *University College of the Fraser Valley*, ANTONIA KRONLUND, *Brock University*, & BRUCE W. A. WHITTLESEA, *Simon Fraser University* (sponsored by Bruce W. A. Whittlesea)—Inhibition as a psychological construct has been used to explain a wide range of cognitive behaviors including phenomena such as negative priming, inhibition of return, directed forgetting, and retrieval-induced forgetting. In general, these phenomena typically show a decrement in performance, measured by accuracy or reaction time, relative to a baseline response. Such decreases in performance have been argued to reflect inhibitory processes which serve to suppress a response to a stimulus. The central aim of the present research is to examine the utility of an inhibitory account of retrieval-induced forgetting. In particular, the experiments reported here demonstrate the limitations of an inhibitory account, and instead support an interference-based account of retrieval-induced forgetting.

(4072)

Can Combining Delay and Integration Reverse Retrieval-Induced Forgetting? JASON C. K. CHAN, KATHLEEN B. McDERMOTT, & HENRY L. ROEDIGER III, *Washington University* (sponsored by Jason M. Watson)—Previous work has shown that integrative encoding (Anderson & McCulloch, 1999) and delay (24 h; MacLeod & Macrae, 2001), in isolation, eliminate retrieval-induced forgetting (RIFO). In the present study, we examined the combined effects of integration and delay on RIFO using prose materials similar to those in college textbooks. We obtained reliable RIFO when integration of the prose

material was made difficult (by randomizing the presentation order of the sentences) and when the delay was short (20 min). No RIFO was observed when the materials were presented in a coherent fashion (high integration) or when the delay was long (24 h). When these two factors were combined (i.e., high integration and a long delay), we obtained retrieval-induced facilitation (replicating Chan, McDermott, & Roediger, 2006). Thus, the present work helps specify the conditions under which retrieval induces facilitation and inhibition.

(4073)

On the Persistence and Durability of Retrieval-Induced Forgetting. BENJAMIN C. STORM, ROBERT A. BJORK, & ELIZABETH LIGON BJORK, *UCLA* (sponsored by Robert A. Bjork)—Retrieval-induced forgetting is believed to reflect inhibitory control processes that reduce the accessibility of items that interfere with attempts to retrieve target items from memory. To date, however, very little research has explored the persistence and durability of the phenomenon. Recently, we have shown that although retrieval-induced forgetting may make items less recallable initially, such items will benefit more from future learning than will items that did not initially suffer from retrieval-induced forgetting. Here, we report the long-term consequences of repeatedly inducing and releasing the effect of retrieval-induced forgetting. Our results suggest that, given the same number of study trials, items that were intermittently inhibited between study trials were more recallable after a week delay than were items that were not intermittently inhibited between study trials. This counterintuitive finding is discussed in relation to the inhibitory account of retrieval-induced forgetting and the new theory of disuse (Bjork & Bjork, 1992).

(4074)

Is Source Memory Subject to Retrieval-Induced Forgetting? JERI LITTLE, ELIZABETH LIGON BJORK, ROBERT A. BJORK, & VIEN NGUYEN, *UCLA* (sponsored by Elizabeth Ligon Bjork)—Practicing the retrieval of some items can impair the retrieval of related, but unpracticed, items—an effect known as retrieval-induced forgetting (RIF), argued to arise from inhibitory processes (Anderson, Bjork, & Bjork, 1994). The present research asked whether RIF would occur for both item memory and source memory—in particular, the identity of items as well as their location in a display. Participants studied 6 exemplars from each of 10 categories, with the exemplars presented three at a time in a triangular formation above their category name. Participants were then given retrieval practice on 3 exemplars (from 5 categories each) in their previously presented positions. After a filled delay, both item memory and source memory were assessed, with preliminary results indicating RIF effects for item memory but not for source memory, implying that perhaps certain types of information associated with a given item—such as its location—remain retrievable even when access to its identity has been inhibited.

(4075)

Individual Differences in Inhibitory Control: RIF, TNT, and OCD. BENJAMIN C. STORM, MONICA BIRNBAUM, ELIZABETH LIGON BJORK, & ROBERT A. BJORK, *UCLA*—Retrieval-induced forgetting is believed to reflect the lasting consequences of inhibitory control in memory. According to this account, attempting to retrieve a target item from memory also activates other items, creating competition, and requiring that such competing items be inhibited. Similar control processes have also been argued to play a role in allowing participants in think/no-think experiments to prevent unwanted memories from coming into awareness. Subjects in the present research took part in both a retrieval-induced forgetting experiment and a think/no-think experiment. If the forgetting observed in the respective paradigms reflects similar inhibitory control processes, performance on the two experiments should be highly correlated. The present research also explored the relationship between performance on these two paradigms and obsessive compulsive disorder, with the hypothesis that individuals who experience recurrent, persistent, and unwanted thoughts and compulsions might have impaired inhibitory control.

(4076)

Does Traveling Backward in Time Induce Forgetting of the Present? COLLEEN M. KELLEY & CARISSA A. ZIMMERMAN, *Florida State University*, & PETER F. DELANEY & LILI SAHAKYAN, *University of North Carolina, Greensboro*—A number of theories explain forgetting over time as due to ongoing changes in context that reduce accessibility to memories. Most experimental manipulations of context involve physical cues, whether they are list-wide, such as location, or item specific, such as color or voice. Sahakyan and Kelley (2002) manipulated mental context by asking participants to think about their parents' home after studying a list of words and before studying a second list. This change of mental context reduced memory for the first list. The present work asks whether mentally traveling farther back in time creates a larger context change than does thinking back to a more recent time, analogous to the greater changes in context that underlie a longer delay in forgetting curves.

(4077)

Can We Forget by Doing Nothing? The Role of Forgetting Strategies in Directed Forgetting. NATHANIEL L. FOSTER & LILI SAHAKYAN, *University of North Carolina, Greensboro* (sponsored by Edward J. Wisniewski)—There has been no systematic investigation of how different “forgetting strategies” that people adopt in order to forget unwanted information influence the success of intentional forgetting. The reported study examined how forgetting strategies affect the recall of strong versus weak items in the list-method directed forgetting paradigm. Item strength was manipulated by embedding the item-method directed forgetting procedure within each of the two study lists—that is, by cuing participants to either remember or forget each item immediately after it was presented. Half of the participants were then instructed to forget the entire list 1 before learning list 2. The results indicate that strategic processes influence directed forgetting, with active forgetting strategies leading to greater directed forgetting than do passive strategies. Furthermore, active forgetting strategies lead to equivalent forgetting of strong and weak items, whereas passive strategies primarily influence forgetting of strong items. Implications for the directed forgetting theories are discussed.

(4078)

Effects of Encoding Strategy on Retrieval-Induced Forgetting and Inhibition. PAUL LADNY & KELLY M. GOEDERT, *Seton Hall University* (sponsored by Kelly M. Goedert)—Current research in the field of forgetting indicates that interference may arise during recall due to competition between memories. To reduce interference, an inhibitory mechanism may impair the undesired interfering memories so that the desired memory can be retrieved. This phenomenon is known as retrieval-induced forgetting. The present study explored the use of encoding strategy on within-category retrieval-induced forgetting and cross-category inhibition during recall and recognition by explicitly instructing participants to study similar exemplars together. A postexperiment questionnaire also assessed how participants encoded the category–exemplar pairs. Even though an effect of cross-category inhibition was observed, within-category retrieval-induced forgetting was not found. These results suggest that a similarity encoding strategy can limit, but does not eliminate, the inhibitory effect.

• MODELING MEMORY •

(4079)

Two Dimensions Are Not Better Than One: STREAK and Unidimensional Signal Detection Models of Remember/Know Performance. JEFFREY J. STARNES & ROGER RATCLIFF, *Ohio State University* (sponsored by Mark A. Pitt)—The STREAK model of remember/know (RK) performance yields estimates of both global (dx) and specific (dy) memory strengths, corresponding to familiarity and recollection. This distinguishes STREAK from traditional signal detection models that accommodate RK data with a single strength dimension and the

familiar strength estimate d' . We compared these models by evaluating the correlation of strength estimates from an RK test to subsequent associative recognition performance. Simulations showed that, when data are generated from the processes assumed by STREAK, dy correlates much more highly with associative recognition than either dx or d' . Contradicting this prediction, results showed that the dy estimates produced by STREAK were no more predictive of associative recognition performance than either dx estimates from this model or d' estimates from a unidimensional model. Moreover, the unidimensional model fit better than STREAK for the majority of participants.

(4080)

Mimicry in Models of Remember–Know Judgments. ANDREW L. COHEN, CAREN M. ROTELLO, & NEIL A. MACMILLAN, *University of Massachusetts, Amherst*—Current competing models of remember–know judgments are based on very different underlying assumptions, but are often difficult to distinguish empirically. One source of this ambiguity is model mimicry: Each model is flexible enough to fit many data sets generated by its competitors. We used a simulation technique to assess the relative flexibility of the process-pure, dual-process, one-dimensional, and STREAK models of remember–know judgments. Each model's flexibility was evaluated against data from simulated individual “subjects” and data averaged across simulated “subjects,” in three commonly used remember–know paradigms. Using the simulation results to reevaluate past modeling results in light of model flexibility, we find that the one-dimensional signal detection model is generally to be preferred. We also conclude that some empirical paradigms are ill-suited for distinguishing among the models. For example, under certain conditions, it is particularly difficult to distinguish the one-dimensional and dual-process models in the old/new + remember/know paradigm.

(4081)

Toward a Complete Decision Model of Item and Source Recognition. MICHAEL J. HAUTUS, *University of Auckland*, & NEIL A. MACMILLAN & CAREN M. ROTELLO, *University of Massachusetts, Amherst*—In a recognition memory test, subjects may be asked to decide whether a test item is old or new (item recognition) or to decide which source might have presented it for study (source identification). Confidence-rating-based ROC curves for these tasks are quite different, leading to the inference of different decision processes. However, a complete account of the judgments requires a single model that can be fit to the entire data set. In the style of Banks (2000), we postulate a detection-theoretic decision space whose dimensions are item strength and the relative strength of the two sources. The model implements optimal decision boundaries but nonoptimal allocation of attention, and accounts for existing data without assuming any threshold processes.

(4082)

A Comparison of Single- and Dual-Process Models of Retrieval Experiences. LUTZ CÜPPER, EDGAR ERDFELDER, & MONIKA UNDFORF, *University of Mannheim* (sponsored by Edgar Erdfelder)—The results of recent studies that compared single- and dual-process models for the remember–know (RK) or remember–know–guess (RKG) paradigm pose a challenge to dual-process models. However, these studies often focused on selected dual-process models and single-process competitors. We conducted a model selection study that aimed at comparing several dual-process models (DPSD, four-states, SAC, STREAK) with each other and with a single-process signal-detection model. The models were evaluated with regard to their construct validity and their descriptive adequacy on the basis of 46 RKG experiments from 32 publications. Although the models' construct validity was assessed by means of likelihood-ratio testing, both likelihood-ratio testing and AIC differences were employed to quantify their descriptive adequacy. Our results were in favor of some dual-process models, whereas other dual-process models performed worse than the single-process model.

(4083)

On the Use of Signal Detection Models in Contrasting Yes–No and Forced-Choice Discrimination. MOSES M. LANGLEY, *Iowa State University* (sponsored by Robert West)—Signal detection (SD) models predict the superiority of two-alternative forced-choice (2AFC) detection over yes–no (YN) detection by a factor of $\sqrt{2}$. Thus, to make balanced comparisons between performances in these tasks, the equation for estimating 2AFC detection performance involves a division by $\sqrt{2}$. Although the detection literature provides a long and consistent history of confirmation for this prediction (Wickelgren, 1968), the prediction often fails when extended to discrimination tasks (Creelman & Macmillan, 1979). Nevertheless, SD models have been widely used to contrast discrimination in YN and 2AFC tasks. The present experiments explicitly examined the $\sqrt{2}$ prediction under theoretically ideal conditions for the use of SD models in discrimination estimation; the $\sqrt{2}$ prediction was generally unsupported for both the equal-variance and the unequal-variance SD model. These results challenge prior assertions that SD model estimates are the appropriate means for contrasting YN and 2AFC discrimination.

(4084)

Some-or-None Recollection in Recognition Memory: Evidence From Conjoint Modeling of Item and Source Information. SERGE V. ONYPER, *St. Lawrence University*, & MARC W. HOWARD, *Syracuse University*—Recent years have seen the development of consensus that recognition memory is subserved by familiarity and a recall-like recollection process. However, considerable debate still exists about the form of the recollection process and the relationship between recollection and familiarity. Evidence from conjoint judgments of item and source information shows curvilinear source ROCs when conditionalized on item confidence. This finding has been taken as evidence against a two-process account (e.g., Slotnick & Dodson, 2005). We conducted an experiment in which subjects rated both confidence and source for words or pictures. We successfully fit a dual-process model with some-or-none recollection simultaneously to the item and source data. This variable recollection model postulates that recollection is a continuous process, but that it also exhibits threshold behavior (see also DeCarlo, 2002, 2003). This model approximates single-process accounts and all-or-none dual-process accounts as limiting cases and should provide a general framework for describing recognition performance across a wide variety of circumstances.

(4085)

Using Factors Selectively Influencing Processes to Construct a Multinomial Processing Tree. SHENGBAO CHEN, *JMW Truss*, & RICHARD J. SCHWEICKERT, *Purdue University* (sponsored by Richard J. Schweickert)—Data often indicate that manipulating an experimental factor changed a single probability in a multinomial processing tree, evidence that the factor selectively influenced a process. (Such evidence often arises when the process dissociation procedure is used.) A systematic way is presented to test whether two experimental factors each selectively influenced a different process in a multinomial processing tree; and, if so, to construct a multinomial processing tree accounting for the data. We show that if the data were produced by any underlying multinomial processing tree, there is an equivalent relatively simple tree. The equivalent tree must have one of two forms. In one form, the selectively influenced processes are sequential; in the other, they are not sequential. If the processes are sequential, the data sometimes indicate the order in which they were executed.

• DEPTH AND MOVEMENT PERCEPTION •

(4086)

Induced Motion Effects in a Target Throwing Task. CRYSTAL D. OBERLE, JOANNA M. BAUGH, & HEIDI S. LOVEJOY, *Texas State University*—Computerized induced motion experiments have revealed that target pointing is less affected than perceptual judgments (Abrams

& Landgraf, 1990; Post & Welch, 2004) or is completely immune to the illusory motion (Bridgeman et al., 1981; Rival et al., 2004). The present research investigated the effects of background motion on throwing performance. Forty participants completed 50 trials of a target throwing task, 10 for each of the following motion background conditions: none, rightward, leftward, upward, and downward. Although condition did not affect vertical deviation from the target's center [$F(4,156) = 2.51, p = .06$], it did affect horizontal deviation [$F(4,156) = 6.01, p = .0002$]. Planned comparisons revealed that only performance in the rightward and leftward motion background conditions differed from performance in the no-motion background condition. Relative to the latter control trials, rightward background motion caused leftward throwing errors, and leftward background motion caused rightward throwing errors, consistent with the induced motion effect.

(4087)

Effects of Motion Type and Response Method on Representational Momentum in a Large Visual Display. SUSAN E. RUPPEL, *University of South Carolina Upstate*, & TIMOTHY L. HUBBARD, *Texas Christian University*—Effects of motion type (i.e., whether motion appears continuous or implied) and response type (pointing, probe judgment) on memory for the final location of a moving target (representational momentum; RM) have been debated. Also, displays in previous studies of RM typically subsumed a relatively small portion of observers' visual fields, and it is possible that visual information outside the boundaries of the display anchored (or otherwise influenced) observers' judgments. The present study presented continuous motion and implied motion, and used natural pointing, mouse pointing, and probe judgment response measures. Motion was displayed on a Smartboard touchscreen (77-in. diagonal) that subsumed a relatively large portion of observers' visual fields. RM was not influenced by motion type; RM was larger with mouse pointing and natural pointing when continuous motion was presented, whereas RM was larger with mouse pointing and probe judgment when implied motion was presented. Implications for theories of RM are discussed.

(4088)

Visual Perception of Self-Rotation in a Virtual Environment. ANDREAS E. FINKELMEYER & MARC M. SEBRECHTS, *Catholic University of America* (sponsored by James H. Howard, Jr.)—In three experiments, we investigated the ability of human observers to indicate the amount of a previously presented self-rotation in a virtual environment. Experiment 1 compared active–physical rotations with passive–visual rotation modes. Experiment 2 investigated the influence of the horizontal and vertical field-of-view (FOV), and Experiment 3 compared conditions of mismatching physical and rendering FOV. In all three experiments, observers gave their judgment by rotating back to the start, or pointing to it. Observers generally underestimated the amount of performed rotation, and had increasing errors with larger angles. Response mode had the largest effect on these errors: Judgments were less biased and more accurate when rotating back than when pointing, suggesting different cognitive processes for the two response modes. Despite dramatic differences in appearance, movement mode (Experiment 1) and FOV manipulations (Experiments 2 and 3) had relatively smaller effects on the observers' judgments, primarily in the form of interactions.

(4089)

Biomechanical Capture in Rotational Locomotion. HUGO BRUGGEMAN, *Brown University*, & HERBERT L. PICK, JR., *University of Minnesota*—In human terrestrial locomotion, activation of the inertial system is causally related to self-generated activity of the biomechanical system. The biomechanical information has been proven to be dominant in guiding terrestrial locomotion without vision or hearing. However, we wanted to know whether such biomechanical capture of guidance might still be influenced by the inertial information from stepping. In a series of three experiments, participants completed updating tasks of spatial rotation for several different conditions of

stepping on a treadmill, all of which produced a constant stepping rate but differed in the physical turning rate of the body. Our findings confirm that guidance is dominated by biomechanical information. However, it is organized not simply from biomechanical information in isolation but from co-occurring biomechanical and inertial information. We conclude that the biomechanical and inertial systems have evolved into an interconnected unit with enhanced perceptual acuity through activation-dependent excitatory interactions.

(4090)

Visually Induced Steering Errors From Simulated Blowing Snow Are Affected by Environmental Objects. ROGER LEW, BRIAN P. DYRE, AARON POWERS, & FRANK YARBROUGH, *University of Idaho*—Translating through laterally blowing snow creates nonrigid transparent optical flow with two distinct foci of expansion (FOE) corresponding to the snow and ground. Such optical flow induces illusory perceptions of heading relative to the ground and produces systematic steering errors, whose magnitude and direction depend on the angle between the vectors defining the snow and observer movements. At small angles (4° – 8°), observers misperceive curvilinear movement toward the snow FOE (attraction errors) and steer away from it. At larger angles ($>16^{\circ}$), observers misperceive curvilinear movement away from the snow FOE (repulsion errors) and steer toward it. Here, we examined whether randomly placed posts projecting from the ground affect these steering errors. We found that the density of the posts affected the angle at which errors of attraction cross over to errors of repulsion, suggesting that the illusion may be influenced by the magnitude of relative motion between the snow and environment.

(4091)

Seeing on Another World: Perceptual Challenges of Lunar Operations. MARY K. KAISER & ALBERT J. AHUMADA, JR., *NASA Ames Research Center*—The lunar environment provides different perceptual affordances than does Earth. There are no ambient sounds or scents. The suits that humans must wear to survive greatly attenuate and alter tactile stimulation. Even the gravitational–inertial cues differ, due to the lower gravity. Consequently, there is a heightened dependence on visual cues; yet many of these are altered or compromised as well. The absence of an atmosphere impacts illumination conditions and distance cuing. Furthermore, current plans to conduct operations near the lunar poles will result in low sun angles, exacerbating problems associated with shadowing and glare. We will discuss the challenges that these conditions will present to the human explorers, and consider some possible mitigations and countermeasures.

• SPATIAL COGNITION •

(4092)

Spatial Distortions With Successively Flashed Stimuli. DIANA BOCIANSKI, *RWTH Aachen University*, GISA ASCHERSLEBEN, *University of the Saarland*, & JOCHEN MÜSSELER, *RWTH Aachen University*—When observers are asked to localize the peripheral position of a flashed probe with respect to a previously presented comparison stimulus, they tend to judge it as being more toward the fovea than the comparison stimulus is. Experiments revealed that the mislocalization only emerges when comparison stimulus and probe are presented successively, not when they are presented simultaneously. In addition, the mislocalization decreases with larger interspaces between stimuli, and it is reversed with stimulus onset asynchronies above 400 msec. Findings are discussed as spatial effects of priming mechanisms.

(4093)

Recovering 3-D Structure From 2-D Images by Integrating Visual and Haptic Inputs. BING WU, ROBERTA L. KLATZKY, & GEORGE STETTEN, *Carnegie Mellon University* (sponsored by Roberta L. Klatzky)—A 2-D figure translating behind a slit can be perceived but appears distorted. We performed a 3-D analogue. By moving an imaging transducer over a box, the subject viewed successive slices of a

hidden virtual rod, displayed either at the haptically explored location (via an augmented-reality visualization) or displaced to a remote LCD that separated the visual and haptic inputs. The subject matched the virtual rod's pitch and/or yaw with a physical rod. When the virtual rod tilted in only one dimension, subjects performed well with both displays. However, when judging pitch and yaw together, and when visual information was spatially incongruent with haptic, subjects made large errors. These frequently took the form of near-correct magnitude but reversed direction, suggesting that responses were based on discrete codes. We suggest that when complex 3-D structure must be inferred from 2-D images, displaced visual information interferes with spatiotemporal integration.

(4094)

The Influence of Concurrent Verbal Working Memory Load on Spatial Orientation in a Virtual Environment. JENNIFER E. SUTTON, *Brescia University College*, & HOLLY M. CSIKOS & MARC F. JOANISSE, *University of Western Ontario*—It has been suggested that adults' flexible use of both geometric and feature information in spatial reorientation tasks is mediated by linguistic processing (Hermer-Vazquez et al., 1999). However, some recent research has cast doubt on whether linguistic processing is really necessary for feature use in such tasks (Ratliff & Newcombe, 2005). In the present study, adult participants performed a reorientation task in a virtual rectangular room that had either four identical white walls (no-feature room) or three identical white walls and one red wall (feature room). On some trials, participants also performed either a concurrent verbal shadowing task or a digit memory task. Neither of these concurrent tasks interfered with participants' use of the colored wall feature to reorient themselves. However, verbal shadowing did interfere with the use of geometric cues in the no-feature room, an effect not addressed in previous studies.

(4095)

Map Drawing Reveals Spatial Mental Model Development Following Virtual Navigation. MARC M. SEBRECHTS, JASON SPITALETTA, & JENNIFER MILES, *Catholic University of America*—This study used detailed analysis of map drawing to examine development of spatial mental models in a controlled virtual environment. Participants followed a specified route through a virtual building, and drew a map of that building following each trial. Video recording tracked the progression of individual map drawings as well as the final product. Substantial differences emerged in strategy, structure, and sequence of map production. The data provide some support for the typical landmark, route, survey sequence of acquisition, but also showed strong distinctions between formation of specific route-based representations and survey-like representations embedded in a more general framework. Continuous tracking of drawing identified particular characteristics of the participants' models, including a tendency to use route primacy and recency, the anchoring of elements around key structural features, variation in the importance of orientation and alignment, and shifting priorities between objects and paths.

(4096)

Mediation of Sexually Dimorphic Cognitive Task Performance by Hormonal Contraceptives. WHITNEY WHARTON, *University of Wisconsin, Madison*, ELLIOT HIRSHMAN, *George Washington University*, PAUL MERRITT, *Texas A&M University, Corpus Christi*, & SAMANTHA PARIS & LINDSAY DOYLE, *George Washington University*—The present study investigated whether hormonal contraceptives mediate performance on sexually dimorphic cognitive tasks across the menstrual cycle in younger individuals. Visuospatial tasks included the mental rotation, spatial orienting, and visual search tasks. Recognition memory and digit span performance were also examined. The results show the following. (1) The relation between menstrual cycle phase and visuospatial performance is different in OC users and nonusers. (2) Visuospatial performance is influenced by the androgenic activity of OCs. Importantly, Yasmin users not only performed more poorly on visuospatial tasks than did 2nd- and 3rd-

generation pill users, but they performed worse than OC nonusers. (3) The hormone that influences visuospatial task performance is different for OC users and nonusers. Our results show that the androgenic component in OCs mediates visuospatial task performance in OC users. On the other hand, visuospatial task performance in naturally cycling females is influenced by naturally fluctuating estrogen levels.

(4097)

Reorienting When Cues Conflict: Using Geometry and Features Following Landmark Displacement. KRISTIN R. RATLIFF & NORA S. NEWCOMBE, *Temple University* (sponsored by Kristin R. Ratliff)—Three experiments were conducted to test the idea that use of features during reorientation is highly dependent upon their perceived usefulness and prior experience as proposed by the adaptive combination view rather than by a modular view wherein geometric information always dominates behavior. When featural landmarks are placed in conflict with the geometry of an enclosed space, we found that (1) adults favor geometric information only in a small room and favor features in a larger room, (2) large room training increases use of features in a small room, and (3) using multiple landmarks that move dependently increases feature use in a small room. Although geometric information is important during reorientation, its supposed dominance over featural information is limited to small, fully enclosed spaces with only one feature. Flexible reorientation, encompassing all available spatial cues, is characteristic in larger spaces or when learning history and experience have established the usefulness of features.

(4098)

Transfer of Orthogonal and Parallel Incompatible Mappings to the SNARC Effect. GI YEUL BAE, JONG MOON CHOI, & YANG SEOK CHO, *Korea University*, & ROBERT W. PROCTOR, *Purdue University* (sponsored by Yang Seok Cho)—Three experiments examined the effect of prior practice on performance of a subsequent parity judgment task. In Experiment 1, a magnitude judgment task preceded the parity judgment task. A reversed SNARC effect was obtained when participants practiced with incompatible mapping (large–left/small–right), indicating that new associations between number magnitude codes and response codes, which were created when participants performed the magnitude judgment task, were maintained throughout the subsequent task. In Experiment 2, a parallel stimulus–response compatibility task was performed as practice. A regular SNARC effect was obtained regardless of whether participants practiced with compatible or incompatible mapping. However, in Experiment 3, in which participants practiced an orthogonal compatibility task, the SNARC effect was smaller when participants practiced with up–left/down–right mapping than with up–right/down–left. These results suggest that the SNARC effect is due to polarity correspondence between stimulus and response codes, rather than to spatial correspondence.

(4099)

Horizontal and Vertical Preparation in Right–Left Prevalence. AKIO NISHIMURA & KAZUHIKO YOKOSAWA, *University of Tokyo* (sponsored by Kazuhiko Yokosawa)—Horizontal stimulus–response compatibility (SRC) effect is often larger than vertical SRC effect when stimulus and response simultaneously vary in both dimensions. We investigated the role of horizontal and vertical set preparation in this right–left prevalence effect by switching the tasks on the basis of horizontal or vertical dimensions. In Experiment 1, we manipulated the preparation time for the upcoming task dimension by varying the cue–target SOA. A right–left prevalence effect was observed only when participants prepared for the upcoming task. The absence of the right–left prevalence effect with 0-msec SOA was replicated in Experiment 2. In Experiment 3, the right–left prevalence effect emerged with simultaneous presentation of task cue and the target when participants prepared for each dimension on the basis of its frequency. We discuss the findings in terms of the speed and the activation level of horizontal and vertical spatial codes.

• ASSOCIATIVE LEARNING •

(4100)

Does My Lie Have to Imply? The Role of Implication in Eyewitness Memory. DEBORAH K. EAKIN & JESSICA WOOD, *Mississippi State University*—Exposure to misleading postevent information typically impairs memory for the original event, a finding known as the misinformation effect (e.g., Eakin, Schreiber, & Sergeant-Marshall, 2003). One component of the typical misinformation paradigm is that most of the postevent information corresponds with the event information, implying that the information in which the misleading information is embedded is a reiteration of the original event. We manipulated implication by presenting misleading items in a narrative that differed from the slide show; both the location of the event and the persons described varied from the original event (no-implication condition). Memory for event information was compared between this condition and one for which the narrative reiterated the slide show (implication condition). We obtained a significant misinformation effect regardless of implication condition. Even when a relationship between the original and postevent was not implied, memory was impaired by the presence of misleading postevent information.

(4101)

Adaptation to Temporal Covariations. ANNIKA WAGENER & JOACHIM HOFFMANN, *University of Würzburg*—There is ample evidence demonstrating covariation learning between identity and location of targets. We explored whether temporal information (length of foreperiod) also enhances target processing when it covaries, either with target identity or target location. In our experiments, either a short or a long foreperiod preceded one of two targets, occurring typically at one of two locations. Participants' task was to identify the presented targets by pressing a left or a right button as quickly as possible. The results revealed an adaptation to the employed covariations: There were processing benefits for those targets and for those locations which were likely for a particular foreperiod. We attribute the observed temporal validity effects to acquired associations between representations of temporal information and representations of target identities and target locations.

(4102)

Examining the Retrieval Process in Mediated Learning Using Priming Effects. JAMES A. KOLE & ALICE F. HEALY, *University of Colorado*—The covert mediation model posits that mediators connect cue and target and are automatically activated during retrieval, even after extended retrieval practice. Three experiments tested this model using mediated priming effects. In each experiment, participants used the keyword method to learn French vocabulary and subsequently completed a modified lexical decision task in which they first translated a French word, then made a lexical decision on either a semantic associate of the keyword, a semantic associate of the English translation, a semantically unrelated word, or a nonword. The amount of practice translating the French words was varied before completing the lexical decision task, and participants were tested for explicit memory of keywords with a cued recognition test. A mediated priming effect was found only when no additional translation practice was administered. However, explicit memory for the keyword was high even with translation practice. The results argue against the covert mediation model.

(4103)

Subject-Controlled Feedback in a Verbal Learning Task. ASHLEY N. D. MEYER & JESSICA M. LOGAN, *Rice University*—Giving subjects control over the feedback they receive during learning may improve feedback effectiveness and later memory performance. Such subject-controlled feedback has been found to be more effective than experimenter-controlled feedback in the motor learning domain, but little is known about its effectiveness in the verbal domain. Using foreign language vocabulary (German–English word pairs), we exam-

ined how learning was influenced by three feedback conditions: no feedback, automatic feedback given after every response, and subject-controlled feedback in which subjects decided whether they needed to see the correct answer after a recall attempt. Similar to findings in the motor learning domain, any feedback resulted in improved cued recall performance as compared with the absence of feedback. Unlike in the motor learning domain, subject- and experimenter-controlled feedback resulted in similar cued recall performance. The results have implications for further understanding the role that metacognition plays in the effectiveness of feedback during learning.

(4104)

Associative History Modulates Human Learning: Evidence From Implicit Tasks. THOMAS BEESLEY & MIKE E. LE PELLEY, *Cardiff University* (sponsored by Andrew Delamater)—It has been shown in both animal and human learning that the predictive history of cues modulates the new associations that are formed with novel outcomes. Models which allow for changes in the “associability” of cues have been developed in the associative learning literature, yet whether similar cue-processing effects can be observed in implicit learning is unknown. We explored this possibility using the serial reaction time task. During pretraining, some cues consistently predicted outcomes, whereas others were relatively nonpredictive. During this stage, participants’ responses reflected the differences in predictiveness of trials. When all cues were then consistently paired with new locations, participants learned about cues that were previously good predictors faster than they learned about cues that were previously poor predictors. The results suggest that the prior predictiveness of cues modulates implicit sequence learning and that associability effects in humans are not necessarily a product of rational inference.

(4105)

Holographic Neural Networks. MICHAEL N. JONES, *Indiana University, Bloomington*—Holographic neural networks (HNNs) have been enormously successful in engineering but have seen limited attention as cognitive models. An HNN has no fixed set of connections but, rather, represents a node as a complex enfolding of weights in a Riemann space. Complex-valued weights are computed deterministically, effectively giving a single holographic node the computational power of an entire traditional connectionist network (TCN). HNNs have several appealing characteristics when compared with TCNs, including greater storage capacity with fewer nodes, no need for error feedback or iterative learning, the ability to represent complex stimulus spaces (e.g., XOR) with a single layer, and intrinsic response confidence estimates. HNNs also display associative commutativity: A network trained on S–R mappings can produce R–S mappings without inversion or additional training. Furthermore, HNNs have architectural similarities to biological neurons and are related to quantum models, which are gaining popularity as models of cognition. I will compare HNNs and TCNs on pattern classification and present extensions to models of complex cognition.

(4106)

Aging and Updating Causal Beliefs. SHARON A. MUTTER, ANTHONY R. ATCHLEY, & LESLIE F. PLUMLEE, *Western Kentucky University*—In a causal learning task, unrelated food cues presented in compound were followed by an allergic reaction (e.g., AB+), then single food cues from these compounds were revalued (A–). Young and older adults learned causal relationships between the compound and single cues and the outcome, but unlike young adults, older adults did not retrospectively revalue the causal effectiveness of the absent cues (B). Older adults’ within-compound associations for the unrelated foods were weaker than those of young adults, suggesting that they were unable to update the causal value of the absent cues because the single food cues did not effectively activate the representations of these cues. However, a second experiment showed that older adults did not revalue absent cues even when foods in the compound cues had strong preexisting associations. This suggests that changes in older

adults’ inferential reasoning processes also contribute to age differences in updating causal beliefs.

• **RECOGNITION MEMORY** •

(4107)

Distinguishing Among Remembered, Familiar, and Just Known Memories: An Experimental Analysis. SARAH J. BARBER & SUPARNA RAJARAM, *Stony Brook University*, & ELIZABETH J. MARSH, *Duke University* (sponsored by Suparna Rajaram)—How does the shift from episodic to semantic memory take place? Although this change in memory awareness over time has been demonstrated in real-world classrooms (e.g., Conway, Gardiner, Perfect, Anderson, & Cohen, 1997), the present experiment demonstrates a decrease in remember and an increase in just-know responses in a controlled laboratory paradigm. Participants read short stories containing easy and hard facts. On an immediate, a delayed, or a delayed-repeated general knowledge test, participants provided remember, just-know, and familiar responses. Our results indicate that recalled responses are associated more often with remember responses on an immediate test but with just-know responses on a delayed test. Furthermore, this shift occurs for easy but not for difficult factual information. Our results also show that familiar responses (similar to the know response in the traditional remember-know paradigm) show a different pattern from just-know responses.

(4108)

Processing Fluency Affects Subjective Claims of Recollection. BRIAN P. KURILLA & DEANNE L. WESTERMAN, *Binghamton University*—Previous studies that have used the remember-know paradigm to investigate subjective awareness in memory have shown that fluency manipulations impact knowing but not remembering (e.g., Rajaram, 1993), a finding typically accounted for by invoking inferential processing in judgments of familiarity but not recollection. However, in light of criticisms of this procedure, as well as findings that fluency affects a variety of subjective judgments, the present study was conducted to investigate whether recollection might also be inferential and not solely the product of conscious retrieval. When using the standard remember-know procedure, manipulations of perceptual fluency increased know responses but had no effect on remember responses, replicating previous findings. However, when employing an independent ratings method (Higham & Vokey, 2004), manipulations of perceptual and conceptual fluency increased claims of both familiarity and recollection, suggesting that the conclusion that fluency affects only know responses may be an artifact of the standard remember-know procedure.

(4109)

How Does Response Time Inform Recollection-Based Retrieval Strategies? DAVID A. GALLO & MICHAEL HAWKINS, *University of Chicago*—On recognition tests, familiar lures can be rejected if they fail to cue expected recollections, or if they successfully cue the recollection of inconsistent information. We designed a task to measure these two rejection processes. Subjects studied unrelated words, with some followed by a corresponding picture. On the picture recollection test, subjects could reject familiar lures if they failed to cue picture recollections (distinctiveness heuristic), whereas on the picture exclusion test, subjects could reject familiar lures if they successfully cued picture recollections (recall-to-reject). False recognition patterns were consistent with these different processes. We hypothesized that the distinctiveness heuristic should be less strategic than recall-to-reject, and hence faster. Although response latencies were faster on the picture recollection test, experimentally speeding response times reduced accuracy on each test to the same degree. Latencies may be a better index of strategy differences than experimentally manipulating response time, which appears to reduce recollection overall.

(4110)

Recollection in Semantic Decisions. LILLIAN PARK, *Rotman Research Institute*, MARY PAT McANDREWS, *Toronto Western Hospi-*

tal, ROBYN WESTMACOTT, *Hospital for Sick Children*, & MORRIS MOSCOVITCH, *Rotman Research Institute, University of Toronto*—Recently there has been interest in how episodic memory aids and contributes to performance on semantic tasks. We investigated the contribution of recollection on a categorization task. Participants were asked to categorize names of famous people to their proper field (e.g., arts, sports, politics, etc.) and were presented with two choices. Participants were faster and more accurate when they had a personal memory associated with a famous name than when they did not, even though the names were matched for familiarity and the number of facts associated with them. fMRI data revealed that left medial temporal lobe activation during categorization was greater for famous names that evoked a personal memory relative to the famous names that were correctly categorized but had no personal memories associated with them. Although autobiographical episodic memories are not necessary in order complete the task, recollection of episodic content appears to be invoked when available.

(4111)

Careful Inspection of Memory Reduces Recognition Memory Accuracy. J. THADEUS MEEKS, *University of Georgia*, GABRIEL I. COOK, *Claremont McKenna College*, & ARLO CLARK-FOOS, GENE A. BREWER, & RICHARD L. MARSH, *University of Georgia*—Intuitively, if one inspects memory more closely, one should be more accurate in reporting the results of that inspection. We addressed this issue by comparing conditions in which people had to discriminate remembering from knowing when they claimed an item was old with their rationales for claiming that new items were new. In the latter case, we asked whether items lacked familiarity, whether they would have been remembered if studied, or whether a recall-to-reject strategy was being employed. In comparison with standard recognition memory, both of the more detailed inspection strategies resulted in worse recognition memory performance. The result was replicated using 3 old response options and 3 new options compared with standard recognition memory, and it even replicated in a sequential judgment condition too. One possibility for this counterintuitive result is that maintaining many qualitative response options in working memory actually acts as a cognitive load and reduces performance.

(4112)

Giving a More Specific Warning Increases Errors Learned From Fiction. LISA K. FAZIO, SAMUEL SCHNUR, & ELIZABETH J. MARSH, *Duke University* (sponsored by Elizabeth J. Marsh)—Readers learn both true and false information from fictional stories (Marsh, Meade, & Roediger, 2003). Warning readers that a story may contain errors does not reduce suggestibility. Suggestibility is only reduced when readers evaluate each individual sentence for errors. Sentence-by-sentence evaluation likely teaches readers what kinds of errors are embedded in the story, whereas the general warning could be interpreted in many different ways (e.g., that the overall premise of the story is fictional). We created a more specific warning that highlighted the type of error embedded in our stories. In the trial-by-trial monitoring condition, the more specific warning increased the detection of errors but did not affect later suggestibility. Control subjects suffered with a specific warning, producing more misinformation on the final test. The specific warning presumably increased attention to the story errors, leading to their fluent retrieval later, with negative consequences.

(4113)

Recognition of Details Never Experienced: The Effects of Encoding and Age. ROBYN E. HOLLIDAY, *University of Kent*, & CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*—Child-normed lists of categorical items were used to investigate whether encoding list items as pictures or whole words or word fragments would affect 7-, 11-, and 13-year-olds' recognition of studied words (targets) and meaning-related unrepresented words (critical lures). Children studied one block of three lists as pictures, one block of three lists as whole words (read condition), and one block of three lists as word

fragments (self-generate condition). In all three encoding conditions, the to-be-studied item was first presented for 2 sec as a word in black lowercase letters. This word was then replaced by a picture, or the whole word (read condition), or a word fragment (self-generate condition). Each block was followed by a recognition test of whole words under repeated measures conjoint recognition retrieval instructions (verbatim, gist, verbatim + gist). The encodings were manipulated within participants. False recognition of critical lures increased with age, but the age increase was reduced when lists were encoded as pictures. Findings are discussed in relation to fuzzy-trace theory and the distinctiveness heuristic.

(4114)

Effects of Bilingualism on Recollection and Familiarity. ZOFIA WODNIECKA, *York University and Rotman Research Institute*, FER-GUS I. M. CRAIK, *Rotman Research Institute*, & ELLEN BIALYSTOK, *York University*—We examined the effects of bilingualism on recollection and familiarity in younger and older adults. Previous work has shown that bilingualism enhances executive functions and offsets age-related decline in cognitive control. Since recollection requires executive control to a greater extent than does familiarity, which is mostly an automatic process, we predicted that bilingualism would enhance recollection but would have little effect on familiarity. Younger and older adult monolinguals and bilinguals studied items (words, abstract objects, and faces) and then performed both an inclusion recognition test (in which they responded “yes” to both studied and new items repeated once after various lags) and an exclusion recognition test (in which they responded “yes” only to the studied items). In general, bilingual younger and older adults showed higher levels of recollection than their monolingual counterparts. These results extend the relationship between bilingualism and executive control to processes accompanying retrieval of information from memory.

(4115)

Recollection and Familiarity for Public Events in Neurologically Intact Older Adults and Brain-Damaged Patients. RALUCA PETRICAN & MORRIS MOSCOVITCH, *University of Toronto*—Despite extensive investigations of laboratory-acquired memories, there is a dearth of research on memories formed in real-life settings. We used the remember-know paradigm to investigate changes in recollection and familiarity of public events ranging across the life span of two groups of neurologically intact older adults (old-old, 74–85; young-old, 58–69) and patients with medial and anterior temporal lesions. First, in neurologically intact participants, recollection rates decreased linearly as a function of time elapsed since the event occurred, at a significantly higher rate than the corresponding decrease in familiarity. Second, consistent with the age-related semanticization hypothesis, across decades, old-old participants exhibited lower recollection (but not familiarity) rates relative to young-old participants. Finally, medial temporal lesions severely and disproportionately impaired recollection relative to familiarity, whereas anterior lateral temporal damage left intact recollective rates. We discuss the present results in the context of neuroanatomical and process-oriented theories of memory “aging.”

(4116)

On the Nature and Timing of Perceptual and Conceptual Familiarity in Recognition Memory: A Comparison Between an Event-Related Potentials and a Speed-Accuracy Trade-Off Study. ANGELA BOLDINI & SALVADOR ALGARABEL, *University of Valencia*, & ANTONIO IBANEZ & TERESA BAJO, *University of Granada*—Although early dual process theories of recognition memory (RM) claimed that familiarity is mainly perceptually based, later studies showed that familiarity can also be semantically based. An event-related potentials (ERPs) study was carried out to investigate electrophysiological correlates and timings of perceptually based and conceptually based familiarity processes in RM. Subjects were presented with categorized pictures at study, whereas perceptual/semantic sim-

ilarity was manipulated at test. Behavioral results showed the effects of both perceptual and semantic manipulations; ERPs results showed that, within the same 300–550-msec poststimulus time window, amplitudes for perceptually driven judgments went in opposite directions to amplitudes for conceptually driven judgments with respect to baseline. These findings suggest a possible dissociation between perceptual and semantic bases for familiarity. The same experiment was also carried out using a speed–accuracy trade-off technique (signal response procedure—without ERPs recordings) and consistent data were obtained with respect to familiarity’s time course.

(4117)

The Role of Past in the Simulation of Autobiographical Future Episodes: A Study With Young and Old Adults. NADIA GAMBOZ & MARIA A. BRANDIMONTE, *Suor Orsola Benincasa University* (sponsored by Maria A. Brandimonte)—Human beings’ ability to envisage the future has been recently assumed to rely on the reconstructive nature of episodic memory (Schacter & Addis, 2007). In this research, young and old adults mentally reexperienced and preexperienced temporally close and distant autobiographical episodes, and rated their phenomenological characteristics (D’Argembeau & Van der Linden, 2004). Additionally, they performed a delayed recognition task including remember–know judgments on new, old-remember, and old-imagine words. The results showed that, for both age groups, past and future temporally close episodes included more phenomenal details than did distant episodes, in line with the episodic constructive simulation hypothesis (Schacter & Addis, 2007). However, in the recognition task, both groups falsely attributed, with a high level of confidence, old-imagine words to remembered episodes. While partially in line with previous results, these findings call for a more subtle analysis in order to discriminate representations of past episodes from true future events simulations.

(4118)

Recognition Without Identification of Songs. BOGDAN KOSTIC & ANNE M. CLEARY, *Colorado State University*—Recognition without identification (RWI) is discrimination between studied and nonstudied items that are unidentified. This study examined RWI in music. Participants heard brief piano songs at study. In Experiment 1, identification at test was hindered through song fragmentation. An RWI effect was shown; among unidentified songs, participants discriminated between auditory fragments of studied and nonstudied songs (even with low identification rates, and even when the songs had been identifiable at study). Experiment 2 showed that song RWI can be based on a song’s isolated rhythm. Experiment 3 showed that it can be based on a song’s tonal information separated from its rhythm; how-

ever, without the original rhythm, maintaining note order is critical for obtaining the RWI effect. Thus, song RWI requires either some of the song’s rhythm or some ordered tonal information during recognition. Implications for theories of recognition memory and theories of music cognition are discussed.

(4119)

Action–Sentence Compatibility and Its Impact on Recognition Memory. DOMINIC A. SIMON, *New Mexico State University*—In an attempt to replicate the action–sentence compatibility effect (ACE, Glenberg & Kaschak, 2002) and to determine its impact on memory, participants read sentences and then moved a mouse to indicate their judgments of sentence sensibility. Sentences varied in sensibility, concreteness, implied movement direction, and compatibility between implied and appropriate response movement direction. The ACE was partially replicated: For sentence reading times, there was a significant interaction between implied direction and response direction compatibility such that compatible sentences were read relatively quickly when the implied direction was away from the reader, but slowly when it was toward. Main effects also emerged for implied direction and concreteness. On a test of sentence recognition, abstract sentences were better remembered than concrete ones, and there was an interaction between concreteness, implied movement, and compatibility of the response direction. As hypothesized, action–sentence compatibility affected sentence recognition, though not in a straightforward manner.

(4120)

Serial Memory for Real-World Objects: How Visually Precise? DANIEL A. GAJEWSKI & JOHN W. PHILBECK, *George Washington University*—Is immediate memory for real-world objects more visually precise than memory over longer retention intervals? Experiment 1 examined object memory as a function of serial position in a forced-choice recognition task with the visual similarity of different-token distractors manipulated to probe the visual precision of memory. Accuracy was greater for the most recently viewed objects and when the distractors were dissimilar. Surprisingly, the effect of similarity did not differ across serial positions. Experiment 2 included a test-delay manipulation (immediate vs. end of session) to further extend the interval between exposure and test. Overall performance declined when the test was delayed until the end of the session, but the effect of distractor similarity again did not depend on the timing of the test. The results suggest that whereas the probability of successful retrieval changes over the course of viewing, the precision of the memory upon successful retrieval is relatively stable.

POSTER SESSION V
Grand Ballroom, Convention Center
Saturday Evening, 6:00–7:30

• BILINGUALISM •

(5001)

The Relationship Between Implicit and Explicit Second-Language Processing: The Role of Cross-Language Similarity. LEIDA C. TOLENTINO & NATASHA TOKOWICZ, *University of Pittsburgh* (sponsored by Charles A. Perfetti)—Previous research suggests that beginning adult second-language (L2) learners are implicitly sensitive to grammar and meaning in L2 despite near-chance performance on overt judgments (McLaughlin et al., 2004; Tokowicz & MacWhinney, 2005). As predicted by transfer theories (MacWhinney, 2005), this sensitivity is modulated by the degree of similarity between the native language and the L2. The present study explores the relationship between implicit and explicit L2 processing in L2 learners, and how cross-language similarity influences this relationship. The brain activity of native English speakers was recorded as they performed grammaticality judgments on Spanish sentences. The three types of agreement violations used were similar in the two languages, different in the two, and unique to L2. After a baseline assessment, we improved participants' accuracy and then retested them. We compare ERP components to overt responses before and after accuracy improvement and contrast responses to the three types of grammatical violations.

(5002)

Bilinguals Sweating in the Lab: “Stop That” More Arousing in L1, “I Love You” in L2. JIMMY TONG & CATHERINE L. CALDWELL-HARRIS, *Boston University*—A growing body of work documents bilingual speakers' experience of greater emotional resonance in their first language compared to their second. Mandarin–English speakers who were born in the U.S. to immigrant parents or immigrated during childhood or adulthood rated the emotional intensity of auditory phrases while skin conductance was monitored. Skin conductance responses (SCRs) were highest for taboo phrases and lowest for neutral phrases, with no differences between English and Mandarin for these phrase types. Childhood reprimands (*Stop that!* or *Shame on you!*) elicited stronger SCRs in Mandarin, the L1, than in English, the L2, replicating analogous findings in Spanish and Turkish. Whereas in a prior study of Spanish, the reprimand effect held only for late learners of English, in the present study, it occurred for all participants regardless of age-of-acquisition of the second language. A new effect was that compliments/endearaments (*Thank you*, *Good job*, and *I love you*) elicited stronger SCRs in English than in Mandarin.

(5003)

English Words Connected Via Hebrew Morphology: L1–L2 Bidirectional Effects on Semantic Similarity. TAMAR DEGANI, *University of Pittsburgh*, ANAT PRIOR, *Carnegie Mellon University*, & NATASHA TOKOWICZ, *University of Pittsburgh*—Semantic similarity ratings of monolingual English speakers were compared with those of proficient Hebrew and English bilinguals (English–Hebrew and Hebrew–English). Both bilingual groups rated semantically unrelated English word pairs as more similar in meaning when they shared a single translation in Hebrew. Furthermore, English word pairs whose Hebrew translations shared a morphological root were also rated as more similar than words that had morphologically unrelated Hebrew translations. The unique morphological structure of Hebrew allowed us to examine pairs that were morphologically related but semantically unrelated. For example, the word SiPuR (*story*) and the word SaPaR (*barber*) share the morphological root S.P.R. Hebrew structure exerted an influence on English semantic processing for all bilingual participants, demonstrating bidirectional influences of first and second languages for highly proficient late L2 speakers. Thus, semantic organization and processing of bilinguals are reciprocally shaped by the semantic and morphological structure of both of their languages.

(5004)

Cross-Linguistic Syntactic Influence in Korean–English Bilingual Production: Evidence From Syntactic Priming. JEONG-AH SHIN & KIEL CHRISTIANSON, *University of Illinois, Urbana-Champaign*—This study examined cross-linguistic influence in Korean–English bilingual sentence production through syntactic priming. Syntactic persistence across languages has provided evidence for shared bilingual syntactic processing in production. This study is the first to be conducted with two typologically different languages, touching on the question what kind of syntactic information is interactive in bilingual production: surface word order or hierarchical structural relations. Experiment 1 showed that participants were likely to produce English prepositional datives primed by Korean postpositional datives, revealing that both structure and word order of Korean primes influenced the use of alternative English structure. Also, cross-linguistic syntactic priming effects were found regardless of word order. The preliminary data from Experiment 2 showed that participants produced Korean canonical postpositional datives regardless of English primes, revealing that no cross-linguistic syntactic priming occurred from English primes to Korean targets. This asymmetry in cross-linguistic influence is discussed in terms of bilingual language dominance.

(5005)

Natural Language Switching: Limits on the Role of Inhibitory Control. TAMAR H. GOLLAN & VICTOR S. FERREIRA, *University of California, San Diego* (sponsored by Craig R. M. McKenzie)—Bilinguals sometimes switch languages in conversation with other bilinguals even though nothing requires them to and even though laboratory studies reveal robust language switching costs. In three experiments, we investigated whether bilinguals incur switch costs when they name pictures in an either-language condition, inviting voluntary language switching. Bilinguals also named pictures in two language-selective conditions (i.e., dominant-language only, and non-dominant-language only). Our results suggest that voluntary language mixing is radically different from published reports of cued-language mixing in some ways (e.g., responses in the nondominant language were faster in language-mixed than in nondominant-only blocks, and there was no age-related increase in switching costs). In other ways our findings validate the literature on cued-task switching in suggesting that switches between natural alternative tasks still incur some costs. We discuss why bilinguals choose to switch and pay the cost, and how our findings constrain models of bilingual control.

(5006)

Codeswitching in Bilinguals: Testing the Triggering Hypothesis in Perception and Production. GERRIT JAN KOOTSTRA, JANET G. VAN HELL, & TON DIJKSTRA, *Radboud University Nijmegen*—Bilinguals switch without effort from one language to another in many communicative situations, a phenomenon called codeswitching. According to the triggering hypothesis, codeswitches are more likely to occur in the neighborhood of trigger words: language-ambiguous words such as cognates (words sharing form and meaning across languages) or homophones (words sharing only form across languages). The dominant research method in the codeswitching literature is corpus research on offline codeswitches that occurred in natural discourse. We tested the triggering hypothesis in the lab, using the confederate scripting technique and a self-paced reading task in Dutch–English bilinguals. Bilinguals were presented with codeswitched or non-codeswitched sentences containing a trigger word or a control word. Preliminary results indicate that trigger words indeed facilitate codeswitching, but codeswitching is more likely to occur when trigger words have a form and meaning overlap across languages.

(5007)

Language Switching in Picture Naming and Word Naming: The Consequences of Different and Same Script Bilingualism. NORIKO HOSHINO, *Tufts University*, & JUDITH F. KROLL, *Pennsylvania*

State University—In the present study, we asked whether different-script bilinguals can suppress cross-language activation more effectively than same-script bilinguals by using a language switching paradigm. Japanese–English and Spanish–English bilinguals named pictures or read words out aloud in L1 and L2 based on the color of the background. In picture naming, the two bilingual groups were identical in L2, whereas in L1 they differed in the magnitude of switch cost and in speed. The Japanese–English bilinguals showed a greater switch cost and were slower in L1 than the Spanish–English bilinguals. In word naming, however, the two bilingual groups were similar in L1 but the Spanish–English bilinguals were faster in L2 than the Japanese–English bilinguals. These results suggest that Japanese–English bilinguals suppress their L1 more strongly than Spanish–English bilinguals and that the script difference between L1 and L2 influences reading and speaking differently. Implications for models of bilingual lexical access will be discussed.

• READING •

(5008)

Is the Processing of Successive Words Strictly Serial During Reading? ALBRECHT W. INHOFF, CHIN AN WANG, MATTHEW SOLOMON, & BRADLEY SEYMOUR, *Binghamton University*—Eye movements were recorded while participants read one-line sentences. Each sentence contained a critical three-word sequence with a 3-letter target word in the middle. The parafoveal preview of the target was manipulated so that it was either fully visible or masked until the eyes moved to the right of the blank space preceding it. The visibility of the posttarget word was also manipulated so that it was visible at the onset of its fixation or after a short delay. If the processing of consecutive words in the sentence was strictly serial, then skipping of a masked target should be due to oculomotor overshoot. In this case, readers should regress to the target or the skipped target is processed while it is visible to the left of the fixated posttarget location. In either case, readers should not extract linguistic information from the posttarget location immediately after it is “erroneously” fixated.

(5009)

The Word Grouping Hypothesis in Eye Movements During Reading. DENIS DRIEGHE, *Ghent University*, & ALEXANDER POLLATSEK, ADRIAN STAUB, & KEITH RAYNER, *University of Massachusetts, Amherst*—In an eyetracking experiment, the distribution of landing position and the duration of first fixations in a region containing either an article and a noun (e.g., *the terrorists*) or a high-frequency three-letter word and a noun (e.g., *two terrorists*) were compared. The first fixations on the blank space between the high-frequency three-letter word and the noun were fewer in number and shorter in duration as compared to the first fixations on the surrounding letters. This pattern did not occur when the noun was preceded by an article. We will model this pattern within the E-Z Reader model (Reichle, Rayner, & Pollatsek, 2003) to determine whether this pattern is solely due to the increased skipping of the article or whether it can be considered as evidence for the word grouping hypothesis (Radach, 1996) stating that an article and a noun are processed as a perceptual unit in eye movements during reading.

(5010)

The Effect of Phonological Neighborhood on Eye Movements During Reading. MARK YATES, JOHN FRIEND, & DANIELLE M. PLOETZ, *University of South Alabama*—Previous research has indicated that phonological neighbors speed processing in a number of isolated word recognition tasks (e.g., lexical decision, naming, and semantic categorization). The study reported here extends this research by evaluating the effect of phonological neighborhood on reading for meaning. Eye movements were recorded while participants read sentences containing target words that had either small or large phonological neighborhoods. The results show that participants fixated for less time on words with many neighbors relative to those with few

neighbors. Interestingly, the effect was evident in measures assumed to reflect early lexical processing (e.g., first-fixation duration). This is taken as an indication that phonology plays an important and quick acting role in silent reading. The results will be interpreted in terms of current models of eye movement control during reading.

(5011)

Saccadic Targeting to Dichoptically Presented Words. HAZEL I. BLYTHE & SIMON P. LIVERSEGE, *University of Southampton*, & JOHN M. FINDLAY & HOLLY S. S. L. JOSEPH, *University of Durham*—Liversege, Rayner, White, Findlay, and McSorley (2006) showed that both adults and children exhibit disparity between the fixation positions of the two eyes when reading, and that disparate retinal inputs are fused to form a unified percept. We varied the relative horizontal position of word or nonword stimuli that were presented dichoptically to each eye as children and adults’ binocular eye movements were measured. Participants were required to make a lexical decision. We report binocular landing position, fixation duration, vergence movement, refixation, and response accuracy data. We will discuss our results in relation to three theoretical issues: (1) the size of Panum’s fusional area for linguistic stimuli, (2) whether this changes with age, and (3) whether saccades for each eye are targeted independently during binocular saccades to dichoptically presented stimuli.

(5012)

Eliminating the Subordinate Bias Effect With Elaboration: Evidence From Eye Movements. JORIE COLBERT & ANNE E. COOK, *University of Utah*—When context preceding an ambiguous word instantiates the subordinate meaning of the word, readers will fixate longer on the ambiguous word compared to a control condition. This difference in fixation time has been called the subordinate bias effect (Pacht & Rayner, 1993; Rayner, Pacht, & Duffy, 1994). In most previous studies of this effect, contextual manipulations have contained very few references to either the dominant or subordinate meaning of the ambiguous word prior to the presentation of the ambiguous word. In the present study, we increased the strength of the context preceding the ambiguous word through elaboration. Data from several eye tracking measures suggest that the subordinate bias effect was eliminated when preceded by elaborated, biasing context (based on both participant and item variability). This result indicates that although effects of meaning dominance are robust, they can be mediated (or ordered) with sufficient contextual support.

(5013)

Visual Attention in Normal Readers: Different but Similar. CHERIE L. LA ROCQUE, TROY A. VISSER, & JENEVA L. OHAN, *University of British Columbia, Okanagan*—Numerous studies have demonstrated that reading-impaired individuals perform worse than normal readers on a variety of visual attention tasks. However, less is known about the relationship between reading ability and visual attention among normal readers. In the present study, undergraduate normal readers were given a series of measures to assess different aspects of reading ability as well as a visual attention task requiring them to identify two targets presented in rapid temporal succession. Here, second-target identification accuracy is reduced when the intertarget interval is less than about 700 msec (attentional blink; AB). As with impaired readers, we found larger ABs among less skilled normal readers. However, the magnitude of this difference was relatively small. This may suggest that once an individual has exceeded a threshold level of reading ability, visual attention does not play a significant role in reading performance as it does in reading-impaired individuals.

(5014)

Analyses of Proofreading Efficiency and Skill. KAZUHIKO YOKOSAWA & MICHIKO ASANO, *University of Tokyo*—During proofreading, some anomalous words can be detected easily and others with difficulty. This illustrates that many factors should affect the

anomalous word detection. Professional proofreaders and novices participated in detection experiments. Based on the behavioral data, we tried to find out the important factors of efficient proofreading by multiple regression analysis. We tested the contribution of factors like phonological or semantic similarity to the contextually correct word, location in sentence, text span needed to detect the anomalous word, etc. The results of regression analysis showed that the text span needed for anomalous word detection had large influence on proofreading. Comparison of the detection rates for professional proofreaders and novices also supported this notion. Professionals could process larger span of text at a time than novices and achieved higher anomalous word detection performance.

(5015)

Methods of Testing and Diagnosing Model Error: Dual and Single Route Cascaded Models of Reading Aloud. JAMES S. ADELMAN & GORDON D. BROWN, *University of Warwick*—Models of visual word recognition have been assessed by both factorial and regression approaches. Factorial approaches tend to give a relatively weak test of models, and regression approaches give little indication of sources of problems for models, especially when parameters are not optimal. A new alternative method, involving regression on model error, combines these two approaches with parameter optimization. The method is illustrated with respect to the dual route cascaded model of reading aloud. In contrast to previous investigations, this method provides clear evidence that there are parameter-independent problems with the model.

(5016)

The Cross-Script Length Effect on Reading Aloud. KATHLEEN RASTLE, *Royal Holloway University of London*, TAEKO WYDELL, *Brunel University*, & JELENA HAVELKA, *University of Kent*—The finding that length influences naming latency for nonwords in particular has been used to support models of reading aloud that involve serial processing. However, because length is normally confounded with consistency this finding has also been explained by parallel models as a frequency by consistency interaction. Our research resolves this issue by investigating length effects in two highly consistent biscriptal languages. Experiment 1 examined length effects in Japanese Kana when words were presented in the script in which they normally appear or in a script in which they never appear. Experiment 2 examined length effects in Serbian when participants were biased to interpret bivalent stimuli in the script in which they are words or in the script in which they are nonwords. The results in both cases showed a larger length effect when stimuli were treated as nonwords, thus offering strong support to models of reading aloud that involve serial processing.

• LEXICAL ACCESS •

(5017)

Visual Word Recognition: Moving Beyond the Single Syllable. MELVIN J. YAP & DAVID A. BALOTA, *Washington University*—The extant literature in visual word recognition has been largely dominated by the study of monosyllabic words in computational models, factorial experiments, and more recently, megastudies. We present a large-scale study of pronunciation and lexical decision latencies for 9,639 monomorphemic mono- and multisyllabic words. Through hierarchical regression techniques, we explore the influence of standard variables such as phonological onsets, length, orthographic neighborhood size, phonological neighborhood size, and word frequency. Importantly, we also investigate the unique influence of other variables, including (1) number of syllables, (2) syllabically defined feedforward and feedback phonological consistency, (3) composite rank-transformed frequency, (4) new orthographic and phonological similarity measures, (5) stress typicality, and (6) semantics. Using the full set of predictors, we were able to account for substantially more variance in both pronunciation (65.9%) and lexical decision (65.6%) performance than in previous megastudies. These results provide impor-

tant new constraints for emerging models of multisyllabic visual word recognition.

(5018)

Interpreting Chicken-Scratch: Lexical Access With Handwritten Words. ANTHONY S. BARNHART & STEPHEN D. GOLDINGER, *Arizona State University*—Research in spoken and visual word perception shows a striking asymmetry: Studies of spoken word perception typically employ natural, human-produced stimulus tokens. By contrast, studies of visual word perception has almost exclusively employ standardized, computer-generated typefaces. Although considerable research (e.g., in computer science) has focused on “decoding” handwriting, almost no research has assessed whether signature findings in lexical access are affected by the use of naturally produced items. By only using pristine stimuli, studies of printed word perception may systematically under- or overestimate the importance of psychological variables and processes. We will report initial experiments comparing artificial and natural tokens of written words, examining effects of frequency, regularity, orthographic neighborhood density, feedforward and feedback consistency, and imageability. The results indicate that the natural physical ambiguity of handwritten stimuli slows processing, allowing effects that only appear minimally for typewritten words to be magnified, exerting stronger influences on recognition.

(5019)

Unitization Effect in English and Chinese: Orthography and Language Experience. LIANG TAO, *Ohio University*, & ALICE F. HEALY, *University of Colorado*—Four groups of subjects (native Chinese speakers, and native English speakers in Chinese language courses at 3 levels) identified English words and 2-syllable Chinese words from strings of letters and Chinese characters, and detected word components (the letter *t* in English, and the character “have” as a component of 2-character Chinese words) in 5 stimuli (English and Chinese scrambled-order text containing real words, English text, Chinese text in characters and in the Roman alphabet). A unitization effect (more detection errors on *t* in high-frequency words than in other words) was obtained for the English texts. The effect was larger with normal than with scrambled text. But no frequency effect was found on the bisyllable Chinese words. The findings suggest that logographic and alphabetic writing systems evoke different cognitive processes. High-frequency English words are processed as fused chunks, whereas multisyllable Chinese words are processed as loosely packed units during reading.

(5020)

Interactive Processing Between Radicals and Word in Reading Chinese. JOANNE LEE, *Wilfrid Laurier University*, & LEONARD KATZ, *University of Connecticut*—The majority of printed Chinese words are composed of two radicals, one providing semantic information and one providing phonologic information. The two radical also have their own “stand-alone” meanings and pronunciations which are very often different from the meaning and pronunciation of their combination (i.e., the word). Two experiments provided evidence that phonologic information in the phonological radical was activated during reading of a two-radical word, even when it differed from the pronunciation of the whole word. The more similar the pronunciations of radical and word, the slower was (1) word recognition in a lexical decision task and (2) judgments that involved the phonological radical’s meaning. The results suggest that information in radicals interacts with word-level information and may play that role in a manner that is similar to the interaction of graphemes and morphemes, on the one hand, with word-level information, on the other, in alphabetic orthographies.

(5021)

Word Role Matters in Nonalphabetic Systems: Testing Letter Detection in Chinese. SETH N. GREENBERG, VINCE CHUAN, &

MARK HANSELL, *Carleton College*—Investigations of letter detection behavior have yielded patterns suggesting that high frequency function words engender more detection failures than usually lower frequency content words. A variety of studies have implicated both the frequency of words as a unitizing force that denies letter access, and the role of words that inhibits detection in function morphemes because such words are deemphasized in the working representation of text. Until recently such observations had been limited to alphabetic writing systems. However, Tsao and Healy have determined that frequency differences also affect letter detection in logographic systems (i.e., Mandarin Chinese). The present work used a Chinese character that can operate either as a vacuous function morpheme or as a content morpheme, and determined that in its function role it engenders more errors in embedded radicals, indicating that in these writing systems as well letter detection is at risk in function units because of their role.

(5022)

Morphemic Ambiguity Resolution in Processing Spoken Chinese. YIU KEI TSANG & HSUAN-CHIH CHEN, *Chinese University of Hong Kong* (sponsored by Hsuan-Chih Chen)—Chinese monosyllables are distinct phonological units of the language because they typically represent morphemes and can be written down with individual logographic characters. A morphemically ambiguous situation occurs when a syllable is part of a compound word, but its dominant meaning bears no relationship to the word. We present results of two experiments designed to investigate meaning dominance and semantic context in morphemic ambiguity resolution using a visual world paradigm. In Experiment 1, a disyllabic word starting with an ambiguous syllable was presented, and participants were asked to judge whether it matched with the items presented on the display screen while their eye movements were recorded. In Experiment 2, a biasing context preceded the presentation of the critical word. Both meaning dominance and context showed reliable effects on the eye movement data. The results give some cues about the time course of morphemic ambiguity resolution in processing spoken Chinese.

(5023)

Prelexical Decomposition of Compound and Pseudocompound Words. UN-SO PARK-DIENER, GREG B. SIMPSON, GEORGE KELLAS, & APRIL FUGETT, *University of Kansas*—Many studies suggest that morphological decomposition of compound words happens early in the visual word recognition process, possibly automatically. In that case, morpheme-like constituents of pseudocompound words (e.g., *brandish*) should also be decomposed during the early stage of visual recognition, although such effects should disappear quickly, as the decomposition does not help with identification of the whole word. Priming effects of compound words and pseudocompound words on their constituents were assessed at SOAs of 150, 300, and 500 msec, using masked primes. At the earliest SOA, both word types primed their first constituents (e.g., *blackboard* primed *black*, *brandish* primed *bran*), supporting the hypothesis of early decomposition. At the later SOAs, only the compound words continued to prime their constituents, while the pseudocompound words primed their first constituents only at the longest SOA. These results are discussed in light of current theories of morphological decomposition.

(5024)

Dissociative Effects of Prime Duration, Lexicality, and Word Frequency in Lexical Decision. MARY L. STILL & ALISON L. MORRIS, *Iowa State University*—To investigate orthographic priming, researchers have used lexical decision tasks where targets are primed by orthographically similar or dissimilar words or nonwords. Although results are mixed, similar word primes often produce interference, whereas similar nonword primes often produce facilitation. In addition to lexicality, prime duration and word frequency also produce dissociative effects. To better understand these findings, we used three prime durations with the lexical decision task: 60, 250, and 400 msec. The data

show that similar word primes produced interference for low-frequency targets at 60 and 250 msec and for high-frequency targets at 250 and 400 msec. Similar nonword primes produced facilitation for low-frequency targets at 250 msec and for high-frequency targets at 250 and 400 msec. The results are discussed in terms of the competition hypothesis, an alternative theory of orthographic priming based on word/nonword encoding and prime–target competition, and in terms of their implications for word recognition theories.

(5025)

Masked Priming: Manipulating the Scope of Prime Validity in Lexical Decision. REMO JOB, *University of Trento*, & FRANCESCA PERESSOTTI & CLAUDIO MULATTI, *University of Padua*—Bodner and Masson (2001) showed that in a lexical decision task, repetition proportion influences the size of the priming effects for both words and nonwords, thus supporting a retroactive account of masked priming. In a lexical decision task, we manipulated the repetition proportion for words while holding it constant for nonwords. An account stating that context influences prime validity in a way that high prime validity induces to rely stronger on primes, predicts that repetition proportion should influence both word and nonword processing even if repetition proportion is manipulated for words only. The results showed that priming interacts with repetition proportion for words, whereas priming does not interact with repetition proportion for nonwords. New definitions of context and prime validity should be proposed.

• LANGUAGE PRODUCTION •

(5026)

Lexical Bias in Speech Production: How Efficient Can a Lexical Editor Be? NAZBANOU NOZARI & GARY S. DELL, *University of Illinois, Urbana-Champaign*—The lexical bias effect (the tendency for phonological speech errors to create words more often than nonwords) has been debated for over 30 years. One account attributes the effect to a lexical editor, a strategic component of the production system that examines each planned phonological string, and suppresses it if it is a nonword. The alternative explanation is that the effect occurs automatically as a result of phonological-lexical feedback. In four experiments using a new production paradigm, we explicitly asked participants to do lexical editing on their planned speech. Our experimentally created “lexical editor” needed 300 msec to recognize and suppress nonwords, as determined by comparing response times when editing was and was not required. Therefore, we concluded that even though strategic lexical editing can be done, any such editing that occurs in daily speech, which involves rates of up to 3 words/sec, occurs sporadically, if at all.

(5027)

Phonologically Mediated Priming Resolves Tip-of-the-Tongue States. LISE ABRAMS & LISA A. MERRILL, *University of Florida* (sponsored by Lise Abrams)—Previous research demonstrates that tip-of-the-tongue (TOT) states, the temporary inability to retrieve a known word, can be resolved following presentation of phonologically related words. The present study investigated whether phonologically mediated priming—that is, where the prime and target are only indirectly related—can also help resolve TOT states. Participants answered general knowledge questions designed to induce a TOT state and then named pictures where one was either a prime or an unrelated picture. The prime was a near-synonymous picture that corresponded to a dominant (e.g., *couch*) and secondary (e.g., *sofa*) name. The secondary name was phonologically related to the TOT target (e.g., *socialism*). Following TOT responses, producing the dominant name led to greater target retrieval than did an unrelated name, showing that the phonologically related secondary name (without being produced) primed the target. These results suggest that spontaneous resolution of TOT states in everyday life may actually reflect phonologically mediated priming.

(5028)

Conceptual Coherence Affects Phonological Activation of Context Objects During Object Naming. FRANK OPPERMAN & JÖRG D. JESCHENIAK, *University of Leipzig*, & HERBERT SCHRIEFERS, *Radboud University Nijmegen* (sponsored by Jörg D. Jescheniak)—Whether the not-to-be-named context object is processed up to a phonological level during speech planning is a question of continuing debate. While some studies presented evidence in favor of such a view (e.g., Meyer & Damian, in press; Morsella & Miozzo, 2002; Navarrete & Costa, 2005), other studies failed to do so (e.g., Bloem & La Heij, 2003; Bloem et al., 2004; Jescheniak et al., 2007). In a series of four picture–word interference experiments containing a target and a context object, we demonstrate that phonological activation of context objects is reliably observed if target and context object are embedded in a conceptually coherent scene and that this activation disappears if both objects are presented in arrays of arbitrary objects. This pattern suggests that details of the visual input—in particular, its conceptual coherence—have important consequences for the lexical processing of not-to-be named context objects.

(5029)

Orthographic Morphology: Evidence From Acquired Dysgraphia. BRENDA RAPP & SIMON J. FISCHER-BAUM, *Johns Hopkins University*—A persistent question in language production concerns the level/s of representation and processing at which morphological knowledge and processes operate. It is generally accepted that there is an abstract, amodal level of morphological representation; however, there is less consensus regarding additional modality-specific morphological representations/processes. While there is considerable linguistic, psycholinguistic, and cognitive neuropsychological evidence of morphological processes that manipulate phonological morphemes, there is little evidence regarding orthography-specific morphological processes that assemble or generate orthographic morphemes. Favoring this hypothesis would be observations of individuals with acquired language impairments who produce morphological errors (e.g., *playing* → *PLAYED*) exclusively or primarily in the written modality. We present four case studies documenting the pattern of morphological errors largely restricted to written production. We conclude that the evidence favors a cognitive architecture that includes orthography-specific morphological representations and processes.

(5030)

Representing Verbs: An Empirical Test of FUSS. SILVIA SBISÀ, *University of Trieste*, SIMONA COLLINA, *Suor Orsola Benincasa University*, & KINOU WOLF & PATRIZIA L. TABOSSO, *University of Trieste* (sponsored by Patrizia L. Tabossi)—FUSS is a statistical model that represents the meanings of object and action words (Vigliocco et al., 2004). It assumes that word meanings are grounded in conceptual feature representations. These are bound into lexico-semantic representations that work as interfaces between conceptual knowledge and other linguistic information. A central claim of the model is that the meanings of object and action words can be modeled in a single semantic space using the same principles and tools. The present study, conducted on the Italian version of FUSS, presents a series of experiments showing that while performing reasonably well with nouns, in about 60% of cases the model represents as semantically close verbs that fail to prime one another in priming experiments and are rated as semantically far by speakers. Theoretical and methodological implications are discussed.

(5031)

Verb-Based Effects in Long-Term Structural Priming. JACQUELINE M. DIEHL & MICHAEL P. KASCHAK, *Florida State University*—Recent studies of structural priming have demonstrated that whereas there is evidence of verb-based effects (e.g., stronger priming when verbs are repeated between prime and target sentences) in short-term priming, such effects are absent in long-term priming. It has been

posited that this pattern is due to the operation of two mechanisms in structural priming: an implicit learning mechanism that drives structural priming in short- and long-term situations, and an explicit memory mechanism that produces the verb-based effects in short-term priming. We present evidence in support of this approach, demonstrating that verb-based effects can be observed in long-term priming situations, but only when participants show evidence of being explicitly aware of the manipulation of certain verbs in the experiment. Thus, the critical factor determining when verb-based effects are observed may not be whether the priming is short- or long-term, but how aware participants are of the priming manipulation.

(5032)

Processing Segmental and Prosodic Information During Cantonese Word Production. ANDUS W. K. WONG & HSUAN-CHIH CHEN, *Chinese University of Hong Kong*—Four experiments were conducted to investigate how subsyllabic, syllabic, and prosodic information is processed in Cantonese word production using a picture–word interference task. Experiments 1 and 2 demonstrated that naming responses were facilitated when the distractor shared either an identical onset or an identical rhyme with the picture name, compared with an unrelated distractor, and that no reliable effect was shown by the tone-related distractors. Experiment 3 revealed a robust syllable priming effect, as well as null effects of the onset-related and the rhyme-related distractors. Experiment 4 showed that both syllable-related and syllable + tone-related distractors facilitated naming responses, together with a reliable interaction between syllable and tone relatedness of the distractors. These results indicate that subsyllabic and tonal components of Cantonese monosyllables are represented and processed relatively independent of each other, and that the status of syllable units is more prominent than that of subsyllabic units in phonological encoding.

(5033)

Phonological Syllables Control Segmental Encoding in Mandarin Chinese. JENN-YEU CHEN, *National Cheng Kung University*, PADRAIG G. O'SEAGHDHA, *Lehigh University*, & KUANG-HUNG LIU, *National Cheng Kung University*—Word pair recitation is slower when the words share beginnings than when they do not. In three Chinese experiments, we observed equivalent repetition costs among disyllables whether the shared contents formed a segmental syllable, a tonal syllable, or a character. This indicates phonological competition between the discrepant second syllables of the word pairs. However, when we varied whether the shared beginnings comprised a syllable (while controlling the number of shared segments) we observed greater costs in syllable mismatch (e.g., *ken3-shi2 ke3-ni4*) than in match conditions (e.g., *ken3shi2-ken3qie4*), indicating within-syllable in addition to between-syllable competition. The additional cost of syllable mismatch did not occur in word pairs that did not share segments and so is not structural. These findings are consistent with the view that in Chinese syllables are primary planning units that control later stage segmental encoding.

(5034)

Orthographic and Semantic Radical Effects of Picture–Word Naming in Chinese. I-FAN SU, *University of Sussex*, QINGFANG ZHANG, *Institute of Psychology, CAS*, & BRENDAN S. WEEKES, *University of Sussex* (sponsored by Brendan S. Weekes)—Previous Chinese picture–word interference studies have shown robust orthographic effects; however, no study has yet established its loci. Weekes et al. (2002) found no interaction between orthography and phonology. Hence we speculated that orthographic effects occur between orthography and semantics via the semantic pathway. Mappings between orthography and meaning were manipulated by three levels; orthographic, opaque and transparent distractors, varying the extent that meaning was represented in relation to the shared semantic radical of the target. The results showed the greatest naming facilitation when distractor words were orthographically similar to the depicted target compared to unrelated distractors. Although slower than ortho-

graphic distractors, distractors with opaque semantic mappings also showed facilitation, proceeded by transparent semantic distractors. The observation that orthographic and semantic factors interact suggests that orthographic facilitation and semantic interference are based on a lexical–semantic conflict co-located at the lemma level via the semantic route (Roelofs, 1992; Schriefers et al., 1990).

(5035)

The Grammatical Class Effect in Picture–Word Interference: Evidence From Chinese Classifiers. JINGYI GENG & XI YU, *Beijing Normal University*, & YANCHAO BI, *State Key Laboratory of Cognitive Neuroscience and Learning* (sponsored by Matthew Finkbeiner)—Speech production theories generally assume that word selection is a competitive process, and that selection considers only words belonging to the target grammatical class. We present a study on Mandarin Chinese classifier production using the picture–word interference paradigm to evaluate these assumptions. Classifiers are obligatory before nouns in Chinese whenever a number or deictic is used. Participants named pictures with classifier NPs (e.g., “one /liang4/ car”) accompanied by visually presented distractors that are either another classifier (/zhi1/) or words from a nontarget grammatical class (“who”). Distractors were matched on variables including lexical frequency, visual complexity, and imageability. It was observed that the classifier produced stronger interference effects than the nonclassifier distractor, and that this grammatical class effect disappeared when the participants named the pictures with bare nouns (“car”). These results are consistent with the hypothesis that grammatical class constrains lexical selection in speech production.

(5036)

Word Retrieval in Old Age: Integrating Functional and Structural Neuroimaging. MEREDITH A. SHAFTO, *University of Cambridge*, EMMANUEL A. STAMATAKIS, *University of Manchester*, & PHYLLIS P. TAM & LORRAINE K. TYLER, *University of Cambridge*—Older adults suffer word-finding failures due to phonological access deficits; recent research suggests this is underpinned by atrophy in regions involved in phonological processing, including left insula. To examine the effect of this atrophy on neural activity, younger and older adults completed a picture naming task in the fMRI scanner and indicated word-finding successes and failures. If atrophy underpins older but not younger adults’ performance, older adults should have less activity during word-finding and a stronger relationship between neural atrophy and retrieval success. Both age groups activated similar regions during successful retrieval. During retrieval failures only younger adults showed additional activity in regions important for phonological processing, including left insula. Follow-up analyses confirmed that age-related atrophy was affiliated with decreased activity. Finally, only older adults showed a correlation between neural activity and retrieval failure rate, further supporting the role of neural atrophy in word-finding success in old age.

• ATTENTIONAL CONTROL •

(5037)

Neural Correlates of Attentional Bias: How Social Experience Influences Attention to Valenced Information. GIOVANNA EGIDI, HADAS SHINTEL, HOWARD C. NUSBAUM, & JOHN T. CA-CIOPPO, *University of Chicago*—How do neurophysiological processes mediate attention toward positive and negative emotional and social information? Are these processes modulated by individual differences in social isolation? Evidence suggests that emotional information, and in particular negative information, is more likely to orient selective attention. Additionally, research suggests that lonely individuals attend more to social information compared to socially connected individuals. We recorded event-related potentials while participants high or low in perceived social isolation performed color and emotional Stroop tasks with positive and negative social and emotional words. The analyses identified interference-related evoked po-

tentials in the centro- and right-frontal regions beginning around 350–400 msec after stimulus onset. These potentials varied as a function of both stimulus valence—positive or negative—and participants’ perceived social isolation. These results suggest that social isolation modulates the neurophysiological mechanisms underlying attention to social and emotional information.

(5038)

Even Attentional Capture by Singletons is Contingent on Top-Down Control Settings. LOGAN CORNETT, *Oregon State University*, ERIC RUTHRUFF, *University of New Mexico*, & MEI-CHING LIEN, *Oregon State University* (sponsored by Mei-Ching Lien)—We examined whether spatial attention is captured by object salience (e.g., singletons) or by a match to current attentional control settings (contingent capture). We measured the N2pc, a component of the event-related brain potential thought to reflect lateralized attentional allocation. A previous N2pc study found capture by singletons, but may have encouraged participants to actively search for singletons. Therefore, we looked for singleton capture when people were searching for a specific color (red or green) in the target display. On every trial, this target display was preceded by a noninformative cue display containing a salient color singleton. The key manipulation was whether the singleton had the target color or nontarget color. We found signs of attention capture (a cuing validity effect and an N2pc) only for singletons in the target color, suggesting that capture is strongly contingent on attentional control settings, not object salience.

(5039)

Relation Between Performances and Metacognitions on Attention: Paper-and-Pencil Testing With Younger and Older Adults. SATORU SUTO, *Chuo University*, & ETSUKO T. HARADA, *Hosei University*—In general, performances of attention tasks decline with aging from younger to older adults. However, is there any decline also in metacognition of attentional functioning, or what kind of relationship is there between performances and metacognition about attention when with two groups of different ages? Ninety-three undergraduate students (18–22 years) and 220 elderly people (60–83 years) participated in a paper-and-pencil testing experiment, in which participants executed 6 kinds of attention tasks, and also answered questionnaires about daily activities with divided attention and cognitive failures. Even though the path analysis revealed significant relationships between all measures of performance and age, there were also negative relationships between metacognitions of cognitive failure and age, and no significant relationship between metacognitions of dividend attention and age. These results suggest that the self-monitoring functions relating to metacognition decline with age, and that only objective measures or performances of attention can assess cognitive aging.

(5040)

Is “Attention Capture” the Same as “Stimulus Control”? DAVID A. WASHBURN & NATASHA A. BARRETT, *Georgia State University*—Many theoretical models distinguish between sources of behavioral control that are executive or intentional versus those that are reactive or automatic. In a series of experiments, we have further examined whether attention to sudden changes in the environment (of the type termed “stimulus capture”) is distinct from attention to stimuli that are prepotent as a result of conditioning (i.e., stimulus control). Summarizing across several experimental tasks (e.g., visual search, flanker), we report data showing how these environmental constraints versus experiential constraints differ with respect to the accuracy and latency of responses, and with respect to brain activity as revealed using transcranial Doppler sonography. The results favor a model of attention control that includes separable and competing sources of control from the environment, from activation or habit, and from intentions or plans.

(5041)

Effect of Task Irrelevant Information on Forming an Attentional Set. WILLIAM STURGILL, *Rockhurst University*—One service working

memory provides to goal directed responding is to inhibit task irrelevant information and to favor task relevant information in forming an attentional set. Problems related to failure to inhibit task irrelevant information are wide ranging. Is irrelevant information inhibited (not represented) or merely devalued (yet represented in working memory)? Evidence was gathered from a priming paradigm in which the prime and target were separated by varying SOAs. Targets were geons plus color; primes were words naming objects differing in color diagnosticity (high, low). Shape congruency to the primed concept was manipulated as was color congruency (for HCD primes). Subject's task was to name the ink color in the target. Initial results suggest that an attentional set is formed across SOA emphasizing task relevant information, and that the predictability of the irrelevant information (shape) inversely relates to how little it interferes with task relevant processing (color naming).

(5042)

Endogenous Disruption of Exogenously Driven Prior Task Interference During Task Switching. MARK E. FAUST, AGNES JASINSKA, CURTIS POLLARD, RICH PREVILLE, JUNAID MERCHANT, & FADEL Z. ZEIDAN, *University of North Carolina, Charlotte*—We have previously reported on a prior task interference (PTI) effect, that reflects the deleterious influence of a previously relevant, but now irrelevant, stimulus attribute (e.g., color) following a switch to a new task. This PTI effect appears to be primarily due to stimulus-driven reactivation of the prior task set during performance of the switched-to task in that it did not diminish across the first two trials of the switched-to task and was not modulated by switch delay. We report 2 new experiments demonstrating that a stop signal during the prior task, and the addition of a requirement for control on a stimulus dimension relevant for both tasks (e.g., semantic category), modulate the magnitude of the PTI effect. These results suggest the inhibitory control of stimulus-driven activation of task-irrelevant information is at a lower level in a hierarchical system of cognitive control processes.

(5043)

Impaired Inhibitory Control in Recreational Cocaine Users. LORENZA S. COLZATO, *Leiden University*, WERY VAN DEN WILDENBERG, *University of Amsterdam*, & BERNHARD HOMMEL, *Leiden University*—Cocaine is taking the place of ecstasy as second preferred recreational drug. Chronic use (daily consumption of cocaine) impairs response inhibition (Fillmore & Rush, 2002) but it is an open question whether and to which degree findings from chronic users extend to the “upcoming type” of recreational users (monthly base: 1–4 g). By using a stop-signal task we investigated the ability to inhibit and execute behavioral responses in adult recreational users and in a poly-drug-matched sample (controlled for age, race, gender distribution, level of intelligence). The results showed that users required considerably more time to inhibit responses to stop-signals than did nonusers, whereas the two groups did not differ in their ability to execute responses. Hence, recreational use impairs response inhibition, although to a smaller magnitude than chronic use, indicating that the degree of cocaine use is proportional to the magnitude of performance difficulties.

(5044)

Influencing the Lingering Garden Path Effect Through Tasks of Executive Control. EVANGELIA G. CHRYSIKOU, KATHRYN SCHERTZ, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania* (sponsored by Sharon L. Thompson-Schill)—Garden path sentences produce comprehension difficulties because they lead the reader to an initial incorrect understanding of the meaning of the sentence. Research has shown that elements of the incorrect interpretation “linger” even after one has revised the original interpretation and presumably comprehended the sentence correctly. The present research examined whether exposure to a category-generation pretask, which has been shown to involve higher order cognitive executive processes, would influence lingering garden path effects. Participants

were randomly assigned to either a category-generation or a control condition and asked to read 92 sentences. Garden path sentences were randomly presented among five types of control sentences. Following each sentence, participants responded to a follow-up comprehension question. Correct responses, time to respond, and sentence reading speeds were measured. The results revealed significant lingering garden path effects, which were more pronounced in the category-generation condition and are consistent with proposals of fatigue in cognitive control.

(5045)

Mind Wandering Under Dual Task Conditions. PETER DIXON & HENRY LI, *University of Alberta*—Previous research by Schooler and colleagues has demonstrated that readers can reliably detect when they are mind wandering and not fully comprehending. In particular, when readers are periodically interrupted and asked whether they are on task, their responses correlate with subsequent measures of comprehension. In the present research, readers were asked to detect the letter *e* as well read for comprehension. Consistent with previous research using this task, the letter-detection task did not have substantial effects on comprehension. However, under these dual-task conditions, there was no relationship between the responses to mind-wandering probes and comprehension. We conclude that mind wandering (as measured by probe responses) interferes with elaborative processing but not low-level comprehension.

(5046)

Intertrial Control Overrides Top-Down Control in the Simon Task: An Event-Related Potential Study. GAMZE ALPAY & BIRGIT STÜRMER, *Humboldt University, Berlin*—In the Simon task, responses are faster when the response location corresponds to the task-irrelevant stimulus position (compatible assignment) than when it does not (incompatible assignment). This compatibility effect diminishes after a preceding incompatible trial. We investigated whether intertrial adaptation interacts with top-down control by cuing targets in a Simon task. Event-related brain potentials were recorded, and the contingent negative variation (CNV) in the cue–target interval was analyzed as a measure of action preparation. Cues with varying validity either predicted the task-irrelevant stimulus position or the compatibility of the target (enabling intentional preparation). Cuing the compatibility with full validity accelerated responses for compatible trials. This precue benefit was only observed with preceding compatible trials, whereas there is no Simon effect after incompatible trials at all. Moreover, the CNV was largest after preceding compatible trials and full cue validity. Intratrial control, hence, appears to override top-down control in the Simon task.

• CLASSIFICATION •

(5047)

Classifying Partial Exemplars Leads to Learning Within-Category Information. ERIC G. TAYLOR & BRIAN H. ROSS, *University of Illinois, Urbana-Champaign* (sponsored by Brian H. Ross)—Recent work shows that category learning by classification may not result in learning some important knowledge people clearly possess, such as within-category information. However, most classification studies are conducted under narrow conditions not representative of natural classification. We compared “standard” classification to a slightly modified but more realistic task where exemplars appeared with missing features, with the idea that this change might lead to a wider distribution of attention. Typicality ratings collected after learning showed that learners who classified exemplars with absent features (Experiment 1) or occluded features (Experiment 2) were more sensitive to prototypical but nondiagnostic features (e.g., has two eyes is typical of cats but does not distinguish them from dogs) than standard classification learners. These results indicate that classification can, under some conditions, promote the learning of within-category information. Furthermore, they suggest the need to reconsider other

findings that depend on specifics of the standard classification paradigm.

(5048)

Classification Versus Inference Tasks: Why Do They Lead to Differences in Category Representation and Use? BENJAMIN JEE, *University of Illinois, Chicago* (sponsored by Susan R. Goldman)—Category learning research has contrasted two tasks: classification learning (CL) and inference learning (IL). In their review of this literature, Markman and Ross (2003) concluded that IL leads to prototype representations, whereas CL leads to representations around diagnostic features. This study explored why this is the case, and how these differences affect knowledge use. Participants learned about a new category through a CL or IL task. To tease apart the attentional and processing demands of these tasks, a restricted-inference learning (RIL) condition was included, in which participants performed an IL task involving only diagnostic features. The results showed that in terms of both category representation and use, performance in the RIL condition was more similar to CL than IL. Thus, differences in representation between IL and CL tasks may be due to the ways in which features are attended and encoded, rather than characteristics inherent to the learning processes themselves.

(5049)

Conceptual Judgments of Expert Versus Novice Chemistry Students: An fMRI Study. JAMES K. NELSON, *Dartmouth College*, RAPHAEL A. LIZCANO, *Harvard University*, LESLIE J. ATKINS, *Lesson Lab Research Institute*, & KEVIN N. DUNBAR, *University of Toronto*—Using fMRI, advanced chemistry and nonchemistry students were imaged while judging representations of molecules before and after a phase change (liquid to gas). Chemistry experts show relatively high levels of left inferior frontal activity on this task compared to novices, whereas novices show relatively high levels of inferior temporal and occipital activity compared to experts. This pattern of results is consistent with chemistry novices treating the task as a form of perceptual classification, whereas chemistry experts treat the task as a form of semantic/conceptual classification. Comparisons between this and an earlier fMRI study using a Newtonian mechanics task have implications for domain-specific differences in conceptual change in chemistry and physics education.

(5050)

Stereotype Threat Depends on Task Reward Structure and Task Type. LISA R. GRIMM, ARTHUR B. MARKMAN, W. TODD MADDOX, & GRANT C. BALDWIN, *University of Texas, Austin*—Research documents performance decrements in tasks resulting from the activation of negative task-relevant stereotypes. We suggest these negative stereotypes produce a prevention focus (i.e., a sensitivity to losses) that mismatches the positive feedback typically given in tasks. Performance usually suffers because this mismatch creates lower levels of flexibility than are observed in people who do not have this negative stereotype. To test this possibility, we induced a positive or a negative stereotype in participants and then gave them a complex classification task in which they either gained points or lost points. Individuals with a negative stereotype performed much better in this task when they lost points than when they gained points. In contrast, those with a positive stereotype performed better when they gained points than when they lost points. This pattern reversed when participants were given an information integration task for which cognitive flexibility is disadvantageous.

(5051)

Domain-Specific Inquiry Strategies. LINDSAY BLAU PORTNOY & MITCHELL RABINOWITZ, *Fordham University* (sponsored by Mitchell Rabinowitz)—Prior research shows that people distinguish cognitively between different categories—for example, animate and inanimate, causal and noncausal, and human and nonhuman. The present research investigates whether people use different patterns of

inquiry for different domains. We investigated this by asking people to generate questions about the content areas of history and biology. Seven categories of questions were identified: requests for information, questions about function, inquiries about why, questions about features, possibility statements or questions, mechanism questions, and requests for further information. Students' questions were sorted into these categories to discern patterns of inquiry. For biology, students tended to ask questions regarding function and possibilities, whereas in history, students tended to ask questions requesting additional information. These results indicate that people approach different knowledge domains with different inquiry strategies.

(5052)

The Influence of Causal Information on Treatment Choice. JENNELLE E. YOPCHICK & NANCY S. KIM, *Northeastern University*—Knowledge of the causal structure of a category has been shown to influence categorization (e.g., Ahn, 1998; Rehder, 2003) and diagnostic reasoning (Kim & Ahn, 2002; Kim & Keil, 2003). In two studies, we examined whether causal information presented in a causal chain (X causes Y which causes Z) affects treatment choice for mental disorders. For Study 1, artificial disorders were created using symptoms from the DSM-IV-TR (APA, 2000). These had either a biological root cause and psychological intermediate cause, or a psychological root cause and biological intermediate cause. Lay participants were asked to rate which of two fictitious treatments, a drug or a psychotherapy, would be more effective in treating each disorder. People reliably chose to map treatment choice onto the root cause of the mental disorder. Study 2 replicated this result using blank properties as symptoms. Possible implications for theory-based categorization and clinical practice are discussed.

• CONCEPTS •

(5053)

Spatial Processing and Category-Specific Deficits. CHRIS HOPE & LORI BUCHANAN, *University of Windsor*—There are a variety of explanations for the finding that some neurological patients are impaired at naming pictures of living things while being relatively unimpaired at naming pictures of nonliving things. Explanations range from those centered on characteristics of the objects themselves to those relating distinct naming abilities to evolutionary pressures. A series of experiments test the claims of several of these explanations. The findings are not entirely compatible with any of the extant theories but suggest a hybrid explanation that will be described in the presentation.

(5054)

Questioning the Role of Procedural Learning in Probabilistic Categorization. MEGAN HEFFERNAN & BEN R. NEWELL, *University of New South Wales*—The dual system account has dominated research on how people learn probabilistic categories. One widely used probabilistic categorization task is the weather prediction task (WPT), which is claimed to engage the procedural system. Two variables which are thought to impact on the procedural system differentially are memory load and delay of feedback. It is claimed that memory load does not impair the procedural system, whereas delay of feedback does. We investigated the effect of these two variables on WPT performance to assess its use as a procedurally mediated task. In three experiments results were inconsistent with this characterization. In Experiments 1 and 2, two different concurrent tasks interfered with performance on the WPT. In Experiment 3, delay of feedback did not interfere with WPT performance. These findings contradict the popular view of the WPT as a procedurally mediated task and questions its use as a demonstration of procedurally mediated learning.

(5055)

Representing Competition Among Relations During Conceptual Combination. CHRISTINA L. GAGNÉ & THOMAS L. SPALDING,

University of Alberta—Several questions have arisen concerning Gagné and Shoben's (1997) mathematical instantiation of relation availability based on their CARIN theory of conceptual combination. In particular, these questions focus on the issue of whether the notion of competition, as opposed to absolute relation frequency, is necessary, and the issue of whether the mathematical instantiation actually represents competition. First, we show that competition is indeed a critical factor in fitting the RT data. Second, we show that Gagné and Shoben's mathematical instantiation of relation availability does reflect competition among relations. Finally, we provide two new mathematical instantiations of relation availability that also fit the RT data well, indicating that the use of negative exponentials in the original formula is not critical to fitting the data, but that including a measure of competition is critical.

(5056)

Processing Novel Conceptual Combinations in Discourse Contexts. ERICA L. MIDDLETON, *University of Illinois, Urbana-Champaign*, & KATHERINE A. RAWSON, *Kent State University* (sponsored by Katherine A. Rawson)—A central theoretical debate in conceptual combination research concerns how people interpret novel noun–noun (NN) combinations (e.g., “bee spider”). Most of this work has focused exclusively on the processing of novel NN combinations in isolation. However, novel NN combinations encountered in nonexperimental situations are usually embedded in a discourse context. Thus, current theories may be limited to the extent that the processes involved in interpreting novel NN combinations in context are different than those involved in processing combinations in isolation. The results of two experiments suggested that the processes involved in interpreting novel NN combinations in context include but are not limited to the processes involved in interpreting novel NN combinations in isolation. Specifically, whereas processing novel NN combinations in context and in isolation both involve meaning generation processes, the processing of novel NN combinations in context can also involve anaphor resolution.

(5057)

Learning at Multiple Levels of Abstraction: The Case of Verb Argument Constructions. AMY PERFORIS & CHARLES KEMP, *MIT*, ELIZABETH WONNACOTT, *University of Oxford*, & JOSHUA B. TENENBAUM, *MIT* (sponsored by Joshua B. Tenenbaum)—We propose hierarchical Bayesian models (HBMs) as a framework for explaining how people can learn inductive constraints from experience. Specifically, we explore a simple HBM for the acquisition of verb argument constructions. HBMs learn at multiple levels simultaneously, inferring specific as well as general information. For instance, the model might learn which sentence constructions can be used with each specific verb, as well as constraints on how verbs in general are used: whether any given verb is likely to occur in multiple constructions or just one, or which constructions are most common in the language as a whole. Our model can acquire these two levels of knowledge on the basis of child-directed syntactic input alone, and can also explain adult performance on artificial language learning tasks that parallel the learning problem faced by children (Wonnacott et al., 2007).

(5058)

Interacting Aliens: Inferring Causal Structures From Covariational Data. RALF MAYRHOFFER, MICHAEL R. WALDMANN, & YORK HAGMAYER, *University of Göttingen*—Although human and nonhuman animals can undoubtedly learn causal model representations, there has been a debate about whether they can infer causal structure from covariation data alone in the absence of other cues (e.g., temporal order). Causal Bayes nets provide one rational account of how expert systems can induce structure from covariations, which has led to the proposal that humans may use related causal learning strategies. Based on the mind-reading alien paradigm introduced by Steyvers et al. (2003), we found impressive learning performance over a wide range of parameterizations for some causal structures but also systematic failures for others. We show that people's learning capacities can be ex-

plained by pattern-based, heuristic strategies, and that these heuristics do not rely on the Markov assumption, a crucial property of causal Bayes nets. Thus, the computational routines based on causal Bayes nets seem to exaggerate the information processing capacities of humans.

• PROBLEM-SOLVING •

(5059)

Effects of Semantic Knowledge on Algebraic Modeling. KRISTIE J. FISHER & MIRIAM BASSOK, *University of Washington*—When people solve arithmetic word problems they tend to align semantic object relations with arguments of arithmetic operations. Martin and Bassok (2005) found that such “semantic alignments” accompany mathematical modeling. They found semantic alignments in a word problem-solving task (arithmetic) that most students performed correctly, but not in an isomorphic equation-construction task (algebra) that many students performed incorrectly using a nonmodeling translation heuristic. We replicated the equation-construction task of Martin and Bassok and compared the time it took students to read aligned and misaligned relational statements (e.g., “six times as many cupcakes as trays” vs. “six times as many cupcakes as muffins,” respectively) they had to model. We found semantic alignments in students who performed the task correctly, and no semantic alignments in students who constructed incorrect algebraic equations. This interaction indicates that semantic alignments also accompany correct algebraic modeling.

(5060)

The Roles of Learning and Working Memory in Fluid Intelligence. ELAINE TAMEZ, JOEL MYERSON, & SANDRA HALE, *Washington University*, & JING CHEN, *Grand Valley State University*—Learning, as measured by laboratory tasks, typically correlates poorly with intelligence test scores. Recently, however, Williams and Pearlberg (2006) developed a learning task that showed an unexpectedly large correlation with the Raven's Advanced Progressive Matrices. Their task involved learning to recall ten three-word lists in response to ten different cue words (e.g., *lie: fan, rim, dry*). We examined the relation between learning on this task, working memory, and fluid intelligence. Performance on Williams and Pearlberg's learning task explained one-third of the variance in Raven's scores. Working memory (Operation Span) did not account for any additional (unique) variance. Our results, taken together with those of Williams and Pearlberg, strongly suggest that learning is a major component of what intelligence tests measure.

(5061)

Age-Related Changes in Primary and Secondary Memory in Relation to Fluid Intelligence. DUNEESHA DE ALWIS & JOEL MYERSON, *Washington University*, DAVID P. McCABE, *Colorado State University*, & CHRIS KUDELKA & SANDRA HALE, *Washington University* (sponsored by Joel Myerson)—Data from a cross-sectional study of 210 adults, 18–90 years of age, revealed that immediate recall of the initial and middle portions of a 16-word list declined with age whereas recall of the end portion did not. Thus, secondary memory appears to be much more age-sensitive than primary memory. Consistent with Unsworth and Engle (2006) secondary memory predicted Raven's scores, even with age controlled, whereas primary memory did not. In fact, recall from secondary memory predicted Raven's scores as well as performance on complex span tasks did. Comparison of immediate recall of the list with immediate recall of a subsequent 16-word list revealed that susceptibility to proactive interference (PI) increased with age, but most of the age-related decline in Raven's scores remained unexplained after controlling for the increase in PI.

(5062)

Memory for Mental Disorder Categories Across Levels of Expertise. JESSECAE K. MARSH, *Yale University* (sponsored by Woo-kyoung Ahn)—In addition to assigning patients to sometimes poorly defined diagnostic categories, mental health clinicians must remember spe-

cific information about individual patients. Expertise traditionally provides memory benefits for such specific domain-relevant information. However, expertise has been notoriously difficult to demonstrate within mental health clinicians. Does this indicate that expertise does not develop for these hard-to-define categories and there are no resulting changes across experience for memory of patients? Three participant groups (undergraduates novices, clinical student trainees, and clinicians with 10+ years experience) read passages describing mental disorder patients. Free recall performance differed across groups: Trainees recalled the most facts directly from the passages, whereas clinicians recalled more features that were absent from the passages but inferable about the patients. These results obtained despite equivalent baseline memory capacity and feature inference ability across groups. We discuss our results in relation to the medical expertise literature and to the treatment of mental disorders.

(5063)

Strategy Use in the Raven's: Evidence for Item Subsets and the Role of Flexibility. EMILY SWENSEN & DAVID Z. HAMBRICK, *Michigan State University*—The question of what underlies the general factor of intelligence (g) has remained unanswered for more than a century. This study examined the role of strategy use in one highly g -loaded test, Raven's Advanced Progressive Matrices (Raven's). Concurrent think aloud protocols were used to examine what type of strategy (analytic, visuospatial, both, or indistinguishable) individuals primarily used to solve each item on the Raven's. Domain-general and task-specific components conceptualized to reflect underlying processes on the Raven's were also measured. The results indicated that there are distinct subsets of analytic and visuospatial items that are optimally solved using a matching strategy. Furthermore, a task-specific component, flexibility in strategy use, predicted Raven's performance above and beyond working memory, cognitive style, and cognitive flexibility. The findings suggest that part of what underlies performance on the Raven's, and consequently g , is the ability to detect and flexibly use strategies.

(5064)

The Role of Implicitly Activated Associates on Intuitive Problem Solving. JENNIFER L. DYCK & DANI MCKINNEY, *SUNY, Fredonia*—Previous studies of intuitive problem solving have found that feelings of warmth are not always predictive of ability to generate solutions. We examined the role of implicitly activated associates on ability to solve word problems. Participants were presented with dyads of triads where one triad was coherent—that is, three words all related to a solution word—while the other triad was composed of unrelated words. Solution words had either high or low connectivity of its associative network, and each word in the triad was a member of this set. Participants were to choose the correct triad, rate feelings of warmth, and generate a solution word. The results indicated that feelings of warmth were highest for items with highly interconnected networks. However, correct solutions were generated more often for items with loosely interconnected networks. Findings indicate that implicitly activated associates may help explain feelings of warmth discrepancies in problem solving.

(5065)

Fifth Graders' Learning About Probability From Experiments They Perform. PATRICIA BAGGETT, *New Mexico State University*, ANDRZEJ EHRENFEUCHT, *University of Colorado*, & LAURA MICHALIK, *New Mexico State University*—Probability is a difficult concept to teach, especially in elementary grades. The mathematical concepts involved are subtle and difficult even for adults, who often form misconceptions (frequently cited in the research literature). Yet statewide math standards require that data analysis and probability be included in the K–5 math curriculum. The recommended pedagogy is constructivist—namely, students are expected to form their own conclusions based on the material they study. A fifth grade class in the southwestern United States participated in hands-on experiments in-

volving chance over a three-month period, collecting and analyzing data and interpreting results. We will describe their experiments, the strategies the students used to predict outcomes, what they learned, and what misconceptions they formed. We will also suggest how lessons about probability could be designed and presented to help prevent students from forming misconceptions and to increase their understanding of the topic.

(5066)

Time of Day Effects on Insight Problem Solving. MAREIKE WIETH & CAMERON B. HARRIS, *Albion College*—During a person's nonoptimal time of day the ability to inhibit irrelevant information has been found to be reduced compared to their optimal time periods (Hasher, Zacks, & May, 1999). In order to solve insight problems the solver must often overcome the current representation of a problem and find an alternative way of structuring the problem space. It was hypothesized that time of day would influence participants' insight problem solving rate. Across several experiments participants were asked to solve a variety of insight problems. The results showed that participants were more successful at solving problems during their nonoptimal time of day than during their optimal time of day. The results also suggest that these findings might be due to participants' increased tendency to break mental set during their nonoptimal time of day. Perhaps participants' reduced ability to inhibit irrelevant information encouraged a variety of problem representations, leading to greater problem solving success.

• SOURCE MEMORY •

(5067)

The Impact of Feedback at Test on Source Memory and Old/New Recognition. SEAN LANE, STEPHANIE GROFT, & CRISTINE ROUSSEL, *Louisiana State University*—Prior work in our laboratory revealed that receiving feedback about the accuracy of test decisions during a training period reduced source monitoring errors on subsequent items. Because research (e.g., Kantner & Lindsay, 2006) has found that the effect of feedback on recognition varies by type of stimuli, it is unclear whether our findings are a function of type of stimuli or type of test decision. In the present study, we had participants study pictures and form images. At test, we varied whether participants received feedback during a training phase of the test and whether they received a source or an old/new recognition test. On the source test, the feedback manipulation significantly reduced source misattributions (images called pictures). On the old/new recognition test, the manipulation led to a liberal bias. Our results suggest that feedback about source decisions may be more effectively utilized by participants than feedback about old/new judgments.

(5068)

A Source Misrecollection Account of Remember False Alarms. DAVID P. MCCABE, *Colorado State University*, & LISA GERACI, *Texas A&M University*—Proponents of discrete dual-process memory theories have suggested that remember responses in the remember-know paradigm reflect a conscious recollection process, whereas know responses reflect a familiarity process. Based on this assumption, others have argued that the existence of remember false alarms is problematic for discrete dual-process theories because conscious recollection should not occur for items that were not studied. We propose a source misrecollection account of remember false alarms that explains these responses in a manner consistent with the principles of discrete dual-process theories. According to the source misrecollection account, recognition probes, whether old or new, can elicit recollection of studied items, features of studied items, or items from a context other than the experiment. Two experiments are reported demonstrating the plausibility of this account, showing that subjects were more likely to give remember responses to distractors that had been encountered in a "preexposure" phase, than to experimentally novel distractors.

(5069)

The Effects of Complexity on Source Memory ROCs. LINDA J. MURRAY, COLLEEN M. PARKS, & ANDREW P. YONELINAS, *University of California, Davis* (sponsored by Andrew P. Yonelinas)—Source-memory receiver operating characteristics (ROCs) are typically flatter than those seen in item recognition, and they are U-shaped in *z*-space. There is considerable debate, however, regarding why the *z*ROCs are U-shaped and what conditions are necessary to observe these effects. In the present study, we examined whether source *z*ROCs become more linear as the complexity of the study event increases by manipulating stimulus type (simple or complex) and source type (simple or complex) in a fully crossed design. Preliminary results show source *z*ROCs that are U-shaped in the simple stimulus–simple source condition, somewhat flatter in the two conditions with one simple and one complex factor, and almost perfectly linear in the complex stimulus–complex source condition. This pattern indicates that increasing stimulus complexity or source complexity leads source *z*ROCs to become more linear. Whether these effects reflect changes in recollection or familiarity is discussed.

(5070)

Effects of Study Task on the Neural Correlates of Encoding Operations Supporting Successful Source Memory. HEKYEONG PARK, MELINA R. UNCAPHER, & MICHAEL D. RUGG, *University of California, Irvine*—The present study investigated whether the neural correlates of successful source memory vary according to the nature of study processing. Participants studied visually presented words, each displayed in one of two background contexts. At test, participants were asked to make old/new recognition and source memory judgment. In one study–test cycle, the study words were subjected to animacy judgments, whereas in another cycle the study task required a judgment about number of syllables in each word. fMRI was employed to contrast the neural activity elicited by study words that attracted accurate source judgments on the later memory test, as opposed to words that were later forgotten or for which source information was unavailable. In both tasks, study words that were later assigned to the correct source elicited enhanced activity in ventral extrastriate cortex. In addition to these common effects, task-selective effects were observed, including animacy-specific medial temporal lobe subsequent memory effects. These findings extend previous studies by demonstrating that the neural correlates of successful encoding differ according to study task when the later memory test emphasizes source rather than item information. The findings add further support to the proposal that neural activity supporting successful episodic memory encoding varies according to the online processing engaged by an episode as it is experienced.

(5071)

Children's Encoding Focus and Later Source Monitoring Decisions. STACIE L. CRAWLEY, NORA S. NEWCOMBE, & HANNAH BINGMAN, *Temple University* (sponsored by Nora S. Newcombe)—Generally speaking, source monitoring decisions are made by reviewing the qualitative characteristics associated with a memory and determining whether there is a sufficient amount of information to attribute the memory to a particular source. Previous work on children's encoding focus and source monitoring decisions has shown that when children focus on a speaker's emotions during encoding, there is improvement between the ages of four and six in source memory and, more specifically, in memory for particularly helpful source-identifying information (Kovacs & Newcombe, 2006). Two studies are presented that test the role of different encoding instructions and their effect on later source monitoring. When children reflect on a speaker's emotions at encoding, source monitoring improves. However, when the focus is turned inward or on other features, such as semantic and perceptual information, source monitoring declines. Implications for the development of source monitoring and strategy are discussed.

(5072)

Source Memory, Subjective Awareness, and the Word Frequency

Mirror Effect. JASON L. HICKS, BENJAMIN A. MARTIN, & NOELLE L. BROWN, *Louisiana State University*—We examined the relative contribution of recollection and familiarity in source decisions. Subjects encoded low- and high-frequency words on either the left or right side of a computer monitor. The SM-first group first made a left/right/new source decision, followed by a recollect/familiar decision. The RF-first group made decisions in the opposite order. Compared to the SM-first group, the RF-first group was more likely to use the “recollect” claim and less likely to use the “familiar” claim for targets, but not for lures. Compared to the RF-first group, the SM-first group had better source memory for items “recollected” and a trend of better source memory for items deemed “familiar.” Both groups had better source memory in the state of recollection as opposed to familiarity, but in the familiarity state source memory was above chance. The low-frequency advantage was present in the states of recollection and familiarity, rather than in recollection only.

• EMOTION AND MEMORY •

(5073)

Emotional Memory Enhancement: A Meta-Analysis. BRANDY A. BESSETTE-SYMONS & WILLIAM J. HOYER, *Syracuse University*—Emotional material is remembered better than neutral material, the emotional memory enhancement effect (EME). We report the results of a series of meta-analyses based on 67 samples that describe the magnitude of EME for positive and negative stimuli. EME was larger for negative stimuli ($d = .81$) than for positive stimuli ($d = .58$) when analyses were based on free recall, cued recall, and recognition hit rates. Stimulus type (pictures, words) was a significant moderator for negative EME but not for positive EME. The analysis based on accuracy and corrected recognition scores (hits/FA) revealed EME for negative stimuli ($d = .49$) but not for positive stimuli ($d = .15$). Regarding R/K differences, both negative ($d = 1.2$) and positive ($d = .46$) stimuli showed more R responses than did neutral stimuli; in contrast, only negative stimuli ($d = -.6$) differed from neutral stimuli for K responses. Theoretical implications are discussed.

(5074)

Binding Theory Predicts Memory Performance in RSVP Picture Lists. GREGORY E. DEVORE, DAVID GILSDORF, & PAUL HAERICH, *Loma Linda University*—Binding Theory predicts enhanced memory performance for negative emotional stimuli in heterogeneous lists combining negative and neutral stimuli at sufficiently fast presentation rates. Counterintuitively, it also predicts no difference in memory performance for negative and neutral stimuli in homogenous lists. These results have been previously supported using taboo and neutral lexical stimuli. We tested the predictions of binding theory using neutral or negative images selected from the International Affective Picture System. Subjects were presented six homogenous lists of 9 items each. The results indicate no significant differences in recognition or temporal memory between negative and neutral picture stimuli presented in homogenous lists ($ps > .40$). Subjects displayed greater confidence for correctly as compared with incorrectly answered recognition and temporal memory items ($ps < .001$); however, confidence did not vary with valence ($ps > .17$). Taken together, these results support the predictions of Binding Theory for homogenous lists of images.

(5075)

Killing Good Memory for Emotional Words. STEPHEN R. SCHMIDT, *Middle Tennessee State University*—Memory for negative affect emotional words (e.g., *kill, hate, died*) often exceeds memory for matched neutral words. This effect may be due to the emotion evoked by the words, or to some factor confounded with word type. To explore the role of emotion in memory for emotional words, participants read sentences that activated either highly emotional meanings of target words (*Shane DIED in his car last night*), or low emotional meanings of the targets (*Shane's old car DIED last night*). One

group of participants rated the targets on several dimensions, and a second was asked to freely recall the targets. The high emotional contexts led to higher levels of emotion, but poorer recall, than did the low emotional contexts. In an item analysis, rated distinctiveness, but not rated emotion, was positively correlated with recall. These results suggest that distinctiveness, rather than emotion, is responsible for good memory for emotional words.

(5076)

Response Bias in “Remembering” Emotional Stimuli: A New Perspective on Age Differences. AYCAN KAPUCU, CAREN M. ROTELLO, REBECCA E. READY, & KATHARINA N. SEIDL, *University of Massachusetts* (sponsored by Caren M. Rotello)—Older adults sometimes show a free recall advantage for emotionally positive, rather than neutral or negative, stimuli (Charles, Mather, & Carstensen, 2003). In contrast, younger adults respond “old” and “remember” more often to negatively valenced materials in recognition tests. Both recognition effects are due to response bias changes rather than enhanced memory accuracy or the use of recollection (Dougal & Rotello, 2007). We presented older and younger adults with emotional and neutral stimuli in a remember-know paradigm. Signal-detection and model-based analyses showed that memory accuracy did not differ for the neutral, negative, and positive stimuli, nor was recollection used. However, both age groups showed large and significant response bias effects of emotion: Younger adults tended to say “old” and “remember” more often to negative words compared to positive and neutral words, whereas older adults responded “old” and “remember” more often to both positive and negative words than to neutral stimuli.

(5077)

Cognitive Basis of the Positivity Effect in Old Age. CHRISTIE CHUNG, MEREDITH BROWN, NAVINE NASSER-GHODSI, & SUZANNE CORKIN, *MIT*—The tendency of older adults (OA) to remember positive information better than negative information is well-documented, but its cognitive basis awaits deeper examination. We examined the cognitive mechanisms supporting this positivity effect using the think/no-think paradigm (Anderson & Green, 2001). Young adults (YA) and OA learned negative, positive, and neutral word pairs. They were asked to recall the second member of some of the studied pairs (think condition), but to suppress their memory for others (no-think condition). They then recalled the second members for all studied pairs. YA showed enhanced memory for negative and positive words in the think condition, and stronger suppression of these words compared to neutral words in the no-think condition. OA displayed similar patterns for positive words, but showed no significant enhancement or suppression for negative words. The positivity effect may stem from OA’s overall decreased cognitive control for negative but not for positive information.

• VISUAL PERCEPTION AND IMAGERY •

(5078)

Cognitive and Autonomic Measures of Object Familiarity. FRANK M. MARCHAK, TANNER L. KEIL, PAMELA S. WESTPHAL, DAVID M. BECHBERGER, & JENNIFER E. TIERNEY, *Veridical Research and Design*—Altoff and Cohen (1999) found differences in eye movement measures to images of novel and repeated faces and attributed this effect to differences in the underlying cognitive processes involved in face perception. This effort examined the relationships among skin conductance and pupil diameter—measures of autonomic arousal—and cognitive measures of eye movement and reaction time when viewing images of familiar and unfamiliar objects. Thirty subjects viewed 40 images of objects, half familiar and half unfamiliar, while measures were taken of eye movements, mean pupil diameter, electrodermal activity (excursion, rise time), and reaction time. A within-subjects MANOVA was conducted using object familiarity as a factor. There was a significant overall effect of prior exposure [$F(7,424) = 20.537, p = .000$]. The implications of these find-

ings are discussed in terms of the relationship between measures of cognitive and autonomic activity.

(5079)

A Technique for Measuring Single-Item Identification Efficiencies. AMI EIDELS, JASON M. GOLD, JAMES T. TOWNSEND, & BRIANNA CONREY, *Indiana University, Bloomington* (sponsored by Jason M. Gold)—Thresholds and corresponding efficiencies (ideal/human thresholds) in identification tasks are typically computed by collapsing data across all items (stimuli) within a given task in order to obtain a “multiple-item” summary measure of performance. However, some stimuli may be processed more efficiently than others, and such differences are not captured by such conventional multiple-item threshold measurements. Here, we present a simple technique for measuring “single-item” identification efficiencies. The resulting efficiencies describe the ability of the human observer to make use of the information provided by a single stimulus item within the context of the larger set of stimuli. We applied this technique to the identification of several different classes of complex patterns embedded in noise, including 3-D rendered objects and Roman letters. Our results show that efficiency can vary markedly across stimuli within a given task, demonstrating that single-item efficiency measures can reveal important information lost by conventional multiple-item efficiency measures.

(5080)

Looking as if You Know: Implicit Identification Guides the Eyes in Object Recognition. LINUS HOLM, JOHAN ERIKSSON, & LINUS ANDERSSON, *Umeå University* (sponsored by Timo Mäntylä)—Sometimes we seem to look at the very objects we are searching for, without consciously seeing them. Does attention to an object precede conscious object recognition? We addressed this question in two recognition experiments involving pictures of fragmented objects. In Experiment 1, participants preferred to look at the target object rather than a control region 25 fixations prior to explicit recognition. Furthermore, participants inspected the target as if they had identified it around 9 fixations prior to explicit recognition. In Experiment 2, we investigated whether semantic knowledge might explain the systematic object inspection prior to explicit recognition. Prior knowledge about target name increased participants’ scanning efficiency. The control region was rejected faster when the participants knew the target’s name. The findings suggest that semantic memory is involved in gaze control during visual recognition, guiding the eyes to diagnostic regions before we become aware of the target’s identity.

(5081)

A Statistical Model for Discriminating Between Subliminal and Near-Liminal Performance. RICHARD D. MOREY, JEFFREY N. ROUDER, & PAUL L. SPECKMAN, *University of Missouri, Columbia*—The concept of a psychophysical threshold is foundational in perceptual psychology. In practice, thresholds are operationalized as stimulus values that lead to a fairly high level of performance such as .75 or .707 in two-choice tasks. These operationalizations are not useful for assessing subliminality—the state in which a stimulus is so weak that performance is at chance. We present a hierarchical Bayesian model of performance that incorporates a threshold that divides subliminal from near-liminal performance. The model provides a convenient means to measure at-chance thresholds and therefore is useful for testing theories of subliminal priming. We show that the model performs well in simulation and apply it to a subliminal priming experiment.

(5082)

Face Scanning Strategies in Monkeys (*Macaca mulatta*): An Eye Movement Investigation. CHRISTOPH D. DAHL, CHRISTIAN WALLRAVEN, HEINRICH H. BÜLTHOFF, & NIKOS K. LOGOTHETIS, *Max Planck Institute for Biological Cybernetics* (sponsored by Heinrich H. Bülthoff)—It has been demonstrated that monkeys

process conspecific faces holistically—unlike human or marmoset monkey faces (Dahl et al., *Proc.R.Soc.B*, accepted). Face inversion or blurring systematically affected the proportion of fixation and viewing time. Here, we describe the scanning characteristics on monkey and human faces using a nonreinforced paradigm. Upright and blurred monkey faces elicited initial fixations and refixations of eyes, before transferring to lower facial parts. For human faces, an initial fixation in the upper face regions was followed by an unspecific saccade to other regions. Inversion elicited an initial fixation on the upper quadrants of monkey faces, followed by fixations across the whole face. Inverted human faces, however, differed relatively little from upright human faces. Depending on the presentation condition of a face, the same face can trigger a different scanning behavior, which in turn is specific to the species affiliation, indicating a high-level influence.

(5083)

Feature Migration in the Standing Wave Illusion. ELISABETH HEIN & CATHLEEN M. MOORE, *University of Iowa*—A bar flickering in counterphase with two flanking bars can disappear, leaving the perception of two jittering flanking bars—the standing wave illusion. It has been observed informally that surface features of the invisible central bar “migrate” to the flanking bars. If the central bar is gray and the flanking bars are white, then when the central bar is invisible, the flanking bars can appear grayish. This feature migration suggests the assignment of features to currently represented objects in the scene through object-mediated updating processes. The aim of this study was to measure feature migration in the standing wave illusion formally. We obtained reports of both the visibility of the central bar and of perceived surface features of the flanking bars as a function of flanker duration. The results are consistent with the phenomenology. We are now in a position to test an object-mediated updating account of feature migration.

(5084)

Can Memory Effect Visual Perception? DAVID MARSHALL & PAUL ATCHLEY, *University of Kansas*—Reentrant processing within the visual system allows for the possibility that pattern-level memory information can affect visual processing at the object formation level. This possibility was explored by manipulating the number of possible target identities in an alternative forced choice target identification task using a simultaneous onset masking paradigm. Identification accuracy scores between a two-alternative forced choice (AFC), a four AFC task, and a response control condition (used to control for possible response level effects) were compared. Accuracy scores were significantly higher in the four AFC task, indicating that pattern level memory information did affect visual perception. The results could not be explained by response-level effects.

(5085)

Limits of Coactivation: Redundancy Gain in Three-Dimensional Visual Stimuli. SONJA ENGMANN & DENIS COUSINEAU, *University of Montreal* (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. Race models predict a gain due to redundancy, but models of coactivation give a much better approximation of the strength of this gain. Evidence of a redundancy gain has previously been found for stimuli from three different modalities (tactile, auditory, and visual). However, these results are difficult to replicate with purely visual stimuli. A series of several experiments with varying stimulus attributes revealed the limits of processing redundant stimuli. Although we found evidence of a redundancy gain for three-dimensional stimuli, this gain cannot always be attributed to coactivation. We argue that the variability in size of the redundancy gain is related to the structure of the visual system, and depends strongly on the type of stimulus attributes. Alternative models, with properties of both race and coactivation models, are proposed to accommodate differences in processing for visual attributes.

(5086)

Imagery Skills in Members of Different Professions and Gifted Children. OLESYA BLAZHENKOVA & MARIA KOZHEVNIKOV, *George Mason University* (sponsored by Maria Kozhevnikov)—This research was conducted to investigate differences in imagery between different professional groups. Scientists ($n = 24$), visual artists ($n = 11$), architects ($n = 15$), and humanities professionals ($n = 23$) completed spatial imagery tests assessing abilities to process spatial relations, and object imagery tests assessing abilities to process visual appearances of objects in terms of color and shape. Whereas visual artists showed above average object imagery but below average spatial imagery abilities, scientists showed an opposite pattern. To investigate developmental aspects of such dissociation in imagery ability, three groups of children 8–18 years old, with strong interest to one of the above fields (science, visual arts, or humanities), were compared on a similar battery of spatial and object imagery tests. The results were consistent with those obtained from adult professionals, supporting the existence of the trade-off between object and spatial imagery abilities.

(5087)

Discriminability and the Preferred Level of Face Categorization. CHRISTOPHER J. D’LAURO, *University of Colorado*, JAMES W. TANAKA, *University of Victoria*, & TIM CURRAN, *University of Colorado* (sponsored by Tim Curran)—People usually categorize objects more quickly at the basic level (e.g., “dog”) than at the subordinate (e.g., “Collie”) or superordinate (e.g., “animal”) category levels. Notable exceptions to this rule include objects of expertise, faces, and atypical objects (e.g., “penguin”), all of which show faster-than-normal subordinate level categorization. We hypothesize that the subordinate level reaction time advantage seen for faces is the result of their high discriminability. First, we replicated the subordinate-level advantage for faces (Experiment 1) and then showed that a basic-level advantage for faces can be elicited by increasing the perceptual similarity of the face stimuli, making discrimination more difficult (Experiment 2). Finally, we repeated both effects within subjects, showing individual faces were slower to be categorized in the context of similar faces and more quickly categorized among diverse faces (Experiment 3). These data suggest a common framework for face and object categorization.

• SKILL ACQUISITION •

(5088)

Learning With Practice: To Speed Up, or Not to Speed Up? EMILY E. BOHLSCHIED, SCOTT D. BROWN, & ANDREW J. HEATHCOTE, *University of Newcastle* (sponsored by Andrew J. Heathcote)—When given extended practice on a cognitive task with instructions to be both fast and accurate, participants typically become faster while maintaining constant accuracy (Heathcote, Brown, & Mewhort, 2000). However, when Dutilh and Wagenmakers (unpublished data) emphasized either speed or accuracy in a between-subjects manipulation they found that some participants in the speed stress condition improved accuracy while maintaining a constant speed. We used the same task, lexical decision, and tested a larger number of participants using a within-subjects design to manipulate the instructions given to participants (speed vs. accuracy emphasis). Most participants displayed a constant error rate accompanied by decreasing RT in both speed and accuracy emphasis blocks, with only a few participants who started with speed emphasis instructions displaying a fairly constant RT and increasing accuracy with practice. We discuss the implications for criterion setting in speeded choice models (e.g., Brown & Heathcote, 2005; Ratcliff & Smith, 2004).

(5089)

Improving Mathematics Learning by Rearranging Practice Problems. DOUG ROHRER & KELLI TAYLOR, *University of South Florida*—Although mathematics students typically devote most of

their study time to practice problems, little is known about how mathematics learning is affected by even the simplest changes in practice strategy. In the experiments reported here, subjects were assigned the same practice problems, and only the practice schedule was manipulated. Once practice was complete, subjects were tested between one day and four weeks later. Tests scores increased sharply if (1) different types of practice problems were interleaved and not grouped together, or (2) practice problems of the same type were distributed across practice sessions. In each experiment, the less effective schedule was the one used in a majority of mathematics textbooks.

(5090)

Effects of Difficulty, Specificity, and Variability on Training to Follow Navigation Instructions. VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado*, IMMANUEL BARSHI, *NASA Ames Research Center*, & LYLE E. BOURNE, *University of Colorado*—Subjects were trained to follow navigation instructions telling them to move in grids on a computer screen simulating a 3-dimensional space. They repeated and then followed the instructions by mouse clicking on the grids. They were trained, given a short distractor task, and then tested. There were three groups differing in the message lengths received during training: easy (short lengths), hard (long lengths), and mixed (all lengths), with all subjects given all lengths at test. There was a significant interaction of condition and message length at test. The mixed group was best on most lengths, and the easy group was better than the hard group on short lengths, whereas the hard group was better than the easy group on long lengths. The results support the advantages of both specificity and variability of training but do not support the hypothesis that difficult training would lead to overall best performance at test.

(5091)

The Impact of Item-Focused and Relational Processing on Episodic Memory and Artificial Grammar Knowledge. THOMAS WATKINS, ROBERT MATHEWS, & SEAN LANE, *Louisiana State University* (sponsored by Robert Mathews)—Two artificial grammar learning experiments were conducted to study the acquisition of episodic and grammar knowledge with manipulations designed to enhance one or the other type of knowledge. In the first experiment, subjects were trained to recognize specific exemplars (item-focused emphasis) or to identify patterns of family resemblance (relational focus), and then participants were given both an episodic (specific exemplar recognition) and a grammar (valid string identification) test. The item-focused emphasis led to better episodic knowledge and equivalent grammar knowledge. The second experiment investigated the same training types over a longer training period and under presence or absence of interference from different study lists. The results confirmed that the two types of knowledge can be independently manipulated and that both types of knowledge are used together whether it is beneficial or not for overall performance. The results are not consistent with current exemplar models or single system abstraction models.

(5092)

Timing Is Everything: Effects of Attention and Modality on Statistical Learning. LAUREN L. EMBERSON, *Cornell University*, CHRISTOPHER M. CONWAY, *Indiana University*, & MORTEN H. CHRISTIANSEN, *Cornell University* (sponsored by Morten H. Christiansen)—Previous studies have pointed to both attentional (Turke-Brown et al., 2005) and modality-specific (Conway & Christiansen, 2006) effects on statistical learning. Here, we demonstrate that these effects of modality and attention interact, modulated by the timing of stimulus presentation. We presented participants with sequential input by interleaving a stream of auditory syllables with a stream of visual shapes, with the order of presentation determined by separate statistical relations in each modality. Participants were asked to only attend to stimuli in one modality. The rate of stimuli was manipulated across attention and modality conditions. For long presentation rates, attention facilitated visual but not auditory statistical

learning. In contrast, short presentation rates resulted in the opposite pattern: Attention facilitated auditory but not visual statistical learning. Thus, presentation rate differentially modulated the effects of modality and attention on statistical learning, pointing to separate modality-specific mechanisms for auditory and visual statistical learning.

(5093)

Implicit Learning and its Relation to Language: Evidence From Adults, Children, and Deaf Children With Cochlear Implants. CHRISTOPHER M. CONWAY, JENNIFER KARPICKE, & DAVID B. PISONI, *Indiana University*—Immediate memory span is typically assessed using unstructured lists (e.g., digit span or nonword repetition tasks). However, some studies have shown that memory for structured lists improves as compared to random or unstructured patterns, and that this increase in immediate memory span can be a useful measure of implicit learning. Here, we report data from a structured sequence learning task obtained from three groups of participants: adults, children, and deaf children with cochlear implants. The results show that implicit learning for visual sequential patterns is strongly associated with language abilities in all three groups. In addition, visual sequence learning in the group of children with cochlear implants was worse compared to normal-hearing age-matched children, suggesting that a period of sensory deprivation (profound deafness) results in a disturbance to implicit sequence learning skill. These results have important theoretical, clinical, and methodological implications for understanding implicit learning and its relation to language.

(5094)

Sleep Does Not Enhance Motor Sequence Learning. DENISE J. CAI & TIMOTHY C. RICKARD, *University of California, San Diego* (sponsored by Timothy C. Rickard)—Motor sequence skill is believed to be enhanced by sleep consolidation. A replication of earlier experiments, however, demonstrates that the sleep enhancement effect can be explained as a consequence of data averaging. In a second experiment that equates time-of-day and time-since-sleep for both the training and testing sessions, no effect of sleep was observed, suggesting that earlier results suffered from a confound involving one or both of those factors. These findings invite a substantial reevaluation of the role of sleep in motor skill learning.

(5095)

A Full Night's Benefit From a Mere Nap: Consolidation of Perceptual Learning of Synthetic Speech. KIMBERLY M. FENN, DANIEL MARGOLIASH, & HOWARD C. NUSBAUM, *University of Chicago* (sponsored by Howard C. Nusbaum)—Performance in a synthetic speech learning task improves immediately after training, but appears to deteriorate over the course of a day. After a 12-h waking interval, performance levels decline to approximately half of the initial learning. However, after a subsequent night of sleep, performance is restored to posttraining levels. If sleep occurs prior to a waking interval, no learning is lost due to time awake; sleep inoculates learning against subsequent waking degradation (Fenn et al., 2003). Here, we show that participants who were permitted to nap for 1.5 h in the afternoon showed no significant change in learning after a 12-h retention interval ($p > .3$), whereas control participants, not permitted to nap, lost about half of their initial performance gain ($p < .0001$). This suggests that in a generalized speech task, a nap can function to aid learning in much the same way as a full night of sleep.

(5096)

A Diffusion Model Account of Practice. GILLES DUTILH, *University of Amsterdam*, JOACHIM VANDEKERCKHOVE & FRANCIS TUERLINCKX, *University of Leuven*, & ERIC-JAN WAGENMAKERS, *University of Amsterdam* (sponsored by Jeroen G. W. Raaijmakers)—When people repeatedly perform the same cognitive task, their response times (RTs) invariably decrease. This effect has been extensively studied in the past, with most research focusing on the specific

question of how the RT mean decreases with practice. In order to provide a more general account of the practice effect, we applied the Ratcliff diffusion model to data from a 10,000-trial lexical decision task. The diffusion model estimates parameters that represent psychological processes by describing the practice-induced changes for both entire RT distributions and the proportion of errors. The data show that practice leads to improvement on RT when participants are instructed to respond accurately, and leads to improvement on accuracy when participants are instructed to respond quickly. A diffusion model analysis suggests that the effect of practice is to enhance the speed of information processing, to decrease response caution, and to decrease peripheral processing time.

• ASSOCIATIVE LEARNING AND MEMORY •

(5097)

The Effect of Tobacco Abstinence on Text Comprehension. ADAM COBB, PAUL S. MERRITT, & LUKE MOISSINAC, *Texas A&M University, Corpus Christi*, & ELLIOT HIRSHMAN, *George Washington University* (sponsored by Paul S. Merritt)—Previous research has shown reductions in memory performance following 24 h of abstinence from tobacco use. (Hirshman et al., 2004). However, no research has been conducted regarding tobacco abstinence and text comprehension. This study was conducted to explore the effects of tobacco abstinence on text comprehension. We tested 25 moderate to heavy smokers when smoking normally (ad lib) and after 24 h without tobacco use (abstinent). Participants read two SAT passages in each condition (at the beginning and end of each session). Following each reading, participants completed standard SAT questions designed to assess text comprehension, followed by 5 min of free recall. Recall was analyzed using latent semantic analysis. No significant main effect of tobacco abstinence was found for text comprehension or free recall; however, there was a significant interaction between smoking condition and time of assessment in which performance declined from Test 1 to Test 2 during the abstinent session.

(5098)

The Tenacious Nature of Binding Errors for Arousing Pictures. DEANNA L. NOVAK & MARA MATHER, *University of California, Santa Cruz* (sponsored by Margaret Wilson)—Arousal associated with an item enhances memory for its location and other intrinsic details (Mather, 2007). However, arousal-enhanced memory binding might have a cost when initial binding is incorrect and needs to be updated. To examine whether misbindings are more difficult to correct for arousing items than for nonarousing items, we asked participants to study a slide show sequence of 64 picture–location conjunctions and then to recall the location of each picture. Participants repeated this study–test sequence until they were able to accurately recall the locations of all 64 pictures. Initially, participants were able to recall significantly more negative than neutral picture locations, consistent with previous studies. However, in subsequent learning blocks the advantage reversed. Participants were more likely to repeat mistakes for negative images than for neutral images. This reveals a trade-off for arousing items: fast learning but impaired flexibility in memory binding.

(5099)

The Effects of Emotional Association and Intervals on Evaluation of Advertised Products. KEN MATSUDA & TAKASHI KUSUMI, *Kyoto University*—This study investigates the causal factors of J-curve effect by evaluation and recognition of advertised products paired with affective pictures. Participants were shown advertisements with pictures that varied in emotional valence from negative to positive. Five minutes or 1 week later, two groups of participants rated old and new products on liking, purchase intention, and recognition or recognized association between advertisements and images, respectively. Although liking and purchase intention ratings at the 5-min delay showed a monotonic increase from negative to positive valence, the

ratings at the 1-week delay showed a J-curve effect; both liking and purchase intention received higher ratings at both ends of the valence, relative to the middle. In addition, memories of products were maintained, but the association between affective pictures and advertisement decreased. The J-curve effect was explained by the decrease of association between affective stimuli and products, and by maintenance of affective intensity.

(5100)

The Effect of a Concurrent Memory Load on the Directed Forgetting of Emotional Pictures. MASANOBU TAKAHASHI, *University of the Sacred Heart*—In a list-method directed forgetting task, midway through presentation of the lists, directed forgetting participants are instructed to forget the first half of the list and remember only the second half of the list. In contrast, control participants are instructed to remember both first and second halves of the list. At recall test, all the participants are required to recall all previously learned items. Typically, as for the first list, the directed forgetting participants show lower recall performance than do control participants. However, previous studies demonstrated that such a directed forgetting effect disappeared with a concurrent memory load during the presentation of second list. In the present study using emotionally negative pictures, the directed forgetting effect emerged (Experiment 1), but the effect was not disrupted by the concurrent memory load (Experiment 2). These results suggest that a different mechanism underlies the directed forgetting effect in the negative pictures.

(5101)

Searching for Interference Effects in Proper Name Learning. LORI E. JAMES, KETHERA A. FOGLER, & SARAH K. TAUBER, *University of Colorado, Colorado Springs*—Interference or competition effects have been suggested as a possible cause of the notorious difficulty of learning proper names for previously unknown individuals. In several name-learning experiments, we included manipulations aimed at maximizing the potential for interference. For example, in one experiment we forced some participants to make guesses aloud about uncertain names, whereas for other participants we strictly prohibited guessing, with the expectation that guessing would increase interference, and in another experiment participants learned ambiguous (confusable) and unambiguous name and occupation pairs, with the expectation that ambiguity would increase interference. We also compared performance of young and older participants, because older adults appear highly susceptible to disruption from interference on other memory tasks. However, we found no evidence that the manipulations designed to elicit interference effects increased the difficulty of name learning. Altogether, our findings indicate that interference is not the mechanism underlying the difficulty of name learning.

(5102)

Emotion and Delay Effects on False Memories. CAGLA AYDIN & CHARLES J. BRAINERD, *Cornell University*, MARK L. HOWE, *Lancaster University*, & VALERIE F. REYNA, *Cornell University* (sponsored by Valerie F. Reyna)—It has recently been found that the induction of positive affect elevates false memories, whereas the induction of negative affect may reduce them. To date, however, such findings have only been obtained with immediate memory tests. In the present experiments, the memory effects of emotion induction were measured on 1-week delayed tests, as well as on immediate tests. In addition, emotion induction sometimes occurred before target materials were studied (a storage manipulation), while at other times, emotion induction was interpolated between study and test (a consolidation manipulation). The induction procedure, a word-rating task, equated the distance between positive, neutral, and negative affect. The conjoint-recognition procedure was used on both the immediate and delayed tests, and the parameters of the conjoint-recognition model were estimated to determine the process-level effects of emotion induction on both true and false memories.

(5103)

Encoding Versus Retrieval Processes in False Recognition. STEPHEN A. DEWHURST & EMMA BOULD, *Lancaster University*—Two experiments investigated the roles of encoding and retrieval processes in the memory illusions produced by associated (DRM) and categorized lists. Smith et al. (2002) argued that the DRM effect is caused by associations made at encoding whereas the category repetition effect is caused by associations made at retrieval. In contrast to this view, we found parallel effects of both encoding and retrieval manipulations on the DRM and category repetition illusions. In Experiment 1, explicit instructions to generate associates at study increased false recognition using both list types. In Experiment 2, test-induced priming had no effects on false recognition. These findings suggest that memory illusions produced by both DRM and categorized lists are primarily the result of associative processes at encoding.

(5104)

Learning Theory From a Hazard Function Perspective. LARA N. SLOBODA, RICHARD A. CHECHILE, & RAYMOND S. NICKERSON, *Tufts University* (sponsored by Raymond S. Nickerson)—Hazard functions are a general tool for examining stochastic models. In this poster we explore learning theories in terms of a hazard function analysis. In particular we investigate the general Weibull class of hazard models. This function allows (depending on a shape parameter) for either decreasing, constant, or increasing hazard. An example of a constant hazard function is the classic operator model for learning that posits a fixed proportion of the still unlearned items are conditioned on each study trial. We also show that this learning model nonetheless results in a monotonic decreasing hazard rate if there is inhomogeneity of either individuals or items. Fitting available learning data on an individual basis we find support for a decreasing hazard function for learning. Implications for these findings on existing theories of learning are explored.

(5105)

Fast Mapping as a Mechanism for Semantic Learning in Healthy Adults and Amnesia. TALİ ATIR, *Haifa University*, MORRIS MOSCOVITCH, *Rotman Research Institute, University of Toronto*, & RACHEL TOMER & ASAF GILBOA, *Haifa University*—Fast Mapping (FM) is an incidental associative learning mechanism which enables children to acquire new vocabulary and semantic concepts following a single exposure. Information acquired through FM is thought to be independent of the episodic memory system. Little is known about FM in adults. We used FM to teach adults novel word–picture and word–fact–picture associations (e.g., facts and names of exotic birds) in an incidental learning paradigm. Participants saw and heard sentences requiring them to select one of two pictures (one familiar and one novel). Free and cued recall of novel labels was poor. Cued recall of semantic facts was very good, as was forced-choice recognition of the novel associations, despite equal familiarity with both lures and targets. Memory performance remained unchanged after a week. Learning of semantic associations through FM is supported by the adult brain, and we also explore whether FM supports new semantic learning in hippocampal amnesia.

• FALSE MEMORY •

(5106)

The Modality Effect in False Recognition: Evidence From the Criterial Recollection Task. BENTON H. PIERCE, *Texas A&M University, Commerce*, & DAVID A. GALLO, *University of Chicago*—Previous studies have shown that false recognition of semantic associates is greater following auditory than visual study. We asked whether this modality effect generalizes beyond the DRM false memory task. Subjects studied unrelated concrete words, with some words presented auditorily and others presented visually. At test, subjects had to selectively search their memory for the recollection of one modality or the other (the criterial recollection task; Gallo, Weiss, &

Schacter, 2004). Using visual presentation at test (Experiment 1), subjects made fewer false recognition responses when searching memory for visual recollections compared to auditory recollections, thereby replicating previous findings. However, inconsistent with previous studies, we found this same effect when using auditory test presentation (Experiment 2). These results suggest that the effect of study modality on false memories generalizes beyond the DRM false memory task, and that study modality may exert a larger influence than test modality on retrieval monitoring processes.

(5107)

True and False Memories of Children and Adults for Verbal and Written Presentation of DRM Lists. MAYA M. KHANNA, *Creighton University*, & MICHAEL J. CORTESE, *University of Nebraska, Omaha*—True and false recall of children and adults was examined via the DRM paradigm. Lists were presented verbally in Experiment 1 and in written form in Experiment 2. In all experiments, lists were composed of semantic associates, phonological associates, or a hybrid of both associate types. Lists consisted of words that are well-known by children and adults. In the verbal presentation modality, children were found to produce higher ratios of false to true memories than were adults in all three list types. However, in the written presentation modality, children and adults produced similar ratios of false to true memories across list types. This interaction of presentation modality and age is due to the children engaging in lower levels of semantic processing in the written condition as compared to the verbal condition. Taken together, the results are more easily explained via the activation monitoring framework than by the fuzzy-trace theory.

(5108)

The Role of Activation in Creating False Memories of Perceptual Experience. JASON ARNDT, EMILY READ, MERCEDES HUFF, CHAK FU LAM, & YINA NG, *Middlebury College*—We investigated the role of activation processes in producing false memories for lure items in the Deese/Roediger–McDermott paradigm. Each theme related to a lure item was presented in a single, unusual looking font. We manipulated variables that should influence critical lure activation (e.g., MBAS; number of associates of a lure that were studied), as well as whether lures were shown in the same font used to study their associates. In general, more errors were committed when lures were shown in a font used to present their associates during encoding. Furthermore, the size of the increase in errors was greater when lures were presented in a font that was associated with conditions that increased lure activation. These results suggest that lures become associated with features of presentation context, and that activation processes play a critical role in generating those associations, consistent with the claims of activation-monitoring theory (Roediger et al., 2001).

(5109)

Time Pressure at Retrieval After Gesture Encoding: Diminishing the False Memory Suppression Effect. JENNIFER L. TOMES, KAREN G. NICHOLSON, & KATHYRN I. POWLES, *Mount Allison University*—Previously we found that, relative to hearing list items, viewing distinctive representational gestures when studying items suppresses false memory creation in the DRM. We recently examined whether this suppression effect is related to encoding processes or a retrieval strategy by comparing the effect across self-paced and time-pressure conditions. If the suppression effect is related to encoding processes it should be comparable across conditions, whereas if the effect reflects a retrieval strategy it should be eliminated under time constraint. Relative to hearing words, studying words with gestures suppressed false memory creation, but only in the self-paced condition. In contrast, relative to hearing words, studying words with gestures led to an improvement in the recognition of studied words and a reduction in false alarms for new unrelated words, which was comparable across conditions. The results suggest that the false memory suppression effect that occurs with viewing distinctive gestures reflects a retrieval strategy.

(5110)

Differential False Memory Effects of Phonological and Semantic DRM Lists. CHI-SHING TSE & W. TRAMMELL NEILL, *University at Albany*—In a variation of the DRM-list procedure (after Deese, 1959; Roediger & McDermott, 1995), subjects studied word lists that were associated phonologically or semantically to a “critical item” (CI). Some lists included the CI, allowing measurement of hit rates as well as false-alarm rates on a subsequent recognition memory test. Replicating previous results, semantically related lists produced lower discrimination (d') and more false alarms for CIs than yoked list associates. Although phonologically related lists also increased false alarms to the same CIs, discrimination was higher than for yoked list associates, and was increased relative to the same CIs in unrelated study lists. The results suggest that implicit associative activation cannot account for false-recognition effects of phonologically related lists.

(5111)

Retrieval Inhibition Versus Encoding Explanations of (List-Method) Directed Forgetting. SAMEER BAWA, BARBARA A. SPELLMAN, & CHAD S. DODSON, *University of Virginia*—Two types of accounts have been offered to explain list-method directed forgetting: encoding disparities (across lists) and retrieval inhibition. Our evidence supports the latter. Experiment 1 tested retrieval inhibition against a differential encoding account (Sahakyan & Delaney, 2003). Participants were instructed to encode both lists in the same way. We manipulated whether the second list created proactive interference. With encoding strategies equated, directed forgetting effects did in fact emerge, but only when proactive interference was present, consistent with retrieval inhibition. Experiment 2 tested retrieval inhibition against a selective rehearsal account (Benjamin, 2007) using a recognition task. We manipulated whether encoding strategies were controlled across lists. Equating encoding strategies eliminated directed forgetting effects in recognition, again consistent with retrieval inhibition. Our findings suggest that researchers should control how participants encode study items in list-method directed forgetting, but that retrieval inhibition nonetheless best accounts for its effects.

(5112)

Effects of Backward Associative Strength on the False Recognition of Words. MARIA A. ALONSO, *University of La Laguna*, & EMILIANO DIEZ & ANGEL FERNANDEZ, *University of Salamanca*—Two experiments explored the effect of associative-strength manipulations on false recognition, using the DRM paradigm. In both experiments, list items were selected on the basis of their backward-association relationship with their corresponding critical words. The results of Experiment 1 replicated the general finding that false recognition tends to increase as the number of studied associates also increases. More interestingly, the results of Experiment 2 demonstrated that, when the overall associative relation between list items and the critical word was kept constant, variations in the number of associates did not significantly affect levels of false recognition. These results suggest that false recognition is dependent on total activation rather than on the number of independent contributors, and they are consistent with current activation-based accounts of false memory phenomena.

(5113)

Is Forced Confabulation More Dangerous Than False Memory Implantation? JENNIFER K. ACKIL, *Gustavus Adolphus College*, & MARIA S. ZARAGOZA, *Kent State University*—That witnesses can be led to report details that are suggested or implanted by an interviewer is well established in the eyewitness memory literature. The forced confabulation effect extends this finding by demonstrating that false memories can also arise from misinformation that witnesses are knowingly forced to confabulate themselves (Ackil & Zaragoza, 1998). The present study assessed the relative consequences of these two suggestive interview techniques (memory implantation vs. forced confabulation) following tests of source memory or free recall. After

viewing video events, all participants were knowingly forced to confabulate answers and read experimenter provided answers in response to an interviewer's blatantly false questions. Two weeks later, false memory was assessed using either a source memory or free recall test. Whereas memory implantation and forced confabulation both led to false memories, the relative danger of these suggestive interview techniques varied with the type of memory test employed.

(5114)

Font Reinstatement Encourages, and Sometimes Discourages, False Recognition. SHARON D. LYNN & JASON L. HICKS, *Louisiana State University* (sponsored by Jason L. Hicks)—We studied the error-inflating and error-editing potential of font reinstatement in an associative false memory paradigm. List “themes” ranging from 2 to 6 items were encoded in a unique visual font. For each theme, either a studied word or the critical lure was tested via recognition, with half of each in the corresponding study font and half in a switched (but studied) font. False recognition was higher when font was reinstated, but not for theme list lengths of 2. Speeding recognition decisions eliminated this interaction, producing generally greater false memory for reinstated font and for longer list lengths. When asked the reason for rejecting critical items, a recall-to-reject mechanism was selected more often when font was reinstated and when list length was short. We conclude that font reinstatement inflates false recognition, but also promotes the feeling that people can recall studied items and therefore reject critical lures.

(5115)

True and False Memory for Color Information. ANDREA N. ESLICK, *Duke University*, & ANNE M. CLEARY, *Colorado State University* (sponsored by Anne M. Cleary)—The present study used a modification of the Deese/Roediger–McDermott (1995) false memory paradigm to investigate true and false memory for color related stimuli. Participants were presented with control and color related words (e.g., RUBY, CRIMSON, BLOOD) and participants false alarmed more to critical (e.g., RED) than to noncritical color names. The second experiment investigated whether or not false memory would emerge for the actual color that the word represents. Participants were shown control and color related words in different font colors (e.g., RUBY, CRIMSON, BLOOD shown in yellow, orange, and gray font, respectively). Of interest was whether participants would false alarm to the critical color. The results indicate that participants false alarm to critical color names at significantly higher rates than to noncritical color names. However, this effect did not extend to the actual colors themselves. Presenting the words in colored fonts actually worked to reduce false memory for noncolor control lists.

(5116)

Effects of Stress on Suggestibility to Misinformation. MINE MISIRLISOY, *Florida State University*, & KATINKA DIJKSTRA, *Erasmus University Rotterdam*—Stress is a variable that usually accompanies the situations in which consequences of false memories are crucial, such as courts, therapy sessions, and/or phone scams. The aim of the present study was to investigate the potential effects of stress on suggestibility to misinformation, in younger and older adults. The experiment involved the participants watching a clip of a burglary and listening to a narrative that described the event, followed by a recall test of their memory. The narrative was either a correct reflection of the event or it included some critical misinformation. Stress was induced to half of the participants right before recall, using the Trier Social Stress Test (Kirschbaum, Pirke, & Hellhammer, 1993). Older adults who received misinformation had higher false recall rates when they were under stress than when they were not. However, induced stress did not affect false recall rates of younger adults.

(5117)

Age-Related Increases in False Memory Under an Item-Specific Processing Strategy. KARIN M. BUTLER, *University of New Mexico*,

MARK A. McDANIEL, *Washington University*, DAVID P. McCABE, *Colorado State University*, & COURTNEY C. DORNBURG, *Sandia National Labs*—Internally generating an item-specific characteristic for each studied word from DRM lists (Deese, 1959; Roediger & McDermott, 1995) decreases false memory in young adults (McCabe, Presmanes, Robertson, & Smith, 2004). Theoretically, the item-specific characteristics act as additional unique source information bound to each studied item at encoding, and at retrieval young adults can use its absence to reject nonpresented associated words that might otherwise be falsely recalled. In two experiments, we examined whether older adults could use this strategy to reduce their false memory in the DRM paradigm. Remarkably, older adults' memory accuracy was not improved by item-specific encoding, a finding consistent with poorer distinctive processing in older adults.

(5118)

Semantic Basis of the False-Memory Illusion. YI YANG & CHARLES J. BRAINERD, *Cornell University*, MARK L. HOWE, *Lancaster University*, & VALERIE F. REYNA, *Cornell University* (sponsored by Charles J. Brainerd)—In the DRM paradigm, a short list of words creates an illusory memory of an unstudied but associatively related word. What accounts for list differences in the strength of this illusion? Previous research has identified only two factors: mean backward associative strength (MBAS) and level of true recall. In a multivariate study, we analyzed the ability of an expanded set of semantic variables (e.g., synonymy, antonym, concreteness, categorizability,

emotional valence, emotional arousal) to predict list differences in illusion strength. Multiple regressions showed that (1) list variance was satisfactorily explained by a subset of these semantic variables, (2) MBAS did not explain any of the variance in false recognition, and (3) MBAS explained significant variance in false recall but so did semantic variables. Thus, DRM false memory has a strong semantic basis. It is a truly meaning-driven illusion.

(5119)

Mindshare Matters in Comparative Advertising: When it Pays to Compare. SARA L. APPLETON-KNAPP, *San Diego State University*, & ANTONIA KRONLUND, *Brock University*—Exposure to low-share brands causes illusory recollection of high-share competitors (Kronlund et al., 2007). We tested advertisements in which a low-share brand was directly compared to a high-share brand or to “the leading brand.” Participants falsely recalled the high-share brand when it was not named, and they recalled the low-share brand at significantly lower levels than when the high-share brand was named or than when the low-share brand was advertised alone. We believe that participants generated the high-share brand when it was not named and that this generation contributed to the false recall of that brand, at the expense of recall for the low-share, advertised brand. We argue that such illusory recollection occurred because generation of the high-share brand acted as a learning event (Bjork, 1988), increasing recall of the high-share brand, but taking cognitive resources away from encoding of the low-share advertised brand.