

**Semantic Priming**

**Grand Ballroom JKL, Friday Morning, 8:00–9:20**

*Chaired by David A. Balota, Washington University*

**8:00–8:15 (1)**

**Effects of Semantic Priming and Stimulus Quality: Insights From RT Distributional Analyses.** DAVID A. BALOTA & MELVIN J. YAP, *Washington University*—In a series of experiments, reaction time (RT) distribution analyses were used to examine the nature of the influence of semantic priming on lexical decision and word-naming performance. In contrast to variables that both shift and skew the RT distributions (e.g., word frequency and lexicality), semantic relatedness produces primarily a shift in the RT distribution, with no increase in skewing. In the standard clear target conditions, the shifting of the RT distribution suggests a constant influence of priming on lexical processing across all targets. In contrast to this shifting, the interactive effects of target degradation and semantic priming primarily occur at the tail of the RT distribution, suggesting an additional process invoked with degraded targets. Interestingly, this pattern was also found when primes were highly masked. The discussion focuses on single versus multiple process models of semantic priming.

**8:20–8:35 (2)**

**On a PDP Model of Lexical Processing: More Words About Stages.** DEREK BESNER, SZYMON WARTAK, & SERJE ROBIDOUX, *University of Waterloo*—Plaut and Booth (2006 in *Psych. Rev.* and Plaut & Booth 2000, also in *Psych. Rev.*) assert that their PDP model of lexical processing simulates the repeated observation, in the context of lexical decision, that (1) stimulus quality and semantic relatedness interact on RT, but that (2) stimulus quality and word frequency have additive effects on RT. The results of new simulations with their model undermine this conclusion.

**8:40–8:55 (3)**

**Relational Integration in Lexical Processing.** ZACHARY ESTES, *University of Warwick*, & LARA L. JONES, *University of Georgia*—Relational integration is the inference of some semantic relation (e.g., containment) between two concepts (e.g., BEAN and JAR), such that they jointly refer to a single object or event (BEAN JAR). We investigated the influence of relational integration on lexical processing. In Experiment 1, lexical decisions for the exact same word pairs were faster when they were easily integrated (e.g., HORSE DOCTOR) than when they were more difficult to integrate (e.g., DOCTOR HORSE). In Experiment 2, this “integrative priming” was obtained across varying proportions of related prime–target trials. Experiments 3 and 4 used a variable prime–target SOA to compare the temporal dynamics of integrative priming with those of associative and semantic priming. Integrative priming was dissociated from associative priming at a 2,000-msec SOA (Experiment 3), but closely resembled semantic priming from early (100-msec) to late (2,500-msec) SOA conditions. Relational integration appears to act prospectively and occur inevitably.

**9:00–9:15 (4)**

**Masked Associative/Semantic and Identity Priming Across Languages With Highly Proficient Bilinguals.** MANUEL PEREA, *Universitat de València*, & JON A. DUÑABEITIA & MANUEL CARREIRAS, *Universidad de La Laguna*—One key issue for models of bilingual memory is to what degree the semantic representation from one of the languages is shared with the other language. Prior research has suggested that there are shared conceptual representations for cognates, but not for noncognates. However, there is no reason a priori to consider that the conceptual representation of noncognates differs from that of cognates. Experiment 1 was a between-language masked associative priming lexical decision experiment in which we used noncognate pairs with highly fluent bilinguals. The results showed a significant between-language associative priming effect. Experiment 2 showed that the magnitudes of the between-language and

within-language associative priming effects were quite similar. Finally, Experiment 3 showed a significant translation priming effect for noncognates. Thus, highly fluent bilinguals do develop between-language links with noncognates at the conceptual level. We examine the implications of these results for models of bilingual memory.

**Judgment and Decision Making 1**

**Grand Ballroom ABC, Friday Morning, 8:00–10:00**

*Chaired by Christine Ruva, University of South Florida*

**8:00–8:15 (5)**

**Judgments of Functional Relationships in Systems of Three Variables.** KENT L. NORMAN & BENJAMIN K. SMITH, *University of Maryland, College Park*—The participants were told the relationship between variables A and B and between B and C and then asked to judge the relationship between A and C. The order, the names, and the relationships (increasing, decreasing, and no change) were varied systematically and resulted in 72 judgment problems. Four groups of 15 participants each made judgments for fictitious systems of variables in chemistry, psychology, or economics. An additional chemistry group was allowed the option “don’t know.” Although there were no mathematically correct answers, the results showed consistent patterns of inference (transitivity, bidirectionality, and solvability), but no effect due to system. For example, positive relationships between A and B and between B and C resulted in a positive relationship between A and C (transitivity and bidirectionality). A number of other consistent inferences were found for mixed relationships that are being used to formulate a theory of inference for systems of variables.

**8:20–8:35 (6)**

**The System of Concepts Behind the Simplest Medical Diagnosis.** ROBERT M. HAMM, *University of Oklahoma*—The simplest situation for medical diagnosis and treatment involves one disease, one dichotomous test for it, and one treatment for it. However, seven primary concepts and eight derived concepts are applicable to this situation. Psychologists have studied physicians’ judgments of most of the primary concepts (pretest probability, sensitivity, specificity, utility of correct, missed, and unnecessary treatments and of correctly not treating), but only a few of the derived concepts (probabilistic inference: posttest probability via Bayes’s Theorem; treatment decisions). Judgments of other concepts (e.g., utility impacts of unnecessary treatment and of missed treatment; action threshold, no-test/test threshold, and test/treat threshold probabilities; choice whether to test, treat, or neither) have been little studied. How accurate are they? By what processes are they made? How may they be aided? Consideration of the full system of concepts provides a context in which the practical importance of improving probabilistic inference can be realized.

**8:40–8:55 (7)**

**Testing a Class of Utility Models.** RICHARD A. CHECHILE & SUSAN F. BUTLER, *Tufts University*—The Miyamoto (1988) generic utility theory (GUT) is a utility representation that captures a wide class of other utility models. Moreover, the entire class of models can be evaluated by examining a key parameter that emerges whenever there are mixed gambles, i.e., a gamble with a possible gain and a possible loss. In a comprehensive experiment, it is shown that this parameter varies in a systematic fashion that is inconsistent with the GUT class of models. The implications of the experiment are developed for a theory of risky choice.

**9:00–9:15 (8)**

**Response Time Tests of Take-the-Best and Rational Models of Decision Making.** ROBERT M. NOSOFSKY & F. BRYAN BERGERT, *Indiana University, Bloomington*—We develop and test generalized versions of take-the-best (TTB) and rational (RAT) models of multi-attribute paired-comparison inference. The generalized models make allowance for subjective attribute weighting, probabilistic orders of at-

tribute inspection, and noisy decision making. The key new test involves a response time approach. TTB predicts that response time is determined solely by the expected time required to locate the first discriminating attribute, whereas for RAT, the critical factor is the difference in summed evidence across the two alternatives. In a training environment in which ideal-observer TTB and RAT strategies yield equivalent decisions, the response time results suggest that the vast majority of participants adopted the generalized TTB strategy. The response time approach is also validated in an experimental condition in which use of a RAT strategy was essentially forced upon subjects.

9:20–9:35 (9)

**Why You Think Milan Is Larger Than Modena: Neural Correlates of the Recognition Heuristic.** KIRSTEN G. VOLZ, *Max Planck Institute for Human Cognitive and Brain Sciences*, LAEL J. SCHOOLER, *Max Planck Institute for Human Development*, RICARDA I. SCHUBOTZ, *Max Planck Institute for Human Cognitive and Brain Sciences*, MARKUS RAAB, *Flensburg Universität*, GERD GIGERENZER, *Max Planck Institute for Human Development*, & D. YVES VON CRAMON, *Max Planck Institute for Human Cognitive and Brain Sciences* (read by Lael J. Schooler)—When ranking two alternatives by some criteria and recognizing only one of the alternatives, participants overwhelmingly adopt the strategy, termed the recognition heuristic (RH), of choosing the recognized alternative. Understanding the neural correlates underlying decisions that follow the RH could help determine whether people make judgments about the RH's applicability or simply choose the recognized alternative. We measured brain activity using fMRI while participants indicated which of two cities they thought was larger (Experiment 1) or which city they recognized (Experiment 2). In Experiment 1, increased activation was observed within the anterior frontomedian cortex (aFMc), precuneus, and retrosplenial cortex when participants followed the RH compared with when they did not. Experiment 2 revealed that RH decisional processes cannot be reduced to recognition memory processes. Because the aFMc has previously been associated with self-referential judgments, we conclude that RH decisional processes involve an assessment about the applicability of the RH.

9:40–9:55 (10)

**Fitting the Diffusion Model to Experimental Data: Methods and Tools.** JOACHIM VANDEKERCKHOVE & FRANCIS TUERLINCKX, *Katholieke Universiteit Leuven* (read by Francis Tuerlinckx)—The diffusion model for the simultaneous analysis of reaction time and accuracy data has been applied in various domains (e.g., signal detection, numerosity or distance judgments, masked letter discrimination, memory retrieval, and lexical decision). However, applying the model is a difficult feat, in practice. We present some simple methods and a fast, user-friendly program that should allow anyone to perform diffusion model analyses. We show how the program allows users to impose substantive across-condition restrictions on the model by implementing design matrices. It becomes possible to flexibly regress model parameters onto experimental variables and to construct model queues to quickly compare different model formulations, and thus test many kinds of hypotheses. We also show a method to handle outliers, which consists of a preprocessing stage (to remove fast guesses) and a mixture model, with the diffusion model as one component and a distribution representing the contaminant data points as another component.

#### Recognition Memory Processes

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

Chaired by Mark T. Reinitz, *University of Puget Sound*

8:00–8:15 (11)

**Context Effects on Conjunction Errors for Faces and Words.** MARK T. REINITZ, *University of Puget Sound*—Does shared context influence rate of conjunction errors (false alarms to recognition items constructed from parts of previously studied items)? Drawings of faces

were studied on blue and red backgrounds. Conjunction test items were constructed from parts of faces that had been either the same or different colors during the study phase. The subjects made more false alarms to conjunction faces that were constructed from same-color parents, regardless of whether those parents had been close or far on the study list. However, when compound words served as stimuli, no color-based context effect was found. This indicates that context effects may be stimulus specific. The results disconfirm simple familiarity-based explanations for some memory conjunction errors, and show that context may serve as a retrieval cue for stimulus parts.

8:20–8:35 (12)

**Feature and Conjunction Errors for Unfamiliar Faces in a Continuous Recognition Memory Task.** TODD C. JONES, *Victoria University, Wellington*, & JAMES C. BARTLETT, *University of Texas, Dallas*—In two recognition memory experiments, subjects viewed grayscale images of unfamiliar faces in a single list and judged the status of each face using a 6-point confidence rating scale (e.g., with 1 = very sure new and 6 = very sure old). In both experiments, some faces were repeated (old) after lags of 0, 1, 5, or 20 trials. For other faces, the inner features and outer features of two presented “parent” faces were swapped to form conjunction lures later in the list. In Experiment 2, part-old/part-new faces (feature lures) were included. The lag retention intervals for the conjunction and feature conditions were also 0, 1, 5, or 20 trials. In contrast to prior results with compound words (Jones & Atchley, 2006), which supported a general dual-process approach to recognition memory, the present results may be explained by a single process (i.e., familiarity).

8:40–8:55 (13)

**Familiarity-Based Recognition Is Slower Than Recollection-Based Recognition: Is It an Experimental Artifact?** JERWEN JOU, DULCE A. CARREON, & FERNANDO CHAPA, *University of Texas, Pan American*—According to the dual-process theory of recognition memory, familiarity and recollection are two independent and qualitatively different processes, and the former experience occurs earlier than the latter in the course of recognition. However, the reaction time (RT) for the “know” (familiarity-based) recognition has been found to be consistently longer than for the “remember” (recollection-based) recognition in the literature, which contradicts the temporal order in which these two experiences occur, according to the dual-process theory. The dual-process theorists argue that this is an artifact of instruction in which participants are led to first evaluate their experience against the remember criterion; they will identify it as a know experience only if it fails to meet the remember criterion. Thus, they argue that the two-stage experience evaluation process creates the above know/remember RT pattern. We examined the RT distribution patterns in several experiments using different instructions and consistently found a unimodal RT distribution pattern. This finding is problematic for the dual-process theory, but can be easily explained by the single-dimension strength theory of recognition memory.

9:00–9:15 (14)

**ERP Components Involved in Recognizing Visual Associations.** NICOLE K. SPEER & TIM CURRAN, *University of Colorado, Boulder*—Most recognition memory studies have focused on memory for individual items, but people frequently need to remember associations between items. Associative memory is thought to rely primarily on recollection processes, but may be supported by familiarity processes if the items can be unitized into a single representation. In two ERP experiments, participants studied pairs of fractals and were later tested on their ability to distinguish old pairs from new pairs (re-paired fractals or pairs of novel fractals). Early visual ERP components were sensitive to the novelty of the fractals, but later components indicative of both familiarity and recollection were sensitive to the novelty of the association between fractals. These relationships persisted even in a condition designed to make unitization more difficult. These results suggest that accurate memory for visual associations may be depen-

dent on both familiarity and recollection processes, even when the items are not easily unitized.

9:20–9:35 (15)

**Cue Substitution and Error Patterns in Episodic Recognition.** MICHAEL S. HUMPHREYS & ANGELA M. MAGUIRE, *University of Queensland*—We present evidence that there are two and possibly three error patterns in episodic recognition. Synonym pairs were selected, along with a weak associate of one member of the pair. When synonyms and their weak associates are studied individually, synonyms of studied words are recognized only slightly more often than unrelated distractors. This pattern is inconsistent with a strong “semantic” component to recognition. However, after studying two lists—one containing pairs, the other containing single items—synonym distractors are recognized significantly more often than unrelated distractors for the pair list. This pattern is consistent with the use of a recall-to-recognize strategy, with no responding based on familiarity alone. A third pattern appears to emerge when subjects are asked to recognize words from both lists. This third pattern may be produced by a proportion of subjects responding on the basis of “gist.”

#### Speech Perception

Grand Ballroom GH, Friday Morning, 8:00–10:20

Chaired by Richard E. Pastore, *SUNY, Binghamton*

8:00–8:15 (16)

**Auditory Backward Recognition Masking for Normally Distinct Stimuli.** RICHARDE E. PASTORE, JEREMY R. GASTON, & JESSE D. FLINT, *SUNY, Binghamton*—Backward recognition masking and forward recognition contrast are poorly understood higher-level stimulus interactions that are probably extremely important in a variety of perceptual situations. Typically investigated with brief, but clearly detectable stimuli near the frequency DL, recognition ability is reduced if followed by an intermediate frequency stimulus, and often enhanced if preceded by the same intermediate stimulus. We conjecture that, when faced with limited stimulus quality, perceptual accuracy is a function of perceptual context and/or poststimulus processing time. If valid, forward contrast and backward recognition masking should be found with brief (thus, spectrally broad) stimuli far beyond the nominal frequency DL (e.g., a musical 5th). Backward recognition masking is investigated as a function of masker delay with normally dissimilar target tones (a musical 5th), with target duration as the new dependent measure. Possible implications for speech are discussed.

8:20–8:35 (17)

**Recalibration of Phonetic Categories by Lip-Read Speech Versus Lexical Information.** SABINE VAN LINDEN & JEAN VROOMEN, *Universiteit van Tilburg* (read by Jean Vroomen)—When listeners hear an ambiguous phoneme, they flexibly adjust the phonetic categories of their language in accordance with lip-read information that tells what the phoneme should be (i.e., recalibration; Bertelson, Vroomen, & de Gelder, *Psych. Sci.*, 2003). Here, we compared recalibration induced by lip-read versus lexical information. The listeners were exposed to an ambiguous phoneme halfway between /t/ and /p/ that was either dubbed onto a face articulating /t/ or /p/, or embedded in a word ending in /t/ or /p/. In four experiments, we demonstrate that both information sources induce similar aftereffects despite their differences in nature.

8:40–8:55 (18)

**Audiovisual Integration of Letters and Speech Sounds: A Fechnerian Scaling Analysis.** HANS COLONIUS, *Universität Oldenburg*, ADELE DIEDERICH, *International University Bremen*, & EHTIBAR N. DZHAFAROV, *Purdue University*—Recent studies suggest that multisensory brain areas play a role in the audiovisual integration of graphemes and phonemes, similar to what has been observed for the integration of speech information with lip movements. In psy-

chophysical experiments, the simultaneous presentation of visual and auditory target graphemes and phonemes usually leads to faster reaction times and more accurate recognition and discrimination performance compared with unimodal presentations. However, not much is known about the subjective representation of graphemes and phonemes underlying these cross-modal effects. Is the subjective bimodal representation simply an amalgamation of unimodal features? Or do cross-modal effects suggest the existence of bimodal characteristics not present in any unimodal context? Here, we present a Fechnerian scaling analysis based on a version of the theory of dissimilarity developed by Dzhaferov and Colonius that permits a construction of subjective distances among stimuli of arbitrary complexity from their pairwise discriminability.

9:00–9:15 (19)

**Assessing Infants' Cortical Response to Speech Using Near-Infrared Spectroscopy.** ESWEN FAVA, HEATHER BORTFELD, & RACHEL HULL, *Texas A&M University*, & DAVID BOAS, *Harvard Medical School* (read by David Boas) (sponsored by Heather Bortfeld)—Near-infrared spectroscopy (NIRS) is an optical imaging technique that uses relative changes in total hemoglobin concentration and oxygenation as an indicator of neural activation. In earlier work, we demonstrated that this procedure is viable for assessing the relation between speech processing and brain function in human infants. Specifically, we observed a dissociation of activity in the left temporal and primary visual regions of 6–9-month-old infants during exposure to audiovisual and visual-only stimuli. In the present study, we examined bilateral temporal activation while infants of the same age were exposed to the same audiovisual and visual-only materials. The results reveal heightened activity in the left temporal region relative to the right in the audiovisual but not the visual-only condition. These findings highlight the utility of NIRS for establishing neural correlates of language development in older infants, a task that is difficult to accomplish without the use of attention-getting visual stimuli.

9:20–9:35 (20)

**Infants' Ability to Recognize Speech in Noise: Effects of Noise Type and Location.** ROCHELLE S. NEWMAN, *University of Maryland, College Park*—In the present research, we examine factors that influence infants' abilities to attend to a particular talker in the midst of background speech noise. In these studies, infants (ages 5–13 months) hear a talker repeat either their own name or another infant's name in the presence of background noise. If infants listen longer to their own names than to the foil names, it is taken as an indication of the ability to attend to that talker and recognize the words she was saying. Infants are capable of succeeding at this task at as young as 5 months of age, if the signal-to-noise ratio is high enough. But surprisingly, effects of the type of noise in the distractor stream (a single voice vs. multitalker babble) and of differences in spatial location between the target and distractor streams are quite different than those shown by adults.

9:40–9:55 (21)

**Integrating and Parsing Voicing Cues Over Time.** DAVID W. GOW, *Massachusetts General Hospital*—The phonetic feature cues that allow us to recognize different segments in connected speech have a complex and often variable temporal organization. Gow's (2003) feature cue parsing account of context effects in the perception of assimilated speech suggests that listeners rely on auditory/phonetic grouping mechanisms to recover the underlying alignment between feature cues and segmental positions. In a series of mousetracking experiments involving fricative-stop sequences in which voicing cues and other aspects of timing were manipulated, we found evidence for new progressive and regressive context effects predicted by the feature cue parsing model. These studies examined both postrelease voicing found in English and prevoicing found in many other languages. These results are discussed in the context of various models of phonetic context effects. The implications of this work for understanding

why some languages have productive regressive voice assimilation and others do not is also discussed.

#### 10:00–10:15 (22)

**Sentential and Lexical Influence on the Perception of Acoustic Cues for Word Boundaries.** SVEN L. MATTYS, *University of Bristol*—This study investigates the effect of sentential context and lexical knowledge on the perception of word boundaries in connected speech. Listeners heard near-homophonous phrases (*plumpie*) in isolation, in a sentential context, or in a lexical context. The acoustic cues and the sentential context were piloted to provide strong versus mild support for one segmentation alternative or the other (*plum pie* vs. *plump eye*). A forced-choice task, in which listeners indicated which of two words they heard (*pie* or *eye*), revealed compensatory mechanisms between the sources of information. The effect of both sentential and lexical contexts was larger when the acoustic cues were mild than when they were strong. Moreover, lexical effects were accompanied by a reduction in sensitivity to the acoustic cues. Only sentential context affected response criterion. The results highlight the graded and interactive nature of multicue segmentation and functional differences between sentential and lexical contributions to this process.

#### Animal Learning

Room 335, Friday Morning, 8:00–9:20

Chaired by Ralph R. Miller, *SUNY, Binghamton*

#### 8:00–8:15 (23)

**Contrasting Reduced Overshadowing and Forward Blocking.** DANIEL S. WHEELER & RALPH R. MILLER, *SUNY, Binghamton* (read by Ralph R. Miller)—Preexposure of a cue without an outcome ( $X-$ ) prior to compound pairings with the outcome ( $XZ \rightarrow O$ ) can reduce overshadowing of a target cue ( $Z$ ). Moreover, pairing a cue with an outcome ( $X \rightarrow O$ ) before compound training can enhance its ability to compete with another cue (i.e., blocking). Four experiments were conducted in a conditioned barpress-suppression preparation with rats to determine whether spacing of the  $X-$  or  $X \rightarrow O$  trials would differentially affect the magnitude of reduced overshadowing and blocking. Experiment 1A showed that reduced overshadowing was larger with massed than with spaced trials. Experiment 1B found that blocking was larger with spaced than with massed trials. Experiments 2A and 2B indicated that these effects of trial spacing were both mediated by the associative status of the context at test. The results are interpreted in the context of contemporary learning theories.

#### 8:20–8:35 (24)

**Contrasting Models of Timing With a Double Bisection Procedure.** ARMANDO D. MACHADO, *Universidade do Minho*—I report a series of studies designed to contrast current models of animal timing using a double bisection procedure. Pigeons learned two conditional discriminations: (1) to choose a red key after a 1-sec signal and a green key after a 4-sec signal, and (2) to choose a blue key after a 4-sec signal and a yellow key after a 16-sec signal. Next, the birds were exposed to signals ranging from 1 to 16 sec and given a choice between the green and the blue keys, the keys associated with the same 4-sec signal. At issue was how preference for the green key changed with the test signal duration. Across five studies, I varied the training durations, the method of assessing the preference for the green key, the nature of the sample stimulus, and how the two basic discriminations were integrated. In this talk, I will discuss the implications of the results of these studies for two models of timing, a cognitive information-processing model (scalar expectancy theory), and a behavior learning-based model (learning-to-time).

#### 8:40–8:55 (25)

**Pigeons Matching Pennies.** FEDERICO SANABRIA & ERIC THRAILKILL, *Arizona State University*—The matching pennies game (MPG) provides an opportunity to examine learning in pairs of pi-

geons interacting dynamically. “Chasers” received food for matching the key response of “evaders”; evaders received food for responses on the complementary key. Roles of chaser and evader were reversed in mid-session. Under various payoff matrices, stable choice proportions (1) corresponded to Nash equilibria, and (2) were under the control of discriminative stimuli indicating role assignment. A linear-operator learning model accounted for stable-state choices and transitions in choices after changes in the payoff matrix.

#### 9:00–9:15 (26)

**Discrimination Learning in Paramecia.** HARVARD L. ARMUS, AMBER R. MONTGOMERY, & REBECCA L. GURNEY, *University of Toledo*, & JENNY L. JELLISON, *Waynesburg College*—It has been shown (Armus & Montgomery, 2001) that paramecia are attracted to the cathode area of a water-filled trough and avoid the anode area when a train of 6.5-V DC, 500-msec shocks is applied. Based on this finding, we attempted to condition both approach and avoidance responses to light or dark areas of a trough when these areas were paired with cathode or anode shock. One experiment with anode shock and two using cathode shock have shown successful approach and avoidance conditioning and subsequent extinction of a brightness discrimination task based on such shock stimulation.

#### Vision, Depth, and Motion

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

Chaired by Charles Leek, *University of Wales, Bangor*

#### 8:00–8:15 (27)

**The Structure of 3-D Shape Representations in Human Vision Revealed by Eye Movements During Object Recognition.** CHARLES LEEK, *University of Wales, Bangor*—How does the visual system represent the shapes of 3-D objects for recognition? To examine this issue, we measured eye movements during single object identification. In contrast to, for example, research on scene perception and reading, there is surprisingly little evidence about eye movement patterns in relation to the recognition of 3-D objects. We asked three questions. First, can fixation data reveal preferences for specific types of shape features? Second, are gaze preferences consistent between stimulus encoding and recognition? Third, are they invariant across 3-D viewpoint and illumination? An area of interest analysis revealed remarkable consistency in the eye movement patterns between stimulus encoding and recognition, and across different viewpoints and lighting conditions. These gaze patterns are not predicted by current saliency models based on low-level image features. Rather, the results suggest that fixation patterns during object recognition are driven by higher-level 3-D object representations.

#### 8:20–8:35 (28)

**A View From Afar: Designing Remote Vision Systems to Support Natural Depth Perception.** MARY K. KAISER & BARBARA T. SWEET, *NASA Ames Research Center*, STEVEN MACRAMALLA, *University of California, Santa Cruz*, & MICHAEL LOGAN, *NASA Ames Research Center*—Both interpupillary distance (IPD) and eye height (EH) are known to play roles in depth and size perception. However, the manner in which these cues interact is not well understood, especially for applications that support remote observation of an environment (e.g., a planetary rover). In our study, we systematically covary these parameters (ranging from hypo- to hypernominal values) and examine the impact on observers’ absolute and relative size and distance judgments, both when viewing immersive (i.e., VE) and nonimmersive (i.e., desktop) displays. We will discuss implications both for depth-cue integration models, and for the design of remote viewing systems that can successfully support the operator’s natural utilization of ecological depth cues.

#### 8:40–8:55 (29)

**Blinded by the Light: The Effects of Glare on Driving Performance.**

ROB GRAY, *Arizona State University, East*, & DAVID M. REGAN, *York University*—When driving in high-glare conditions, such as those involving low sun or approaching headlights at night, the visibilities of objects are reduced and low-contrast objects may be rendered invisible. A major cause of the disabling effect of glare is that light is scattered within the eye, thus reducing the contrast of the retinal image. Neither Snellen acuity nor contrast sensitivity predict an individual's susceptibility to glare. Although susceptibility to glare does increase with age, there is a large individual variation within all age groups. We report that the presence of simulated glare from the sun reduces the safety margins used during left turns at intersections and that interindividual differences in the effect of glare on driving safety can be predicted by a simple glare susceptibility test. Especially for approaching cars of low contrast, the probability of misjudgments likely to result in a collision rose steeply in glare conditions.

**9:00–9:15 (30)**

**Learning to Imitate: EEG Analysis of Sequential Attempts to Imitate Complex Hand Movements.** THOMAS F. SHIPLEY & PETER J. MARSHALL, *Temple University*, & CÉDRIC BOUQUET, *Université de Poitiers*—Watching someone do something and then imitating them requires transforming visual information into appropriate motor commands. Some theories suggest this complex task is partially facilitated by dynamic information, available to sight, activating the motor cortex. Here, we use mu rhythm desynchronization as an index of motor area activity during perception of action. We investigated whether a first attempt to imitate an action influenced the subsequent observation of the same action. We taught subjects a new action (writing Vietnamese script letters) by having them watch demonstrations of each letter. We found significantly increased desynchronization of mu for the second observation of an action relative to the first observation, and relative to a condition in which subjects saw the action but were instructed to write an English letter. We tentatively conclude that the perceptual processes involved in observation with the intention to imitate depend on previous motor experience of the action to be imitated.

**9:20–9:35 (31)**

**Color Effects on Self-Motion Perception.** FREDERICK BONATO & ANDREA BUBKA, *St. Peter's College*—It is well known that optical flow patterns are important for facilitating self-motion perception, but do different characteristics of the pattern have differing degrees of influence? We showed observers two video clips shot from a first-person perspective. One clip was in full color and the other was identical except it was in gray shades. The clips were rear-projected on a large screen, such that the image presented was large in terms of visual angle. Visually produced self-motion perception (vection) was measured with a computer-interfaced slide control. Results: The full color clip resulted in a faster onset and stronger salience of vection. Analyzed in the context of other experiments, these results suggest that flow patterns that contain features typically encountered during self-motion (e.g., color) play a stronger role in facilitating self-motion perception. These varying strengths of visual field characteristics may be the result of evolution and/or perceptual learning.

**9:40–9:55 (32)**

**Visual Flow Speed Discrimination While Walking.** FRANK H. DURGIN, *Swarthmore College*, KRISTA GIGONE, *University of Rochester*, & MIKIO AKAGI & KRISTINA SIMMONS, *Swarthmore College*—For highly predictable events, perceptual discrimination may be aided by anticipatory changes in coding space. For example, apparent visual flow speeds are reduced when walking (Durgin, Gigone, & Scott, 2005); we additionally find improved visual discrimination of flow speeds (near walking speed) during walking. However, it has been shown that the discrimination of object rotations from parallax is made worse during self-motion, such that real object rotations become difficult to detect (Wallach, Stanton, & Becker, 1974). Here, we show that advantageous visual speed subtraction applies to the (highly predictable) ground plane. When speed judgments are given for virtual

scenes consisting of either forests or fields, there is little evidence of self-motion-induced speed subtraction in the forest, but substantial subtraction in the field. Perceptual systems can better modify their coding spaces to take advantage of structural regularities in well-learned contexts, such as when walking on ground planes.

**SYMPOSIUM: Is Reinforcement Learning Coming of Age?**

**Grand Ballroom JKL, Friday Morning, 9:40–11:50**

*Chaired by Jonathan D. Cohen, Princeton University, and Randall O'Reilly, University of Colorado, Boulder*

**9:45–10:05 (33)**

**Interactive Dynamics of Striato-Cortical Circuits in Reinforcement Learning: Computational Models and Empirical Tests Thereof.** MICHAEL FRANK, *University of Arizona*, & RANDALL O'REILLY, *University of Colorado, Boulder*—The basal ganglia are thought to participate in action selection by facilitating adaptive frontal cortical action plans while suppressing those that are less adaptive. The dynamics of this circuitry in reinforcement learning, decision making, and working memory have been explored via a series of interrelated computational models. I will present novel predictions arising from these models that have been confirmed in experiments with multiple patient populations (Parkinson's, ADHD, ventromedial damage), pharmacological manipulation in healthy participants, and neuroimaging (ERP and fMRI). Converging data across models and studies demonstrate the usefulness of computational approaches for understanding complex neural dynamics in reinforcement learning.

**10:10–10:30 (34)**

**Error and Conflict, Prediction, and the Adaptive Regulation of Control.** JOSHUA BROWN, *Indiana University, Bloomington*, & TODD S. BRAVER, *Washington University*—The ability to monitor and control one's own behavior is fundamental to cognition. In the last decade, a number of studies have shown how specific brain regions, such as the anterior cingulate cortex (ACC), serve to monitor performance by signaling behavioral errors and response conflict. Tasks such as the Stroop task and Eriksen flanker task elicit conflict between mutually incompatible response processes, which may, in turn, lead to adaptively increased cognitive control of behavior. The recently proposed error likelihood hypothesis suggests that the ACC and surrounding areas will become active in proportion to the perceived likelihood of an error. This hypothesis was originally derived from a computational model prediction, in which reinforcement-learning signals train the ACC to respond to situations in which errors occur more frequently. The model suggests that conflict and error likelihood signals in the ACC may thus be the product of a common reinforcement-learning signal such as that embodied by dopaminergic midbrain cells.

**10:35–10:55 (35)**

**Planning and Model-Free Versus Model-Driven Behavior.** NATHANIEL DAW & PETER DAYAN, *University College London*—In neuroscience, reinforcement-learning models have mostly been applied to the understanding of subcortical habit-learning machinery, specifically midbrain dopamine neurons and their most prominent target, the striatum. Much evidence from psychology, systems neuroscience, and behavioral economics suggests that this system is accompanied by and competes with another decision system, which is associated with the prefrontal cortex and with more cognitive planning based on explicit contemplation of action outcomes. We offer a characterization of these latter functions in terms of model-based reinforcement learning. This framework allows us to address two questions raised by the apparently duplicative nature of the brain's decision systems: Why should the brain employ multiple decision-making systems, and how should it solve the additional decision problem that then arises, of arbitrating between them when they disagree? The model provides a unifying explanation for a body of behavioral data concerning the circumstances under which each system dominates.

**11:00–11:20 (36)**

**Exploration Versus Exploitation: The Dynamics of Dopamine–Norepinephrine Interactions.** SAMUEL McCLURE & JONATHAN D. COHEN, *Princeton University*—Reinforcement-learning models describe mechanisms for maximizing reward by sampling a wide range of behaviors and strengthening actions leading to states with the highest value. However, once these mechanisms have begun to identify behaviors that lead to reward, they face the conundrum of whether to focus on these behaviors (exploitation), or to continue to sample others that may lead to even greater rewards (exploration). Managing this trade-off between exploitation and exploration is a fundamental requirement of an adaptive system, especially in nonstationary environments in which the value of different states and the reward characteristics of behavior may change over time. In this presentation, we will describe mechanisms—based on the noradrenergic system in the brain—that respond to ongoing assessments of utility and interact with dopaminergic reinforcement-learning mechanisms to adaptively regulate the balance between exploitation and exploration.

**11:25–11:45 (37)**

**Role of Reinforcement Learning in Symbolic Models of Cognition.** WAI-TAT FU & JOHN R. ANDERSON, *Carnegie Mellon University*—We propose a reinforcement-learning mechanism as a model for recurrent choice and extend it to account for skill learning. The model is inspired by recent research in neurophysiological studies of the basal ganglia, and provides an integrated explanation of recurrent choice behavior. This includes effects of differential probabilities, magnitudes, variabilities, and timing of reinforcement. The model can also produce the violation of independence, preference reversals, and the goal gradient of reinforcement in maze learning. An experiment was conducted to study learning of action sequences in a multistep task. The fit of the model to the data demonstrated its ability to account for complex skill learning. The advantages of incorporating the mechanism into a larger cognitive architecture are discussed.

**Social Judgment and Decision Making**  
**Grand Ballroom ABC, Friday Morning, 10:20–12:00**

*Chaired by Kimihiko Yamagishi, Tokyo Institute of Technology*

**10:20–10:35 (38)**

**The Accuracy of Self-Estimates of Ability.** PHILLIP L. ACKERMAN & STACEY D. WOLMAN, *Georgia Institute of Technology*—How accurate are self-estimates of ability? This question has occupied numerous psychologists over the past 100 years. The answer to the question has been elusive, because several investigations have yielded contradictory conclusions. Recent investigators have suggested that the accuracy of self-estimates of abilities is exceptionally low, especially among individuals who are low in actual ability. An empirical investigation of self-estimates of verbal, math, and spatial abilities is reported with a battery of parallel objective tests. Self-estimates were also obtained before and after objective ability testing, in order to examine whether self-estimates changed after direct objective testing experience. Self-estimates showed small to large effect-size correlations with objective tests—larger for math and smaller for verbal. We also explore determinants of individual differences in self-estimates, including personality and interest variables. Results are discussed in relation to the principle of aggregation and Brunswik symmetry.

**10:40–10:55 (39)**

**Decision Heuristics Examined in the Context of Presidential Choice.** X. T. WANG, *University of South Dakota*—We examined the effectiveness of cognitive heuristics and affect-based heuristics in predicting presidential choices. The participants, recruited before the 2004 presidential election, were asked to self-generate the issues that would determine their voting decision and to provide evaluations and likelihood assessments of these issues regarding each of the two pres-

idential candidates. Choice distributions derived from different decision heuristics were evaluated against actual voting distributions in terms of descriptive fit between predicted and actual choices and predictive accuracy (who would be the winner of this sample and by how much). Using the partisan identification heuristic as a benchmark, the heuristics that rely on simple counts outperformed the normative heuristics that use both cue values and cue weights (such as Franklin's rule). Affect heuristics based on three social group emotions (admiration, contempt, and pity) performed even better in their descriptive fit and predictive accuracy. The implications for understanding public choice are discussed.

**11:00–11:15 (40)**

**Individual Differences, Mood, and Creative Problem Solving.** G. KAUFMANN, *Norwegian School of Economics and Business Administration*, & O. LUND MARTINSEN, *Norwegian School of Management*—The full picture from extant research shows a highly complex relation between mood and creative problem solving. Often, positive mood predicts superior performance, whereas negative mood is either detrimental or has no effect, but under certain conditions, the reverse pattern is found. One possible explanation of these striking discrepancies in research findings is that individual differences may significantly moderate the relation. In two experiments, positive mood was compared with a neutral mood condition, and the potential moderating effect of individual differences in cognitive styles on insightful creative problem solving was examined. Strong interactions between mood and cognitive styles on performance were observed. Those preferring an explorative–innovative style of problem solving showed a strong decline in performance under the positive mood condition, whereas the opposite was the case for those preferring an assimilative–adaptive style. For the male group, the interaction explained all the variance.

**11:20–11:35 (41)**

**The Effect of Minimal Scrutiny on the Exertion of Effort.** YAAKOV KAREEV & JUDITH AVRAHAMI, *Hebrew University of Jerusalem*—Even with ample time and data at their disposal, people often make do with small samples, which obviously increases their risk of making the wrong decision. A theoretical analysis indicates, however, that when the decision involves selection between two competing, adaptive agents, eager to be selected, an error-prone evaluation may be beneficial to the decision maker. There, the chance of an error can motivate competitors to greater efforts, improving the overall level of performance (which is the prime concern of the decision maker). The theoretical argument was tested empirically by comparing the effects of two levels of scrutiny. The results show that minimal scrutiny can indeed lead to better overall performance, and that the effect is conditional on a bridgeable difference between the competitors. We conclude by pointing out that error-prone, small-sample-based decisions not only improve agents' performance, but may also maintain competition and diversity in the environment.

**11:40–11:55 (42)**

**Evaluations of Pleasurable Experiences: The Peak-and-End Rule.** AMY DO, ALEX RUPERT, & GEORGE L. WOLFORD, *Dartmouth College* (read by George L. Wolford)—Prior research suggests that the addition of mild pain to an aversive event may lead people to prefer and directly choose more pain over less pain (Kahneman, Frederickson, Schreiber, & Redelmeier, 1993). Similarly, people rate a happy life that ends suddenly as better than one with additional years of mild happiness (Diener, Wirtz, & Oishi, 2001), even though the former objectively consists of less pleasure than the latter. Applying these concepts to pleasure, we investigated the impact of varying intensity and amount of pleasure on retrospective evaluations of pleasurable experiences. The results of this study support the idea that people irrationally report lower levels of pleasure for an experience in which additional mild pleasure is added to the end of a pleasing event.

**Motor Control****Grand Ballroom DE, Friday Morning, 10:20–12:00***Chaired by Bennett I. Bertenthal, University of Chicago***10:20–10:35 (43)**

**Automatic Imitation of Biomechanically Impossible Actions: Effects of Priming Movements Versus Goals.** BENNETT I. BERTENTHAL, *University of Chicago*, & MATTHEW R. LONGO, *University College London*—Recent research suggests that automatic imitation is mediated by a common code for the observation and execution of actions. Although the response is triggered automatically by the observed action, it is unclear whether the common code is sensitive to top-down effects. We addressed this question by investigating whether the basis for automatic imitation can be primed by prior instructions. Automatic imitation of finger actions was tested by manipulating whether the movement was biomechanically possible or impossible, while holding the goal constant. When no mention was made of this difference, comparable automatic imitation was elicited from possible and impossible actions, suggesting that actions were coded as goals. By contrast, when attention was drawn to this difference, only possible movements elicited automatic imitation. These results suggest that an observation–execution matching system is modulated by top-down influences, coding actions in terms of movements or goals, depending on the focus of attention.

**10:40–10:55 (44)**

**Neuropsychological Evidence for a Multiple-Route Model of Action Imitation.** ALESSIA TESSARI, *Università di Bologna*, & RAFFAELLA I. RUMIATI, *S.I.S.S.A.* (sponsored by Raffaella I. Rumiati)—This study tested the validity of a multiple-route model of action imitation. Patients with either left- or right-brain damage were tested on an imitation task of either meaningful or meaningless actions, presented in separated blocks or intermingled. None of the patients showed dissociations between imitation of meaningful and meaningless actions in the mixed presentation. However, 8 patients showed dissociation between imitation of the two types of action in the blocked presentation. Patients adopt the strategy of using the direct route to imitate both types of action in the mixed presentation in order to minimize the cognitive costs. In the blocked condition, they use two different routes, depending on the stimuli. The patients showing an advantage in imitation of meaningful actions have a damaged direct route; in contrast, the patients imitating meaningless actions better select the partially damaged semantic route despite having an intact direct route.

**11:00–11:15 (45)**

**Extending and Evaluating the Posture-Based Model of Motion Planning.** JONATHAN VAUGHAN, *Hamilton College*, STEVEN JAX, *Moss Rehabilitation Research Institute*, & DAVID A. ROSENBAUM, *Pennsylvania State University*—The posture-based model of motion planning synthesizes complex movement trajectories for reaching, obstacle avoidance, and grasping, by generating novel postures based on prior experience. Forearm and tool movements around obstacles in 3-D space have been modeled by superimposing a reversible “bounce” movement on the direct movement from a start to a goal posture. The model succeeds for a variety of movement conditions. In particular, 3-D trajectories (with up to 10 postural degrees of freedom) have been realistically simulated using the observed starting posture and computed goal and bounce postures. The model’s simulated trajectories for the elbow, hand, and tool were at least as similar to those of observed participants as each participant’s trajectories were similar to any other participant’s. Extending the model to other tasks and using different criteria for selection facilitates evaluating its predictions and those of other models of movement planning.

**11:20–11:35 (46)**

**Automatic and Effortful Processes in Response Cuing.** JOS J. ADAM, *Maastricht Universiteit*—Forewarning people about upcoming events

and impending actions improves performance. The preparatory processes underlying this performance enhancement have been studied in response-cuing paradigms, with precues providing advance information about the stimulus and its associated response. A robust finding from this paradigm is an advantage of unilateral left–right cues over bilateral inner–outer cues. According to a recent account of this left–right (or hand) advantage, the grouping model, left–right cues are pull cues and inner–outer cues are push cues, evoking exogenous and endogenous control, respectively. In a series of experiments, the characteristics of the cues were manipulated: onset versus no onset, spatial versus symbolic, and valid versus invalid cues. The results showed a consistent dissociation between left–right and inner–outer cues, providing converging evidence for the notion that left–right cues induce a fast, automatic selection of the cued responses, whereas inner–outer cues need slower, effortful processes to establish a selective preparatory set.

**11:40–11:55 (47)**

**Modulating the Masked Congruence Effect With the Hands and the Mouth.** MATTHEW FINKBEINER & ALFONSO CARAMAZZA, *Harvard University*—The direction of the masked congruence effect (Dehaene et al., 1998) was investigated in two different response modalities: manual and verbal. The participants categorized target words (e.g., BLOOD, LIME) according to their canonical color of red or green either by pressing an appropriate button or by saying the appropriate color name. Unbeknownst to the participants, target words were preceded by congruent, incongruent, or neutral primes. A robust masked congruence effect was obtained in both response modalities. Interestingly, interference was obtained when responses were made manually and facilitation was obtained when responses were made verbally. The shift in polarity of the masked congruence effect as a function of response modality suggests that response selection, despite being formally equivalent in the two modalities, is modulated by the effectors that are ultimately recruited to execute an overt response. These findings have important implications for our conceptualization of information processing.

**Word and Letter Processing****Grand Ballroom GH, Friday Morning, 10:40–12:00***Chaired by Laurie B. Feldman, SUNY, Albany and Haskins Laboratories***10:40–10:55 (48)**

**Orthographic Neighborhood Size Modulates Effects of Semantic Transparency in Forward-Masked Morphological Priming.** LAURIE B. FELDMAN, DANA BASNIGHT-BROWN, & YUKI KANAI, *SUNY, Albany, and Haskins Laboratories*—We probed how the number of orthographic neighbors of an English target influenced forward-masked (FM) decision latencies while varying prime type. Magnitudes of morphological facilitation tended to be greater when target neighborhood was small ( $n < 3$ ) but neighborhood facilitation interacted significantly with prime type. Specifically, the degree of semantic relatedness between morphologically related prime and target produced different effects for targets from small and large neighborhoods, such that faster latencies for FIXABLE–FIX (semantically transparent) relative to FIXTURE–FIX (partially transparent) type pairs appeared only when targets had few neighbors. Moreover, FITNESS–FIX (orthographic) inhibition was significant in large but not in small neighborhoods. Attenuated FM morphological facilitation in the context of large orthographic neighborhoods, together with greater orthographic inhibition and effects of semantic transparency when target neighborhood is small, implicate very early lexical influences on morphological processing.

**11:00–11:15 (49)**

**Do Transposed-Letter Similarity Effects Occur at a Morpheme Level? Evidence for Ortho-Morphological Decomposition.** JON A.

DUÑABEITIA, *Universidad de La Laguna*, MANUEL PEREA, *Universitat de València*, & MANUEL CARREIRAS, *Universidad de La Laguna* (read by Manuel Carreiras)—When does morphological decomposition occur in visual word recognition? An increasing body of evidence suggests the presence of early morphological processing. If this is so, we would expect that transposed-letter effects would be greater within morphemes than across morphemes. Experiment 1 was run in Basque, an agglutinative language, using nonsuffixed and suffixed words. The results showed the usual transposed-letter effect for nonaffixed words (e.g., *judge*–*JUDGE* vs. *jupbe*–*JUDGE*), whereas there were no signs of a transposed-letter effect across morpheme boundaries for affixed words. In Experiment 2, this issue was revisited in a nonagglutinative language (Spanish), with prefixed and suffixed words. Again, the results showed a transposed-letter effect for nonaffixed words, whereas there were no signs of a transposed-letter effect across morpheme boundaries for affixed words (prefixed or suffixed words). These findings support the view that morphological decomposition operates at an early stage of visual word recognition.

#### 11:20–11:35 (50)

**Masked Priming With Orthographic Neighbors: An ERP Investigation.** JONATHAN GRAINGER, STÉPHANIE MASSOL, & STÉPHANE DUFAU, *Université de Provence*, & PHILLIP J. HOLCOMB, *Tufts University*—The masked priming technique was combined with ERP recordings to provide a further investigation of the effects of orthographic neighbors on visual word recognition. Prior work has shown inhibitory effects of high-frequency orthographically similar prime words during the recognition of low-frequency target words (e.g., *blue*–*BLUR* vs. *hand*–*BLUR*) in the lexical decision task, a phenomenon thought to reflect inhibitory processes operating during lexical selection. We therefore predicted that the N250 ERP component, which is thought to reflect sublexical processing during visual word recognition, would show priming effects from orthographic neighbors that resemble repetition priming effects. On the other hand, priming effects on the N400 component should be greatly attenuated or even reversed compared with repetition priming. The results are in line with the predictions.

#### 11:40–11:55 (51)

**ALI Is Alive and Well and Living in Both Hemispheres.** SACHIKO KINOSHITA & LEANNE KAPLAN, *Macquarie University*—The existence of abstract letter identities (ALIs) was investigated using the masked cross-case letter-priming procedure. Previous studies (Arguin & Bub, 1995; Bowers, Vigliocco, & Haan, 1998) found little priming for cross-case dissimilar letters (e.g., *a/A*, *b/B*) in the alphabet decision task and the vowel–consonant decision task and suggested that there is little evidence for ALIs. However, letter priming was quite weak in these tasks, even for cross-case similar letters (e.g., *c/C*, *v/V*). We used a letter-matching (same–different) task and found equally robust masked letter priming for both cross-case similar and dissimilar letters, supporting the existence of ALIs. Consistent with Bowers and Turner’s (2005) result for words, visual field (right or left) of prime presentation did not change this pattern, suggesting that ALIs are not hemisphere specific.

#### Attentional Processes Room 335, Friday Morning, 9:40–12:00

Chaired by Bruno G. Breitmeyer, *University of Houston*

#### 9:40–9:55 (52)

**Attentional Processing Capacities of the Visual “Zombie” and “Homunculus.”** EVELINA TAPIA & BRUNO G. BREITMEYER, *University of Houston* (read by Bruno G. Breitmeyer)—In two experiments using masked priming, we investigated whether or not (1) non-conscious visual processing requires attention and (2) there are differences between attentional control during masked (nonconscious) and nonmasked (conscious) priming. Using tasks that required subjects to

respond either to a single feature (color or form) or a combination of features (color and form) of a mask primed by a preceding target, we found that an irrelevant, unattended feature of an invisible (masked) target does not produce priming effects, whereas the relevant, attended feature does. Moreover, our findings indicate that the attentional capacity of the “zombie,” or nonconscious processor, is limited, relative to that of the “homunculus,” or conscious processor.

#### 10:00–10:15 (53)

**Attenuation and Priming Revisited (and Revived): Effects of Perceptual Load on Correlational Cuing.** J. TOBY MORDKOFF & ROSE HALTERMAN, *Pennsylvania State University*—Treisman’s attenuation and priming model of selective attention was developed using data from tasks with high perceptual load, such as dichotic listening. When Miller tested (and disconfirmed) this model using correlational cuing, only low-load displays were employed. We retested the model in a high-load task and found new evidence in favor of attenuation and priming. More generally, these data provide additional evidence concerning the role of perceptual load in determining the locus of selective attention.

#### 10:20–10:35 (54)

**The Stroop Dilution Effect: Lexical or Featural?** W. TRAMMELL NEILL & PATRICK A. O’CONNOR, *SUNY, Albany*—The Stroop effect, in which color naming is slowed by a distractor word that denotes a different color, is diminished by the presence of an additional neutral word. This “Stroop dilution” has been attributed to either competition between the distractor and diluter for lexical processing capacity, or interference between their sensory representations. In this experiment, subjects identified the color of a neutral word at fixation, flanked by a congruent or incongruent distractor. Congruency affected responding only if the distractor and carrier words mismatched in letter case (upper or lower). The results support the conclusion that Stroop dilution is caused by featural crosstalk (Brown, Roos-Gilbert, & Carr, 1995). Hence, contrary to Roberts and Besner (2005), Stroop dilution does not challenge the view that word recognition is an automatic process.

#### 10:40–10:55 (55)

**Temporally Selective Attention Modulates Early Auditory Processing: Event-Related Potential Evidence.** LISA D. SANDERS & LORI ASTHEIMER, *University of Massachusetts, Amherst*—Selective attention provides a mechanism by which people preferentially process subsets of stimuli when faced with overwhelming amounts of information. For example, spatially selective attention is important for perceiving complex visual scenes in which multiple objects are presented simultaneously. Spatially selective attention is also important for auditory perception when sounds are presented from multiple locations. However, a more common auditory perceptual problem arises from the rapidly changing nature of sounds including speech and music. When presented with complex, rapidly changing auditory information, listeners may need to selectively attend to specific times rather than locations. We present evidence that listeners can direct selective attention to time points and that doing so improves target detection, affects baseline neural activity preceding stimulus presentation, and modulates auditory evoked potentials at a perceptually early stage. These data suggest listeners may use temporally selective attention to preferentially process the most relevant segments in auditory streams.

#### 11:00–11:15 (56)

**Is the Analysis of Two-Word Strings the Simplest Achievement of Conscious Cognition?** ANTHONY G. GREENWALD & DARIO CVENCEK, *University of Washington*—Because it is empirically tractable, priming by visually masked word stimuli has become the dominant procedure for investigating capabilities and limits of unconscious cognition. If one shows that some cognitive task cannot be done by unconscious cognition, then successfully doing the task must require conscious cognition. This reasoning provides a strategy for re-

vealing the lowest-level achievements of conscious cognition. The methodological challenges faced in pursuing this strategy included making effects of visually masked primes (1) easily reproducible, (2) empirically strong, (3) acceptable as indicators of nonconscious cognition, and (4) sensitive to specific levels of analytic processing. Importantly, there is not yet any replicable indication that unconscious cognition can analyze information contained in the ordered sequence of two meaningful units such as words, digits, or morphemes. Unexpectedly, the findings also revealed two qualitatively different modes of unconscious cognition, only one of which includes semantic analysis.

#### 11:20–11:35 (57)

**Influence of Practice With Incompatible Mappings on the Simon Effect.** KIM-PHUONG L. VU, *California State University, Long Beach*—Two experiments examined the influence of prior practice with a spatially incompatible mapping on the Simon effect as a function of the dimension (vertical or horizontal) along which the stimuli and responses varied in practice and transfer sessions. With little practice, the Simon effect in the transfer session was eliminated only when the spatial dimension was horizontal in both practice and transfer. With more practice, the Simon effect was eliminated for all combinations of practice and transfer dimensions. Within-dimension transfer effects for the horizontal dimension after a small amount of practice can be attributed to reactivation of specific stimulus–response associations defined for the practice task. However, the between-dimension transfer effects evident after a larger amount of practice cannot be explained in this manner and suggest that subjects acquired a general procedure to respond opposite to the stimulus location.

#### 11:40–11:55 (58)

**Transfer of Noncorresponding Spatial Mappings to the Auditory Simon Task.** ROBERT W. PROCTOR & MOTONORI YAMAGUCHI, *Purdue University*, & KIM-PHUONG L. VU, *California State University, Long Beach*—This study examined transfer of noncorresponding stimulus–response mappings to an auditory Simon task for which stimulus location was irrelevant. For a horizontal auditory Simon task, transfer of noncorresponding left–right spatial associations was found after 300 trials of practice with an incompatible mapping of auditory stimuli to responses, but not with an incompatible mapping of visual stimuli to responses. When auditory stimuli and responses varied along the same dimension (vertical or horizontal) in practice and transfer sessions, large transfer effects were obtained. However, when they varied along orthogonal dimensions, there was no transfer across dimensions of the previously practiced noncorresponding spatial mapping. Compared with previous studies that used a visual Simon task in the transfer session, these findings indicate that prior task-defined associations have less influence on the auditory Simon effect than on the visual Simon effect.

#### Event Cognition

##### Grand Ballroom I, Friday Morning, 10:20–12:00

Chaired by G ery d'Ydewalle, *Katholieke Universiteit Leuven*

#### 10:20–10:35 (59)

**Semantic, Aesthetic, and Cognitive Effects of Flashbacks in Film.** G ERY D'YDEWALLE & ALINE SEVENANTS, *Katholieke Universiteit Leuven*—Principles of film editing were investigated by assessing the semantic, cognitive, and aesthetic consequences of inserting flashbacks. A short narrative film was presented, either with flashbacks or in chronological/linear order. In Experiment 1, the gravity of the acts committed by the two main actors was perceived to be more salient in the linear than in the flashback version. Aesthetic assessment did not vary as a function of the linearity. In Experiment 2, pupil size of the viewers, as a measure of mental load, was registered online. In the flashback version, mental load was heightened because the flashbacks disrupted the linear story grammar. In the discussion about distinctive

advantages of intellectual versus narrative editing, intellectual editing lost the case, in the present study. Flashbacks did not enhance aesthetic judgments, and linearity emphasized the semantic features of the leading actors with less consumption of mental resources.

#### 10:40–10:55 (60)

**The Role of Beginnings, Ends, and Overlap in Event Representations.** SHULAN LU, LONNIE WAKEFIELD, & TOM FAULKENBERRY, *Texas A&M University, Commerce*—Everyday events have beginnings and ends, and often overlap with other events in time. What role does each of the three parameters play in event representations? Consider the case of Jack, who walks in and puts down a newspaper. He then performs the target events: drinking coffee and reading a newspaper. He sits back and looks into space. For each frame, we kept such setup constant, but systematically varied the timing between the two target events. The participants viewed a film and then answered one of the three questions regarding either the beginnings, ends, or overlap in events. There were no differences between the three types of questions in terms of accuracy, but there were significant differences in reaction time. The present study showed that the beginnings, the ends, and the overlap each play a role in event representations, but the overlaps and end states are accessed much faster in event representations than are the beginnings.

#### 11:00–11:15 (61)

**The Human Brain's Response to Change in Cinema.** JEFFREY M. ZACKS & KHENA M. SWALLOW, *Washington University*, NICOLE K. SPEER, *University of Colorado, Boulder*, & COREY J. MALEY, *Washington University*—To understand activity, people segment it into meaningful events, possibly based on changes in salient physical and conceptual features. This study directly explored the role of changes in conceptual features, such as the characters and locations depicted in the film, in the processing of events. We measured brain responses to boundaries between meaningful events in a narrative film that was coded for conceptual changes (i.e., points at which characters, goals, interpersonal interactions, or characters' interactions with objects changed). The participants passively viewed the film while brain activity was recorded with fMRI, and they later segmented the film into meaningful events. Transient changes in brain activity were observed at event boundaries. Regions showing selective responses to conceptual changes were also observed, and these overlapped with those responding around event boundaries. These results suggest that people understand narrative films by segmenting them into events, and that this process may be based on perceiving conceptual changes.

#### 11:20–11:35 (62)

**Living in History: The Effects of War, Terrorism, and Natural Disaster on the Organization of Autobiographical Memory.** NORMAN R. BROWN, *University of Alberta*, PETER J. LEE, *Bilkent University*, MIRNA KRSLAK, *University of Alberta*, FREDERICK G. CONRAD, *University of Michigan*, TIA HANSEN, *Aalborg Universitet*, & JELENA HAVELKA, *University of Kent*—A two-phase procedure assessed the cross-national impact of war, terrorism, and natural disaster on the organization of autobiographical memory. During Phase 1, participants responded to 20 neutral cue words by recalling personal memories; during Phase 2, they thought aloud while dating each. We found that 27% of dating protocols from Bosnia referred to historical information, as did 7% of Serbian protocols, 5% of Montenegrin protocols, and 13% of the protocols from Izmit, Turkey (earthquake epicenter in 1999). In contrast, Canadians, Danes, and Michiganders almost never mentioned historical information. This was also true for Israelis (who had experienced the second Intifada) and New Yorkers (who lived in the city at the time of the WTC attack). We conclude that autobiographical and historical memory are interrelated only when public events have a direct, forceful, and prolonged impact on a population, and that wars and disasters create personally relevant public periods, but terrorism does not.

**11:40–11:55 (63)**

**Retrieval Efficacy in an Online Diary Study.** KATINKA DIJKSTRA, MINE MISIRLISOY, LIBBY CURRAN, LAUREN BREWER, CHELSEY CLIFTON, & ADAM VIETH, *Florida State University*—Activity information contained in an autobiographical memory is a better cue for later retrieval than other cues (Dijkstra & Misirlisoy, in press; Wagenaar, 1986). A 4-month online diary study was conducted to compare the efficacy of activity, goal, and first-word cues. Diarists were 21 adults who each submitted 200 entries over a 4-month period. Reten-

tion probes were administered halfway through and at the completion of the study. The results for the first retention task indicated no differences in the number of entries generated with the different cues ( $F < 1.6$ ). However, when only accurate entries were considered, there was a difference in cue efficacy for the number of accurate entries generated with the different cues [ $F(2,17) = 10.24, p < .01$ ] and their proportion from the total of entries submitted with those cues [ $F(2,17) = 7.65, p < .01$ ]. In both cases, accuracy was higher for diary entry retrieval based on activity cues relative to goal and first-word cues.

**SYMPOSIUM: Cognitive Aging: Genetics, Behavior,  
Neuroscience, and Technology**  
**Grand Ballroom JKL, Friday Afternoon, 1:30–3:40**

*Chaired by Soledad Ballesteros,  
Universidad Nacional de Educación a Distancia, Madrid,  
and Lars-Göran Nilsson, Stockholms Universitet*

**1:40–1:55 (64)**

**Selective Gene–Environment Interactions and Memory Function.** LARS-GÖRAN NILSSON, *Stockholms Universitet*—Associations between two genes, *ApolipoproteinE (APOE)* and *Catechol O-methyltransferase (COMT)*, and performance in episodic memory tasks will be presented and discussed in relationship to main effects and gene–environmental interactions in healthy individuals (35–80 years of age). We found that participants with mild head injury but without *APOE ε4* showed no decline in memory performance. Participants with *APOE ε4* showed decline in performance, and those with both *APOE ε4* and head injury showed a dramatic decline. This study confirms that *APOE ε4* is a risk factor for later cognitive decline, that mild injury in isolation does not increase the risk, but that head injury in combination with the *APOE ε4* leads to a synergistic effect. For the *COMT* gene, the data pattern is different. Carriers of the Met allele show no decline, whereas carriers of the Val allele show a decrease in performance. None of these alleles interacts synergistically with mild head injury.

**2:00–2:15 (65)**

***APOE*, Memory, and Olfaction: Evidence From a Population-Based Study.** MARIA LARSSON & MARGARETA HEDNER, *Stockholms Universitet*, JONAS K. OLOFSSON, STEVEN NORDIN, & ROLF ADOLFSSON, *Umeå Universitet*, KRISTEL SLEEGERS & CHRISTINE VAN BROECKHOVEN, *Universiteit Antwerp*, & LARS-GÖRAN NILSSON, *Stockholms Universitet*—The  $\epsilon 4$  allele of the *APOE* gene is a well-established risk factor for Alzheimer’s disease (AD). Also, recent evidence indicates that the  $\epsilon 4$  allele may have negative repercussions on the olfactory system. This work investigates the dose effect of the *APOE* gene (i.e., no  $\epsilon 4$  allele, one  $\epsilon 4$  allele, two  $\epsilon 4$  alleles) on a semantically driven olfactory task (i.e., odor identification) and a control task (vocabulary) in a large population-based sample screened for dementia. The sample was divided into middle-aged (45–60) and elderly (65–80). The results revealed an interaction effect involving age and *APOE* status, such that *APOE* dose had no impact on olfactory performance in the middle-aged group whereas the elderly homozygotic  $\epsilon 4$  carriers (two  $\epsilon 4$  alleles) performed selectively more poorly in the olfactory task, as compared with the elderly heterozygotic  $\epsilon 4$  carriers (one  $\epsilon 4$  allele) and the group with no  $\epsilon 4$  allele. Interestingly, *APOE* had no influence on the control task. The findings suggest that elderly individuals of high and low genetic risk for developing AD may be differentiated on the basis of olfactory proficiency.

**2:20–2:35 (66)**

**Physical Fitness and Cognitive Functioning in Old Age.** SOLEDAD BALLESTEROS, MONTSERRAT GONZÁLEZ, SUSANA PAZ, JULIA MAYAS, BEATRIZ GARCÍA, & JOSÉ MANUEL REALES, *Universidad Nacional de Educación a Distancia, Madrid*—Aging is associated with the decline in most cognitive processes; however, there are notable exceptions, such as perceptual priming and verbal knowledge. A wealth of evidence suggests that physical activity is related to cognitive health. It has been proposed that losses in the hippocampus and in the frontal, parietal, and temporal cortices can be reduced by practicing physical exercise. Recent literature suggests that physical exercise and active lifestyles can maintain brain plasticity and reduce cognitive decline in old age. The effects of fitness training on cognitive performance, especially in tasks tapping selective attention, executive control, speed of processing, and episodic, semantic, and implicit memory, were investigated in a sedentary group of older adults and in a group of the same age whose members had practiced physical exercise regularly at least for the last 10 years. The in-

fluence of an active life in the cognitive functioning of older adults will be discussed.

**2:40–2:55 (67)**

**Positive and Negative Effects of Bilingualism on Cognitive Aging.** FERGUS I. M. CRAIK & ELLEN BIALYSTOK, *Rotman Research Institute and York University*—In this paper, we describe a series of experiments that examine the effects of bilingualism on cognitive aging. Previous work by Bialystok (2001) has shown that bilingual children show a processing advantage in experimental situations involving conflict. In subsequent work with younger and older adults, we have found that younger bilinguals show a slight advantage over their monolingual peers, but also that the bilingual superiority typically increases with age—suggesting that bilingualism may be a protective factor against normal age-related cognitive decline. The present experiments extend this work by illustrating situations in which there are positive, negative, and no effects of bilingualism on cognitive performance. We also offer some speculations on the nature of the bilingual advantage and disadvantage and on factors underlying the effects.

**3:00–3:15 (68)**

**Dedifferentiation of Neural Function With Age.** DENISE PARK, *University of Illinois, Urbana-Champaign*—There is increasing evidence that neural structures activate less selectively with age, providing evidence for “dedifferentiation” of neural function. Evidence for dedifferentiation occurs across multiple neural sites. For example, frontal recruitment tends to be bilateral in the old when young adults evidence unilaterality. We recently have found evidence that older adults show bilaterality in the parietal cortex when performing a spatial judgment task, in contrast to the young, who show unilateral activations. We have also reported, across multiple studies, less specialization in the ventral visual cortex of older adults for places and faces. We have also found that object-processing areas showed less specialization in the old, in contrast to the young, who evidenced a robust effect. Interestingly, with increased focal attention to stimuli, ventral visual areas in the old become “tuned” and show more specialization. The aforementioned data will be reviewed in this presentation, and the implications of these findings for theoretical models of cognitive aging will be discussed.

**3:20–3:35 (69)**

**Interactive Technology and Cognitive Well-Being: New Approaches to Maintaining and Improving Cognitive Functions in the Elderly.** JOHN WATERWORTH, *Umeå Universitet*—A growing body of evidence emphasizes the potential of new interactive technologies both to maintain and to improve some cognitive functions in the elderly. We selectively review examples of readily available and widely used technologies from the fields of gaming, problem solving, and communication in terms of their adaptability and suitability for this purpose. We also discuss examples of specially designed and implemented devices for cognitive and mood enhancement, including stroke recovery, coping with some of the effects of Alzheimer’s disease, and environmental support for independent living. Prototypes developed during our own project work will also be presented. These include so-called “mood devices” (aimed at anxiety reduction and some types of depression), memory enhancement applications (which also serve as facilitators for social interaction), and tools for diagnosing and treating hemispheric imbalances. One important result of this work has been the derivation of a general approach to designing technology according to the needs of elderly users.

**Judgment and Decision Making 2**  
**Grand Ballroom ABC, Friday Afternoon, 1:30–2:50**

*Chaired by Kathleen M. Galotti, Carleton College*

**1:30–1:45 (70)**

**Making Decisions With Your Spouse.** KATHLEEN M. GALOTTI, *Carleton College*—Parents of kindergarten students participated in a

longitudinal study, tracking them up to three times over the course of a year as they made a decision for educational placement (from among 7–8 available options) for their child for the following year. Ninety-six couples have participated to date. This presentation will examine the effects of having a similar or dissimilar decision-making style or a shared versus a delegated decision-making process with one's spouse on both performance measures and affective reactions to the process. We will also examine whether having values, goals, or criteria in common makes the process easier or harder.

1:50–2:05 (71)

**Pretrial Publicity and Collaboration Affect Juror Memory and Decision Making.** CHRISTINE L. RUVA, *University of South Florida*—Previous research by this author suggests that pretrial publicity (PTP) may impart its biasing effect on jury decision making by influencing jurors' memory for the trial. The present three-phase experiment ( $N = 319$ ) further explored the mechanisms responsible for the biasing effects of PTP by examining the how jury deliberation (collaboration) and PTP effect juror memory and decision making. Jurors who were exposed to negative PTP were significantly more likely than nonexposed jurors to find the defendant guilty, indicate higher guilt ratings, impose longer prison sentences, perceive the defendant as being less credible, and misattribute the source of information contained only in the PTP as being presented as evidence at trial. The effect of PTP on guilt ratings was mediated by these source misattributions and the perceived credibility of the defendant. Collaboration had significant effects on juror memory, verdicts, length of prison sentences, and the perceived credibility of the defendant.

2:10–2:25 (72)

**When Preschoolers and Adults Fail to Ignore Privileged Information.** DANIEL M. BERNSTEIN, *Kwantlen University College*, & JESSICA A. SOMMERVILLE & ANDREW N. MELTZOFF, *University of Washington*—Young children have trouble understanding the concept of false belief, whereas older children and adults do not. In a standard false belief task, one character (C1) places an object in one location and leaves the room while another character (C2) moves the object to another location. Subjects report where C1 will look for the object upon returning to the room. We modified this discrete task to measure potential errors on a continuum. Three-year-olds, five-year-olds, and adults watched C1 place an object in a 5-foot-long box and leave the room. Subsequently, C2 moved the object to another location within the same box. After a 45-sec distractor task, the subjects estimated where C1 would look for the object. All age groups were significantly biased by the second location, although adults were less biased than children. These results demonstrate lifelong difficulty ignoring privileged but irrelevant information.

2:30–2:45 (73)

**Superficially Irrational, Subconsciously Reasonable: Measuring Presumptions Decision Makers Are Unaware of.** KIMIHIKO YAMAGISHI & YU NISHIMURA, *Tokyo Institute of Technology*—The decision-making literature offers abundant examples of ratio bias, wherein people judge uncertainty expressions by ratios composed of greater numbers (e.g., 100 out of 5,000) as more “probable” than those consisting of smaller ones (1 out of 50). As an instantiation of the ratio bias, we investigated a choice anomaly that decision makers preferred a 9/100 chance of winning a gamble over 1/10. Our analyses went beyond previous account of this irrationality by empirically assessing decision makers' subconscious belief pertaining to this decision. Concretely, we employed the implicit association test (IAT), a popular procedure in social psychology to measure subconscious beliefs such as prejudice. We found that decision makers exhibiting such preferences associated the 9/100 chance with “benefits” more strongly than they did 1/10. Thus, we conclude that people consistently preferred the alternative that they unconsciously evaluated as more lucrative. We shall discuss potential contributions of the IAT to judgment and decision-making research.

## How Geometric Information Is Represented and Used Grand Ballroom DE, Friday Afternoon, 1:30–3:10

Chaired by Janellen Huttenlocher, *University of Chicago*

1:30–1:45 (74)

**Evidence That Room Shape Does Not Play a Special Role in Human Spatial Memory.** TIMOTHY P. MCNAMARA & JULIA SLUZENSKI, *Vanderbilt University*—Spatial memory research with humans and nonhuman species suggests that geometric information in extended surfaces (such as the walls of a room) provides particularly useful information for navigation and reorientation, in comparison with geometric information in discrete surfaces (such as the objects within a room). Participants in three experiments learned the configuration of a room with four corners and the configuration of four objects within the room while standing in a fixed position. The configurations were either rectangular (Experiment 1) or irregular (Experiments 2 and 3). In no experiment was room configuration recalled more accurately than object configuration. In addition, spatial memories both for rooms and for objects were affected by manipulations of learning viewpoint and imagined heading during recall. These results suggest that extended surfaces and object layouts are represented similarly in human memory and serve similar roles in spatial functioning.

1:50–2:05 (75)

**Combining Geometric and Featural Information in Reorientation.** NORA S. NEWCOMBE & KRISTIN R. RATLIFF, *Temple University*—In this paper, we present the results of several lines of work that combine to support an adaptive combination view of how geometric and featural information are used in reorientation and to refute an alternative account postulating modularity. Specifically, the first two lines of research were designed to explore findings that featural information is more likely to be used in larger than in smaller enclosures. One set of studies employed a “room within a room” situation. A second set employed a paradigm, previously used only with nonhuman animals, in which featural and geometric cues were placed in opposition. Finally, we present data on reorientation within an octagonal enclosure, to address the question of whether featural information is integral to reorientation or merely used in a second step to narrow search following reorientation by geometry alone.

2:10–2:25 (76)

**Does Memory for Metric Interobject Relations Survive Disorientation in Human Adults?** M. JEANNE SHOLL, *Boston College*—It has been reported that the geometric shape of a room, but not the geometric arrangement of the objects contained therein, is preserved after disorientation, leading to the claim that metric interobject relations are not represented in spatial memory. This claim rests on the premise that disorientation disrupts the normal use of egocentric location codes, which, when a person is oriented, are updated by a path-integration process. Research conducted in my laboratory suggests that the apparent disruption in remembered interobject relations is not attributable to disorientation but is, instead, a function of the precision with which object location codes are established at learning. The present paper describes this research and its implications for the representation of metric interobject relations in human spatial memory.

2:30–2:45 (77)

**Coding Location in Enclosed Spaces: Is Geometry the Principle?** JANELLEN HUTTENLOCHER & STELLA F. LOURENCO, *University of Chicago*—Both animals and human toddlers can find an object in a rectangular enclosure after they have been disoriented. In a rectangular space, they use geometric cues (relative lengths of walls) to discriminate among different corners (long wall to the left, short to the right). It has been claimed that this ability is “modular”—that is, exclusively geometric. The present study demonstrates that the ability toddlers exhibit is a more general one—namely, to discriminate relative quantity even when it is not geometric. Using a square enclosure, we show that

toddlers use relative cues, the sizes of figures on different walls, to characterize different corners. We also show that they do not use absolute features to distinguish different corners. Possible reasons for differences in the ability to use relative versus nonrelative cues are discussed.

### 2:50–3:05 (78)

#### **Failure to Represent Geometry in People With Williams Syndrome?**

BARBARA LANDAU, *Johns Hopkins University*, LAURA LAKUSTA, *Harvard University*, & BANCHIAMLACK DESSALEGN, *Johns Hopkins University*—Abundant evidence shows that species as diverse as rats, chicks, and human toddlers and adults all reorient themselves by using the overall geometric structure of a layout. In contrast, the use of surface featural cues is more variable in reorientation tasks, depending on age, context, and task conditions. We present evidence on reorientation in people with Williams syndrome—a rare genetic deficit in which language is preserved but spatial representations are severely and selectively impaired. We find a highly unusual pattern of performance in reorientation tasks, with failure to reorient using geometry alone, but success when geometry can be combined with surface featural cues. The results are discussed in the context of current theories of modularity in reorientation and of the relevance of language in modulating early spatial representations.

### Word Production

Grand Ballroom GH, Friday Afternoon, 1:30–2:50

Chaired by Randi C. Martin, *Rice University*

### 1:30–1:45 (79)

#### **Word Selection Without Competition: Evidence From Verb Generation.**

RANDI C. MARTIN & YAN CHENG, *Rice University*—Word production models often postulate that competition is involved in selecting representations at various stages. Consistent with such views, previous findings on verb generation have suggested that response difficulty is determined by the strength of competing responses. However, Martin and Cheng (in press) demonstrated that for young and older subjects and for a patient with brain damage in a region postulated to be involved in resolving competition, difficulty in verb generation was related to the strength of association between the nouns and the most highly associated verbs and not to the strength of competitors. A follow-up study investigated whether the lack of competition was due to the absence of a single correct response. However, when the first letter of a target verb was provided, the results still failed to show evidence of competition. We conclude that competition does not occur at the conceptual stage involved in selecting a verb concept.

### 1:50–2:05 (80)

#### **Effect of Word Length on Object Naming and Reading Aloud.**

MARKUS F. DAMIAN & JEFFREY S. BOWERS, *University of Bristol*, & KATHARINA SPALEK, *Radboud Universiteit Nijmegen*—Models of single-word spoken production typically predict that shorter utterances should be initiated more quickly than longer ones. This prediction has been tested by comparing sets of stimuli of various length in spoken tasks and attempting to match stimuli on aspects other than utterance length. We introduce an alternative manipulation in which Dutch and English speakers named two sets of objects, one with monosyllabic names in Dutch and bisyllabic names in English and the other vice versa. We reasoned that a length effect should emerge as an interaction between object set and response language. No such interaction was found, suggesting that contrary to what is typically assumed, object naming is not constrained by the length of the utterance. By contrast, the interaction emerged when speakers read aloud the printed object names, confirming the relatively well-established length effect in this domain and validating the general method.

### 2:10–2:25 (81)

**The Syllable's Role in Chinese Word Production Revisited.** JENNYEU CHEN, *National Cheng Kung University*, & GUAN-HONG LIU

& TRAIN-MIN CHEN, *National Chung Cheng University*—We previously observed a significant form preparation effect for the segmental syllable (syllable without the tone) in Chinese word production and argued that the segmental syllable is processed as a stored phonological unit. Employing the same task in a series of experiments, we found that there was no additional preparation effect when the shared segments crossed the syllable boundary, that the effects were similar whether the words sharing the first tonal syllable had the same or different numbers of syllables, or whether these words had the same or different tonal patterns. The size of the preparation effect for the tonal syllable varied with the size of the syllable, with one segment shared contributing to a 6-msec preparation effect. We conclude that the segmental syllable preparation effect was segmental, not syllabic, in nature. However, the domain of planning in Chinese single-word production appeared to be the syllable, not the word.

### 2:30–2:45 (82)

#### **Investigating the Source of Texture in Graphemic Representations: Evidence From Dysgraphia.**

ANGELA C. JONES & JOCELYN R. FOLK, *Kent State University* (read by Jocelyn R. Folk)—There is evidence that the orthographic representations used for spelling may be textured, in that letters within a word may vary in representational strength. A dysgraphic patient, J.R.E. (Rapp, Folk, Boteler, & Skultety, 1998), who had damage at the level of the graphemic buffer, produced more errors on consonant digraphs than on nondigraph consonant clusters (e.g., cruSH vs. cruST). A sample of neurologically intact spellers (Jones & Folk, 2005) produced more errors on particular letters within vowel digraphs while performing a shadowing task, which disrupted buffering, during spelling. This effect of representational texture may arise from two possible sources: interaction of the sublexical and lexical processes at the graphemic buffer or from differing levels of difficulty in acquiring graphemes. The present study seeks to identify the source of this effect by examining the spelling performance of two dysgraphic patients, J.D.O. and M.M.D., who have damage to their lexical and sublexical processes.

### Sensory Abilities and Sensory Integration

Room 335, Friday Afternoon, 1:30–3:50

Chaired by Elizabeth T. Davis, *Georgia Institute of Technology*

### 1:30–1:45 (83)

#### **Multisensory Processing: Ambient Sounds Enhance Visual Perception and Source Memory of Visual Objects.**

ELIZABETH T. DAVIS, KEVIN SCOTT, KENNETH HAILSTON, & JARRELL PAIR, *Georgia Institute of Technology*, & LARRY F. HODGES, *University of North Carolina, Charlotte*—Can ambient sounds boost the subjective 3-D quality of visual displays, enhance a sense of “presence,” or facilitate source memory of where visual objects appeared? Sixty college-age students were tested within a virtual environment to provide answers. The subjects perused four similarly furnished rooms, each with a distinctive wall color; some heard unique low- or high-fidelity ambient sounds within each room (e.g., thunder in a yellow room), whereas others heard nothing. Afterward, they completed a questionnaire, recalled objects seen on bookcases and in which room each had been seen, and then matched each object to a specific room in a forced choice recognition test. Ambient sounds significantly increased the subjective 3-D quality of visual displays and a sense of “presence.” Moreover, high-fidelity audio resulted in better recall and recognition than did low-fidelity or no-audio conditions. The multimodal display created a richer perceptual context in which to anchor objects to specific locations within the environment, thus enhancing source memory.

### 1:50–2:05 (84)

#### **Can Dogs Predict Earthquakes? A Possible Auditory Answer.**

STANLEY COREN, *University of British Columbia*—Since the first such report in 373 BC in Greece, there has been a widespread belief that dogs and other animals can predict disasters, such as earthquakes.

The occurrence of a 6.8-magnitude earthquake in the Pacific Northwest during a long-term study looking at activity and emotional changes in dogs as a function of weather allowed exploration of this question. Forty-one percent of 193 dogs showed a marked increase in activity level and apparent distress the day before the earthquake. Hearing-impaired dogs did not appear to anticipate the event. Dogs with floppy ears, which slightly raises hearing thresholds, were less likely to be responsive. Dogs with smaller head size (with lower thresholds for higher frequencies) were more likely to anticipate the earthquake. This suggests that high-frequency sounds of underground rocks breaking or scraping that are beyond human hearing range may be the signal that dogs are responding to.

### 2:10–2:25 (85)

**Predicting Cognitive Impairment From Olfactory Sensitivity Measures: A “Continuous” Approach.** ANA GARRIGA-TRILLO, CEEN-UNED, & FRANCISCO AGUILERA-GENICIO, *Universidad Nacional de Educación a Distancia, Madrid*—Deficits in olfactory sensitivity have been found in neurodegenerative diseases, using various sensitivity measures. Devanand (2004), using a 10-smell test, has predicted Alzheimer’s disease when considering healthy subjects, patients with minimal to mild cognitive impairment (MMCI), and patients with Alzheimer’s disease. Not considering neuro-degenerative diseases or groups with differential cognitive impairment, this research will study whether olfactory sensitivity can predict “continuous” cognitive impairment in an elderly Spanish sample ( $N = 65$ ), using both parametric and nonparametric techniques. Cognitive impairment was measured by the Mini-Mental State Examination and the Eurotest (Carnero, 2005). Olfactory sensitivity was measured by the number of correct odor identifications with a nonverbal task and by thresholds. Results show that (1) the number of odors correctly identified can predict cognitive impairment with both tests and (2) olfactory thresholds can only predict Eurotest’s scores. Therefore, olfactory sensitivity can predict cognitive impairment when both types of statistical analyses were used.

### 2:30–2:45 (86)

**Haptic Recognition of Static and Dynamic Expressions of Emotion in the Live Face.** SUSAN J. LEDERMAN, *Queen’s University*, ROBERTA L. KLATZKY, *Carnegie Mellon University*, & ANETA ABRAMOWICZ, KATHERINE SALSMAN, RYO KITADA, & CHERYL HAMILTON, *Queen’s University*—If humans can detect the wealth of tactile and haptic information potentially available in live facial expressions of emotion (FEEs), they should be capable of haptically recognizing the six universal expressions of emotion (anger, disgust, fear, happiness, sadness, and surprise) at levels well above chance. With minimal training, the overall mean recognition accuracy was 51% for statically expressed FEEs that were actively explored using both hands. The corresponding mean accuracy was 74% when the FEEs were dynamically expressed beneath the subject’s stationary hands. Chance was 16.7%. With the exception of static fear, all FEEs were successfully recognized above chance level. Overall confidence and information transmission were also higher for dynamic than for corresponding static faces. Our performance measures—accuracy, response latency (dynamic FEEs only), and confidence ratings—confirm that happiness, sadness, and surprise are well recognized, followed by anger, disgust, and fear.

### 2:50–3:05 (87)

**Incorporating External Objects Into the Body Schema.** FAY SHORT & ROBERT WARD, *University of Wales, Bangor* (read by Robert Ward) (sponsored by Charles Leek)—We investigated the plasticity of the body schema and the conditions under which external objects, in a virtual reality environment, could be incorporated into the body schema. Previous research has shown that faster responses are made to targets on the body, in comparison with just off the body (Hari & Jousmäki, 1996). A similar effect was found for virtual “limbs,” with faster responses to targets on versus off the virtual limb. For this measure, the visual appearance and spatial location of the virtual limbs

were irrelevant, but controllability, predictability, and task relevance of the limbs were necessary for incorporating the limb into the body schema. We conclude that the body schema can be extended to incorporate objects under the consistent, predictable control of the individual.

### 3:10–3:25 (88)

**Prism Adaptation Is Not Abolished by Delayed Visual Feedback.** ROBERT B. WELCH, *NASA Ames Research Center*, MERRIT HOOVER, *University of California, Santa Cruz*, & JENNIFER SWEETON, *Stanford University*—On the basis of the research of Richard Held and his colleagues (e.g., Held, Efstathiou, & Greene, 1966), it has long been an article of faith that visual feedback delays as short as 0.3 sec completely abolish prism adaptation and, by extension, adaptation to any form of sensory rearrangement. We think there are several reasons why Held et al. found this result: (1) the absence of error-corrective feedback during their exposure phase and (2) their use of continuous, rather than discrete, visual–motor responses. Our research compared prism exposure with and without visual error-corrective feedback from discrete target-reaching responses, with delays ranging from 0 to 10 sec. Congruent with our expectations, we obtained substantial adaptation in even our longest delay condition, as measured by post-/preshifts in open-loop hand–eye coordination, partial intermanual transfer of these shifts, and adaptive changes in visual straight ahead.

### 3:30–3:45 (89)

**The Cross-Modal Spotlight of Attention.** HONG Z. TAN, *Purdue University*, & ROB GRAY, *Arizona State University East*—Previous research on cross-modal attentional orienting has reported speeded reaction times (RTs) when the stimuli from the different modalities have been in the same location and slowed RTs when the stimuli have been presented in very different locations—for example, opposite sides of the body. However, little is known about what occurs between these two extremes. We systematically varied the separation between cues and targets to quantify the spatial distribution of cross-modal attention. In all the experiments, the participants judged whether a visual target (presented at different lateral positions) appeared above or below their forearm. We used two cross-modal cuing conditions (vibrotactile cues presented on the forearm or auditory cues presented below the forearm) and one unimodal cuing condition (visual cues presented on the forearm). The distribution of attention following the cross-modal cues was generally more diffuse than the distribution for the unimodal cues. Implications for the development of multimodal interfaces are discussed.

## Psycholinguistics

### Grand Ballroom I, Friday Afternoon, 1:30–3:10

Chaired by Boaz Keysar, *University of Chicago*

### 1:30–1:45 (90)

**Cultural Differences in Perspective Taking.** SHALI WU & BOAZ KEYSAR, *University of Chicago* (read by Boaz Keysar)—Theories suggest that East Asian cultures promote an “interdependent” self, whereas Western cultures promote an “independent” self. We investigated whether this cultural difference affects the mental processes that underlie perspective taking. Chinese pairs and American (non-Chinese) pairs played a communication game. One participant instructed the other (“the addressee”) to move objects in an array that included mutually visible objects and objects that only the addressee could see. Eye movement of the addressee served as an index of referent identification. We found a clear difference between the Americans and the Chinese. Americans showed a strong egocentric tendency, often treating objects the instructor could not see as targets. This interfered with the detection of the target. In contrast, Chinese addressees were almost never egocentric. This suggests that cultural patterns that focus attention on either the self or the other determine the way people take perspective in communication.

**1:50–2:05 (91)**

**Given/New Effects in Spoken Discourse: For the Speaker, or for the Addressee?** ALEXIA GALATI & SUSAN E. BRENNAN, *SUNY, Stony Brook* (read by Susan E. Brennan)—In spontaneous speaking, new information tends to be expressed clearly, whereas given, predictable, or previously-referred-to information tends to be attenuated. Current debate concerns whether this given/new effect is due to audience design (speakers adapting to addressees by taking their knowledge and needs into account) or is simply an automatic process by which speakers do what is easiest for themselves. In 20 groups of 3, one speaker retold the same Road Runner cartoon story twice to one addressee (so the second retelling was to an old addressee) and once to another (new addressee), counterbalanced for hypermnnesia (Addressee 1/Addressee 1/Addressee 2 or Addressee 1/Addressee 2/Addressee 1). We compared events realized, words, details, perspectives, and word lengths (for lexically identical expressions) for a given speaker across all three retellings. Stories retold to old addressees were attenuated, in comparison with those retold to new addressees. We conclude that the given/new effect is partner specific, guided by the needs of addressees.

**2:10–2:25 (92)**

**Memory Observed, in Different Languages.** VIORICA MARIAN & MARGARITA KAUSHANSKAYA, *Northwestern University*—The present study examined the relationship between language and memory and showed that language guides retrieval of general factual information about the world. Questions about everyday knowledge were used to test Mandarin–English bilinguals' memory in two languages. Accuracy and RT patterns revealed that accessibility of knowledge was improved when the language at the time of remembering corresponded to the language of original encoding. Language-dependent memory effects were stronger in bilinguals' more proficient language. These findings suggest that memory and language are tightly connected and that linguistic context at the time of learning may become imprinted into memory content. Language-dependent memory may be a universal mechanism underlying human cognitive processing, may operate within a larger associative network, and may be phylogenetically adaptive. Its ontogeny could be traced to the brain's development from conflating content and context to differentiating them, while continuing to etch (linguistic) background into (memory) content.

**2:30–2:45 (93)**

**What We Know About What We Have Never Heard.** IRIS BERENT, *Florida Atlantic University*, DONCA STERIADE, *Massachusetts Institute of Technology*, TRACY LENNERTZ, *Florida Atlantic University*, & VERED VAKNIN, *University of Haifa*—Are speakers equipped with preferences regarding structures that they have never encountered? We assess this question by examining the restrictions on onset structure. Linguistic research suggests that onsets of rising sonority are preferred to onsets with sonority plateaus, which, in turn, are preferred to onsets of falling sonority (e.g., bnif > bdif > lbif). Our evidence suggests that such preferences modulate the perception of unattested auditory onsets by English speakers: Universally dispreferred onsets are more likely to be misperceived as disyllabic (e.g., lbif → lebif), in comparison with onsets that are relatively preferred (e.g., bdif). Unlike English speakers, Russian speakers (whose language tolerates all three types of clusters) are able to perceive these targets accurately. The perceptual illusions of English speakers are also inexplicable by several statistical properties of the English lexicon. We conclude that the systematic misperception of universally dispreferred onsets might reflect their markedness in the grammars of all speakers.

**2:50–3:05 (94)**

**Past Tense in Second Language and Stressed Native Speakers.** CRISTINE C. ROUSSEL & JANET L. McDONALD, *Louisiana State University* (read by Janet L. McDonald)—Previous studies on neurologically damaged populations have shown that native speakers with phonological deficits have difficulty with the regular past tense, whereas native speakers with semantic deficits have difficulty with

the irregular past tense. The present study had neurologically intact populations, second-language speakers, and unstressed and stressed natives produce and judge past tense forms of regular and irregular verbs. L2 learners with poor L2 phonological skills had more difficulty with regular past tense than did L2 learners with good phonological skills or unstressed native speakers. L2 learners with poor L2 semantics had more difficulty with irregular past tense than did L2 learners with good semantics or unstressed natives. Consistent with the above, we had partial success impacting native speaker's performance on the regular past tense with noise stress and on the irregular past tense with deadline pressure.

**Parafoveal Processing During Reading**  
**Grand Ballroom JKL, Friday Afternoon, 4:10–5:30**

*Chaired by Ralph R. Radach, Florida State University*

**4:10–4:25 (95)**

**Task Effects on Parafoveal Processing in Continuous Reading.** RALPH R. RADACH, *Florida State University*, ALBRECHT W. INHOFF, *SUNY, Binghamton*, & LISA GLOVER & CHRISTIAN VORSTIUS, *Florida State University* (sponsored by Albrecht W. Inhoff)—Task-related intraindividual variations of word processing in reading are currently not well understood. We used two tasks, simple word verification versus complex comprehension questions, to emphasize processing on different levels. College students read sentences containing seven- and eight-letter high- versus low-frequency target words, with both task conditions blocked in counterbalanced order. Saccade-contingent display manipulations served to manipulate the availability of information from parafoveally viewed target words. Consistent with earlier research from our laboratories, we found substantially larger fixation durations, gaze durations, and total reading times in the semantically more demanding comprehension task. The parafoveal preview benefit was more pronounced for high-frequency target words but did not differ between task conditions. We conclude that demands of semantic processing strongly modulated lexical access but did not come into play during early phases of processing. The implications for models of information processing and oculomotor control in reading are discussed.

**4:30–4:45 (96)**

**Reading Transposed Text Without Parafoveal Preview: The Importance of Word-Initial Letters.** SIMON P. LIVERSEGE, *University of Southampton*, SARAH J. WHITE, *University of Durham*, & REBECCA L. JOHNSON & KEITH RAYNER, *University of Massachusetts, Amherst*—Rayner, White, Johnson, and Livesedge (2006) showed that text including words with transposed letters is more disruptive to reading when the transpositions are located at the beginning of words than when they are located at the end or at internal positions. The present study tested whether the letters at the beginning of words are so important only because of the benefit provided by parafoveal preview or whether word-initial letters are important because of the nature of the word recognition process. Participants read text in which words with transposed letters were included and the text either was presented normally or all of the words to the right of the fixated word were always masked. The position of the transpositions was manipulated as in Rayner et al. The results suggest that the positions of the word-initial letters are most important, even when there is no parafoveal preview. The results will be discussed in relation to models of word recognition.

**4:50–5:05 (97)**

**Parafoveal Processing Influences Word Frequency and Predictability Effects on Eye Movements During Reading.** CHRISTOPHER J. HAND, SÉBASTIEN MIELLET, PATRICK J. O'DONNELL, & SARA C. SERENO, *University of Glasgow* (read by Sara C. Sereno)—In reading, the parafoveal preview of a word (i.e., the information obtained from a word before it is fixated) influences the subsequent fixation time on that word. The present study manipulated the word frequency

and contextual predictability of target words in short passages as readers' eye movements were recorded. Parafoveal preview on targets was manipulated post hoc by conditionalizing fixation times on launch site (i.e., the distance between the prior fixation and the beginning of the target)—under the assumption that a closer launch site yields a better preview. Analyses revealed a three-way interaction between frequency, predictability, and preview, suggesting an early lexical locus of contextual effects. Determining the relationship between frequency and predictability effects and delineating the temporal dynamics of context effects have important implications for theories of language processing and models of eye movement control during reading.

5:10–5:25 (98)

**Parafoveal Processing Within Compound Words: Semantic, Lexical, or Orthographic?** SARAH J. WHITE, *University of Durham*, & JUKKA HYÖNÄ & RAYMOND BERTRAM, *University of Turku*—Previous studies suggest that the orthographic, but not semantic, characteristics of parafoveal words can be preprocessed prior to fixation (Rayner, Balota, & Pollatsek, 1986). The present study tested whether parafoveal lexical or semantic processing can occur when the parafoveal information is within the fixated word. Specifically, the experiment investigated whether readers extract semantic information from the second constituent while fixating the first constituent of a compound word in Finnish. There were four preview conditions for the second constituent: identical, semantically related, semantically unrelated, and semantically meaningless (nonword). The results indicate that the parafoveal second constituent is lexically and semantically preprocessed while fixating the first constituent but that the effect of such parafoveal processing is delayed, so that it impacts only on late processing of the compound. The results will be discussed in relation to compound word processing and current models of eye movements during reading.

#### Causal Reasoning

Grand Ballroom ABC, Friday Afternoon, 3:10–5:10

Chaired by Kelly M. Goedert, *Seton Hall University*

3:10–3:25 (99)

**Evaluating When Subjects Recruit the Causal Discounting Heuristic.** KELLY M. GOEDERT, *Seton Hall University*—When making causal inferences from contingency information, subjects perceive a moderately effective cause as less effective when concurrently presented with a highly effective cause of the same event (i.e., discounting; Goedert & Spellman, 2005). The purpose of this experiment was to determine whether discounting is employed during contingency encoding or during the causal judgment process. Subjects received contingency information about two treatments for a deadly disease over 36 trials and then rated the effectiveness of each. We gave the subjects information regarding the expense of producing each treatment (\$20 or \$3,000), either before contingency encoding or after encoding but just prior to making their causal judgment. The subjects reduced their discounting of the moderately effective treatment when the highly effective alternative was expensive, regardless of when they received the cost information. These results suggest that at least part of the discounting effect is attributable to processes recruited during causal judgment.

3:30–3:45 (100)

**Causal Reasoning From Interventions in Rats Is Not Due to Retroactive Interference.** KENNETH J. LEISING & JARED WONG, *UCLA*, MICHAEL R. WALDMANN, *Universität Göttingen*, & AARON P. BLAISDELL, *UCLA* (read by Aaron P. Blaisdell)—Blaisdell et al. (2006) found evidence that rats can reason about causal interventions after observational learning of a common-cause model. As an alternative to causal reasoning, the data may be explained through retroactive interference between event–outcome associations. Two experiments tested this hypothesis. Experiment 1 showed that a subject-initiated action, but not an external event, served as an effective intervention.

Experiment 2 showed that subjects could facultatively switch between interventional and observational causal reasoning. These experiments support causal model theory, but not an associative account of causal reasoning in rats.

3:50–4:05 (101)

**Constructing Causality: How Task Set Modulates the Interpretation of Causality.** JONATHAN A. FUGELANG, *University of Waterloo*, MATTHEW E. ROSER, *University of Plymouth*, ADAM E. GREEN & COURTNEY B. STEIN, *Dartmouth College*, MICHAEL S. GAZ-ZANIGA, *University of California, Santa Barbara*, & KEVIN N. DUNBAR, *Dartmouth College*—We investigated the influence of task set on the interpretation of causality, using fMRI. Participants were imaged while viewing dynamic events in which a circular object collides with and is followed by movement of a second circular object, versus events in which a spatial gap precedes the movement of a second circular object. In addition, the participants were instructed to imagine that the two objects were either billiard balls or positively charged particles that repel each other. When the participants were making judgments about billiard balls, regions in the right-frontal and right-parietal cortices were selectively recruited. When the participants were making judgments about particles, homologous regions in the left hemisphere were recruited in concert with the right-frontal/parietal network. Taken together, these findings support the hypothesis that the interpretation of causality is a constructive process involving the interplay between basic perception and inference that depends on the nature of the task.

4:10–4:25 (102)

**A Causal Model of the Meaning of Cause, Enable, and Prevent.** STEVEN A. SLOMAN, *Brown University*, ARON K. BARBEY, *Emory University*, & SERGIO CHAIGNEAU, *Universidad Adolfo Ibáñez*—The verbs “cause,” “enable,” and “prevent” express beliefs about the way the world works. We offer a theory of their meaning in terms of the structure of those beliefs expressed using qualitative properties of causal models, a graphical framework for representing causal structure. We propose that these verbs refer to a causal model relevant to a discourse and that “A causes B” expresses the belief that the causal model includes a link from A to B, “A enables B” entails that the model includes a link from A to B and that A represents a category of events necessary for B, where an alternative cause of B exists, and “A prevents B” entails that the model includes a link from A to B and A represents a category that is necessarily absent for B to occur. This theory is able to account for a variety of data on human reasoning.

4:30–4:45 (103)

**Category-Based Induction As Causal Inference: A Test of Normative Principles.** SERGEY V. BLOK, *University of Texas, Austin*, & STEVEN A. SLOMAN, *Brown University*—The induction of properties from one category to another is often mediated by causal explanation (Medin et al., 2003; Rehder, 2006; Sloman, 1994). We evaluate whether such causal explanation is compatible with a normative theory of causal inference based on causal Bayes's nets (Pearl, 2000; Spirtes, Glymour, & Scheines, 1993). We derived several principles of causal inference from the theory (screening off, explaining away, undoing, conjunction, and asymmetry) that we tested using inductive arguments involving familiar causal scenarios. The scenarios spanned a variety of domains, including disease and toxin transmission and functional relations among artifacts, as well as economic and political relations. Participants made inductions and generated causal models for each scenario. The results from two experiments mostly supported predictions, although the evidence in favor of screening-off in the context of common cause models was weak. Conditionalizing predictions on individuals' causal models typically improved the fit of the normative theory.

4:50–5:05 (104)

**Relevance and Category-Based Induction.** AIDAN FEENEY, *Durham*

University, JOHN D. COLEY, *Northeastern University*, AIMEE K. CRISP, *Durham University*, & ANNA VITKIN, *Northeastern University*—We presented participants with sets of category-based arguments involving three premises. Premises were presented one at a time and disappeared once they had been read. Arguments within a set were identical, apart from the first premise, which was manipulated so as to produce consistent arguments (*magpies, panda bears, zebras*), misleading arguments (*brown bears, panda bears, zebras*), and control arguments (*otters, panda bears, zebras*). Conclusions were specific (all black and white animals) or general (all animals). Analysis of premise reading times revealed longer reading times for the second premise in the control condition than in the other two conditions and shorter reading times for the final premise in the consistent condition than in the other conditions. These results support a relevance account of induction and suggest that premises may achieve relevance by disconfirming hypotheses about the nature of the blank predicate, as well as by making particular background knowledge available.

**Perceptual Learning and Perceptual Organization**  
Grand Ballroom DE, Friday Afternoon, 3:30–5:30

Chaired by Barbara A. Doshier, *University of California, Irvine*

**3:30–3:45 (105)**

**Dynamics and Modes of Perceptual Learning.** BARBARA A. DOSHER, *University of California, Irvine*, & ZHONG-LIN LU, *University of Southern California*—Perceptual learning reflects the improvements of perceptual task performance with training or practice. Recent proposals have suggested that perceptual learning may often reflect learned reweighting of associations to decision structures (Doshier & Lu, 1998, 1999) and that an augmented Hebbian learning model may account for perceptual learning (Petrov, Doshier, & Lu, 2005), with or without feedback. This approach is compatible with specific functional forms of the learning function. The functional form of perceptual learning is more consistent with an exponential improvement, suggesting single-process learning for basic visual tasks. There was no support for either a combination of local experts or cascades of different learning processes at different levels of the visual system.

**3:50–4:05 (106)**

**Modeling the Effect of Differential Experience on Perception and Memory.** ANGELA B. NELSON & RICHARD M. SHIFFRIN, *Indiana University, Bloomington* (read by Richard M. Shiffrin)—Our studies explore the effects of differential experience on perception and memory. Participants trained for 2 weeks, searching for (initially novel) Chinese characters in visual displays. Training frequency for different characters varied geometrically. Transfer tasks were (1) pseudolexical decision, (2) 2AFC perceptual identification, and (3) episodic recognition memory. Frequency effects in each generally conformed to those found for words (with one exception). Although the REM model has successfully predicted word frequency effects in tasks such as these, using words as stimuli, this model is inappropriate in the present context: We arbitrarily assigned characters to training frequency, making unlikely the REM assumption that items of higher frequency share more features. We present a new form of the REM model, appropriate for the training regimen used in our Chinese character studies, and fit the model to the results.

**4:10–4:25 (107)**

**Unconscious Discovery in Concrete and Abstract Perceptual Learning.** EVERETT W. METTLER & PHILIP J. KELLMAN, *UCLA* (read by Philip J. Kellman)—We studied concrete and abstract perceptual learning (PL), using a task involving the discovery of patterns embedded in noise. In stimulus *grids* of 144 squares that could take on any of four grayscale values, subjects judged presence or absence of target patterns made of 10 squares and received accuracy feedback. Perceptual discovery of the target patterns was assessed by accuracy

of classification performance. We found evidence for both concrete PL (targets had constant color and position) and abstract PL (targets changed position or color across trials). Learning was facilitated by a paired comparison format (vs. single-target presentation), and pairing feedback with displays (vs. sequential presentation). Tests for conscious awareness of pattern shape and location showed that perfect performance could occur without awareness in all conditions. We discuss the results in terms of mechanisms that could discover concrete and abstract patterns, including claims regarding the relation of abstract PL to consciousness.

**4:30–4:45 (108)**

**Perceptual and Decisional Effects in Perceptual Learning.** MICHAEL J. WENGER, JENNIFER L. BITTNER, BRIANNA M. SULLIVAN, & REBECCA J. VON DER HEIDE, *Pennsylvania State University*—Our studies of perceptual learning for contrast detection have documented that reductions in thresholds are regularly accompanied by liberal shifts in response bias. These shifts are due to false alarm rates that either do not change or increase as a function of practice. To date, all of this evidence has been obtained in tasks that require explicit presence/absence responses, leaving open the possibility that our results may be due to the act of repeatedly giving presence/absence responses. We tested this hypothesis by assessing false alarm rates only at the beginning and end of practice. The remaining sessions involved 2AFC methods, without the requirement of presence/absence judgments. The results showed reliable decreases in threshold, reliable increases in false alarm rates, and an absence of bias for response interval. This suggests that even in the absence of making presence/absence decisions, observers experience a shift in decisional criteria specific to sensory detection.

**4:50–5:05 (109)**

**Developmental Trends in Utilizing Perceptual Closure for Grouping of Shape.** RUTH KIMCHI & BAT-SHEVA HADAD, *University of Haifa*—We used visual search to study grouping of shape by perceptual closure in individuals 5–23 years of age. Developmental differences were observed in search for a concave target among convex distractors with fragmented stimuli whose completion depended on closure alone or on closure and collinearity. When only closure was available, search efficiency was unaffected by age—efficient for spatially close fragments and inefficient for distant fragments. Similarly, when closure and collinearity were available and the fragments were spatially close, all age groups searched efficiently. However, when the fragments were spatially far apart, younger children searched inefficiently. Efficiency improved between ages 5 to 10. These results suggest that young children can utilize closure as efficiently as adults for closed or nearly closed stimuli. When the closure-inducing fragments are spatially distant, older children and adults, but not 5-year-olds, can utilize collinearity to enhance closure for the grouping of shape.

**5:10–5:25 (110)**

**News Regarding the Gestalt Figural Cue of Convexity: Context Effects and Hidden Competition.** MARY A. PETERSON & JEE HYUN KIM, *University of Arizona*—In demonstrations employing alternating black/white convex/concave regions, convex regions are likely to be seen as figures. Experiment 1 showed that for black/white displays, convex regions were decreasingly likely to be figures as region number decreased from 8 to 2 (80%–57%). We suggest that some cue favoring the concave region competes with convexity; its effectiveness decreases as region number increases (context matters). In Experiments 2 and 3, context overcame the competing cue only when the concave regions were uniform in color, providing global evidence that they were part of a larger area. Experiment 4 showed no effects of the competing cue in outline displays. We suggest a neurobiologically plausible manner whereby local small area competes with convexity only when different features fill alternating regions. To our knowledge, this is the first suggestion that a local small area is a figural cue and the first evidence of context effects in this domain.

**Object-Based Attention****Grand Ballroom GH, Friday Afternoon, 3:10–5:30***Chaired by Yaoda Xu, Yale University***3:10–3:25 (111)**

**The Neural Signature of Visual Object Grouping.** YAODA XU & MARVIN M. CHUN, *Yale University*—Grouping between visual elements plays an important role in governing object-based visual attentional selection (e.g., Egly et al., 1994). The neural signature reflecting such a selection process, however, remains largely unknown. Using a visual short-term memory paradigm, we previously showed that the inferior intraparietal sulcus (IPS) selects visual objects via their locations (Xu & Chun, 2006, *Nature*). Here, using a similar approach, we asked whether the inferior IPS takes into account the grouping between objects when making selections. Our display contained two black rectangles, similar to that in Egly et al. Inferior IPS activation was lower when two objects appeared on the two ends of the same rectangle than when they appeared on the ends of separate rectangles the same distance apart. Thus, inferior IPS activation reflected whether objects form one or two perceptual groups. To our knowledge, this is the first neural evidence demonstrating grouping-related object-based attentional selection in the brain.

**3:30–3:45 (112)**

**The Neural Correlates of Object Reviewing.** ANDRÉ W. KEIZER, LORENZA S. COLZATO, SERGE A. ROMBOUS, WOUTER TEEUWISSE, & BERNHARD HOMMEL, *Universiteit Leiden* (read by Bernhard Hommel)—Perceiving an object requires the integration of its features across numerous brain maps into transient “object files.” Reviewing part of the integrated features is assumed to cause the retrieval of the whole file, a kind of pattern completion process. Our fMRI study supports this assumption: Overlaid pictures of a face and a house were presented as primes, with the face or house moving in one of two directions. Subjects responded to the direction of the following probe, in which the alternate object moved in the same or the opposite direction as the prime. Motion direction repetition yielded worse performance than did alternation, replicating previous findings (see Keizer’s poster). Motion repetition also activated the cortical areas coding the object that was previously associated with this motion direction (fusiform face area or parahippocampal place area). Retrieval was related to hippocampal activity and the resulting conflict to the anterior cingulate.

**3:50–4:05 (113)**

**Attentional Modulation of the BOLD fMRI Contrast Response Functions in Early Visual Areas.** ZHONG-LIN LU, XIANGRUI LI, & BOSCO S. TJAN, *University of Southern California*, BARBARA A. DOSHER, *University of California, Irvine*, & WILSON CHU, *University of Southern California*—For human observers, contrast response functions (CRFs) of the retinotopically defined cortical regions can be measured with fMRI (Boynton et al., 1999). Here, we evaluated attentional modulation of the BOLD CRFs in early visual areas. Using a rapid event-related design, we measured BOLD responses to sinusoidal gratings in peripheral vision. Subjects were asked to report either the orientation of the grating or the identity of a letter in the center of the display. CRFs in five visual areas, V1, V2, V3v/VP, V3a and V4v, were obtained in the letter (“unattended”) and the grating (“attended”) conditions. We found that attending to the grating increased the baseline of the CRFs by 16%–41% and increased the effective stimulus contrast by 34%–158%. Studying attentional modulation of the full CRFs may provide a framework with which to systematically evaluate attentional effects on BOLD responses in early visual areas.

**4:10–4:25 (114)**

**High-Level Representation of Object Appearance.** GEOFF G. COLE, GUSTAV KUHN, & SIMON P. LIVERSEDGE, *University of Durham*—According to the “new-object” hypothesis, the appearance of a new vi-

sual item can be represented at a relatively high level. The alternative “transient” hypothesis suggests that onsets attract attention as a result of low-level luminance detection. We presented a single new object among an array of old objects via the change detection “flicker” procedure. This ensures that the luminance change associated with onset is equal to that associated with old objects reappearing. Additionally, all objects were Kanizsa figures whose illusory contours are represented at a relatively high level. Change detection performance showed that primacy was accrued only by a change resulting in the appearance of a Kanizsa figure. Similar changes that did not result in the appearance of such a figure or changes that resulted in a Kanizsa figure offsetting did not accrue priority. We argue that onsets can attract attention at the level at which objects are constructed.

**4:30–4:45 (115)**

**Things Are Changing But They’re Still the Same: Change Blindness After the Detection of Change.** JOHN G. JEWELL & KRISTIE M. RUSSO, *St. Joseph’s University*—The magnitude of change necessary for change detection and the extent of change blindness were assessed using static images of morphed faces. The first experiment assessed the amount of change to a stimulus needed for observers to detect a change. A second experiment investigated the influence of instructions on change detection. A third experiment was designed to probe memory for the initial, prechanging stimulus. The results revealed that observers were often change blind. However, some observers were able to detect change when the original image had been altered by an average of 51.50%. Some observers who did detect change were still change blind. We have termed this change blindness, in the face of detecting change, “latent change blindness.” Observers can also be primed to detect changes on the basis of subtle differences in instructions. Finally, results also suggest that change blindness occurs because of the failure to compare pre- and postchanging images.

**4:50–5:05 (116)**

**Modulation of Object-Based Attention by Spatial Focusing: The Mediating Role of Perceptual Organization.** MORRIS GOLDSMITH, MENAHEM YEARI, CHANA FYODOROV, & BEN FRIEDMAN, *University of Haifa*—In the popular double-rectangle cuing paradigm, Goldsmith and Yeari (2003) showed that object-based effects occur when attention is initially spread across the relevant objects (rectangles), but not when attention is narrowly focused at the center of the display (excluding the rectangles). This pattern was explained as follows. (1) The object-based deployment of attention depends on the existence of viable perceptual representations of the relevant objects, capable of guiding attention. (2) Because of the influence of attention on perceptual organization, such object representations are prevented or weakened when attention is focused elsewhere just prior to the attentional deployment. New results, involving manipulations of object salience and object quality (uniform connectedness), in addition to attentional focus, reinforce the proposed framework, showing that initially spread spatial attention is neither necessary nor sufficient for object-based attention to occur and highlighting the mutual interaction between visual attention and perceptual organization.

**5:10–5:25 (117)**

**The Fate of Neglected Stimuli.** SARAH SHOMSTEIN, *Carnegie Mellon University*, RUTH KIMCHI, *University of Haifa*, MARCO NEPPI-MODONA, *Università di Torino*, MAXIM HAMMER, *University of Pittsburgh Medical Center*, & MARLENE BEHRMANN, *Carnegie Mellon University*—Do unattended stimuli influence perception? In the present experiment, patients with visuospatial neglect performed a demanding change detection task on a stimulus presented to the right of a central fixation. Unbeknownst to the participants, a task-irrelevant matrix of elements, organized perceptually by color similarity into stripes or shapes, was presented to the left of the fixation (i.e., the neglected side). This task-irrelevant left-sided distractor either changed or retained its grouping on each trial independently of whether the relevant right-side matrix stayed the same or changed

and, therefore, was either compatible or incompatible with the target response. We observed that task-irrelevant distractors appearing in the neglected field nonetheless influenced the response time of change detection of information presented to the right of the fixation. These results suggest that unattended stimuli influence perception and that visual grouping may arise from perceptual processes that operate preattentively but that this is qualified by strength of organization.

**Metacomprehension**  
**Room 335, Friday Afternoon, 4:10–5:30**

*Chaired by Robert A. Bjork, UCLA*

**4:10–4:25 (118)**

**Predicted and Actual Learning Curves.** NATE KORNEILL & ROBERT A. BJORK, *UCLA* (read by Robert A. Bjork)—Every student would concur that studying results in learning, but to what extent do students understand that more studying results in more learning? We presented 24 word pairs for one (ST), two (STST), three (STSTST), or four (STSTSTST) study/test cycles. In two between-subjects experiments, participants were asked, during the initial study cycle, to predict their recall performance on their last test. Actual recall exhibited a typical learning curve, increasing with study/test cycles. Predicted learning curves, however, were essentially flat. In two within-subjects experiments, the manipulation was made extremely salient by requiring a prediction for every test. Predicted learning curves increased with study in this case, but studying was vastly undervalued. This failure to apply a fundamental learning concept (i.e., that studying helps learning) mirrors the failure of participants to predict forgetting (Koriat, Bjork, Sheffer, & Bar, 2004). A troubling implication is that if students undervalue study, they will understudy.

**4:30–4:45 (119)**

**Metacomprehension for Essay Tests: Why So Poor?** RUTH H. MAKI, DAVID R. M. TROTTER, & BEN WILLIAMS, *Texas Tech University*—We investigated two reasons for low metacomprehension accuracy when participants predict future performance and judge past performance on essay tests. Participants had the essay questions in advance, and/or they took notes while reading. First, we asked whether participants rely more on accessibility, as measured by quantity of recall, than on the quality of their recall and found support for overreliance on quantity, especially when the participants did not take notes. Second, we asked whether giving low predictions to texts that are read quickly, rather than to texts that are read slowly, might underlie poor prediction accuracy. The participants who gave lower predictions to texts that they read the slowest showed better metacomprehension accuracy than did the participants who gave lower predictions to texts that they read the fastest, but only when they had the essay questions in advance. Ignoring the quantity written and using reading time as a guide to judgments may improve metacomprehension accuracy for essay tests.

**4:50–5:05 (120)**

**Educating Students on Test-Taking Strategies: Improving Test Scores Using Bias Profiles.** PHILIP A. HIGHAM, *University of Southampton*—Recent research in metacognition has noted that people can improve the output-bound accuracy of their memory reports by withholding responses. However, in situations in which there is a penalty for incorrect reports (such as in experiments with payoff matrices or formula-scored tests), there is an optimal level of responding that will maximize the corrected score. If too few answers are offered, the score suffers because the quality of withheld responses is high. If too many answers are offered, the penalty for errors brings the score down. Using extensions of Type 2 signal detection theory, I show how bias profiles—which are derived from the payoffs, monitoring level, and forced-report accuracy—can be used to determine this optimal level of bias. I also show how instructing participants to answer tests according to their optimal level of bias can be used to improve their scores.

**5:10–5:25 (121)**

**Appropriate Strategy Selection and Final Test Performance Improvements After Surprise Testing.** AYANNA K. THOMAS, *Colby College*, & MARK A. MCDANIEL, *Washington University*—Although generative study tasks have been shown to improve both memory and metamemory (for a review, see Bjork, 1994), recent studies suggest that memory and metamemory are significantly impaired when processes instantiated by generative study activities are incongruent with those instantiated by the type of test (Thomas & McDaniel, in press). For example, generative study that emphasizes item-specific processing impairs both memory and metamemory when tests of relational information are given. The present study examines whether the impairment instantiated by incongruent generative study–test processing can be ameliorated by surprise testing, followed by the opportunity to restudy. In several experiments, participants engaged in generative study activities and were given tests that were either congruent or incongruent with the study episode. The results suggest that learner difficulties as a result of incongruent task–test processing can be overcome if the utility of specific generative study activities are clearly demonstrated to learners.

**Cognitive Control**

**Grand Ballroom I, Friday Afternoon, 3:30–5:30**

*Chaired by Stephen Monsell, University of Exeter*

**3:30–3:45 (122)**

**Stimulus–Task Associations and the Task Switch Cost.** STEPHEN MONSELL & GUY A. MIZON, *University of Exeter*—Stimuli may activate task sets previously associated with them. Is retrieval of a competing task set an important source of task switch costs? To test this we manipulated associative history when subjects classified words in one of two tasks signaled by a cue. Responses were slower and less accurate to stimuli last encountered in the context of the other task than to stimuli last seen in the same task, even when the response was the same. This effect was greater when the stimulus had previously occurred just once than when it had been encountered many times in both tasks. The effect was smaller with time to prepare between cue and stimulus. But in no case was it smaller on task repeat than on task switch trials. Hence, associative retrieval of task set made a substantial contribution to performance but was not a determinant of task switch costs.

**3:50–4:05 (123)**

**Task-Based Versus Target-Based Preparatory Control in Task Switching: Functional and Neural Dissociations.** HANNES RUGE & TODD S. BRAVER, *Washington University* (read by Todd S. Braver)—Previous task-switching studies have suggested a fundamental limitation in preparatory task control based on advance information, resulting in a reliable residual task-switch cost even under conditions in which preparation time is fully under participant control. The present study contrasted two forms of preparation, based on either advance task or advance target information. Participants performed a cued task-switching paradigm (letter–digit task) in either the standard “cue-first” format or a reverse “task-first” format (blocked conditions). In both conditions, preparation time was controlled by the participant via a manual response. Replicating previous results, in the advance cue condition, there was no correlation between preparation time and task-switching RT or switch cost. However, under advance target conditions, strong negative correlations were observed. These findings suggest functionally dissociable forms of preparatory control, an interpretation supported by our recent fMRI results indicating preparatory brain activity in distinct frontoparietal networks following advance targets versus advance cues.

**4:10–4:25 (124)**

**Context-Dependent Modulation of Task Switch Cost.** MYEONG-HO SOHN & BRUCE C. PETERSON, *George Washington University*—Task switch cost, the deficit of performing a new task, as opposed to repeating the same task, has been attributed partly to the cost of en-

gaging a new task. Because engaging a task requires cognitive resources, switch cost may be modulated by contextual demands for the appropriate level of cognitive control. Our hypothesis was that the level of cognitive control should already be high after a task switch but low after a task repetition. If so, switching to a new task after a task switch should be relatively easier than switching after a repetition. We examined switch cost as a function of the recent task transition and observed a greater switch cost immediately following a repetition than following a switch. This result suggests that a cognitive-monitoring mechanism (e.g., conflict monitoring) can be triggered by a task-level conflict beyond the response-level conflict.

#### 4:30–4:45 (125)

**Individual Differences in Cognitive Control and Susceptibility to False Memories.** JASON M. WATSON, *University of Utah*—Individual differences in working memory capacity (WMC) influence cognitive control and the ability to actively maintain task goals in the face of interfering information. Consistent with this idea, individuals with low WMC perform more poorly than individuals with high WMC in situations where successful performance is dependent on minimizing interference or habit, including the antisaccade task and Stroop color naming. Watson, Bunting, Poole, and Conway (2005) recently reported that individual differences in WMC influenced susceptibility to false memories for nonpresented critical words in the Deese/Roediger–McDermott paradigm. Specifically, individuals with greater WMC recalled fewer critical words (e.g., *sleep*) than did individuals with reduced WMC when the participants were forewarned about the tendency of the associative lists (e.g., *bed, rest, . . .*) to elicit illusory memories. The present study assessed the generality of this finding to an episodic recognition test. The results will be discussed in light of current theories of individual differences in cognitive control.

#### 4:50–5:05 (126)

**Cognitive Aging in Three-Plus-One Dimensions: A Meta-Analysis of Age-Related Dissociations in Response Times.** PAUL VERHAEGHEN,

*Syracuse University*—In a large meta-analysis (1,354 data points collected from 190 studies) on response times and aging, a trifurcation of age-related slowing effects was found. Lexical tasks show no age effect; sensorimotor tasks show a moderate aging effect (about 50% slowing); and spatial tasks show a large aging effect (about 100% slowing). Similar effects are present in the accuracy data. The effects cannot be attributed to speed–accuracy trade-offs, lack of practice within a session, nonlinearity, or unreliability of measures. Iterative tasks (210 data points) show similar effects: Memory scanning and enumeration yield a slowing factor identical to that for lexical tasks, and visual search (both feature and conjunction) and mental rotation yield a slowing factor identical to that for spatial tasks. For tasks of cognitive control (resistance to interference, dual-task performance, task switching) only dual-tasking and global task switching show reliable (and additive) age effects, suggesting an additional dimension of cognitive aging, perhaps associated with multiple task set maintenance.

#### 5:10–5:25 (127)

**Flexibility of Grouping in Perception and Memory.** ANNE GIERSCH, *INSERM*, DAVID LUCK, *Université Louis Pasteur*, & CAROLINE HURON, *INSERM*—We derived a new procedure from a study by Beck and Palmer (2002, *JEP:HPP*) to test the influence of visual exploration strategies on memory. Squares including geometrical features were aligned on a horizontal axis. Proximity was manipulated and produced pairs of figures. During perception blocks, the subjects (18) decided whether or not two adjacent stimuli were identical. The task is easier when the targets belong to the same pair of figures. This advantage decreases when the targets belong more frequently to different pairs. Concerning memory, the subjects were faster at recognizing figures that had been distant rather than close, but only when they had been incited to explore between-group regions during the preceding perception block. Yet grouping by proximity was always spared. Together with eye movement recordings, the results suggest that an unusual representation of a stimulus may be appended to its grouped representation.

**Cognitive Modeling****Grand Ballroom JKL, Saturday Morning, 8:00–9:20***Chaired by Peter R. Killeen, Arizona State University***8:00–8:15 (128)**

**Bits of the ROC.** PETER R. KILLEEN, *Arizona State University*—Signal detection theory is reconstructed as information theory. Iso-informative relative operating characteristics (ROCs) that transmit constant information under bias are described. Maximum-entropy/minimum-information distributions on the evidence axis are exponentials that entail power-law ROCs. These are consistent with many data and with Weber's law. The logarithm of their exponent gives the maximum information that can be transmitted—the channel capacity. Most experiments extract less information than this upper bound. Confidence-rating ROCs convey more information than binary classification. Such ratings category scales of signal strength permit performance to approach the net information available from the signal. Wherever Weber's law holds, channel capacity of a dimension equals the negative logarithm of its Weber fraction. Information theory provides machinery for integrated analyses of human communication ranging from simple detection experiments to complex textual analyses.

**8:20–8:35 (129)**

**A New Type of Hazard Function for the Analysis of Cognitive Models.** JAMES T. TOWNSEND, AMI EIDELS, & KAN TORII, *Indiana University, Bloomington*—Response times (RTs) are the pre-eminent tool for identification of mental processes and their interactions. Although mean RTs are still the modal statistic in the literature, finer grained aspects of RT distributions can reveal much more about the underlying processing system. In cognitive psychology, the hazard function of RTs tells us the probability that processing will terminate in the next instant of time, given that it has not yet finished. Hazard functions are becoming an increasingly popular tool, but a limitation is that they have almost entirely been confined to high-accuracy, correct RTs. This investigation presents a new type of hazard function based on correct versus incorrect responses, and hence applicable to the whole range of accuracy. We compare several classical but distinct RT models and examine the similarity of correct versus incorrect conditional hazard functions, within models.

**8:40–8:55 (130)**

**Neurophysiological Evidence for the Discrete Flow of Information Between Stages of Processing.** GEOFFREY F. WOODMAN & MIN-SUK KANG, *Vanderbilt University*, TAKASHI SATO, *HHMI, Cold Spring Harbor Laboratory*, KIRK THOMPSON, *National Institutes of Health*, & JEFFREY D. SCHALL, *Vanderbilt University*—Reaction time (RT) is often viewed as consisting of the durations of successive processing stages, although it remains controversial as to whether information is transmitted continuously or discretely from stage to stage. To distinguish between these alternative hypotheses, the activity of individual neurons was recorded from the frontal eye field (FEF) of macaque monkeys performing multiple types of visual search tasks in which the target location was indicated by localizing the target object with a saccadic eye movement. The beginning of response preparation was indexed by the onset of movement-related activation in FEF, and saccades were initiated when movement-related activity reached a fixed threshold. We found that the buildup of movement-related activity in FEF was delayed when search was more demanding, and the delay equaled the difference in RT between the search conditions. These results provide neurophysiological support for the discrete transmission of information between stages of processing.

**9:00–9:15 (131)**

**A Bayesian Account of Some Classic Learning Phenomena.** CRAIG R. MCKENZIE, *University of California, San Diego*—A variety of basic trial-by-trial learning phenomena have traditionally been ac-

counted for in descriptive rather than normative (or rational) terms. In this talk, I will argue that some learning phenomena can be explained in normative terms. In particular, I will use a Bayesian model (based on J. R. Anderson, 1990) to explain phenomena such as pre-asymptotic density bias and the partial reinforcement effect. The data are from computer simulations. A Bayesian approach, combined with reasonable assumptions about which events are rare or prior beliefs regarding whether the cues and outcomes are related, can explain a variety of classical learning phenomena in rational terms.

**Location-Based Attention****Grand Ballroom GH, Saturday Morning, 8:00–10:20***Chaired by Martijn Meeter, Vrije Universiteit Amsterdam***8:00–8:15 (132)**

**Why Distractors Are Necessary for the Attentional Blink: Inhibition Is Key, Not Capacity Limitations.** MARTIJN MEETER & CHRISTIAN N. L. OLIVERS, *Vrije Universiteit Amsterdam*—If two targets in an RSVP stream are presented within a few hundred milliseconds of one another, detection of the second target is often impaired—a phenomenon known as the attentional blink. Most accounts assume that the first target (T1) occupies limited-capacity resources that are then denied to the second target (T2). Recent findings argue against such accounts. For example, a blink occurs when a distractor precedes T2. If, instead, T2 is preceded by targets, no blink is observed (e.g., Olivers, van der Stigchel, & Hulleman, 2005). Apparently, it is not T1 that causes the blink, but the presence of distractors. Here, we present a computational model built on the assumption that T1 leads to enhanced processing of the stream. Subsequent distractors are then too strongly processed, causing an attentional gate to close and leading to the attentional blink. The model explains many findings that are problematic for limited-capacity accounts.

**8:20–8:35 (133)**

**Contingent Transient Attention in a Spatiotemporal Array.** BRAD WYBLE & HOWARD BOWMAN, *University of Kent*, & MARY C. POTTER, *Massachusetts Institute of Technology*—We hypothesize that transient attention (Nakayama & Mackeben, 1989) is involved in target detection in the attentional blink. To test this hypothesis, subjects viewed an array of eight locations in which a randomly chosen distractor (keyboard symbol) changed every 27 msec throughout the trial. Participants reported any digits at the end of the trial. A random digit was presented for 107 msec. A brief cue item (digit or symbol) appeared 80–240 msec prior to this digit on some trials. Digit cues were rarely reported by subjects but enhanced report of the following digit (65%) relative to distractor cue (49%) or uncued (48%) conditions. This effect was only observed when cue and target shared the same array location and when the cue–target SOA was short (80 msec). The results suggest that a target triggers a transient form of attention, which spills over to benefit an immediately following target at the same location.

**8:40–8:55 (134)**

**Separation Between Top-Down and Bottom-Up Control of Visual Attention.** KINGSHAN LI & KYLE R. CAVE, *University of Massachusetts, Amherst* (read by Kyle R. Cave)—Recent studies show more and more evidence that attention is controlled by both bottom-up factors and top-down factors. This study was designed to explore how bottom-up factors and top-down factors are integrated. In this task, the top-down information was an endogenous cue that indicated the location of the upcoming target; the bottom-up information was a salient and task-irrelevant singleton. The validity of the cue and the saliency of the singleton were systematically varied. Results showed that the cue effect was not influenced by any variation of the bottom-up information and the singleton effect was not influenced by any variation of the top-down information. In this combination of tasks, previous knowledge about the location of the target can control attentional deployment independently of the singleton, and vice versa, indicating

that top-down attention control and bottom-up attention control are separated to some degree.

#### 9:00–9:15 (135)

**Age-Related Changes in Visual Endogenous and Exogenous Attention Tasks.** JULIA MAYAS & SOLEDAD BALLESTEROS, *Universidad Nacional de Educación a Distancia, Madrid* (read by Soledad Ballesteros)—Selection by location is a very powerful mechanism that enhances performance at attended spatial locations. In this study we investigated the effect of central and peripheral cues in young adults and older adults using valid cues, invalid cues, neutral cues, and no cues, appearing at 200-, 500-, 800-, and 1,000-msec SOAs. The results showed a general age-related slowing. Older adults required more time to respond than young adults in both the endogenous and the exogenous tasks, at all SOAs. In both groups, reaction times to valid cues were shorter than to invalid cues. However, in the older participants, while the disadvantage was similar at the four cuing conditions in the exogenous task, a larger disadvantage appeared at the neutral cue condition in the endogenous task. The results suggest that for the older participants the interpretation of the double arrow signaling both directions produced more confusion than the invalid cue.

#### 9:20–9:35 (136)

**Individual Differences Between Blinkers and Nonblinkers.** SANDER MARTENS & ADDIE JOHNSON, *Rijksuniversiteit Groningen* (sponsored by Addie Johnson)—The attentional blink (AB) is a well-established phenomenon in the study of attention. This deficit in reporting the second of two targets presented in rapid serial visual presentation when it occurs 200–500 msec after the first has been shown to be robust under a variety of conditions. However, we recently reported that some individuals do not show an AB and presented psychophysiological evidence that target processing differed between blinkers and nonblinkers. Here we explore the relation between the AB and different measures of intelligence and working memory (WM) capacity. Most notably, differences were found between nonblinkers and blinkers in verbal WM capacity, but not in intelligence and spatial WM capacity. Verbal WM capacity correlated negatively with AB magnitude, suggesting that more verbal WM capacity substantially helps to overcome restrictions in consolidating relevant information. A tentative conclusion is that verbal processing plays a larger role in the AB than many models assume.

#### 9:40–9:55 (137)

**Distractor Inhibition Is More Effective at the Fovea Than at the Periphery.** ZHE CHEN, *University of Canterbury*—Previous experiments have established that the fovea plays an important role in target detection and recognition. However, whether the fovea also facilitates distractor inhibition remains unclear. Whereas some studies have reported greater distractor interference when the distractor is at the periphery than at the fovea, other experiments have shown the opposite result. The present experiments explore factors that modulate the degree of distractor interference at the fovea. The results show that the efficiency of distractor inhibition at the fovea is a function of attentional deployment and participants' past experience with the stimulus displays. When both factors were controlled, distractor inhibition was more efficient at the fovea than at the periphery. These results underscore the flexibility of the visual system. They suggest that the fovea is not only an efficient target facilitator but also an effective distractor inhibitor.

#### 10:00–10:15 (138)

**Preview Benefits and Deficits in the Eriksen Flanker Task.** EDWARD J. DAVELAAR & DAVID E. HUBER, *University of California, San Diego* (read by David E. Huber)—In the Eriksen flanker paradigm, peripheral flankers help or harm performance depending on their congruency with a central target. It has been observed that immediate preview of the flankers reduces the classic flanker effect. The reported experiments investigated this phenomenon, establishing the separate contributions of identity preview and response preview. Participants

made CV judgments on the middle letter of a five-letter string, and different durations of preview were examined. The results indicate that response preview effects are small and apply similarly across location. In contrast, identity preview is location specific, producing results that reverse depending on flanker preview versus target preview. We explain these effects with perceptual discounting that accrues as a function of preview duration. Depending on which locations and items are previewed, this can result in a “repetition blindness” for flankers, which helps performance by reducing flanker interference, or a repetition blindness for the target, which harms performance.

#### Directed Memory Processes Grand Ballroom DE, Saturday Morning, 8:00–10:00

*Chaired by Martin A. Conway, University of Leeds*

#### 8:00–8:15 (139)

**Directed Remembering.** MARTIN A. CONWAY, *University of Leeds*, HELEN L. WILLIAMS, *University of Leeds*, & MIHÁLY RACSMÁNY, *Hungarian Academy of Science*—Two experiments investigated directed remembering. The first experiment was based on Tulving (1969). Selected items in a list were prioritized and to be recalled (TBR+), other items were TBR but not prioritized, and yet other items were to be forgotten (TBF). Cued recall of TBR and TBF items adjacent to TBR+ items in the study list was compared to TBR and TBF items from other list positions (baseline). Memory for items adjacent to TBR+ items was always poorer than memory for other items, showing a negative effect of competition on memory. The second experiment used a variant of the retrieval practice procedure and, following list learning, a subset of old and new items was recognized. In conditions in which there was no preexisting relation between study items, strong negative effects on memory were observed. The full set of findings is discussed with reference to how details in autobiographical memories come to have different levels of accessibility.

#### 8:20–8:35 (140)

**Recovering Experimentally Blocked Memories: Effects of Context Cues and Recall Instructions.** STEVEN M. SMITH, ISABEL MANZANO, JENNIFER WILLIAMS, & NICK KOHN, *Texas A&M University*—Techniques for triggering recovered memories, such as the use of mental imagery and strong encouragement to recall blocked memories, have been implicated as potential causes of false memories. Do such techniques actually enhance memory recovery, and do they necessarily increase false memories? Powerful memory blocks that are experimentally induced have been shown to be reversible when strongly associated cues are provided (e.g., Smith, Gleaves, Pierce, Williams, Gilliland, & Gerken, 2003). Here, we tested the usefulness of less direct memory cues—namely, mentally and physically reinstated environmental context cues—on the recovery of both accurate and false memories. We also tested the effects on memory recovery of instructions that encouraged various types of focusing on past experiences. Our findings indicate that imagery, in the form of appropriate context cues, and encouragement to recall by the use of certain focusing instructions, can trigger recovery of accurate memories without increasing false memories.

#### 8:40–8:55 (141)

**Individual Differences in Suppressing Unwanted Memories: The Role of Working Memory Capacity.** THEODORE A. BELL & MICHAEL C. ANDERSON, *University of Oregon* (read by Michael C. Anderson)—Anderson and Green (2001) demonstrated that when people confront reminders to an unwanted memory and attempt to stop the retrieval process, later recall of that memory is inhibited. These findings suggest that executive control can be engaged to terminate episodic retrieval by inhibiting the distracting memory. Here, we report two experiments that examine the involvement of executive control in memory suppression using measures of working memory span. After subjects performed the think/no-think task, we measured

their working memory span using Engle's operation span task. In both experiments, working memory span predicted inhibition, with low-span individuals actually showing facilitation of suppressed items above baseline rather than inhibition. These findings link memory inhibition to measures sensitive to executive control, consistent with the demonstrated engagement of dorsolateral prefrontal cortex during memory suppression. They further suggest that individual differences in the vulnerability to intrusive memories are linked to executive control.

#### 9:00–9:15 (142)

**The Unconscious Consequences of Conscious Forgetting.** LILI SAHAKYAN & LEILANI B. GOODMON, *University of North Carolina, Greensboro*—Directed forgetting research shows that people can intentionally forget previously studied information. One strategy by which participants successfully forget is to disrupt their mental context by engaging in diversionary thoughts (e.g., Sahakyan & Kelley, 2002). Disruptions of context impair access not only to the target itself, but also to its implicitly activated associates known to influence memorability of the target (e.g., Goodmon & Nelson, 2004). In several cued recall experiments, we crossed directed forgetting with different types of pre-existing memory variables (such as target set size, connectivity, and backward strength) to investigate which associative connections in the target's network were vulnerable to disruptions of mental context. Results revealed that instructions to forget impacted certain types of the connections but not others. Specifically, directed forgetting impaired target recall by reducing access to the connections emanating from the target (i.e., backward strength) without influencing connections among the target's related memories (i.e., connectivity effect).

#### 9:20–9:35 (143)

**Response Time As a Behavioral Probe to the Control of Memory Access.** SHAYNE D. LOFT, MICHAEL S. HUMPHREYS, & SUSANNAH J. WHITNEY, *University of Queensland*—Methods from the directed forgetting and prospective memory literatures were used to probe memory control processes. Between studying two lists of words, participants were instructed either to forget the first list or to continue remembering the first list. Participants administered forget instructions segregate List 1 from List 2. After study, participants performed a lexical decision task, with an additional requirement to respond with a designated key to studied words (cue detection). In Experiment 1, participants were told to respond to both lists or only to List 2. In Experiment 2, some participants were required to discriminate list membership. The extent to which the intention to detect cues slowed lexical decisions on noncue trials was greater when test instructions were incongruent with study instructions than when they were congruent. Attention allocation to the cue-detection task requirement increased when test instructions were incongruent with the memory structures established at study as a result of the forget or remember instructions.

#### 9:40–9:55 (144)

**Implementation Intentions and Prospective Memory in Young Adults.** DANIEL C. HOWARD & MARK A. McDANIEL, *Washington University*, & KARIN M. BUTLER, *University of New Mexico* (read by Mark A. McDaniel) (sponsored by Mark A. McDaniel)—Prior research has suggested that encoding of prospective memory targets using an implementation intention strategy improves subsequent prospective memory performance in older adults (e.g., Chasteen, Park, & Schwarz, 2001). However, little is known about the strategy's effectiveness for younger adults or about the role that is played by particular components of the implementation intentions procedure. Experiment 1 demonstrated that young adults using a full implementation intention strategy (including mental imagery) had better prospective memory than a control group. Experiment 2 investigated whether implementation intentions buffer against high distraction and whether mental imagery encoding alone would yield a prospective memory benefit similar to that exhibited by the full implementation intention procedure. The full implementation intention procedure was necessary for improved prospective memory performance and for eliminating performance declines in

the presence of high distraction. Implementation intentions appear to foster automatic processing of prospective memory targets.

### Embodiment as a Foundation for Cognitive Science Brown Convention Ctr. Rm. 306, Saturday Morning, 8:00–10:00

Chaired by Martin L. Bink, *Western Kentucky University*

#### 8:00–8:15 (145)

**Embodiment in Education.** ARTHUR M. GLENBERG, *University of Wisconsin, Madison*, & JOEL R. LEVIN, *University of Arizona*—Is embodiment just the latest laboratory curiosity, or might it be an approach to cognition and behavior that allows psychologists to make important practical advances? This talk reports on some of our experimental work applying principles of embodied cognition to formulating and teaching reading comprehension strategies to young readers. These embodied strategies lead to surprisingly large (e.g., close to two standard deviations) gains in reading comprehension, appear to be well-retained, and transfer to related activities.

#### 8:20–8:35 (146)

**Linguistic Content Modulates Response Force.** ROLF A. ZWAAN, LAWRENCE J. TAYLOR, & ROSS P. HENDERSON, *Florida State University*—Three experiments assessed the effects of linguistic content on manual responses. Subjects squeezed rubber bulbs to make sensibility judgments to sentences. Resulting changes in air pressure were measured with millisecond accuracy. The force with which subjects responded was modulated by the content of the sentences. For example, more force was used to respond to "He pushed the car" than to "He started the car." Similarly, more force was used to respond to "He pushed the car" than to "He pushed the cup." Thus, force responses were modulated by both verbs and nouns. Moreover, linguistic content modulated not only response force but also response contour. Squeeze responses were initiated earlier but completed later for sentences such as "He held the apple" than for sentences such as "He dropped the apple." These and potential further results will be discussed in the context of theories of motor resonance in language processing.

#### 8:40–8:55 (147)

**Action Planning and Language Comprehension.** MICHAEL P. KASCHAK & KRISTIN L. BORREGGINE, *Florida State University*—Several recent studies have demonstrated an interaction between action planning and language processing, such that the execution of an action (e.g., moving one's arm away from one's body) is facilitated by simultaneously processing a sentence that describes an action that takes place in the same direction (e.g., handing someone a pen). We report on several studies that manipulate the timing of the execution of the motor response relative to the processing of the sentence. In keeping with theories of action planning, it is shown that the extent to which the processing of a sentence about action facilitates or interferes with the execution of the motor response depends on the point (relative to the sentence) at which the motor response is executed.

#### 9:00–9:15 (148)

**Embodied Preference Judgments: Can Likability Be Driven by the Motor System?** SIAN L. BEILOCK, *University of Chicago*, & LAUREN E. HOLT, *Miami University of Ohio*—Can covert sensorimotor simulation of stimulus-relevant actions impact the affective judgments made about stimuli in our environment—even when there is no intention to act? Skilled and novice typists picked which of two letter dyads they preferred. Dyads always differed by one property: If typed using standard methods, one dyad involved the same finger (e.g., FV), the other different fingers (e.g., CJ). Thus, the former dyad should result in more motor interference than the latter if typed, as the finger movements cannot overlap. Although individuals could not explain how the dyads differed, skilled typists preferred different-finger dyads. Novices showed no preference. A motor dual task performed

while making dyad preference judgments eliminated typists' preferences, but only when that dual-task involved the specific fingers used to type the presented dyads. For skilled typists, perceiving letters prompts the covert sensorimotor simulation of typing them, in turn influencing judgments made about this information.

**9:20–9:35 (149)**

**Space, Objects, and Motor Actions.** MICHAEL E. J. MASSON & DANIEL N. BUB, *University of Victoria*—An arrow can be used to orient attention to the direction in which it points. By contrast, what little evidence there is suggests that manipulable objects attract attention to their handles, not to the direction in which they point (e.g., to the handle of a teapot, not its spout). We resolve this paradox by showing that manipulable objects behave like arrows when responses are simple left- or right-hand keypresses and the attribute that determines the response is extrinsic to the object (subjects respond to the color of a dot placed to the left or right of the object). When the critical attribute is intrinsic to the object (subjects respond to the object's color) and the response options are arbitrary hand gestures rather than simple keypresses, attention is attracted to the object's handle. We conclude that object properties interact with the motor system to modulate visual attention.

**9:40–9:55 (150)**

**Perceptual Grouping in Mathematical Reasoning.** DAVID LANDY & ROBERT L. GOLDSTONE, *Indiana University, Bloomington* (read by Robert L. Goldstone)—Algebraic reasoning is typically considered to be a paradigmatic case of widespread, amodal calculation involving rule-based, symbolic transformations. However, we report evidence that it is strongly influenced by perceptual grouping. Participants judged the validity of a set of equations that tested their ability to apply order-of-operations rules (multiplication precedes addition). Accuracy was greatest when nonmathematical grouping pressures were consistent, rather than inconsistent, with the mathematical grouping. Manipulating perceptual grouping through physical spacing resulted in a sixfold change in errors, and other reliable grouping effects were found based upon alphabetic proximity, connectedness, implied closure, and functional form. Effects of order of operation on spatial grouping were also found in participants' arithmetic productions. We conclude that symbolic reasoning may generally be more visual and external than is usually supposed. Accordingly, we propose a model of algebraic reasoning that focuses on perceptual processes of grouping, matching, marking, and attentional shifting.

#### Animal Cognition

**Grand Ballroom F, Saturday Morning, 8:00–9:40**

*Chaired by William A. Roberts, University of Western Ontario*

**8:00–8:15 (151)**

**Do Pigeons Study for a Test?** WILLIAM A. ROBERTS, *University of Western Ontario*—In a three-key operant chamber, pigeons pecked a triangle on the left key to present a sample stimulus (red or green) on the center key for 5 sec. After seeing the sample, pigeons pecked a circle on the right key to present red and green test stimuli on the side keys. After pigeons had learned to match the sample at 90% accuracy, they were given trials on which only the triangle and the circle were presented. Data are reported on whether pigeons choose to take the test without seeing the sample, leading to only a 50% chance level of reward, or choose to see the sample (study) before taking the test, leading to a 90% level of reward.

**8:20–8:35 (152)**

**The Continuing Search for Symmetry in Pigeons.** PETER J. URCUIOLI & SARAH MICHALEK, *Purdue University*, & KAREN M. LIONELLO-DENOLF, *University of Massachusetts Medical School*—We studied the effectiveness of a variety of training procedures in promoting associative symmetry between simple (hue and form) stimuli

in pigeons. Two-alternative choice procedures were routinely ineffective. By contrast, some pigeons showed evidence for symmetry on nonreinforced probe trials following go/no-go training on symbolic and identity matching. We hypothesize that in go/no-go tasks, the continual and forced exposure to the differential reinforcement associated with the training relations facilitates the formation and merger of stimulus classes that underlie symmetry. Curiously, when behavior on the symmetry test trials themselves is differentially reinforced, the probe-trial data are inconsistent with this hypothesis and with the results from nonreinforced probes.

**8:40–8:55 (153)**

**Estimating the Capacity of a Rat's Working Memory for Object Recognition.** JEROME COHEN, VARAKINI PARAMESWARAN, ANCA MATEI, ROBERT ZUNIGA, & MYRON HLYNKA, *University of Windsor*—We examine the number of objects a rat can retain in its working memory in an object recognition task. In that task, a rat must obtain food under several objects in a foraging arena during a study segment of a trial. After varying delays, the rat is exposed to some of the same unbaited objects and some new baited objects in the test segment of the trial. We compare the observed proportion of correct trials and the distribution of the number of choices to find the baited new objects with hypothetical data based on different numbers of objects the rat could have stored in its working memory.

**9:00–9:15 (154)**

**Memory for Sequences of Different Numbers of Tone Bursts in the Rat.** ANGELO SANTI & PATRICK VAN ROOYEN, *Wilfrid Laurier University*—Two groups of rats were trained with nonspatial response alternatives to discriminate sequences of different numbers of tone bursts. In one group, sequences varied in number with total sequence duration controlled (2 bursts/4 sec and 8 bursts/4 sec). In the other group, total sequence duration, sum of the burst durations, and sum of the gap durations were all controlled. Only the first group learned the discrimination. Retention functions exhibited a choose-many bias at a 1-sec delay and a choose-few bias at an 8-sec delay regardless of the similarity in the intertrial interval and delay interval illumination conditions. This suggests that rats confused the interval of silence during a delay interval with the interval of silence between tone bursts in the sample sequence. Thus, instructional ambiguity effects may be modality specific. Further diagnostic testing provided additional evidence that rats relied on temporal features rather than the number of tone bursts to discriminate the sequences.

**9:20–9:35 (155)**

**Social Spatial Memory in the Radial-Arm Maze.** MICHAEL F. BROWN, MARY ELIZABETH KNIGHT-GREEN, EDWARD J. LOREK, CAROLINE C. PACKARD, WENDY L. SHALLCROSS, & TIMOTHY C. WIFALL, *Villanova University*—Animal working memory has been investigated using a wide range of to-be-remembered stimulus material. However, we know very little about memory for socially transmitted information. In the experiments reported here, pairs of rats made choices in an eight-arm radial maze. On each trial, a randomly selected set of four arms contained preferred food (sucrose pellets) and the remaining arms contained grain pellets. Choices made by the rats were affected by choices made earlier in the trial by their foraging partner. Both the location of arms chosen by the foraging partner and the identity of the food in those locations modulated choice behavior, suggesting that both properties of choices made by the foraging partner are coded in memory.

#### Eyewitness Performance

**Grand Ballroom I, Saturday Morning, 8:00–9:20**

*Chaired by Michael B. Lewis, Cardiff University*

**8:00–8:15 (156)**

**Eyewitness Confidence and Accuracy in Multiple Lineups.** MI-

CHAELE B. LEWIS, *Cardiff University*—The relationship between accuracy and self-rated confidence of eyewitness identification is now well established. This relationship, however, can be influenced by a variety of factors. The present experiment explored the effect that a previous lineup (looking for the same face and without feedback) has on accuracy and the accuracy–confidence relationship. Results show that previously seeing a target-absent lineup reduces accuracy in a subsequent target-present lineup. Furthermore, those people who made an incorrect target-present response showed a reduction in confidence on the later target-present lineup. Finally, the accuracy–confidence correlation was not significantly affected by the previous target-absent lineup. In the conditions where the target-present lineup preceded the target-absent lineup, the accuracy–confidence relationship was considerably increased. The results are discussed in terms of understanding the accuracy–confidence relationship and also the practicalities of employing multiple lineups forensically.

#### 8:20–8:35 (157)

**Calibration Versus Confidence: Making Inferences About the Memory of Others.** ELIZABETH R. TENNEY & BARBARA A. SPELLMAN, *University of Virginia* (read by Barbara A. Spellman)—Research on metamemory shows that people can use beliefs about their own memories in laboratory tasks (e.g., judgments of learning and feeling of knowing) and in real life (e.g., deciding how long to study for a test). Under some conditions, calibration is quite good. Research on jury decision making shows that jurors are often overinfluenced by highly confident witnesses despite the low overall correlation between confidence and accuracy. We suggest that absent supplementary information, people may assume that others are well calibrated. In several studies, we demonstrate that when people have independent information about the calibration of others (e.g., knowledge of others' errors), they may use that information to override statements of confidence. Low-confidence errors can actually serve to enhance credibility. These findings have implications for the legal system and for intelligence analysis.

#### 8:40–8:55 (158)

**The Stranger Effect in Face Recognition and Identification.** RALPH N. HABER & LYN HABER, *Human Factors Consultants*—Variables affecting recognition memory were summarized in Shapiro and Penrod's (1986) meta-analysis of over 190 experiments. However, every face in those experiments was previously unfamiliar. We reviewed every experiment since 1970 that presented individual faces in a recognition paradigm that compared familiar (usually famous) faces and faces never seen before. Familiar faces are recognized nearly perfectly and are relatively unaffected by changes in pose, context, timing of presentation, delay of testing, memory load, or elaboration of processing. In contrast, the stranger effect of unfamiliar faces seen only once reduces recognition accuracy by over 30%, and changes in the pictures and time variables result in significant further decrements. These results indicate upper limits on eyewitness accuracy of identification of strangers seen only once while committing a crime.

#### 9:00–9:15 (159)

**Estimates of Eyewitness Identification Accuracy.** LYN HABER & RALPH N. HABER, *Human Factors Consultants*—We draw on five independent databases for evidence of eyewitness accuracy when identifying a perpetrator from a lineup: a pure estimate of the stranger effect from face recognition experiments; results from laboratory experiments using (gentle) crimes and student subjects; results from field studies using noncrimes and representative subjects; results from military data involving intense stress; and results from archival police data comprised of real eyewitnesses to real lineups administered by real police. The five databases, considered together, suggest that eyewitness identification accuracy in real life barely reaches 50% under idealized conditions, and a 30% to 40% accuracy level is realistic for witnesses/victims of violent crimes.

### SYMPOSIUM: Advances in Prospective Memory Grand Ballroom JKL, Saturday Morning, 9:40–11:50

Chaired by Peter Graf, *University of British Columbia*

#### 9:45–10:05 (160)

**Attention and Mnemonics in Prospective Memory.** PETER GRAF, *University of British Columbia*—On ProM tasks, attention resources are required in the planning phase, for achieving a distinct encoding of an intention to be carried out in the future in the retention phase, for monitoring the occurrence of intention-relevant retrieval cues and in the retrieval phase, for interrupting ongoing activities and for switching between ongoing activities and the intended action. I will report a series of experiments that focused on the attention demands of different retrieval situations and provide evidence that ProM task performance is determined primarily by the difficulty associated with interrupting activities that occur simultaneously with the intention-relevant retrieval cue(s). I will also report recent work on mnemonics or strategies for improving ProM and use the results to propose that mnemonics serve to manage the attentional resources required for each phase of a ProM task, by forging distinctive links between intentions and their retrieval cues/context.

#### 10:10–10:30 (161)

**The Influence of Contextual Association On Prospective Memory.** JASON L. HICKS, *Louisiana State University*, RICHARD L. MARSH, *University of Georgia*, & GABRIEL I. COOK, *Claremont McKenna College*—Having an intention to perform an activity (i.e., a prospective memory) in the near term can interfere with ongoing activities. In addition, associating that intention with distal activities insulates people from interference until the time when the distal activity must be performed. The question we address in this research is whether or not context-linked intentions are cued by related information before the distal activity is engaged, thereby testing the notion of whether an intention is spontaneously retrieved. The interim answer to this question is that linking an intention to a distal context not only insulates one from interference but also prevents one from noticing that intention-related information is being processed unless the intention-related material is a perfect copy cue for responding. We conclude that linking an intention to a specific context protects people from interference, but an exact cue is still noticed and can cause interference even when it occurs in the wrong context.

#### 10:35–10:55 (162)

**Self-Regulatory Strategies and Prospective Memory: The Role of Implementation Intentions.** PETER M. GOLLWITZER, *New York University*, ANNA-LISA COHEN, *University of British Columbia*, & SAM GILBERT, *University College London*—There is growing interest in the beneficial influence that implementation intentions (i.e., if–then plans) have on prospective memory performance (Gollwitzer, 1993, 1999). Recent research (Cohen et al., in press) demonstrated a benefit of implementation intentions in two tasks where failures of executive control are especially prevalent (i.e., task switching, Simon task). In the present study, we investigated whether this self-regulatory strategy can alleviate ongoing task costs associated with prospective memory. Results confirmed this prediction, revealing a decrease in ongoing task latencies for subjects who encoded an implementation intention. In another line of studies, we examine the neuropsychological underpinnings of implementation intentions. Using fMRI, we focus on the effects of implementation intentions on neural systems involved in prospective memory.

#### 11:00–11:20 (163)

**Motivational Factors in Prospective Memory.** SUZANNA L. PENNINGGROWTH, *University of Wyoming*—The study of prospective memory (PM) might benefit by incorporating motivational approaches to cognition. Two types of motivational influence seem especially promising for PM research: task importance and goal-relatedness.

Task importance has been shown to affect several phases of PM, such as encoding/retention (e.g., through strategy use) and performance (e.g., through attention allocation). However, there has been less research examining the relationship between goals and PM. Kruglanski and colleagues' goal systems theory provides a potentially useful framework for investigating the goal-prospective memory relationship. The theory views goals (e.g., "be educated") as mental representations connected to representations of supporting activities (e.g., "study"). By considering some PMs as types of supporting activities (e.g., "download practice questions tonight"), we can make predictions about whether and how goals influence PMs. Research that incorporates motivational features has the potential to inform our understanding of many aspects of PM, including age-related changes and other individual differences.

11:25–11:45 (164)

**Prospective Memory in Aviation, Everyday Tasks, and the Laboratory.** ROBERT K. DISMUKES, *NASA Ames Research Center*—Prospective memory failures in occupations such as aviation and medicine can have fatal consequences. In five of the 27 major U.S. airline accidents between 1987 and 2001 in which crew error was found to be a causal factor, inadvertent omission of a normal procedural step played a pivotal role. As yet, little research has examined prospective memory performance of experts performing familiar tasks. I will briefly summarize our studies using three quite different but complementary approaches: Ethnographic studies, analyses of accident and incident reports, and laboratory studies. The first two approaches revealed five types of situations presenting prospective memory challenges to airline pilots: Episodic tasks, habitual tasks, atypical situations substituted for habitual actions, interrupted tasks, and interleaving tasks/monitoring. An experimental study found that inadequate encoding, inadequate cuing, and competing demands for attention make individuals vulnerable to forgetting to resume interrupted tasks. Field studies of this sort identify unanticipated sources of variance in performance, and combining field and laboratory studies enhances the power of both.

**Text and Discourse Comprehension**  
Grand Ballroom GH, Saturday Morning, 10:40–12:00

*Chaired by Joseph P. Magliano, Northern Illinois University*

10:40–10:55 (165)

**Assessing the Reading Strategies Assessment Tool (R-SAT).** JOSEPH P. MAGLIANO, KEITH K. MILLIS, & SARA GILLIAM, *Northern Illinois University*, & IRWIN LEVINSTEIN & CHUTIMA BOONTHUM, *Old Dominion University*—The goal of this study was to test a computerized assessment of reading skill called the Reading Strategy Assessment Tool (R-SAT). In R-SAT, readers generate verbal protocols as they read. Readers are asked to produce two types of open-ended responses: indirect and direct. The indirect approach requires readers to report thoughts regarding understanding of sentences in the context of the passage, which provides an assessment of reading strategies. In the direct method, readers answer "wh-" questions, which provides an assessment of a reader's ability to access important prior text information while reading. Word matching algorithms are used to assess the quality of test takers' protocols. In this study, we assessed the extent to which R-SAT is indicative of comprehension. The results show that R-SAT accounts for a significant amount of variance in performance on tests of reading comprehension and accounts for more variance than a traditional multiple-choice test.

11:00–11:15 (166)

**Testing Theories of Automaticity in Text Processing: Computational Efficiency and Memory-Based Processing in Conceptual Combination.** KATHERINE A. RAWSON, *Kent State University*, & ERICA L. MIDDLETON, *University of Illinois, Urbana-Champaign*—A prevalent assumption in text comprehension research is that many aspects of text processing are "automatic" for skilled adult readers. Auto-

maticity has typically been defined in terms of properties (e.g., speed, effort). However, these accounts are descriptive and not explanatory. In contrast, the present research tests two theoretical accounts from basic research on automaticity that have greater explanatory power because they define automatization in terms of underlying mechanisms: computational efficiency (underlying computational processes become more efficient with practice) and memory-based processing (underlying basis of processing shifts from computing interpretations to retrieving prior interpretations). Rawson (2004) provided initial evidence for the contribution of these mechanisms to the automatization of syntactic parsing processes. Here, we extend this research by examining these mechanisms in one of the many semantic processes involved during text comprehension (conceptual combination—i.e., combining the meaning of two words to form a new concept).

11:20–11:35 (167)

**Repetition Improves Word Processing Efficiency in Nonnative English Speakers.** FRANCES K. DANIEL, GARY E. RANEY, & TLALOC RODRIGUEZ, *University of Illinois, Chicago* (read by Gary E. Raney)—Reading a text more than once improves many elements of reading performance, but repetition benefits vary on the basis of several factors, such as language skill. For example, native English speakers are thought to process words more efficiently than nonnative English speakers. We explored how repetition influences word processing efficiency for native and fluent nonnative English speakers. To focus readers' attention on word-level processing, we had readers perform a letter detection task while reading short texts twice in succession. Reading time (task performance time) and letter detection accuracy were measured. Native and nonnative speakers performed the task faster during the second reading, but only nonnative speakers showed increased letter detection accuracy during the second reading. We suggest that because processing words for native speakers is relatively automatic, they do not benefit as much from repetition. Because processing words is less automatic for nonnative speakers, repetition of texts helps word processing efficiency.

11:40–11:55 (168)

**Category NP Anaphors in Spoken Language Comprehension.** AMIT ALMOR & MICHAEL C. PHILLIPS, *University of South Carolina*—Two experiments tested the effect of focus and antecedent typicality on the processing of category NP anaphors in spoken language comprehension in the visual world paradigm. Targets were typical (OAK) or atypical (PALM) members of a category (TREE) and were initially mentioned by the subordinate term and later referred to by the category anaphor. In Experiment 1, the referent was first mentioned as the grammatical subject of a simple declarative sentence, and in Experiment 2 the referent was introduced in an *it*-cleft or a *wh*-cleft, resulting in a typicality  $\times$  focus manipulation. Fixation patterns in both experiments showed an early typicality effect and a delayed inverse typicality effect. These results show that spoken language comprehension is similar to reading in how it is affected by semantic overlap between anaphor and antecedent, and further elucidate the separation and temporal relations between referent identification and discourse integration.

**Reasoning With Complex Visualizations**  
Grand Ballroom DE, Saturday Morning, 10:20–12:00

*Chaired by Mary Hegarty, University of California, Santa Barbara*

10:20–10:35 (169)

**Interactions Between Knowledge and Display Design in Interpretation of Complex Graphics.** MARY HEGARTY, MATT S. CANHAM, & SARAH KRIZ, *University of California, Santa Barbara*—Theories of graphics comprehension distinguish between stages of perception, attention, encoding, and inference from graphics. Although it is well established that knowledge and display design can affect graphics comprehension, few studies have examined the stage of

comprehension at which these effects occur. We collected verbal protocols and eye fixations while people interpreted weather maps both before and after receiving instruction on meteorological principles. We also varied the relative visual salience of task-relevant information in different map designs. Knowledge gained from instruction affected early stages of perception and attention as well as later stages of inference from weather maps. Map design affected early stages of perception and attention before instruction and accuracy of inferences after instruction. On the basis of these results, we propose a model of how top-down (knowledge) influences interact with bottom up (display) influences at different stages of interpreting complex graphical displays.

#### 10:40–10:55 (170)

**Using Spatial Transformations to Resolve Uncertainty in Complex Visualizations.** GREGORY TRAFTON, *Naval Research Laboratory* (sponsored by Deborah A. Boehm-Davis)—Previous uncertainty research has focused on the cognitive biases of heuristics (e.g., Tversky & Kahneman, 1974) or how heuristics are used to make optimal decisions (e.g., Goldstein & Gigerenzer, 1999, 2002). Our work focuses not on the heuristics that people use to make judgments under uncertainty, but on the problem-solving strategies that people use to resolve uncertainty. Strategies that help resolve uncertainty are critical in complex visual/spatial domains like meteorology or scientific reasoning where large-scale data need to be analyzed. In these domains, uncertainty is rarely explicitly displayed, so a person's own understanding of uncertainty must be added to the display in order to appropriately use the visualization. To explore how experts and novices deal with uncertainty in complex visualizations, we conducted a series of experiments using expert and novice meteorologists as they were making a weather forecast. We found that experts spatially changed the visualization to deal with uncertainty.

#### 11:00–11:15 (171)

**Impact of Uncertainty Representation on Decision Making.** SUSAN S. KIRSCHENBAUM, *Naval Undersea Warfare Center*, GREGORY TRAFTON & SUSAN B. TRICKETT, *Naval Research Laboratory*, & CHRISTIAN D. SCHUNN & LELYN D. SANER, *University of Pittsburgh*—Uncertain information is common in many domains. We show here how the representation can impact problem solving and the psychological uncertainty of the solver. In submarine target motion analysis (TMA), uncertainty is typically displayed both graphically and by a table of “solutions.” In this study, three display variants were used to display the possible location of an unknown contact. These were tabular, spatial, and both tabular and spatial. Overall, performance was more accurate when the uncertainty was displayed spatially, and participants expressed less uncertainty in gestures and speech when they had both representations. One can speculate that having both representations provides not only the graphical indication required for confidence, but also the numeric representation required for giving action orders.

#### 11:20–11:35 (172)

**The Evolution of Spatial Representations During Complex Visual Data Analysis.** CHRISTIAN D. SCHUNN & LELYN D. SANER, *University of Pittsburgh*, GREGORY TRAFTON & SUSAN B. TRICKETT, *Naval Research Laboratory*, & SUSAN S. KIRSCHENBAUM, *Naval Undersea Warfare Center*—How do problem solvers represent visuospatial information in complex problem-solving tasks? This paper explores the predictions of embodied problem solving and a neurocomputational theory of what factors influence internal representation choices. Data are collected from experts and novices in three different, complex visuospatial problem-solving domains (weather forecasting, submarine target motion analysis, and fMRI data analysis). Internal spatial representations are coded from spontaneous gestures made during cued-recall summaries of problem-solving activities. Analyses of domain differences, expertise differences, and changes over time with problem solving suggest that neurocomputational con-

straints play a larger role than the nature of the visual input or the nature of the underlying real world being examined through problem solving, especially for expert problem solvers. The particular neurocomputational feature that was found to drive internal representation choice is the required spatial precision of the main goals of problem solving.

#### 11:40–11:55 (173)

**Extracting Hierarchical Structure From Biological Diagrams: An Analysis Across Knowledge Levels.** LAURA R. NOVICK & KEFYN M. CATLEY, *Vanderbilt University*—Hierarchical diagrams are common in everyday and scientific contexts. Cladograms, a type of hierarchical branching structure, are one of the most important tools that contemporary biologists use to reason about evolutionary relationships. These diagrams represent hypotheses about nested sets of taxa that are supported by shared evolutionary novelties. Cladograms can be drawn in both a tree form and a ladder form. In two experiments, we investigated students' understanding of the hierarchical relations in these different cladogram formats. College students with varying levels of biology coursework were asked to translate from one type of diagram to another: Euler circle to tree or ladder, tree to ladder, and ladder to tree. Students found ladders more difficult to understand than trees. This was especially true for students with weaker backgrounds in biology. The nature of subjects' errors suggests that the difficulty in understanding ladders may reflect the Gestalt perceptual principle of good continuation.

#### Concepts

**Brown Convention Ctr. Rm. 306, Saturday Morning,  
10:20–12:00**

*Chaired by Ryan D. Tweney, Bowling Green State University*

#### 10:20–10:35 (174)

**Minimally Counterintuitive Concepts Are Preferentially Used in a Story Generation Task.** RYAN D. TWENEY & LAUREN O. GONCE, *Bowling Green State University*—Recent research has shown a memory advantage for minimally counterintuitive (MCI) concepts (“sobbing oak”), over intuitive (INT) concepts (“large oak”) and over maximally counterintuitive (MXCI) concepts (“sobbing flying oak”). All three types of items from one such study (Owsianiecki et al., 2006) were adapted to a structured imagination task (Ward, 1994). Seventeen subjects (advanced undergraduates in a creative writing class) wrote novel stories using three or more concepts from provided lists. The results indicated a slight preference for using MCI items over INT items and a large preference over MXCI items (as in recall studies). Two styles characterized usage of counterintuitive concepts: accommodation (preserving strangeness—e.g., a strange forest with literal sobbing oaks) and assimilation (strangeness used metaphorically—e.g., sobbing oaks as a symbol of sadness). The results suggest extensions to recent theories explaining the counterintuitiveness of religious concepts. Such concepts may rely on accommodative processes as well as enhanced memorability.

#### 10:40–10:55 (175)

**Determining the Dimensionality in Spatial Representations of Semantic Concepts.** GERT STORMS, EEF AMEEL, & STEVEN VERHEYEN, *Katholieke Universiteit Leuven*—When multidimensional scaling solutions are used to study semantic concepts, the dimensionality of the optimal configuration has to be determined. Several strategies have been proposed to choose the appropriate dimensionality. In the present paper, the traditional dimensionality choice criteria were evaluated and compared to a method based on the prediction of an external criterion. Two studies were conducted in which typicality of an exemplar within a semantic concept was predicted from its distance to the concept centroid. In contrast to the low-dimensional solutions selected by the traditional methods, predictions of an external criterion improved with additional dimensions up to dimensionalities that were

much higher than what is common in the literature. This suggests that traditional methods underestimate the richness of semantic concepts as revealed in spatial representations derived from similarity measures.

11:00–11:15 (176)

**Iterated Learning Reveals Inductive Priors in Function and Category Learning.** MICHAEL L. KALISH, *University of Louisiana, Lafayette*, & THOMAS L. GRIFFITHS, *University of California, Berkeley*—Cultural transmission of information plays a central role in shaping human knowledge. Some of the most complex knowledge that people acquire, such as languages or cultural norms, can only be learned from other people, who themselves learned from previous generations. The prevalence of this process of “iterated learning” as a mode of cultural transmission raises the question of how it affects the information being transmitted. The fundamental prediction of a Bayesian analysis of iterated learning is that responses should converge to the learners’ prior over time. We present two experiments that confirm this prediction. In function learning, participants reveal a strong prior bias toward positive linear functions with a weaker bias toward the negative linear. In category learning, participants show a bias toward one-dimensional solutions. These experiments provide an insight into the consequences of intergenerational knowledge transmission and a method for discovering the inductive biases that guide human inferences.

11:20–11:35 (177)

**On Distinguishing Fact From Belief.** MITCHELL RABINOWITZ, JEFFREY WYATT, GEORGIA GARAY, HAROLD FORD, & JING FENG, *Fordham University*—Participants were presented with a list of 20 statements such as “Rich people are happy people” and “There are three colors in the American flag” and were asked to rate each in two ways: Whether they agreed with this statement and whether they thought other people agreed with the statement. It was assumed that a fact was a statement that you agreed with and you thought other people agreed with also. A belief was something that you might agree with but you realized that other people might have differing opinions. Given these stimuli, participants exhibited consensus on what was a fact and what was a belief. They were then presented with an article from the *New York Times* and were asked to rate statements from the article in the same way. With this material, there was very little consensus among subjects in relation to distinguishing fact from belief.

11:40–11:55 (178)

**The Religious Taboo Against Eating Pork: A Hypothesis on Its Origin.** MICHEL CABANAC & MARIE-CLAUDE BONNIOT-CABANAC, *Université Laval*—Among other dietary laws, the Torah and later the Koran forbade the eating of pork. Boar meat has a strong odor that is generally considered to be repulsive. There is no smell if the animal has been castrated, but castration other than for punitive reasons was forbidden in the ancient Middle East, at least by the Semitic peoples among whom this taboo arose. We propose that the pork taboo originated in the unpleasant odor of boar meat.

**Perception and Memory for Visual Information  
Grand Ballroom F, Saturday Morning, 10:00–12:00**

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

10:00–10:15 (179)

**Boundary Extension and Memory for Distance.** JON R. COURTNEY, TIMOTHY L. HUBBARD, & DAWN CARGO, *Texas Christian University* (read by Timothy L. Hubbard)—In boundary extension, memory for a scene includes information that might have been present beyond the boundary of the scene (Intraub & Richardson, 1989). As a consequence, objects are usually remembered as subsuming smaller visual angles (i.e., as further away). One possible explanation is that boundary extension involves displacement in depth (Hubbard 1996).

However, psychophysical studies of memory for distance find that observers usually remember being closer to objects (Algom, 1992). Our experiments examined memory for 3-D scenes, and memory was displaced toward the object (i.e., closer) when assessed by motor judgment (stepping forward or backward to indicate the initial viewpoint) and not displaced when assessed by verbal judgment (using a 5-point *too close–too far* scale). The data suggest boundary extension is probably not due to displacement in depth. Implications for theories of spatial memory, dissociations between memory for distance and area, and ecological validity are discussed.

10:20–10:35 (180)

**Boundary Extension at a Glance and Across an Eye Movement.** CHRISTOPHER A. DICKINSON & HELENE INTRAUB, *University of Delaware*—Does boundary extension (BE) occur rapidly enough to support integration of successive views during visual scanning? Or might a very short-term visual buffer briefly maintain a veridical representation? On each of 36 trials, a single 250-msec scene photo was followed by a masked interval and immediate repetition of the same scene (same view or different view). The repetition was rated on a five-point scale as “same,” “more close-up” or “more wide-angle.” In Experiment 1 ( $N = 72$ ), mask duration was either 250 or 42 msec. Robust BE occurred in both cases. In Experiment 2 ( $N = 22$ ), stimulus and test pictures appeared in different screen locations, requiring a saccade; test onset was gaze contingent (mean time between stimulus and test = 274 msec; EyeLink II). Transsaccadic memory included boundary extension; viewers correctly identified distractors, but identical views looked “too close-up.” Layout extrapolation is available early enough to support view integration during visual scanning.

10:40–10:55 (181)

**Exploring Spatial and Temporal Aspects of Boundary Extension.** HELENE INTRAUB & CHRISTOPHER A. DICKINSON, *University of Delaware*—Does boundary extension (BE) occur uniformly during dynamic presentation of views, or might it develop over time? On each trial, a trio of photos (three per second) was followed by a masked interval (42, 100, or 250 msec) and repetition of a scene from Serial Position 1, 2, or 3. Participants rated it as “same,” “more close up,” or “more wide angle” on a five-point scale (close-up and wide-angle views were tested). In Experiment 1 ( $N = 108$ ), BE occurred for close-ups at all masked intervals. Greater BE in Position 1 than 3 in the 42-msec condition indicates that BE occurs rapidly, but not all at once. In Experiment 2 ( $N = 108$ , close-ups only), the repetition appeared in either the same or a different location, necessitating a gaze shift. BE occurred in both cases. BE’s time course is rapid, unfolding early in processing, so it is present whether or not there is a shift in gaze.

11:00–11:15 (182)

**Canonical Object Orientations Differ When Chosen Versus Drawn (Consistent With Principles of Information Optimization).** MICHAEL K. McBEATH & SUZANNE KHALIL, *Arizona State University*—We tested whether favored, canonical views of 3-D objects systematically vary across (1) domain (photography, line depictions), (2) action (choosing, generating view), (3) elongation (compact, elongated objects), (4) type (horse, auto toys). The results confirmed that observers favor oblique views in photographic and choose-drawing conditions, but near-profile views in generate-drawing condition. There was also a systematic decrease in preferred vantage angle with elongation and type. When objects are chosen or photographed, people prefer angled vantages that provide more overall information, revealing both front and side features of the object. The increased information also makes these vantages more difficult to create, so such views are avoided when drawn. Experiment 2 demonstrated that small deviations in orientation of an object’s “head” bias viewers to favor the side view in which the “head” tilts toward them. In summary, canonical views systematically vary depending on “who has to do the work” of creating the representation, consistent with an information-optimizing strategy.

**11:20–11:35 (183)**

**Memory for Objects From Canonical and Noncanonical Viewpoints: Data and Models.** PABLO GOMEZ & JENNIFER SHUTTER, *DePaul University*, & JEFFREY N. ROUDER, *University of Missouri, Columbia*—This research explores the memory for common objects from “canonical” viewpoints (those that preserve the maximum amount of object structure) and “noncanonical” viewpoints (those that are unusual but still contain enough information about the identity of the object). We present data from three experimental procedures: free recall, view-specific recognition memory (participants were instructed to respond “old” only if the objects was presented in the same orientation as in the study phase), and view-independent recognition memory (participants were instructed to respond “old” to objects presented during the study phase regardless of orientation). The results show a complex pattern that is similar to the recognition/recall dissociation found for word frequency. View-independent recognition memory is better for objects studied and probed from the noncanonical viewpoint, but view-specific memory is not affected by viewpoint. In contrast, performance in free recall test is better for objects studied from the canonical viewpoint.

**11:40–11:55 (184)**

**Perception of Three-Body Center of Mass.** JAY FRIEDENBERG & BRUCE LIBY, *Manhattan College*—We investigated visual center of mass estimation in a three-body system. Stimuli consisted of black dot configurations where the dots formed the apices of isosceles triangles presented at four orientations: up, down, left, and right. We varied the distance between one dot pair while keeping constant the distance between the other two. Errors increased linearly as the configuration deviated away from an equilateral norm—that is, as the ratio of the two equal sides to the third diverged from one. Errors were smallest in the up and down orientations when the triangle’s symmetry axis was vertical. They were greatest in the left and right orientations when the symmetry axis was horizontal. Estimates shifted toward the center of vertically aligned dot pairs when the distance between these dots was large. The results are best accounted for by the combined influence of symmetry axis orientation and the perceived downward pull of gravity.

**Language Production****Grand Ballroom I, Saturday Morning, 9:40–12:00***Chaired by Fernanda Ferreira, University of Edinburgh***9:40–9:55 (185)**

**“Where Was I?”: A Psycholinguistic Investigation of Interruptions to Language Production.** BENJAMIN SWETS, *SUNY, Stony Brook*, FERNANDA FERREIRA, *University of Edinburgh*, & ERIK M. ALTMANN, *Michigan State University* (read by Fernanda Ferreira)—When people communicate in a dialog, the speech stream of one speaker is sometimes interrupted by the speech stream of another. In such cases, it is often difficult for the interrupted interlocutor to return to the point where he or she left off. Hence, interruptions present an interesting problem concerning language production: How do speakers keep track of where they were before being interrupted? We report four experiments that investigate this unexplored issue. Experiment 1 used a seminatural dialog in which a confederate interrupted at predetermined narrative junctures. Measures of resumption difficulty reveal that interruptions with conflicting conversational goals are particularly disruptive, as are interruptions requiring long verbal responses before resumption. Experiments 2 through 4 investigated similar processes for sentence production. Results demonstrate that verbal and nonverbal interruptions early in sentence production are more disruptive than later interruptions. We discuss the implications of these results for theories of language production.

**10:00–10:15 (186)**

**Interjections in Literary Readings and Artistic Performance.** DANIEL C. O’CONNELL, *Georgetown University*, SABINE KOWAL,

*Technische Universität Berlin*, & SCOTT KING, *Loyola University Chicago*—Numerosity and privileges of occurrence of various types of interjections (primary conventional, primary wild, secondary, and onomatopoeic) were investigated in literary readings and an artistic performance. The spoken corpus consisted of 667 interjections. Ameka’s (1992b, 1994) hypothesis that, parallel to their independence from ambient grammar, interjections would also be isolated temporally by preceding and following pauses, was not confirmed. Instead, 77% of the interjections were found to be initializing—that is, preceded by a pause. Functions of interjections are discussed in terms of animators (literary readers, 26% of whose spoken interjections were added) and principals (artistic performers, 79% of whose spoken interjections were added; Goffman, 1981), in terms of literacy and orality, and in terms of the emotional stance and perspective of a speaker at the very moment of utterance.

**10:20–10:35 (187)**

**The Effect of Syntactic Structure on Lexical Priming During Sentence Production.** LINDA R. WHEELDON, *Birmingham University*, MARK SMITH, *Open University*, & IAN APPERLY, NICOLA BERGIN, & CAROLINE TOWNSEND, *Birmingham University*—We report five experiments in which a picture description methodology was used to investigate the effect of lexical repetition across sentences. Participants generated coordinate noun phrase sentences such as “The apple and the dog move up” as well as prepositional sentences such as the “The apple moves toward the dog.” In three experiments, a picture was repeated across similar syntactic structures in either similar or different sentence positions. Lexical repetition speeded sentence production only when it occurred on the first item of the target sentence. However, its occurrence was also dependent on the syntactic role of the to-be-repeated word in the prime sentence. In particular, a noun in a prepositional phrase did not result in facilitation when it was repeated in subject head position. Two further experiments demonstrate that lexical repetition returns when the effect of syntactic structure is removed. Theoretical explanations for this interaction between lexical and syntactic repetition will be explored.

**10:40–10:55 (188)**

**Visual Feedback During Sign Language Production.** KAREN EM-MOREY, *San Diego State University*, NELLY GERTSBERG, *University of California, Irvine*, FRANCO KÖRPICS, *San Diego State University Research Foundation*, & CHARLES E. WRIGHT, *University of California, Irvine*—Speakers monitor their speech output by listening to their own voices. However, signers do not look directly at their hands and cannot see their own faces. We investigated the importance of a visual perceptual loop for sign language monitoring by examining whether changes in visual input alter sign production. Deaf signers produced ASL signs within a carrier phrase under five conditions: blindfolded, wearing tunnel-vision goggles, normal (citation) signing, shouting, and informal signing. Three-dimensional movement trajectories were obtained using an Optotrak Certus system. Tunnel vision caused signers to produce less movement within the vertical (Y) dimension of signing space, perhaps to keep their hand within view. Neither tunnel vision nor blind signing differed significantly from normal signing in the size (volume) of signing space, whereas shouted signing was significantly larger. Thus, signers do not “sign louder” when they cannot see themselves, but they do alter their sign production when vision is restricted.

**11:00–11:15 (189)**

**Two-Year-Olds and Adults: Same Sensitivity, Same Processing.** VIRGINIA V. VALIAN & SANDEEP PRASADA, *Hunter College, CUNY*—Why are children’s utterances (too) short? We propose a fundamental similarity in the components of processing—but not their weights—between 2-year-olds and adults. The limitations of adults’ processing are less obvious than that of children because few “super” adults have the extended resources that would make average adults look limited. We manipulated the conceptual relation between a verb

and its direct object to be predictable (“the cat is eating some food”) or unpredictable (“the cat is eating a sock”). We predicted that 2-year-olds in an imitation task, and adults in an RSVP task, would include more constituents from predictable sentences. In Experiment 1, 2-year-olds confirmed that prediction for subjects, verbs, and direct objects. In Experiment 2, a task modification in which the children placed a sticker on the pictured subject of the sentence after imitating it reduced the effect to verbs alone. In Experiment 3, adults reading passive sentences confirmed the prediction.

**11:20–11:35 (190)**

**Abstract Sentence Representations in 3-Year-Olds: Evidence From Comprehension and Production.** GIULIA M. BENCINI & VIRGINIA V. VALIAN, *Hunter College, CUNY* (sponsored by Virginia V. Valian)—We use comprehension and production data to test the abstractness of 3-year-olds’ syntactic representations. In a comprehension task with reversible passive sentences with animate participants, 53 children between the ages of 35 and 42 months performed above chance (58%) in pointing to the correct depiction of a sentence. In a syntactic priming task, 18 children primed with passives produced significantly more passives (16) in describing pictures with inanimate participants

than did 18 children primed with actives (3). Control children, who did not receive priming, produced no passives. Young 3-year-olds represent sentences abstractly and have syntactic representations for noun, verb, “surface subject,” and “surface object” as well as semantic representations for “agent” and “patient.” Children can flexibly map the semantic and syntactic relations. These findings support early abstraction accounts of acquisition according to which children’s grammars use formal syntactic categories and structural relations from the beginning of combinatorial language.

**11:40–11:55 (191)**

**Speech Priming in Adults and Children.** MELISSA K. JUNGERS & JULIE M. HUPP, *Ohio State University*—Aspects of perceived speech, such as syntactic form and rate, can influence future productions. Do syntactic priming and prosodic priming exist simultaneously? Participants viewed visual scenes and alternated between listening to priming sentences describing the scenes and producing their own descriptions of similar scenes. Listeners’ sentences reflected the rate of the primes. Listeners’ responses to a memory test suggest a representation that includes both the syntax and prosody of the priming sentences. A parallel experiment with 4- and 5-year-olds will be discussed.

**SYMPOSIUM: Statistical Learning: Mechanisms and Limitations**  
**Grand Ballroom JKL, Saturday Afternoon, 1:30–3:40**

*Chaired by Morten H. Christiansen, Cornell University*

**1:40–1:55 (192)**

**Constraints on Visual Statistical Learning Reveal Its Underlying Nature.** BRIAN J. SCHOLL & NICHOLAS B. TURK-BROWNE, *Yale University*—Visual statistical learning (VSL) illustrates the tendency of the visual system to encode subtle statistical regularities without intent or awareness. Previous studies have demonstrated VSL in many contexts but have not explored its constraints. Here, we review three recent studies, each of which asks what is learned during VSL. First, we show that VSL is not a function of mere exposure, but that only selectively attended patterns are learned. Second, we show that VSL is object based (rather than operating over individual features) but can also serve to define what counts as an object. Third, we show that the representations which result from VSL are highly abstracted from the input: In transfer studies, for example, exposure to purely spatial regularities results in learned associations that can be expressed at test in purely temporal sequences, and vice versa. These results illustrate the ways in which VSL may be adapted to real-world visual cognition.

**2:00–2:15 (193)**

**Modality Constraints on Statistical Learning.** CHRISTOPHER M. CONWAY, *Indiana University, Bloomington*, & MORTEN H. CHRISTIANSEN, *Cornell University*—A common assumption in statistical learning research is that it is a single, domain-general process that operates over all types of input. This is not an unreasonable prospect considering that statistical learning has been found to occur across multiple sense modalities and domains. However, we present recent data supporting a “modality-constrained” view of statistical learning. Specifically, we show that learning statistical relations in serially presented input occurs most easily for auditory as opposed to visual or tactile input. Furthermore, each sense modality appears to have slightly different computational strategies for encoding probabilistic structure, with differing sensitivities to sequence-initial or sequence-final fragment information. Finally, using a modified crossover design paradigm, we pit stimulus-specific representations against abstract representations and find evidence for independent, modality-specific processing streams. We take these converging sources of evidence to indicate that statistical learning may arise out of, and even be continuous with, modality-constrained perceptual processing mechanisms.

**2:20–2:35 (194)**

**Statistical Learning Across Domains: Implications for Language Acquisition.** GERRY T. ALTMANN, *University of York*—Language exists in part to describe the world around us. Some (but not all) statistical properties of the language may reflect statistical properties of that world. Here, I shall consider prior empirical and computational research on how statistical learning in one domain may be constrained by statistical learning in another. For both adults and infants, exposure to sequences expressed in one domain facilitates the acquisition of sequential structure in another domain. I shall explore whether the computational principles identified in the modeling of this finding might apply to the mapping we acquire between language and the world. For example, the visual world appears to lack the sequential structure that pervades language. However, I shall argue that the manner in which language and visual attention interact suggests that sequentiality may nonetheless underpin the mapping between these domains.

**2:40–2:55 (195)**

**Constraining Learning: How Infants Choose Among Different Kinds of Structure.** REBECCA GOMEZ & JILL LANY, *University of Arizona*—Research on statistical learning is intriguing for suggesting the extent to which learning is constrained by external structure (as opposed to sensitivities specific to the learner). However, learning appears to be guided both by internal and by external con-

straints. We show how infant learning is mutually constrained by (1) attention to default structure (information that is particularly easy for the cognitive system to process) and (2) a tendency to capitalize on the most stable (or invariant) structure when the default is not useful. We also show how learning is guided by prior experience such that learners can acquire more complex, otherwise unlearnable structure after exposure to simpler forms. Our studies suggest that learning is a dynamically guided process, arising in the interaction of internal and external constraints. Moreover, learners and the structure they can acquire change as a function of experience.

**3:00–3:15 (196)**

**Neural Mechanisms of Learning About Structure.** BARBARA J. KNOWLTON, *UCLA*—Humans have the capacity to implicitly learn structure in the environment through exposure. It is important to describe the properties of implicit learning about structure, in terms of both behavior and neural substrates, to differentiate it from other types of learning. I will discuss behavioral and neuroimaging findings from two tasks—artificial grammar learning and probabilistic classification learning—in which implicit learning has been shown to be able to support performance. In both of these tasks, application of learned information is accompanied by activation in the striatum. However, in both tasks, multiple types of learning about the task structure can support good performance. The type of learning that is striatal dependent appears to be insensitive to demands on attention and appears to proceed automatically. Despite the similarities between learning in these two tasks, an important difference may be the role of feedback, which may further differentiate striatal-dependent learning of structure.

**3:20–3:35 (197)**

**Learning With and About Constraints: Discussion for Statistical Learning Symposium.** ROBERT L. GOLDSTONE, *Indiana University, Bloomington*—I will discuss several themes raised by speakers: (1) the role of modality-specific constraints on statistical learning; (2) the possibility of learning constraints that, in turn, affect the course of future learning; (3) the relations among perceptual, statistical, and associative learning; and (4) potential mechanisms for statistical learning that are incremental, psychologically plausible, and appropriately constrained.

**Perspectives on Memory**

**Grand Ballroom GH, Saturday Afternoon, 1:30–3:10**

*Chaired by Suparna Rajaram, SUNY, Stony Brook*

**1:30–1:45 (198)**

**Collaboration and Individual Memory: Evidence From Immediate and Delayed Recognition.** SUPARNA RAJARAM & LUCIANE P. PEREIRA-PASARIN, *SUNY, Stony Brook*—Nearly four decades of memory research has focused on individual memory’s operating in isolation. The influence of social processes has come into focus only recently in cognitive research. We will present experiments on this relationship. Participants studied unrelated items and performed the recognition memory task individually either following group discussion among three members (collaborative) or no discussion (noncollaborative). Classic effects of levels of processing and picture superiority found in individual memory replicated in both conditions. Importantly, collaboration improved individual memory accuracy. This positive effect extended over time (48 h and 1 week) despite the expected decline in memory sensitivity; participants continued to benefit from others’ input even as false alarms increased. These findings show that consensus is not necessary for benefits from collaboration and that collaborative facilitation on individual recognition memory is robust. We will discuss these findings in the context of the relationship between group and individual memory.

**1:50–2:05 (199)**

**Adaptive Memory: An Evolutionary Perspective.** JAMES S. NAIRNE & SARAH R. THOMPSON, *Purdue University*—Why did

our memory systems evolve? Psychologists generally ignore this question, choosing to focus instead on the proximate mechanisms that underlie specific mnemonic phenomena. In several experiments, we investigated the idea that our memory systems evolved to help us remember fitness-relevant information—specifically, information relevant to survival. In incidental learning experiments, subjects were asked to rate common nouns for their survival relevance (e.g., in securing food, water, or protection from predators); in control conditions, subjects rated the same words for pleasantness, relevance to moving to a foreign land, or relevance to dining at a restaurant. In surprise retention tests, subjects consistently showed the best memory when words were rated for survival; the survival advantage held across recall and recognition, and for both within- and between-subjects designs. These findings suggest that our memory systems are “tuned” to remember fitness-relevant information, perhaps as a result of survival advantages accrued in our ancestral past.

2:10–2:25 (200)

**The Representation of Semantic/Experiential Knowledge in Multiple Cortical Areas and Medial Temporal Lobes.** MARK E. WHEELER, *University of Pennsylvania*, & ROBERT F. GOLDBERG & WALTER SCHNEIDER, *University of Pittsburgh* (read by Walter Schneider)—In an fMRI study, we found that semantic memory, query memory, and object memory activated distinct and widely separated cortical areas built on the top of sensory motor processing systems (vision, auditory, gustatory). The areas were content specific (visual object, language, taste) and activated by word generation, picture perception, and encoding of movies. During question answering, we identified activity in medial temporal and semantic areas specific to the nature of the query (Broca’s area for “what was said,” visual lingual gyrus for “what was shape”). These findings suggest that (1) semantic knowledge is embodied through sensory brain mechanisms with multiple distinct content-specific representation spaces, (2) medial temporal lobes encode information from and replay information to those semantic spaces, and (3) query operates in the same spaces used to encode, manipulate, and retrieve the related information. These results provide insights in the structure, development, and use of semantic memory during active retrieval.

2:30–2:45 (201)

**Ordinal and Other Process Dissociation: Geometric Representation and Testability.** JOHN C. DUNN, *University of Adelaide*—The process-dissociation procedure is used to derive estimates of controlled and automatic memory from performance measured under inclusion and exclusion instructions. A controversial assumption of the model is that the two aspects of memory are independent. Recently, Hirshman (2004) has proposed a weaker version of this model that assumes only an ordinal relationship between each dependent variable and the underlying parameters of the model, and derived a set of conclusions that can be drawn from ordinal differences in inclusion and exclusion performance. I show how the original independence model, Hirshman’s generalization, and other models (e.g., redundancy, exclusivity) may be interpreted as parameterizations of a space consisting of performance under inclusion and exclusion instructions. This representation yields a simple geometric interpretation of Hirshman’s inferences and offers a basis for constructing relatively straightforward tests of these and related models.

2:50–3:05 (202)

**A Topic Model for the Semantic Isolation Effect.** MARK STEYVERS, *University of California, Irvine*, KELLY M. ADDIS, *Indiana University, Bloomington*, & THOMAS L. GRIFFITHS, *University of California, Berkeley*—In a semantic isolation effect (related to the von Restorff effect), there is increased memory for a single unrelated item presented within a series of related items. We present results from two recall experiments that systematically explore the effect of serial position on subsequent recall of the unrelated item. The results indicate that the unrelated item shows a recall advantage rela-

tive to control items across all serial positions when it is the first item recalled at test. When it is not output first, the unrelated item only shows increased recall for later serial positions. We partially model these results with an extension of a probabilistic topic model that encodes and retrieves information at multiple levels of representation. A distribution over topics encodes the organization (“gist”) of the related items, whereas a sparse distribution over words encodes contextually unique items on a study list.

**Mechanisms of Voluntary and Involuntary Attention  
Grand Ballroom DE, Saturday Afternoon, 1:30–3:10**

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

1:30–1:45 (203)

**Intertrial Priming: Decision, Not Selection.** CHRISTIAN N. L. OLIVERS & MARTIJN MEETER, *Vrije Universiteit Amsterdam*—Visual search is speeded when the target-defining property repeats from trial to trial. It is often thought that perceptual priming or weight shifting underlies this effect, giving the target an advantage in selection. Recently, it has been proposed that intertrial effects depend on the relative ambiguity of a task—for example when a distractor is present (Meeter & Olivers, 2006; Olivers & Meeter, 2006). Here, we show that intertrial priming (1) depends only on the ambiguity of the current trial, not on that of the previous trial; (2) is reduced when the distractor becomes more salient; and (3) is increased when the distractor is similar to a possible target, but not when it is similar to the current target. The evidence goes against selection accounts of intertrial priming. Instead, retrieval of the previous target appears to resolve ambiguity by making the task less confusing (Huang, Holcombe, & Pashler, 2004).

1:50–2:05 (204)

**Rethinking Voluntary and Involuntary Spatial Attention.** ALAN KINGSTONE & JELENA RISTIC, *University of British Columbia*, & BETTINA OLK, *International University Bremen*—Spatial orienting has traditionally been investigated using predictive central arrow cues and nonpredictive peripheral onset cues to engage volitional and reflexive attention, respectively. There is a wealth of recent data, however, indicating that central spatially nonpredictive directional cues, like arrows, trigger reflexive orienting. The profound implications that these data have for past and future conceptualizations of volitional and reflexive orienting are discussed. These include, but are not limited to, evidence indicating that traditional measures of volitional orienting have routinely confounded mechanisms of voluntary and involuntary attention.

2:10–2:25 (205)

**The Role of Spatial and Nonspatial Information in Visual Selection.** JAN THEEUWES & ERIK VAN DER BURG, *Vrije Universiteit Amsterdam*—Even though it is undisputed that prior information regarding the location of a target affects visual selection, the issue of whether information regarding nonspatial features such as color and shape has similar effects has been a matter of debate since the early 1980s. In the present study, we used measures derived from signal detection theory and show that perceptual sensitivity is affected by a top-down set for spatial information but not by a top-down set for nonspatial information. Thus, knowing where the target singleton is affects perceptual selectivity; knowing what it is does not help selectivity. Furthermore, perceptual sensitivity can be enhanced by nonspatial features, but only through a process related to bottom-up priming. The present findings have important implications for models of visual selection.

2:30–2:45 (206)

**The Cost of Using Language to Direct Attention.** BRADLEY S. GIBSON & MATTHIAS SCHEUTZ, *University of Notre Dame*—Humans routinely use language to control attention. However, despite

over three decades of research into nature of visual attention, virtually nothing is known about how linguistic symbols are translated into spatial expectancies that are suitable for directing attention. Indeed, the vast majority of previous research has used nonlinguistic symbols such as arrows to study top-down attentional control. Using behavioral evidence obtained from a spatial cuing paradigm as well as a novel connectionist model of visual attention, we found that word cues controlled voluntary attention differently than arrow cues. Although both cues appeared to activate multiple mechanisms of visual attention such as selection and enhancement, word cues consistently generated less activation in these mechanisms across time than arrow cues. Furthermore, the observed differences were attributed to differences in the spatial iconicity of the cues, rather than to differences in complexity or the spatial concepts expressed by the cues.

**2:50–3:05 (207)**

**An Accumulator of Involuntary (and Voluntary) Attention.** WILLIAM PRINZMETAL, *University of California, Berkeley*—Over the last few years, researchers have found differences between voluntary and involuntary attention. For example, Prinzmetal et al. (2005) reported that whereas voluntary and involuntary attention both affected the speed of response in spatial cuing experiments designed around reaction time, only voluntary attention affected accuracy when displays were data limited and there was no speed pressure. In this talk, we present a model of involuntary attention that illustrates how involuntary attention could affect RT without influencing perceptual processing. The theory, based on the “leaky accumulator” model (Usher & McClelland, 2001), accounts for involuntary attention by postulating that involuntary attention primes responses to stimuli presented at the cued location, irrespective of their identity. This theory was tested in experiments in which subjects were put under speed pressure to respond before a deadline. The results were consistent with the accumulator model, but contrary to a perceptual enhancement account of involuntary attention.

#### Metacognition

**Brown Convention Ctr. Rm. 306, Saturday Afternoon, 1:30–2:50**

*Chaired by Colleen M. Kelley, Florida State University*

**1:30–1:45 (208)**

**Sources of the Underconfidence-With-Practice Effect.** COLLEEN M. KELLEY & KATHLEEN A. MULLER, *Florida State University*—People’s ability to accurately monitor their memory is critical to effective control. A puzzling error in such monitoring is the underconfidence-with-practice (UWP) effect. Predictions regarding future memory performance are often overconfident on the first study–test trial but become underconfident on the second trial. Koriat, Sheffer, and Ma’ayan (2002) identified this robust phenomenon in judgments of learning, tested several explanations, and proposed a number more. We tested possible mechanisms for the UWP in a series of cued recall experiments. Experiment 1 investigated whether UWP is due to people’s neglect of the beneficial effects of the first test on later cued recall. Experiment 2 investigated whether UWP arises from basing judgments of learning on performance on the first test trial. Experiment 3 investigated whether UWP is due to neglect of the effects of the second study trial.

**1:50–2:05 (209)**

**The Role of Analytic and Nonanalytic Processes in Subjective Confidence.** ASHER KORIAT & RAVIT NUSSINSON, *University of Haifa*, HERBERT BLESS, *Universität Mannheim*, & NIRA SHAKED, *University of Haifa*—We contrasted analytic and nonanalytic processes underlying subjective confidence by comparing a free-report and a forced-report condition. In both conditions, participants chose an answer to general-knowledge questions and provided reasons in support of their answers. Whereas in the free-report condition they listed all the reasons that came to mind, in the forced-report condition the num-

ber of reasons was experimentally dictated. For the free-report condition, confidence increased with number of reasons, suggesting that it was based primarily on an analytic process that considers the amount of supportive evidence. In the forced-report condition, in contrast, confidence tended to decrease with number of supporting reasons, suggesting a predominant influence of the nonanalytic cue of ease of access. Whereas number of reasons and ease of retrieval are assumed to affect confidence in opposite directions in the forced-report condition, the two cues tend to correlate positively under free reporting, both collaboratively enhancing confidence.

**2:10–2:25 (210)**

**Metacognition of Agency.** JANET METCALFE, *Columbia University*—These experiments investigate people’s metacognitions of agency—that is, the extent to which they feel that they are themselves in control. In a gamelike task in which the person tries to touch “x”s and avoid “o”s, we varied parameters such as speed, difficulty, feedback, the goodness of the mouse control (i.e., turbulence), and how close the player had to come to be scored as correct (i.e., magic). People’s metacognition of control closely mirrored their performance judgments (and their performance) except in the cases of turbulence (when they knew they were out of control despite adequate performance) and magic (when they knew they were not responsible for the favorable outcomes). Implications for our feelings of free will and responsibility, as well as our feelings of “self” and self-involvement, will be discussed.

**2:30–2:45 (211)**

**The Effect of Working Memory Load on Tip-of-the-Tongue States.** BENNETT L. SCHWARTZ, *Florida International University*—Tip-of-the-tongue states (TOTs) are defined as judgments of the likelihood of imminent retrieval for items currently not recalled, whereas feeling-of-knowing judgments (FOKs) are defined as predictions of successful recognition for items not recalled. Because these definitions are similar, it is logical to suppose that the same underlying metacognitive processes dictate both TOTs and FOKs. In Experiment 1, TOTs and FOKs were compared for general information questions. During half of the questions, participants remembered four digits (working memory load) during target retrieval, whereas for the other questions, participants did not have this load. Working memory load did not affect recall, but decreased the number of TOTs and increased the number of FOKs. In Experiment 2, participants maintained six digits during target retrieval. TOTs decreased in the load condition, but FOKs were equivalent in the load and control conditions. This supports a view that TOTs and FOKs are separable metacognitive entities.

#### Mathematical Cognition

**Grand Ballroom F, Saturday Afternoon, 1:30–3:30**

*Chaired by Richard Carlson, Pennsylvania State University*

**1:30–1:45 (212)**

**What Do the Hands Externalize in Simple Arithmetic?** RICHARD A. CARLSON, *Pennsylvania State University*, MARIOS N. AVRAAMIDES, *University of Cyprus*, MELANIE CARY, *University of Wisconsin, La Crosse*, & STEPHEN STRASBERG, *Pennsylvania State University*—Four experiments examined the use of the hands in simple arithmetic tasks. Experiments 1 and 2 demonstrated that pointing increases both accuracy and speed in counting arrays of items, whether those items are identical or distinctive. Experiment 3 demonstrated that individuals tend to nod their heads when not allowed to point, and that nodding is associated with greater accuracy, suggesting that pointing is functional for reasons other than simply providing additional visual information. Experiment 4 examined changes in private speech in adding arrays of digits, depending on whether participants were allowed to use their hands to manipulate the tokens on which digits were presented. Taken together, the results of these experiments are

consistent with recent research suggesting that gesture can serve to reduce cognitive load, and suggest that the hands can provide external support for binding numerical representations to their functional roles.

#### 1:50–2:05 (213)

**The Growth of Children's Arithmetic: Problem-Size Effects in Single-Digit Addition.** JO-ANNE LEFEVRE & MARCIE PENNER-WILGER, *Carleton University*, BRENDA L. SMITH-CHANT, *Trent University*, LISA FAST, *Carleton University*, SHERI-LYNN SKWAR-CHUK, *University of Winnipeg*, & JEFFREY BISANZ, *University of Alberta*—Elementary school children in Grades 1 through 4 (over 200 children in total) were tested for 2 or 3 consecutive years. Each year, they answered single-digit addition problems (e.g.,  $2 + 3$ ) presented on a computer. Latencies and accuracy of responses were recorded. The children also completed a variety of other numerical measures, including counting and number recognition as well as measures of more general cognitive skills, including digit span, vocabulary, and spatial span. Cognitive skills and numerical knowledge were used to predict changes in problem-size effects over time.

#### 2:10–2:25 (214)

**Bidirectional Links in Multiplication Fact Retrieval?** JAMIE I. D. CAMPBELL & NICOLE D. ROBERT, *University of Saskatchewan*—There are multiple sources of evidence that skilled adults' memory for multiplication facts ( $6 \times 9 = 54$ ) incorporates bidirectional links from factors to products and from products to factors. Surprisingly, however, we did not find evidence that practice of specific factoring problems ( $54 = ? \times ?$ ) facilitated performance of corresponding multiplication problems ( $6 \times 9 = ?$ ). We also found no evidence of facilitative transfer of practice from multiplication ( $6 \times 9 = ?$ ) to factoring ( $54 = ? \times ?$ ); in fact, multiplication practice produced item-specific interference with factoring. The results raise questions about the nature and limits of bidirectional processing in multiplication fact retrieval.

#### 2:30–2:45 (215)

**Getting a Grip on Numbers: Numerical Magnitude Priming in Object Grasping.** OLIVER LINDEMANN & JUAN M. ABOLAFIA, *Radboud Universiteit Nijmegen*, GIOVANNA GIRARDI, *Università di Roma, La Sapienza*, & HAROLD BEKKERING, *Radboud Universiteit Nijmegen* (sponsored by Harold Bekkering)—The present study investigates the functional connection between mathematical cognition and motor actions. Participants indicated the parity status of Arabic digits by means of different reach-to-grasp movement toward an object. We observed that precision grip actions were initiated faster in response to small numbers, whereas power grips were initiated faster to large numbers. In addition, the analysis of the grasping kinematics revealed an enlarged grip aperture in presence of large digits. The magnitude priming effects of numbers in the reach onset times were also present when controlling for the amount of fingers involved in the grasping. However, priming effects disappeared when participants merely reached out for the object without grasping it (i.e., pointing movements). Our findings demonstrate that the coding of numerical quantity interferes with the coding of action-related magnitude information and suggest that number processing and motor preparation share common cognitive codes within the same generalized magnitude system.

#### 2:50–3:05 (216)

**Approximate Quantification in Young and Older Adults: An fMRI Study.** DELPHINE GANDINI & PATRICK LEMAIRE, *CNRS and Université de Provence* (read by Patrick Lemaire)—Young and older adults estimated numerosities of collections of 20–50 dots. Trial-by-trial strategy reports, accuracy, and latency revealed that (1) both young and older participants used two main strategies to estimate numerosities: the benchmark strategy (i.e., participants visually encoded the whole set of dots and retrieved an approximate numerical representation in long-term memory) and the anchoring strategy (i.e.,

participants first counted several dots and then estimated the remaining dots on the basis of the first counting and on the surface occupied by the remaining dots); (2) these strategies exhibited different patterns of speed and accuracy; (3) when participants had to use each strategy on all problems, there were no differences between young and older adults' performance; and (4) fMRI data specified the neural bases of age-related differences in approximate quantification. These results have implications for further understanding approximate quantification skills and age-related differences in these skills.

#### 3:10–3:25 (217)

**Processing of Ordinal Information: The Contribution of Parietal Cortex.** WIM FIAS, TOM VERGUTS, FILIP VAN OPSTAL, & JAN LAMMERTYN, *Universiteit Gent* (sponsored by Patrick Lemaire)—Processing of numbers is known to critically rely on parietal cortex. In two fMRI experiments, we investigated whether parietal cortex is also involved in the processing of ordinal information. In the first experiment, we scanned subjects while they learned the implicit order of arbitrary stimuli. With learning, activation in hippocampus and in parietal cortex increased, confirming that parietal cortex plays an important role in the representation and processing of ordinal information. In the second experiment, we took a more direct approach to investigate the commonalities and differences in the neural processing of number and order. We investigated bold responses during number comparison (i.e., which of two numbers is largest) and during letter comparison (i.e., which of two letters appears later in the alphabet). Both comparison tasks activated the same parietal areas. No material-specific parietal activations were observed. We conclude that the neural processing of order and number are closely related.

#### Comprehension of Text and TV

##### Grand Ballroom I, Saturday Afternoon, 1:30–2:50

Chaired by Danielle S. McNamara, *University of Memphis*

#### 1:30–1:45 (218)

**The Coh-Metrix Project: Interactive Effects of Reader and Text on Comprehension.** DANIELLE S. McNAMARA, MAX LOUWERSE, RANDY FLOYD, YASUHIRO OZURU, RACHEL BEST, & ARTHUR C. GRAESSER, *University of Memphis*—The goal of the Coh-Metrix Project (cohmetrix.memphis.edu) is to develop a tool that measures cohesion and to conduct experiments to investigate the interactive effects of text and reader factors, including text cohesion, text genre, text familiarity, and readers' abilities (reading skill, working memory, prior knowledge). We have conducted a series of experiments using both comprehension measures and eyetracking procedures. These studies have confirmed that greater cohesion in text benefits readers, but only under certain circumstances. The experiments have also shown that comprehension and reading behaviors measured by eyetracking reveal different aspects of the comprehension process. The studies have further confirmed that text familiarity and readers' prior knowledge greatly influence comprehension and reading behaviors. This talk will summarize results from six experiments conducted with young readers (Grades 3–5) and adult college students.

#### 1:50–2:05 (219)

**Analysis of Tutorial Dialogue on Cohesion and Language With Coh-Metrix.** MOONGEE JEON, ARTHUR C. GRAESSER, DANIELLE S. McNAMARA, MAX LOUWERSE, & ZHIQIANG CAI, *University of Memphis* (read by Arthur C. Graesser)—We have analyzed tutorial dialogue using Coh-Metrix, a Web-based computer tool we developed that analyzes text and discourse on over 400 measures of language, cohesion, and readability. The modules of Coh-Metrix integrate lexicons, part-of-speech classifiers, syntactic parsers, semantic templates, latent semantic analysis, and other components that have been developed in computational linguistics. Coh-Metrix was used in this study to compare the tutorial dialogues of human tutors

versus AutoTutor, an animated pedagogical agent that helps students learn about conceptual physics by holding a dialogue in natural language. Our analysis showed substantial similarities in the tutorial dialogue with human tutors versus AutoTutor, but there were differences in coreference, semantic/conceptual overlap, syntax, connectives, causal cohesion, logical operators, and other measures. We explored the extent to which the language of student learners was aligned with the tutor and could predict deep learning of conceptual physics.

2:10–2:25 (220)

**Comprehending Expository Text: An Individual Differences Analysis.** MURRAY SINGER, *University of Manitoba*—Causal analysis in comprehending expository text is facilitated by causal connectives and the adjacent appearance of causally related ideas. The present study invoked previous demonstrations that two independent reader characteristics that regulate comprehension are (1) the reading span index of working memory efficiency and (2) predisposition to access relevant knowledge during comprehension (Singer & Ritchot, 1996). The absence of a connective between causally related ideas should impede comprehension for low-access readers but not necessarily low-reading-span readers, and vice versa for greater distances between crucial ideas. Experiments 1 and 2, respectively, manipulated the use of connectives to link crucial ideas and the distance between those ideas. As predicted, on the measure of answer time for a critical question, Experiment 1 revealed a main effect of access and an access  $\times$  connective interaction, but no reading span effects. Experiment 2 revealed the exactly complementary pattern. These results confirm and clarify the principles of the comprehension of expository text.

2:30–2:45 (221)

**Comprehension and Memory for TV Drug Ads.** RUTH S. DAY, *Duke University*—TV ads for prescription drugs last only 30–60 sec yet contain a heavy information load. To what extent do people understand and remember key information such as benefits and risks? Participants viewed ads, and then we tested them using various cognitive tasks (attention, memory, comprehension, problem solving). They performed much better on benefits than on risks. Although various factors may be involved (such as fear of bad outcomes), “cognitive accessibility” played a heavy role. We calculated the cognitive accessibility of the ads, on the basis of various memory and psycholinguistic principles. Benefits were provided in more accessible ways than risks. To test the cognitive accessibility interpretation further, we produced a new TV ad for a hypothetical drug and manipulated various cognitive accessibility factors. When risks were presented in a more cognitively accessible way, performance improved by 80%–800%. Implications for cognitive research, everyday cognition, and health outcomes are discussed.

#### Lexical Processing

Grand Ballroom JKL, Saturday Afternoon, 4:10–5:30

Chaired by Kenneth I. Forster, *University of Arizona*

4:10–4:25 (222)

**Using the Maze Task to Measure Lexical Processing During Sentence Processing.** KENNETH I. FORSTER, *University of Arizona*—Measuring the time taken to process individual words during sentence processing is difficult using self-paced reading methods, and eyetracking appears to be more appropriate. However, it is difficult to know how much processing is completed during the initial fixation and how much is completed during the subsequent saccade. An improved self-paced reading method (the maze task) requires the reader to choose which of two words could continue a sentence. This forces incremental processing at all levels. This method yields estimates of the frequency effect that correspond closely to the values generated by a lexical decision task, whereas eyetracking estimates are generally much smaller.

4:30–4:45 (223)

**Visual Word Recognition and the Mouse-Tracking Paradigm.** JAY G. RUECKL, KAREN AICHER, & DANIEL YAFFEE, *University of Connecticut and Haskins Laboratories*, & MICHAEL J. SPIVEY, *Cornell University*—In the mouse-tracking paradigm, subjects in standard reaction-time tasks respond by moving the cursor from one point to another on a computer screen. Spivey, Grosjean, & Knoblich. (PNAS, 2005) demonstrated that the temporal and spatial characteristics of these cursor movements are shaped by the moment-by-moment dynamics of spoken word recognition, and thus that this paradigm provides an informative alternative to the standard keypress method. In the present experiments we applied this paradigm to visual word recognition. Our results demonstrate how the response trajectories in a visual lexical decision task are influenced by factors such as frequency and lexicality. We also show that this method opens the door to a new set of potentially valuable experimental manipulations.

4:50–5:05 (224)

**The Power Law of Word Frequency in Lexical Decision.** JEFFREY N. ROUDER, *University of Missouri, Columbia*, & FRANCIS TUERLINCKX, *Katholieke Universiteit Leuven*—The conventional wisdom is that mean response time (RT) in a lexical decision task decreases with the logarithm of word frequency. We find that mean RT decreases about 35 msec for each doubling of frequency. This wisdom, however, is contradicted by a more sophisticated distributional analysis. We assessed how word frequency affects RT distributions with a Bayesian hierarchical model in which variability from individuals and items are modeled simultaneously. Analysis reveals that the effect is on the scale rather than on the location of RT distributions. Scale decreased about 11% for every doubling of word frequency. This statement is concordant with a power law relationship between mean RT and word frequency rather than with the conventional logarithmic one. The result is concordant with linear information accumulation models such as Morton’s logogen model and Ratcliff and colleagues’ diffusion model.

5:10–5:25 (225)

**Individual Differences in Lexical Processing and Cerebral Asymmetries.** CHRISTINE CHIARELLO, SUZANNE WELCOME, LAURA K. HALDERMAN, & JANELLE JULAGAY, *University of California, Riverside*, RONALD OTTO, *Computerized Diagnostic Imaging Center, Riverside*, & CHRISTIANA M. LEONARD, *University of Florida, Gainesville*—We introduce the Biological Substrates for Language Project, a large-scale investigation of the association between individual differences in cortical anatomy and variations in visual word recognition, reading, and cerebral lateralization. Participants received seven divided visual field tasks (lexical decision, word and nonword naming, masked word recognition, semantic decision, verb and category generation); standardized reading, IQ, and handedness assessments; and a structural MRI scan. Behavioral findings from the first wave of data collection ( $N = 110$ ) will be presented. We will report task intercorrelations and the relationship of asymmetry and consistency of asymmetry to standardized tests and overall performance. Preliminary findings indicate a different pattern of task correlations for each visual field and some interesting correlates of consistency of asymmetry.

#### Models of Recognition Memory

Grand Ballroom GH, Saturday Afternoon, 3:30–5:30

Chaired by Andrew Heathcote, *University of Newcastle*

3:30–3:45 (226)

**Recollection and Familiarity in Recognition Memory: Evidence From Receiver Operating Characteristics.** ANDREW HEATHCOTE & FRANCES RAYMOND, *University of Newcastle*, & JOHN C. DUNN, *University of Adelaide*—Does recognition memory rely on discrete evidence, continuous evidence, or both? Is information about details available from discrete recollection or continuous information based

on different sets of retrieval cues (cue-dependent familiarity)? We collected data from two item recognition paradigms thought to promote discrete recollection: a paradigm using lures that differ from studied item in plurality and a list discrimination paradigm. Six models were fit, allowing combinations of discrete recollection, cue-dependent familiarity, and unequal familiarity variance. Cue-dependent unequal variance familiarity provided the best model of the plurals data. For list discrimination, discrete recollection provided an improvement, but only when combined with cue-dependent unequal variance familiarity. We reasoned that the presence of lures never studied in either plurality or list might have discouraged recollection in these experiments because these lures could be discriminated on the basis of cue-independent familiarity alone. Two further experiments omitting these lures found no evidence for discrete recollection.

**3:50–4:05 (227)**

**Negative Remembering.** AYCAN KAPUCU, NEIL A. MACMILLAN, & CAREN M. ROTELLO, *University of Massachusetts, Amherst* (read by Neil A. Macmillan)—In recognition memory for words, rating-based ROCs are generally consistent with continuous signal-detection models. In one notable exception, discrimination of words that differ only in whether they are singular or plural can produce linear ROCs consistent with threshold models (Rotello, Macmillan, & Van Tassel, 2000). The intercepts of these ROCs can be interpreted as the rates at which recall-to-accept and recall-to-reject processes take place. We tested this idea by asking subjects to provide remember-know judgments, including the possibility of “negative remembering”—for example, remembering that *frog* had been studied when *frogs* was tested. The rate of “remember” responses, corrected according to a threshold model, was in good agreement with the estimated intercepts.

**4:10–4:25 (228)**

**Analysis of RT Distributions in the Remember-Know Paradigm.** CAREN M. ROTELLO & MIN ZENG, *University of Massachusetts, Amherst*—Do remembering and knowing differ qualitatively (reflecting distinct underlying processes) or quantitatively (reflecting different levels of strength)? Broadly speaking, models of remember-know judgments based on these alternatives have been tested by examining the proportion of “remember” and “know” responses that are made across conditions or levels of confidence. Here, we consider the implications of these models for reaction time data. We replicate Dewhurst and Conway’s (1994) observation that “old” judgments followed by “remember” responses are faster, on average, than those followed by “know” decisions, but show that this effect is largely due to differing distributions of “remember” and “know” responses across confidence levels. In addition, fits of ex-Gaussian distributions of “old” response times for both “remember” and “know” judgments indicate that “remember” and “know” responses are based on the same underlying cognitive processes.

**4:30–4:45 (229)**

**A Direct Test of the Unequal-Variance Signal-Detection Model of Recognition Memory.** LAURA MICKES, JOHN T. WIXTED, & PETER WAIS, *University of California, San Diego* (read by John T. Wixted)—Analyses of the receiver operating characteristic (ROC) almost invariably suggest that, on a recognition memory test, the standard deviation of memory strengths associated with the targets (*s*-target) is greater than that of the lures (*s*-lure). Often, *s*-lure/*s*-target is approximately 0.80. However, that conclusion is based specifically on a Gaussian detection model. We investigated this issue in a more direct way by asking subjects to simply rate the memory strengths of targets and lures using a 99-point scale. From these ratings, means and standard deviations could be directly computed. The results showed that the standard deviation of the ratings made to the targets was larger than the standard deviation of the ratings made to the lures. Moreover, across subjects, the *s*-lure/*s*-target ratio values computed directly from the ratings correlated highly with the ratio estimate obtained from ROC analysis (and both ratios were, on average, approximately equal to 0.80).

**4:50–5:05 (230)**

**Contrasting Dual-Process and Unequal-Variance Signal Detection Models of Recognition Memory.** COLLEEN M. PARKS, ANDREW P. YONELINAS, & NEAL E. KROLL, *University of California, Davis* (sponsored by Neal E. Kroll)—The dual process signal detection (DPSD) model has been used to account for results from a wide range of recognition memory paradigms. However, a number of concerns have been raised about the model, and it has been suggested that an unequal variance signal detection (UVSD) model can provide an equally good, or even better, account of the data. We clarify the core assumptions of the DPSD model and the way it is applied to different paradigms, to dispel some common misconceptions. We then review the literature relevant to a comparison of the two models and show that the DPSD model provides a better account of recognition memory than does the UVSD model. Finally, we consider possible modifications of the UVSD model that might bring the model more in line with the data.

**5:10–5:25 (231)**

**Testing a Hippocampal Model of Source Recollection.** ANDREW P. YONELINAS, *University of California, Davis*, KANE ELFMAN, *Swinburne University*, & COLLEEN M. PARKS, SHAWN BOLIN, & ISAAC LIAO, *University of California, Davis*—Receiver operating characteristics (ROCs) observed in source recognition tests are typically U-shaped when plotted in *z*-space. The extent to which the source *z*ROCs are U-shaped, however, can vary considerably, and the factors influencing the shape of *z*ROC are not well understood. In the present study, we examined the ability of the complementary learning systems (CLS) model (Norman & O’Reilly, 2003) to account for these results and empirically tested a novel prediction of the model which is that as the studied items become less distinct, the threshold nature of the recollective signal produced by the hippocampus should break down and the *z*ROCs should become more linear. The results from several source recognition experiments confirmed the predictions of the model and indicated that the model provides a viable account of source recollection. The results are found to be problematic for a wide variety of alternative recognition memory models.

**Visual Processing**

**Grand Ballroom DE, Saturday Afternoon, 3:30–5:30**

*Chaired by Angela J. Yu, Princeton University*

**3:30–3:45 (232)**

**A Bayesian View of Sensory Conflicts in Decision Making.** ANGELA J. YU, *Princeton University*, PETER DAYAN, *University College London*, & JONATHAN D. COHEN, *Princeton University* (sponsored by Jonathan D. Cohen)—In this work, we present a formal analysis of the computations underlying decision-making tasks in which the sensory inputs provide conflicting information. These tasks have been used to study a wide variety of related cognitive functions, such as decision making, error detection, conflict monitoring, automaticity, and selective attention. In particular, we concentrate on the Eriksen task, a classical paradigm for studying the integration of conflicting sensory information, and the role of selective attention in controlling this integration. We propose two distinct Bayesian models that will be shown to explain existent behavioral data, one focusing on stimulus compatibility and the other on spatial uncertainty. We demonstrate that under certain extensions to the classical Eriksen task, the two models make distinct predictions amenable to experimental verification.

**3:50–4:05 (233)**

**Space and Time, Not Surface Features, Guide Object Persistence.** STEPHEN R. MITROFF, *Duke University*, & GEORGE A. ALVAREZ, *Massachusetts Institute of Technology*—Successful visual perception relies on the ability to keep track of distinct entities as the same objects persisting from one moment to the next. This is a computationally difficult process, and its underlying nature remains unclear. Here, we use the object file framework to explore whether surface feature

information (e.g., color, shape) can be used to compute such object persistence. In three experiments using a wide variety of surface feature information, including color, shape, size, luminance, and topography, we find that spatiotemporal information (location as a function of time) easily determines object files, but surface features do not. The results suggest a strong constraint on the visual system's ability to compute object persistence.

#### 4:10–4:25 (234)

**Object Substitution Masking and Face Processing: ERP Evidence for Early Interference.** JASON E. REISS & JAMES E. HOFFMAN, *University of Delaware* (read by James E. Hoffman)—Object substitution masking (OSM) refers to impaired target identification caused by common onset, but delayed offset, of a surrounding dot mask. This effect is believed to result from reentrant processes that replace an initial “target + mask” representation with one comprised only of mask information. However, few studies have addressed the extent of processing associated with masked targets. We investigated this issue by examining the effect of OSM on the N170 event-related potential (ERP) component, which reflects the degree of structural encoding of perceived face stimuli. Participants viewed a display in which a cropped face or nonface “target” picture was surrounded by dots. As expected, delayed dot offset led to significantly impaired target classification. Importantly, the N170 component was also diminished by OSM. These results indicate that OSM can interfere with face processing at an early stage of encoding and categorization. Findings are discussed in terms of reentrant mechanisms and previous OSM-ERP research.

#### 4:30–4:45 (235)

**Object-to-Feature Interference in a Visual Search Task When Top-Down Impairs Bottom-Up Decision.** ZHAOPING LI, *University College London*, & NATHALIE GUYADER, *Laboratoire des Images et des Signaux* (sponsored by Nigel Harvey)—In our visual search task, the target had a unique (lower level) orientation feature but was identical to distractors in its (higher level) object shape. Through bottom-up processes, the unique feature attracted gaze to the target. Subsequently, viewpoint-invariant object recognition interfered, causing the attended object to be recognized as having the same shape as the distractors. Consequently, gaze often abandoned the target to search elsewhere. If the search stimulus was extinguished at time T after the gaze arrived at the target, reports of target location were more accurate for shorter ( $T < 500$  msec) than for longer presentations. This object-to-feature interference occurs because top-down signals counteract the bottom-up decision. It could underlie familiarity-based visual search asymmetry that finding a familiar object, such as a letter N, among its mirror images is more difficult than the converse, since excess proficiency in object recognition in familiar poses should exacerbate object-to-feature interference.

#### 4:50–5:05 (236)

**Visual Gestalts: Search Asymmetries With Emergent Features.** MARY C. PORTILLO & JAMES R. POMERANTZ, *Rice University* (read by James R. Pomerantz)—We examined visual search asymmetries between stimuli differing in emergent features (EFs, or gestalts) rather than in basic features (BFs). First we identified EFs via configural superiority effects, wherein two stimuli differing in BFs (A and B) become more discriminable by adding informationless context (C) in odd quadrant localization tasks, such that Target AC is easier to spot in a field of three BC distractors than is Target A in a field of three B distractors). Then we looked for asymmetries arising with EF but not with BF displays. We found consistent asymmetries with five EFs: proximity (finding a far target among near distractors is faster than the reverse), orientation (finding a diagonal among horizontals is faster than finding one among verticals), symmetry (asymmetric among symmetric is faster), linearity (nonlinear among linears is faster), and inside/outside (outside among insides is faster). Thus, EFs and BFs behave similarly in visual search and may be equally fundamental in vision.

#### 5:10–5:25 (237)

**Which Visual Images Are Detected Best?** ALBERT J. AHUMADA, JR. & ANDREW B. WATSON, *NASA Ames Research Center*, & LAUREN V. SCHARFF, *Steven F. Austin State University*—Watson, Barlow, and Robson (1983) rated visual stimuli in terms of the least contrast energy necessary for detection and found a Gabor to be the best stimulus. We have plotted the thresholds for the 43 Modelfest images in contrast energy. The best Gabor is slightly worse than a small 4-min-wide spot. When the contrast sensitivity function is taken into account, the best spot is the smallest one (1.0 arc min) and the overall best stimulus is a very small 16-cpd Gabor. The detectability of these small images can be explained by weak spatial summation in the fovea. When summation is accounted for, the spots and the Gabors are all approximately equal and the best stimulus is a narrow 1° long line. Additional studies on the detectability of lines and edge-like dipoles indicate that these stimuli are at least as detectable as spots and Gabors.

#### Concept Learning

**Brown Convention Ctr. Rm. 306, Saturday Afternoon,  
3:10–5:30**

*Chaired by Brian H. Ross,  
University of Illinois, Urbana-Champaign*

#### 3:10–3:25 (238)

**Action Information From Classification Learning.** BRIAN H. ROSS, RANXIAO F. WANG, ARTHUR F. KRAMER, DANIEL J. SIMONS, & JAMES A. CROWELL, *University of Illinois, Urbana-Champaign*—Much of our learning comes from interacting with items. In category learning research, recent work has argued that different ways of learning categories may influence what is learned, but this work has focused on cognition interactions (e.g., inference, problem solving). In the present experiments, we investigated physical interactions with objects. In particular, we asked whether arbitrary actions used during classification learning with objects might be incorporated into object representations and influence later recognition judgments. In a virtual-reality chamber, subjects used distinct arm movements to make different classification responses to objects from different categories. During a subsequent recognition test phase, these objects required arm movements that were consistent or inconsistent with the classification movement. Consistent movements were facilitated relative to inconsistent movements, suggesting that arbitrary action information is incorporated into the representations.

#### 3:30–3:45 (239)

**Category Learning in Children and Adults: Can Kids Learn to Follow the Rules?** AMY S. DESROCHES & JOHN PAUL MINDA, *University of Western Ontario* (read by John Paul Minda)—We investigated the ability of 3-, 5-, and 8-year-old children as well as adults to learn perceptual categories. In one experiment, adults and children performed comparably on categories that could be learned by either a single-dimensional rule or by associative learning. Children were impaired relative to adults in learning categories defined by a disjunctive rule and categories that were nonlinearly separable. These results are consistent with a multiple-systems approach and suggest that younger children have not fully developed the same explicit category learning system as adults. In a second experiment, 5-year-olds and adults first viewed all of the stimuli and named all of the features of each item prior to learning either disjunctive or family resemblance categories. In this experiment, children and adults performed comparably on the disjunctive categories, suggesting that reducing the task demands allows the explicit system to operate.

#### 3:50–4:05 (240)

**Effects of Linguistic Context and Age of Exposure to English on Attention to Manner of Motion.** ALAN W. KERSTEN, *Florida Atlantic University*, CHRISTIAN A. MEISSNER, *University of Texas*,

*El Paso*, BENNETT L. SCHWARTZ, *Florida International University*, ADAM IGLESIAS, *Florida Atlantic University*, & JUSTIN S. ALBRECHTSEN, *University of Texas, El Paso*—Sixty monolingual English speakers and 240 bilingual Spanish–English speakers were tested on a category learning task in which either the manner of motion or the path of an alien creature was diagnostic of category membership. Half of the bilinguals were tested in an English linguistic context, whereas half were tested in Spanish. Bilinguals tested in English performed identically to monolinguals in both the manner and path discriminations. Bilinguals tested in Spanish performed equivalently to monolinguals and bilinguals tested in English on the path discrimination, but performed more poorly than both groups on the manner discrimination. The performance of bilinguals tested in Spanish on the manner discrimination was negatively correlated with age of acquisition of English, indicating better performance in participants with early exposure to English. Performance on the path discrimination was unrelated to age of acquisition. These results will be discussed in relation to the Whorfian hypothesis and theories of bilingualism.

#### 4:10–4:25 (241)

**How Individuals Learn Simple Boolean Systems.** GEOFFREY P. GOODWIN & PHILIP N. JOHNSON-LAIRD, *Princeton University*—The aim of the present experiments was to discover the factors underlying the difficulty of learning Boolean concepts. In contrast to previous research, which has investigated categorization tasks (e.g., Feldman, 2000; Nosofsky et al., 1994), we presented participants with a simple task in which they needed to work out how three switches controlled a light and then describe the concept. Experiments 1 and 2 demonstrated that the number of possibilities for turning on the light, and the number of switches required to turn on the light (relational complexity), influenced conceptual difficulty but showed no effect of minimal Boolean complexity. Experiments 3 and 4 highlighted individuals' use of learning strategies that extend beyond the syntax of Boolean algebra. In sum, the experiments indicated that minimal complexity is a limited theoretical framework for understanding Boolean concept learning. An alternative approach that recognizes the independent effects of several conceptually distinct variables is suggested.

#### 4:30–4:45 (242)

**The Emergence of Multiple Learning Systems.** BRADLEY C. LOVE & MATT JONES, *University of Texas, Austin*—Multiple learning systems models hold that separate learning systems, often organized around discrepant principles, combine their outputs to support human categorization. Rather than propose a complex model, we adopt a complex systems' viewpoint and propose that multiple learning systems emerge from a flexible and adaptive clustering mechanism's interactions with the environment. The model, CLUSTER Error Reduction (CLUSTER), retains the flexibility characteristic of human learning by building knowledge structures as needed to support a learner's goals. Importantly, CLUSTER can apply ostensibly different procedures to different parts of the stimulus space, a hallmark of multiple systems models. An illustrative simulation is considered in which CLUSTER develops a "dual route" solution to capture rule-plus-exception human learning and recognition data. Finally, the results from a behavioral experiment that tests CLUSTER's predictions concerning simultaneous learning of multiple category systems are discussed, as well as CLUSTER's relation to findings from the cognitive neuroscience of category learning.

#### 4:50–5:05 (243)

**Context Effects in Category Learning: An Exploration of Bayesian Models.** MICHAEL C. MOZER, *University of Colorado, Boulder*, MICHAEL JONES, *Indiana University, Bloomington*, & MICHAEL SHETTEL, *University of Colorado, Boulder*—When an individual is asked to categorize a sequence of items, context effects arise: Categorization of one item influences category decisions for subsequent

items. Specifically, after an instance of some target category is presented, the category prototype is pulled toward the instance and the prototypes of other categories are pushed away. Analogous context effects occur in production tasks. These "push" and "pull" effects diminish with experience. We propose and evaluate two principled Bayesian accounts of context effects in categorization. In these accounts, the probability of an instance given a category is encoded as a Gaussian density in feature space, and categorization involves computing category posteriors given an instance. The models differ in how category parameters (means and variances) are updated given an instance. One model updates parameters to maximize the likelihood of the instance, and the other uses a Kalman filter to reestimate the uncertainty distribution of each category.

#### 5:10–5:25 (244)

**The Generalization Hypothesis of Abstract Concept Learning.** ANTHONY A. WRIGHT, *University of Texas Medical School, Houston*, & JEFFREY S. KATZ, *Auburn University*—The first test of the generalization hypothesis of abstract concept learning was conducted with rhesus monkeys, capuchin monkeys, and pigeons learning an expanding training-set, same/different task. Unlike concept learning based on rules relating stimuli of each pair, generalization is based on learning the unique features of stimulus pairs and transfer is based on similarity of transfer to training pairs. The generalization hypothesis predicted increases in trials to acquisition with training-set doublings, but all species showed decreases despite the exponential increase in training pairs to be learned. These differences between predicted and obtained acquisition were not substantially altered by substantial reductions in pairs to be learned or trials in which to learn pairs. The failure of the generalization hypothesis to account for these learning results is central to establishing that transfer to novel stimulus pairs by these species was not based on generalization from individual training pairs but on the same–different relationship with the abstract concept.

#### Aging and Memory

#### Grand Ballroom F, Saturday Afternoon, 3:50–5:30

Chaired by Valerie F. Reyna, *Cornell University*

#### 3:50–4:05 (245)

**Measuring Dual-Retrieval Processes in Aging and Cognitive Impairment.** VALERIE F. REYNA & CHARLES J. BRAINERD, *Cornell University*, & FARRELL J. LLOYD, *Mayo Clinic*—Separating the contributions of dual-retrieval processes to the memory declines that occur during normal aging and in various forms of cognitive impairment have been the focus of much recent research. Although qualitative methodologies, such as remember/know and item versus associative recognition, have been implemented, mathematical models are essential to ensure clean separation and precise quantification of deficits, especially of opponent processes. However, the most commonly used modeling technologies—process dissociation, conjoint recognition, and dual ROC—may impose unacceptable performance demands on impaired populations. We studied an alternative modeling technology that is very low demand because it is defined over simple repeated recall. We applied it to a commonly used clinical test of memory impairment, the Rey task, using data from young adults, healthy aged adults, and impaired aged adults. Excellent model fits were obtained in all groups, and patterns of loss and sparing of dual-retrieval processes conformed to theoretical expectations.

#### 4:10–4:25 (246)

**Assessing Potential Factors That Mediate Age-Related Associative Deficits in Episodic Memory.** MOSHE NAVEH-BENJAMIN, ANGELA KILB, & YOKO HARA, *University of Missouri, Columbia*—One notion put forth to explain age-related episodic memory decline is the associative deficit hypothesis, according to which the decline is partially due to older adults' inability to encode separate components

of episodes as cohesive units. In the present research, we assessed the role of several factors thought to mediate age-related changes in cognition and evaluated their function in the associative deficit. Several experiments assessed the degree to which speed of processing, attentional resources, inhibitory processes, and sensory loss, may underlie older adults' difficulty in encoding and retrieval of associative information.

#### 4:30–4:45 (247)

**Prospective Memory and Aging: Evidence for Preserved Spontaneous Retrieval Processes in Older Adults.** GILLES O. EINSTEIN, MICHAEL SCULLIN, RACHEL BISHOP, & KATIE ARNOLD, *Furman University*, & MARK A. McDANIEL, *Washington University*—Prospective remembering can be accomplished by controlled processes that monitor the environment for target events or by spontaneous processes that reflexively respond to the presence of target events. Following Craik's (1986) theory that normal aging has minimal effects on relatively automatic retrieval processes, the purpose of the present research was to examine whether spontaneous retrieval processes that might underlie prospective memory are preserved in older adults. We examined this by presenting target events during a lexical decision task in which participants were asked to suspend their prospective memory intention. Slowed responding to target events appearing in this context revealed spontaneous retrieval, and, importantly, the levels of slowing were similar for younger and older adults. These results suggest that normal aging does not compromise spontaneous retrieval processes.

#### 4:50–5:05 (248)

**General and Material-Specific Interference Effects of Divided Attention on Remembering and Knowing in Younger and Older Adults.** ERIN I. SKINNER & MYRA A. FERNANDES, *University of Waterloo* (read by Myra A. Fernandes)—We examined how manipulations of attention affect recollective and familiarity-based retrieval processes. Younger and older adults studied a list of words, and in a later auditory recognition test indicated whether each word was remembered, known, or new. Retrieval was performed under full or divided attention (DA) conditions with either an odd-digit task to numbers or an animacy task to words, presented visually. Younger and older adults showed an increase in false remember responses during both DA conditions, indicating a general effect of attention on recollection. Both age groups also showed decreased accuracy in know responses only during the word-based DA condition, indicating a material-specific effect on familiarity. Aging was associated with decreased accuracy in remember but not know responses, and with increased latency in distracting task responses under DA conditions. The results suggest that recollective processes rely on attentional resources, whereas familiarity processes rely on the reactivation of content-specific representations.

#### 5:10–5:25 (249)

**Health Moderators and Mediators of Cognitive Sex Differences.** ÅKE WAHLIN & LARS-GÖRAN NILSSON, *Stockholms Universitet* (sponsored by Lars-Göran Nilsson)—Sex differences in adult cognitive functioning are well documented. Prominent theoretical accounts refer to sex steroid differences or differentially sized cortical regions, differential life experience, and social expectations. We present population-based results concerning the impact of medical health on cognitive sex differences. At odds with some previous findings, the effects of medical health were similar in men and women (i.e., sex differences were not moderated by variation in medical health). However (and in accordance with other reports), inspection of mediating effects (the extent to which sex differences were accounted for by health variation) revealed that, overall, cognitive sex differences were both suppressed and accounted for by health differences, but differently in men and in women. When the impact of health variables was controlled, sex differences tended to magnify on tests for which there was a female advantage but disappear where there was a male advantage.

### Skill Acquisition

#### Grand Ballroom I, Saturday Afternoon, 3:10–5:10

Chaired by William B. Whitten II, *Fordham University*

#### 3:10–3:25 (250)

**Guided Cognition of Unsupervised Learning: Designing Effective Homework.** 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 assignments. Examples include relate to prior experience, illustrate visually, consider divergent answers, role play, and brainstorm. Average- and advanced-ability high school English students performed 21 and 18 percentage points higher on a quiz, respectively, after guided cognition homework, compared to traditional homework. When study time was controlled and when teaching was eliminated, average and advanced students still performed 18 and 6 percentage points better, respectively, after guided cognition homework. When students were allowed to spend as much time as desired to perform the homework, quiz performance was again better after guided cognition homework, and there were no significant correlations of study time with quiz performance.

#### 3:30–3:45 (251)

**The Effect of Presentation Format on Mental Model Acquisition.** MARGARET S. CHAN & JOHN B. BLACK, *Teachers College, Columbia University* (read by John B. Black)—Middle school students learned mental models for systems of three levels of complexity (simple, moderate and complex) from one of three different presentation formats: text, text plus static diagrams and text plus direct manipulation animation. Direct manipulation (or user-controlled) animation is where the student moves a slider (or some other haptic manipulation) to manipulate the value of one variable and while immediately seeing animated depictions of related changes in other variables. Text was sufficient for seventh grade students to learn simple systems, but text plus static diagrams were needed for moderate complexity and text plus direct manipulation animation was needed for complex systems. In contrast, sixth graders needed text plus direct manipulation animation for systems at all three levels of complexity. Thus capability of the students interacted with system complexity to determine the best presentation format for learning mental models of systems.

#### 3:50–4:05 (252)

**Following Verbal and Spatial Navigation Instructions: Training, Retention, and Transfer.** VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado, Boulder*, IMMANUEL BARSHI, *NASA Ames Research Center*, & JAMES A. KOLE, *University of Colorado, Boulder*—Two experiments investigated subjects' ability to follow navigation instructions in a situation mimicking communication between air traffic controllers and pilots. A verbal condition, in which instructions were given orally, was compared with a spatial condition, in which commands were shown on a computer as simulated movements, with equal presentation times in both conditions. Retention and transfer were studied a week later when subjects performed in either the same condition or the other condition. In both sessions, subjects' initial accuracy was much higher in the spatial condition than in the verbal condition, but after three blocks, the accuracy in the two conditions was equivalent. Subjects apparently learned across blocks how to extract equivalent information from both presentations. However, differences in responses to left or right movement instructions suggest that subjects' representation of the movements in the verbal condition was not identical to their representation of the movements in the spatial condition.

#### 4:10–4:25 (253)

**Mental Practice Yields Less Forgetting and Interference Than Physical Practice.** ERICA L. WOHLDMANN, ALICE F. HEALY, &

LYLE E. BOURNE, *University of Colorado, Boulder*—During training, 72 subjects typed 64 four-digit numbers five times each and were given an immediate typing test including 32 old and 32 new numbers. Repetition priming was found; old numbers were typed faster than new numbers. During both refresher training Parts 1 and 2, 1 and 2 weeks later, subjects either physically or mentally typed the 64 old numbers five times each using a response location different from that during training. On a final test 1 week after refresher training Part 2, all subjects physically typed 32 old and 32 new numbers in the same response location used during training. Significant forgetting and interference were found for subjects who typed physically during refresher training. However, perfect retention and general skill improvement were found for subjects who typed mentally during refresher training. We propose that mental practice and physical practice strengthen different aspects of a mental representation formed during motor learning.

**4:30–4:45 (254)**

**The Words of Experts.** MARNIE E. ARKENBERG, *Carnegie Mellon University*, & KEITH E. NELSON, *Pennsylvania State University*—Studies of expertise have generally focused on the increased proficiencies of experts relative to novices. Few studies, however, have investigated the process of becoming an expert. One component of learning a domain is acquiring the nomenclature and category structure associated with it. In this study, we examined the cognitive changes associated with learning domain vocabulary in preschool

children. We were able to demonstrate how acquiring the nomenclature of a domain leads to changes in learning of domain information as well as to changes in representational structure, by examining changes in cognitive and learning abilities that are known to reflect expert status. Our results suggest that substantial vocabulary gains within a domain may catalyze processes that lead to more expert performance over time.

**4:50–5:05 (255)**

**Acquisition of Chess Skill.** MERIM BILALIC & PETER MCLEOD, *Oxford University*, FERNAND GOBET, *Brunel University*, & PETER A. FRENCH, *Humboldt-Universität zu Berlin* (sponsored by Peter A. French)—Studies investigating the relationship between intellectual abilities (nature) and practice (nurture) in the process of acquisition of cognitive skills usually involve persons already skilled in an activity, and thus fail to cover the first stages of skill acquisition. In this study, we followed 66 children who had recently begun to play chess, over 3 years, measuring their progress in chess skill. Besides three different measures of chess skills, we measured children's personality traits, intelligence, fluctuation in motivation, as well as the amount of practice. The results of multilevel modeling indicated a pattern where a strong initial relationship between intelligence and skill was moderated by the amount of practice and interest at a later stage. Although intelligence had a pivotal role at the beginning, motivation, personal traits, interests, and especially the amount of time invested played more important role in chess skill acquisition at a later stage.

**Autobiographical Memory**  
**Grand Ballroom JKL, Sunday Morning, 8:00–9:20**

*Chaired by Sami Güllöz, Koç University*

**8:00–8:15 (256)**

**The First, the Last, and the Unique: Events of Reminiscence Bump.** SAMI GÜLGÖZ & BURCU DEMIRAY, *Koç University*—We explored characteristics of events recalled by adults above age 50, particularly focusing on the reminiscence bump. The memories were retrieved by timeline technique in order to assure that the robust findings in studies using the cue-word method were not method specific. Seventy-two participants between the ages of 52 and 66 recalled specific events from five-year intervals of their lives, resulting in 6,373 memories. The results showed that 49% of memories were from bump years. These memories were rated more highly in novelty and importance for self than were memories from other ages. There was no difference in vividness. When events were classified as first, last, unique, or ordinary on the basis of prior or later experiencing of similar events, bump years contained more first and unique events. Last experiences were rated as more vivid, particularly if they came from bump years in contrast to the recency effect in vividness for other categories.

**8:20–8:35 (257)**

**Analyzing the Reminiscence Bump in Autobiographical Memory: First-Time Experiences, Valence, and Emotionality.** JAAP M. MURRE & STEVE M. JANSSEN, *Universiteit van Amsterdam* (sponsored by Jeroen G. W. Raaijmakers)—People recall a disproportionately large number of personal events from adolescence and early adulthood. Although this “reminiscence bump” has been examined extensively, its causes remain unclear. In this experiment, we investigated the nature of the events recalled in the reminiscence bump. Over 2,400 participants were given 10 cue words each and were asked to describe the personal events that first came to mind. Furthermore, they were asked to date each event reported and to indicate whether it was a “first-time” experience or not. Finally, the participants were asked to rate the valence or strength of emotional reaction to each event. The large number of observations allowed plotting of detailed lifetime distribution curves for each of the conditions in the experiment. The results were analyzed within our theoretical framework for lifetime memory distributions.

**8:40–8:55 (258)**

**Autobiographical Memory and Signal Detection Theory.** EDGAR ERDFELDER, *Universität Mannheim*, DANIEL M. BERNSTEIN, *Kwantlen University College*, MICHAEL E. RUDD, *University of Washington*, & ELIZABETH F. LOFTUS, *University of California, Irvine*—Research on autobiographical memory is often hampered by the fact that the answer key for the test items is unknown. In such cases, standard signal detection methods cannot be applied. As a consequence, there is often no basis for deciding whether experimentally induced increases in memory judgments represent memory illusions induced by response bias effects or by changes in sensitivity. To cope with this problem, we developed a two-components finite mixture extension of the signal detection model for confidence ratings. This model allows us to estimate parameters measuring (1) the proportion of test items that describe true events, (2) the mean familiarities of true and false events, respectively, and (3) the response criteria. We apply the new signal detection mixture model to two recent experiments on revelation effects in autobiographical recognition memory and discuss some theoretical and practical implications of this novel methodology for analyzing autobiographical memories.

**9:00–9:15 (259)**

**Completing Autobiographical Memory Questionnaires Produces Changes in the Memory.** ADRIEL BOALS, *University of North Texas*, & KATHERINE KLEIN, *North Carolina State University* (sponsored by Katherine Klein)—We explored whether expressive writing pro-

duces changes in the phenomenological aspects of the memory of the stressful event. In four related experiments, 417 participants, including 120 who scored at the extremes of a post-traumatic stress disorder screening test, answered questions about their autobiographical memories of a very negative event; half wrote about their deepest thoughts and emotions concerning the event, and half did not. Although reported levels of emotional intensity of the event, distress associated with the event, intrusive and avoidance symptoms, and other phenomenological memory properties decreased over the course of the experiment, these changes did not differ by writing condition. However, the magnitude of change we observed could not be explained by the mere passage of time. We argue that the act of answering our extensive questions about a very negative event produced a change in the phenomenological properties of the memory, masking the effects of expressive writing.

**Spacing and Retrieval Practice**  
**Grand Ballroom GH, Sunday Morning, 8:00–9:40**

*Chaired by Jessica M. Logan, Washington University*

**8:00–8:15 (260)**

**Using Spaced Retrieval Practice to Learn Foreign Language Vocabulary.** JESSICA M. LOGAN, KATHLEEN B. McDERMOTT, & HENRY L. ROEDIGER III, *Washington University*—Spaced practice is believed to be better than massed practice in part because there is a greater degree of effort involved in retrieving an item after a delay than in immediate retrieval. In this study, we manipulated both the length of intervals between English–German word pairs and their repetition (spacing) and task difficulty during the interval. Subjects showed better recall when an interval of difficult activity occurred between study and repetition of a given item than when an easy activity occurred in the interval, regardless of the actual interval spacing. Indeed, a short but difficult interval produced significantly better subsequent recall than did a longer, easier interval. Increasing the difficulty of an intervening task between two presentations of material produced better performance on a final test, which has implications for the development of more efficient practice schedules for students attempting to learn new foreign language vocabulary.

**8:20–8:35 (261)**

**What Can Spacing Studies Tell Us About the Purpose of Rehearsal?** PETER F. DELANEY, *University of North Carolina, Greensboro*, & PETER P. J. L. VERKOEIJEN, *Erasmus Universiteit Rotterdam*—When items are studied more than once, it is generally better to space the repetitions apart rather than to mass them together—a finding known as the spacing effect. Previous research has suggested that both intentional and incidental study produce spacing effects of comparable magnitude. We present experiments that controlled which encoding strategy people used to study massed and spaced words. The studies suggest that people’s rehearsal patterns are important for understanding why spacing effects emerge or fail to emerge in intentional learning. In incidental learning, spacing effects are large and robust. In intentional learning, however, rehearsal sometimes lets people redistribute their practice time to favor spaced presentations. At other times, rehearsal converts massed items into spaced items and eliminates spacing benefits. In both cases, rehearsal functions adaptively to enhance appropriate learning.

**8:40–8:55 (262)**

**Enhancing Learning Through Retrieval Practice: Can Covert Retrieval Speed Up Visual and Visuospatial Learning?** HAL PASHLER & SHANA K. CARPENTER, *University of California, San Diego*—There is increasing interest among psychologists in the potential for enhancing learning and memory through the use of retrieval practice (testing with feedback). While the effectiveness of retrieval practice for learning vocabulary lists, texts, and other verbal materials is well established, its utility for promoting the learning of nonverbal mate-

rials is virtually unexplored. One apparent obstacle is the difficulty in obtaining and scoring a learner's retrieval of nonverbal materials. We report several new studies that examine whether the learning of maps and of faces can be enhanced through covert self-scored retrieval practice. Here, after some initial study, the material was taken away and the person was asked to recall it covertly and, once given feedback, to indicate whether the retrieval was successful. In at least some conditions, such procedures proved noticeably more effective than conventional study procedures, suggesting that retrieval practice may have broad practical application beyond verbal materials.

9:00–9:15 (263)

**Repeated Retrieval During Learning Is the Key to Enhancing Long-Term Retention.** HENRY L. ROEDIGER III & JEFFREY D. KARPICKE, *Washington University*—We report two experiments inspired by Tulving's (1967) early work in manipulating numbers of study and test trials on multitrial free recall learning. In our experiments, subjects learned lists of words across multiple study–test trials and took a final recall test 1 week after learning. In Experiment 1, repeated testing during learning enhanced retention relative to repeated studying, although alternating study and test trials produced the best initial learning and delayed recall. In Experiment 2, recalled items were dropped either from further studying or from further testing in order to investigate how different types of practice affected retention. Repeated study of previously recalled items did not benefit delayed recall, relative to the condition in which items were dropped from further study. However, repeated recall of previously recalled items enhanced delayed recall by more than 100% relative to dropping those items from further testing. Repeated retrieval of information is the key to long-term retention.

9:20–9:35 (264)

**Repetition + Recollection = Recursive Reminding.** DOUGLAS L. HINTZMAN, *University of Oregon*—How does repetition affect memory? One way, which memory theorists have generally ignored, is through the process of recollection. Repetition of an item triggers recollection of previous thoughts about the item (i.e., a reminding), and this recollective experience is itself encoded into memory, where it remains available for later retrieval. This idea is simple, but it helps to explain a number of otherwise puzzling experimental findings on the effects of repetition, particularly when it is applied recursively. As time permits, I will discuss several of these findings.

#### Attentional Limits

Grand Ballroom DE, Sunday Morning, 8:00–10:00

Chaired by Pierre Jolicœur, *Université de Montreal*

8:00–8:15 (265)

**Electrophysiological Evidence for Surprisingly Early Dual-Task Interference in the PRP Paradigm.** BENOIT BRISSON & PIERRE JOLICŒUR, *Université de Montreal* (read by Pierre Jolicœur)—We investigated the locus of interference in the psychological refractory period (PRP) paradigm by measuring the electrophysiological response of participants while they performed modified PRP paradigms. A tone (T1) was presented, followed by a visual target (T2) embedded in a bilateral display, and a speeded response was required for each target. The behavioral PRP effect was obtained in two experiments. In Experiment 1, the N2pc was progressively attenuated as SOA was reduced and the onset latency of the sustained posterior contralateral negativity (SPCN) was progressively lengthened. These results provide strong electrophysiological evidence of PRP interference in the deployment of visuospatial attention (N2pc) and transfer into visual short-term memory (SPCN). In Experiment 2, the posterior visual N1 was attenuated in conditions of greater task overlap, providing further evidence of surprisingly early interference in the PRP paradigm. Implications for models of PRP interference are discussed.

8:20–8:35 (266)

**Modularity Versus Response Selection Bottleneck: The Cause for Dual-Task Costs.** HAGIT MAGEN & ASHER COHEN, *Hebrew University* (read by Asher Cohen)—The influential response selection bottleneck (RSB) model assumes that the existence of a single response selection mechanism is the principal cause for dual-task costs. Many studies using the psychological refractory period (PRP) paradigm appear to support this model. We propose an alternative model that assumes that the architecture of the visual system is modular, and that crosstalk within modules is a major cause for dual-task costs. We present several PRP experiments that pit the predictions of the two models against each other. The results of these experiments support the modularity model and contradict the RSB model. We propose that the modularity assumption, augmented by assumptions concerning the operation of attentional systems, may account for all of the principal results in the PRP literature.

8:40–8:55 (267)

**Capacity Sharing Between Tasks of the Same Type.** RONALD HÜBNER & CAROLA LEHLE, *Universität Konstanz*—Capacity sharing models postulate that capacity is limited but can be divided between tasks. Whereas corresponding predictions were tested mostly by applying two different tasks, in the present dual-task study, tasks of the same type were used (i.e., judging whether a digit was odd or even). It was expected that the crosstalk between the two tasks would reflect the degree of capacity sharing, which was manipulated by instruction. Participants were instructed either to process the tasks more serially or to process them more in parallel. As the observed response time and congruency effects indicate, the participants shared more capacity between the tasks under the parallel instruction than under the serial one. If no specific instruction was given, participants used an intermediate degree of capacity sharing. Thus, the overall results are compatible with the idea of capacity sharing, which is also supported by a formal model that was fitted to the data.

9:00–9:15 (268)

**Posterior Parietal Cortex Dissociates Two Types of Attentional Load: Attentional Indexing and General Effort.** YUHONG V. JIANG & WON MOK SHIM, *Harvard University*—This study aims to dissociate two types of attentional load—attentional indexing and general effort—in the parietal cortex. Using fMRI, we manipulated two types of attentional load parametrically using an attentive tracking task. A rotating pinwheel was presented at each of four visual quadrants simultaneously. Observers tracked the cued spoke of the pinwheel(s) with attention while maintaining central fixation. We manipulated attentional indexing by cuing observers to monitor one or two pinwheels, and manipulated general attentional effort by varying the rotation speed of each wheel. Tracking accuracy deteriorated as each wheel rotated more rapidly and as more wheels were tracked. The posterior parietal cortex, however, was sensitive only to attentional indexing. Its activation was higher when subjects tracked two wheels rather than one, but showed no systematic change at different rotation speeds. We concluded that the posterior parietal cortex is specifically involved in attentional indexing, rather than in general attentional effort.

9:20–9:35 (269)

**Individual Differences in Reading Ability and Dual-Task Performance.** PHILIP A. ALLEN, *University of Akron*, ERIC D. RUTHRUFF, *University of New Mexico*, & MEI-CHING LIEN, *Oregon State University*—Past studies have found that “typical” younger adults do not show automatic lexical access in a dual-task context (e.g., McCann, Remington, & Van Selst, 2000) but that typical older adults do (Allen et al., 2002; Lien et al., in press). These discrepant findings may be due to individual differences in reading skill (older adults typically have more experience with lexical material). To examine this possibility, we tested 24 good younger readers (scoring in the 60th–99th percentile ranks on the Nelson–Denny reading test) and 24 poor younger readers (20th–50th percentile ranks) in a psychological re-

fractory period paradigm in which Task 1 was a tone discrimination or shape discrimination and Task 2 was a lexical decision task that varied word frequency. Our results suggested that good readers can perform lexical access for Task 2 while central resources are busy with response selection for Task 1, but that poor readers cannot.

#### 9:40–9:55 (270)

**Testing the Boolean Theory of Visual Consciousness.** LIQIANG HUANG & ANNE M. TREISMAN, *Princeton University*, & HAL PASHLER, *University of California, San Diego* (sponsored by Anne M. Treisman)—A theory of visual attention (Boolean map theory) claims that only one feature value can be consciously accessed at one instant, whereas multiple locations can be simultaneously accessed as a group. To test this theory, we compared successive and simultaneous presentation of two colors or two locations. For color, but not location, judgments, performance was substantially better for successive than for simultaneous presentations. To ensure that this finding does not reflect stimulus differences, we ran two additional experiments using identical stimuli. Here, two squares were presented, each in one of two possible locations (four locations total) and one of two possible colors (four colors total), either simultaneously or successively. In one experiment, participants reported the colors of the two squares, resulting in a successive advantage. In another experiment, participants reported the locations of the two squares; there, the successive advantage disappeared. These results argue against alternative accounts.

#### Sentence Processing

**Brown Convention Ctr. Rm. 306, Sunday Morning, 8:00–9:20**

*Chaired by Patrizia L. Tabossi, Università di Trieste*

#### 8:00–8:15 (271)

**The Syntactic Processing of Idiomatic Expressions: Compositionality Reconsidered.** PATRIZIA L. TABOSSI & SARA KOTERLE, *Università di Trieste*—People's ability to deal with the syntax of idioms was explored. The results of Experiments 1–3 challenged the main claims of the idiom decomposition hypothesis. Experiment 4 compared the account of this view with the explanations of the lexical representation hypothesis and the configuration hypothesis on a well-known phenomenon: Typically, idioms are recognized faster than are matched controls. The results lent support to the configuration hypothesis. In Experiments 5 and 6, acceptability judgments of syntactically varied idiomatic sentences were collected. Speakers gave consistent judgments, whether they knew the idioms or not. In a final study, flexibility ratings were used to verify the effectiveness of the semantic constraints imposed by an idiomatic string (e.g., *kick the bucket*) and its figurative meaning (e.g., “die suddenly”) in determining speakers' syntactic intuitions. In light of these findings, a novel hypothesis of how people deal with the syntax of idioms is proposed.

#### 8:20–8:35 (272)

**Variability in Judgments of Spoken Irony.** PETER G. WASSERMAN & MICHAEL F. SCHOBEL, *New School for Social Research* (read by Michael F. Schobel) (sponsored by Michael F. Schobel)—How much do people agree on what counts as verbal irony? How is this affected by the nature of the listeners, the utterances, and the circumstances of judgment? Audio samples of potentially ironic speech were collected from a conversation between strangers discussing outfits worn by celebrities in a task adapted from Hancock (2004). Participants were presented with individual utterances with varying degrees of prior conversational context and with or without textual transcripts. Participants rated “How ironic is the speaker?” on a scale from 1 (not at all ironic) to 5 (extremely ironic). Results showed that different participants disagreed on what counted as ironic more often than the previous literature on irony suggested they should. Their judgments were also more affected by prior context than was predicted by theories that assume that irony resides in individual utterances. Judgments of different types of irony may be differently context dependent.

#### 8:40–8:55 (273)

**The Effect of Frequency on the Processing of Pronominal Relative Clauses.** FLORENCIA REALI & MORTEN H. CHRISTIANSEN, *Cornell University* (read by Morten H. Christiansen)—We conducted a large-scale corpus analysis revealing that pronominal object-relative (OR) clauses were significantly more frequent than pronominal subject-relative (SR) clauses when the embedded pronoun was personal (e.g., *you*), whereas the difference was reversed for impersonal pronouns (e.g., *it*). This pattern of distribution provided the framework for testing experience-based approaches to sentence processing in a series of four self-paced reading experiments. The results indicated that differences in pronominal OR/SR processing difficulty mirror the distributional pattern revealed by the corpus analysis. Additionally, a self-paced reading experiment was conducted to explore whether the frequency of co-occurrence of specific lexical items affected processing. Regression analyses confirmed that reading times in embedded ORs were predicted as a continuous function of the co-occurrence frequencies of individual pronoun–verb combinations forming the clause. We conclude that relative clause processing is affected by fine-grained distributional information, providing support for experience-based approaches to language processing.

#### 9:00–9:15 (274)

**What Eyetracking Tells Us About Aspectual Processing That Self-Paced Reading Does Not.** DAVID J. TOWNSEND, *Montclair State University* (sponsored by Charles Clifton, Jr.)—Does “aspectual coercion” occur while one processes the basic content of the sentence or afterward? Participants read sentences such as “For many years/Howard sent/a large check/to his daughter” (cf. Todorova et al., 2000), in which slashes indicated presentation groups in self-paced reading and analysis regions in eyetracking. The materials varied in adverbial phrase (*Last year/For many years*) and object number (*large checks/a large check*). Aspectual coercion affected neither self-paced reading nor first pass time in eyetracking, but it did increase regressive saccades from later regions. Saccades landed most frequently in Region 1 when they were launched from Region 4 and, compared with control sentences, when Region 1 contained a temporal adverbial phrase. Since online processing time measures show no evidence of aspectual coercion, but the patterns of regressions and landing sites do, at least some aspectual processing occurs after processing the basic content.

#### Recognition Memory

**Grand Ballroom F, Sunday Morning, 8:00–9:40**

*Chaired by Lewis M. Barker, Auburn University*

#### 8:00–8:15 (275)

**Studies of Semantic Memory Using Yes–No Recognition Tests.** LEWIS M. BARKER & DALE SMITH, *Auburn University*—Yes–no recognition tests used in four areas of research are compared. In a series of studies, Stanovich and colleagues reported strong relationships between yes–no recognition tests and cognitive abilities related to literacy, such as spelling ability and verbal fluency. Second language acquisition researchers have successfully used the method to assess the overall state of a learner's vocabulary, including vocabulary size. Yes–no tests are presently used in numerous studies of memory, including priming and remember–know judgments. We report here similarities and differences of the above use of yes–no tests with our studies of assessment of domain knowledge in a classroom setting. All of these studies can be conceptualized as investigations of semantic memory. The yes–no test provides a unique methodology in the study of memory, in no small measure because it is amenable to sophisticated quantitative analyses within a signal detection framework.

#### 8:20–8:35 (276)

**Dissociable Effects of Familiarity and Nameability in Memory for Faces and Melodies.** JAMES C. BARTLETT, *University of Texas, Dallas*, ANDREA R. HALPERN, *Bucknell University*, & JACK D.

BIRCHFIELD, *University of Texas, Dallas*—Everyone knows that memory for nonverbal materials increases with familiarity. But memory studies of this type have typically conflated familiarity and nameability. In this study, we disentangled these two variables by using faces and melodies that were (1) unfamiliar (UF), (2) familiar but difficult to name (FD), and (3) equally familiar but easy to name (FE). Two recognition experiments showed that hit rates were higher for FD than for UF items but that false alarm rates were higher as well. These and other findings suggest that when items are difficult to name, preexperimental familiarity is difficult to distinguish from within-experiment (episodic) familiarity. Memory for faces was superior to that for melodies, especially for UF items, but the effects of familiarity on false alarms were the same for both. Despite its generally positive effects, preexperimental familiarity can be a source of confusion in recognizing faces and melodies.

**8:40–8:55 (277)**

**Repeated Measures Conjoint Recognition.** CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*, HETHE BELINGE, *University of Texas, Arlington*, & JULIE MYERS, *Cornell University*—Experimentation with the conjoint recognition model is hampered by the fact that it requires three independent groups of subjects, who respond to recognition tests under different instructional sets. This makes the model unfeasible when the testing of large subject samples is not practicable (e.g., in developmental studies or neuroscience studies). A new repeated measures methodology was developed and applied to experiments on false memory and on the word-frequency mirror effect. The model delivered satisfactory fits, and the behavior of its parameters conformed to theoretical predictions. The model yielded novel findings on dual-process explanations of the mirror effect, which posit that the hit side of the effect is due to higher levels of target recollection for low-frequency words while the false alarm side is due to lower levels of familiarity for such words. The model showed that conclusions that seem to follow from surface-level recognition performance are wrong at the level of retrieval processes.

**9:00–9:15 (278)**

**Decomposing Effects of Lexical Processing on Perceptual Implicit Memory.** SALLY ANDREWS, *University of Sydney*, BEN R. NEWELL, *University of New South Wales*, & RACHEL BOND, *University of Sydney*—A series of experiments demonstrated a novel dissociation between perceptual implicit memory, as indexed by repetition priming effects in the lexical decision task (LDT), and explicit recognition memory. In a common study phase, participants made lexical decisions to horizontal or vertical words presented in an intersecting “crossword” configuration. Subsequent recognition memory was better for attended than for unattended words from the crossword display, regardless of whether the two words had been semantically related, orthographically related, or unrelated. By contrast, a single word LDT for old and new words yielded facilitatory repetition priming for both attended and unattended words from semantically related crossword pairs, whereas the members of orthographically related pairs showed no priming, or inhibition. The results show that lexical identification at study does not provide a sufficient explanation of implicit priming. Lexical selection processes invoked during study appear to be reinstated during implicit, but not explicit, memory retrieval.

**9:20–9:35 (279)**

**The Generality of the Pseudoword Effect in Recognition Memory.** KERRY A. CHALMERS & HEIDI E. TURON, *University of Newcastle*—Greene (2004) reported five recognition memory experiments showing that participants make more positive responses (“yes” responses summed over studied and nonstudied items) to pronounceable nonwords (pseudowords) than to words. He referred to this finding as the *pseudoword effect* and suggested that it extends to very low-frequency words, which are assumed to be unknown to participants. The aim of the present study was to examine the generality of the pseudoword effect. In Experiment 1, using the same stimuli as in

Greene (originally from Whittlesea & Williams, 2000), a pseudoword effect was found. Hits and false alarms were higher for nonwords than for words. However, when very low-frequency words were compared with words in Experiments 2 (very low- vs. low-frequency), 3 (very low- vs. high-frequency), and 4 (very low- vs. mixed high- and low-frequency words), the pseudoword effect was not found. Reasons for the absence of pseudoword effects for very low-frequency words are discussed.

### Movement Control

**Grand Ballroom I, Sunday Morning, 8:00–9:20**

*Chaired by Peter Dixon, University of Alberta*

**8:00–8:15 (280)**

**Grasping and Memory.** PETER DIXON, SCOTT MCANSH, & LENORE READ, *University of Alberta*—Motor control is commonly conceived of as a problem of computing the trajectories (or the corresponding control parameters) that achieve a specified functional goal. Here, we demonstrate that there is a central role for memory in this process. Free-form objects were designed with a range of grasping affordances. Subjects were asked simply to grasp and lift the objects, and the choice of (functionally equivalent) grasping posture was recorded. Subjects tended to select the same posture as that used on previous trials, even when that posture was not optimal. This effect transferred across hands, was independent of the positions of the objects, and could last over several trials, but did not occur when superficially dissimilar objects were used on successive trials. The results suggest that choice of grasp is largely determined by memory for previous grasps under similar conditions.

**8:20–8:35 (281)**

**Explicit Knowledge Can Be Acquired but Not Applied During Aimed Movements in the Serial RT Task.** WILLEM B. VERWEY & INGE S. TER SCHEGGET, *Universiteit Twente*—In two experiments, participants practiced a serial reaction time task with aiming movements. In Experiment 1, participants practiced with a response stimulus interval (RSI) of 200 msec, and in Experiment 2 with a 0-msec RSI. In a subsequent test phase, target size, RSI, and sequence order were varied. Both experiments showed that the longer response times associated with smaller targets did not affect the development and expression of implicit and explicit knowledge. Detailed analyses of response times indicated that implicit knowledge had its effect during the preceding movement, whereas explicit knowledge was used primarily after the preceding movement had been completed. Participants classified as *aware* and *unaware* showed different effects of RSI, supporting the validity of the paper awareness classification test.

**8:40–8:55 (282)**

**Relationships Between Movement Trajectories and Pitch Trajectories in Musical Sequence Production.** PETER Q. PFORDRESHER, *SUNY, Buffalo*—Similarity between movement patterns and resulting feedback influences the speed and accuracy of production, as demonstrated by response-effect compatibility and disruption from altered feedback. However, the bases of this similarity are not well understood in the context of sequence production. In three experiments, I explored possible contributions from transitional properties and schemata. Trained pianists and musically untrained persons produced simple tonal melodies on a keyboard while hearing, over headphones, feedback pitches that either were identical to the produced melody or could form a melody that matched the intended melody with respect to transitional properties (melodic contour) but not constituent pitches. Regardless of whether or not feedback melodies were identical, sequence production was disrupted for both groups when feedback events were delayed by one interonset interval. However, there was less disruption when feedback melodies were atonal. Thus, transitional properties and tonal schemata may jointly determine perception/action similarity during sequence production.

9:00–9:15 (283)

**Intermanual Transfer of Prism Adaptation During Aftereffect Testing.** GORDON M. REDDING, *Illinois State University*, & BENJAMIN WALLACE, *Cleveland State University*—Intermanual transfer of spatial realignment was assessed under two conditions: when the exposed (right) limb or the nonexposed (left) limb was tested first after exposure to rightward prismatic displacement. Exposure performance and the usual direct measures of realignment were unaffected by testing order, but intermanual transfer appeared only when the exposed limb was tested first. These results suggest that intermanual transfer occurs during testing for aftereffects of prism exposure, not during prism exposure itself.

#### Induction and Categorization

Grand Ballroom JKL, Sunday Morning, 9:40–12:00

Chaired by John D. Coley, *Northeastern University*

9:40–9:55 (284)

**Availability and Context-Sensitive Inductive Reasoning.** JOHN D. COLEY, *Northeastern University*, PATRICK SHAFTO, *Massachusetts Institute of Technology*, & DAVID BALDWIN, *Northeastern University*—One hallmark of experience in a given domain is the context-sensitive selective recruitment of different knowledge to guide inductive reasoning. We proposed that different systems of knowledge may be differentially available, and that differences in availability affect the context-sensitive use of knowledge in reasoning. We investigated this differential availability hypothesis in the domain of biology. Undergraduates projected novel diseases or genes among species related taxonomically or ecologically, or unrelated, under speeded or delayed time constraints. Taxonomic inferences were unaffected by time pressure, were consistently stronger for gene versus disease, and were consistently predicted by taxonomic knowledge. In contrast, ecological inferences were only stronger for disease versus gene and were predicted by ecological knowledge when responses were delayed. Together, these results suggest that mere possession of relevant knowledge is not sufficient for fostering context-sensitive inferences, and that differences in the availability of taxonomic and ecological knowledge impact selective use of that knowledge in inductive reasoning.

10:00–10:15 (285)

**Adults' Concepts About Human and Mechanical Representational Systems.** DANIEL T. LEVIN, MEGAN M. SAYLOR, DONALD A. VARAKIN, STEPHEN M. GORDON, KAZUHIKO KAWAMURA, & MITCHELL WILKES, *Vanderbilt University*—Although much research has focused on emerging understandings of representation and mind, little research has explored the adult understanding of different representational systems. In these experiments, we demonstrate that adults differentiate intentional and nonintentional representational systems when reasoning about them. In the first experiment, subjects were taught a novel feature of a computer or a person, and were asked whether the feature characterized other representational systems. The results indicated that when making inductions from a person to a computer, subjects do so more for nonintentional mental properties than for intentional mental properties. In a second experiment, we asked adults to make predictions about the behavior of a person, a computer, and a robot, and found that they assume that humans engage in more object/category-related behaviors than do computers. Combined, these data establish the existence of a category of intentional mental entities, and give guidelines for its deployment in predicting a variety of representationally mediated behaviors.

10:20–10:35 (286)

**Causal Diversity Effects in Differential Diagnostic Reasoning.** NANCY S. KIM & JENNELLE E. YOPCHICK, *Northeastern University*—When a single root cause elicits a branching structure of consequences, inferences about the presence of the root cause are characterized by a causal diversity effect analogous to that seen in adult domain

novices for category-based induction (Kim & Keil, 2003). The present studies further examined the nature of the causal diversity effect. Specifically, we hypothesized that the causal diversity effect can occur during the initial search for information, as in category-based induction (López, 1995; Spellman & Kincannon, 2003). We also hypothesized that automatic assumptions about unspecified alternative root causes contribute to the effect. Participants first learned causal information about one, two, or three potential root cause(s) for an array of medical symptoms. They then considered a hypothetical patient with one symptom confirmed, and requested information about an additional potential symptom to assist in making a diagnosis. The results supported both hypotheses. Implications for differential diagnostic reasoning are discussed.

10:40–10:55 (287)

**Finding Abstract Commonalities of Category Members.** TAKASHI YAMAUCHI, *Texas A&M University*—How do people discover commonalities among different objects? What would be the effective way of finding abstract relational similarity? This study explored these questions by comparing two of the most commonly used functions of categorical concepts: classification and feature inference. The results from three experiments showed that classification, because of its focus on concrete exemplar information, is not very conducive to the discovery of abstract commonalities. In contrast, feature inference, due to its focus on within-category information, is advantageous in finding abstract commonalities among category members. This difference appears to come from the fact that category labels, which can point to category membership information, help construct structured representations and facilitate structural alignment.

11:00–11:15 (288)

**Comparative and Developmental Approach to Studying Nonverbal Numerical Cognition.** ELIZABETH M. BRANNON, JESSICA F. CANTLON, SARA CORDES, KERRY E. JORDAN, EVAN L. MACLEAN, & SUMARGA H. SUANDA, *Duke University*—Our talk broadly addresses whether the quantitative abilities observed in non-human animals and human infants are evolutionarily homologous and developmentally continuous to the nonverbal quantitative abilities seen in adult humans. A first series of experiments compared the precision with which rhesus monkeys and adult humans made numerical discriminations and demonstrated that monkeys, like adults, show a semantic congruity effect when they make ordinal numerical judgments. A second series of experiments examined cross-modal number representations in monkeys and human infants using both looking time methods common to infant developmental studies and an explicit choice task. A final series of experiments compared the representation of time, surface area, and number in infants and nonhuman animals and asked whether there are fundamental commonalities in the way different quantitative dimensions are represented nonverbally.

11:20–11:35 (289)

**The Time Course of Detection, Categorization, and Identification.** THOMAS J. PALMERI, MICHAEL MACK, ALAN N. C. WONG, & ISABEL GAUTHIER, *Vanderbilt University*—We examined the time course of object detection, basic-level categorization, and subordinate-level identification and asked whether detection, categorization, and identification represent sequential stages of object processing. One set of experiments compared the time course of basic-level categorization and subordinate-level identification of faces, dogs, and birds using a signal-to-respond procedure. For all three classes, the observed temporal dynamics argued against stages of basic-level categorization followed by subordinate-level identification. Another set of experiments compared the time course of detection and categorization. Recently, Grill-Spector and Kanwisher (2005) reported that the time courses of detection and categorization were identical, suggesting in the subtitle of their paper that “as soon as you know it is there, you know what it is.” We decoupled the temporal dynamics of detection and categorization by manipulations such as inversion and stimulus degradation. We considered both sets of results in the context of

simple stage models and more general object recognition and categorization models.

**11:40–11:55 (290)**

**Why Do Words Facilitate Early Categorization?** VLADIMIR M. SLOUTSKY, *Ohio State University*—The ability to categorize appears early in development, with words facilitating early categorization. Two explanations have been proposed to explain these effects of words. Some argue that these effects stem from children's knowing that words (and possibly other speech sounds) denote categories. Others argue that auditory information affects attention allocated to corresponding visual input. In particular, early in development, auditory input often overshadows (or attenuates processing of) corresponding visual input. If this is the case, entities that share the label are also perceived as being more similar, and are thus more likely to be grouped together. This general-auditory hypothesis was tested in the reported experiments. The same visual items were paired with various speech and nonspeech auditory stimuli. The results are consistent with the general-auditory account: Auditory input that overshadows visual input also facilitates categorization, whereas auditory input that does not overshadow visual input does not facilitate categorization.

#### Working Memory and STM

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

Chaired by Edward Awh, *University of Oregon*

**10:00–10:15 (291)**

**Visual Working Memory Represents a Fixed Number of Items Regardless of Complexity.** EDWARD AWH, BRIAN BARTON, & EDWARD K. VOGEL, *University of Oregon*—There has been controversy regarding the basic determinants of capacity in visual working memory. Luck and Vogel (1997) found that about four items could be maintained, independent of the number of features that defined each item. However, others have found marked reductions in capacity as object complexity increases (e.g., Alvarez and Cavanaugh, 2004). We examined whether the apparent capacity reductions for complex objects were due to increased similarity between items in these categories. In line with this hypothesis, similarity (operationalized by response time in a one-item change detection task) strongly predicted change detection performance across a wide range of object complexity. Moreover, when sample/test similarity was low, the estimated capacity for even the most complex objects was equivalent to that of the simplest objects ( $r = .84$ ). Thus, although changes between similar items are harder to detect, a fixed number of items are represented in working memory regardless of object complexity.

**10:20–10:35 (292)**

**Forgetting Within the Time-Based Resource-Sharing Model.** VALERIE CAMOS & PIERRE BARROUILLET, *Université de Bourgogne*—Within the time-based resource-sharing model, we have shown that, in working memory span tasks, the amount of forgetting increases with the rate of processing demands during retention of the memory material (Barrouillet, Bernardin, & Camos, 2004). We report a series of experiments aimed at disentangling factors that contribute to forgetting from working memory in tasks that combine a memory demand (e.g., remembering a short list of letters) and a series of processing demands (e.g., verifying several simple mathematical equations after presentation of each letter of the list). The level of articulatory suppression induced by the processing component, as well as the capture of attention involved by this processing, were manipulated independently. Although they both affected recall performance, their respective effects never interacted. These results could support the theoretical view of two separate rehearsal mechanisms (Hudjetz & Oberauer, 2005).

**10:40–10:55 (293)**

**Delayed Recall of Items From Simple and Complex Span Tasks.**

DAVID P. McCABE, *Colorado State University*—Fewer items are recalled from complex working memory span tasks, such as operation span, than from simple span tasks, such as word span. Time-based forgetting theories propose that complex span tasks take longer to perform than simple span tasks, resulting in more forgetting. Alternatively, cue-dependent retrieval theories propose that complex span tasks primarily require retrieval from secondary memory, whereas simple span tasks primarily require retrieval from primary memory. Delayed recall was examined for to-be-remembered items from word span (simple) and operation span (complex) tasks. As expected, during the initial span tasks, recall was greater for items from the word span task. By contrast, delayed recall was greater for items from the operation span task. This latter result, and other more fine-grained analyses, indicate that complex span tasks required retrieval from secondary memory, which later transferred to delayed recall. These results support cue-dependent retrieval theories, but are inconsistent with time-based forgetting theories.

**11:00–11:15 (294)**

**A Fundamental Problem With PDP Models of STM.** JEFFREY S. BOWERS, MARKUS F. DAMIAN, & COLIN J. DAVIS, *University of Bristol*—Botvinick and Plaut (2006) developed a connectionist model of short-term memory (STM) that supports various behavioral findings. Critically, STM span in their model is sensitive to background knowledge of sequential structure (e.g., bigram effects), consistent with behavioral data. However, we demonstrate that their model is not only sensitive to sequential structure but is also dependent on it. For example, if their model is untrained on the sequence ABC, it cannot reproduce it. This contrasts with human performance, and highlights the limits of eliminative connectionist models of mind.

**11:20–11:35 (295)**

**Effects of Similarity at Encoding and Retrieval in Short-Term Order Memory.** SIMON FARRELL & KLAUS OBERAUER, *University of Bristol*—Some models of short-term serial recall hold that phonological similarity has an effect only on discrimination of items at retrieval (e.g., the start-end model [SEM]; Henson, 1998). Other models predict that similarity affects encoding as well. For example, the serial-order-in-a-box (SOB; Farrell, 2006; Farrell & Lewandowsky, 2002) model assumes that items similar to current memory contents are given less encoding weight, and thus predicts an increasing effect of similarity across input position. Additionally, while most models hold that items are suppressed after recall, SOB uniquely assumes that this response suppression will generalize to other, similar items, predicting an increasing effect of similarity across output position. These predictions were tested in a position probed recall paradigm allowing for the dissociation of input and output effects. Data and model simulations provide support for the input mechanism of SOB, but suggest response suppression acts on localist, not distributed, representations.

**11:40–11:55 (296)**

**Does Phonological Short Term Memory Causally Affect Vocabulary Growth?** PRAHLAD GUPTA & JAMIE TISDALE, *University of Iowa*—The well-documented relationship between nonword repetition (NWR) ability and vocabulary learning has two major explanations. One account posits that it is NWR ability that plays a causal role and that phonological short-term memory (PSTM), through its role in NWR, is therefore a causal determinant of vocabulary. Another account proposes the opposite: that it is increasing vocabulary knowledge that drives increasing NWR ability, with PSTM playing little role. We present a theory of phonological word learning that reconciles these perspectives, showing that the opposition between them is spurious. We instantiate our theory as a computational model, offering a precise account of the construct of PSTM, of performance in the nonword repetition task, of novel word learning, and of the relationship between all of these. Simulations show bidirectional causality between PSTM, vocabulary, and NWR, and effects of phonotactic probability and nonword length.

**Spatial Cognition****Grand Ballroom DE, Sunday Morning, 10:20–12:00***Chaired by John P. Spencer, University of Iowa***10:20–10:35 (297)**

**Be Flexible but Keep It Real: The Dynamic Field Theory Offers Behavioral Flexibility With Task-Specific Prediction.** JOHN P. SPENCER, JEFFREY S. JOHNSON, & VANESSA R. SIMMERING, *University of Iowa*, & GREGOR SCHÖNER, *Institute for Neuroinformatics*—A fundamental challenge in cognitive science is to develop theories that can account for the real-time details of human behavior, yet generalize beyond the local domain within which the theory was developed. In this report, we describe a dynamic field theory of spatial cognition that has shown promise in this regard. In particular, we show how the same neurally plausible system can be flexibly “tuned” to capture behavior in three tasks: spatial recall, position discrimination, and change detection. Further, we demonstrate that this theory can generate novel predictions in each domain. We highlight two examples of this confirmed by recent empirical results: enhanced position discrimination and fast repulsion near reference frames, and enhanced change detection for metrically similar stimuli. Together these results offer insights into the origin of behavioral flexibility: The same system can reconfigure itself to perform a variety of tasks.

**10:40–10:55 (298)**

**Spatial Strategy Use Is Measurable and Predictive of Performance.** BEVERLY ROSKOS-EWOLDSSEN, *University of Alabama*, JILLIAN L. PRESTOPNIK, *University of New Mexico*, ADAM HUTCHESON, *University of South Carolina, Columbia*, & J. HENRY McKEEN, *University of Alabama*—Strategies used to complete spatial tasks have primarily been measured post hoc. An exhaustive search of the literature resulted in 35 possible strategies that could be used in spatial orientation or wayfinding tasks involving space around oneself. In Study 1, participants sorted the strategies according to their similarities. Multidimensional scaling of these data produced two dimensions: egocentric versus allocentric and high versus low imagery. Neither survey versus route nor holistic versus analytic dimensions fit the data. In Study 2, participants completed a spatial orientation training study in which they practiced spatial or nonspatial tasks between pre- and posttests and indicated which strategies they used at posttest. In Study 3, participants completed a wayfinding task multiple times and indicated the strategies they had used after each time. The extent to which participants relied on allocentric and high imagery strategies predicted improvement in spatial performance as a function of training, and use of these strategies increased across time.

**11:00–11:15 (299)**

**Maps and Memory Aids Do Not Trump Category Effects in Geographic Location Judgments.** ALINDA FRIEDMAN, *University of Alberta*—Participants estimated the locations of North American cities in both numeric and spatially based tasks to examine why global-scale location estimates tend to be sorted into mutually exclusive regions with gaps between them, why they are biased to the south, and whether giving participants perceptual supports and memory aids would decrease these tendencies. Despite the presence of supports that included location markers color-coded by nation, the identity and estimated locations of the cities remaining continuously visible, the opportunity to change responses at any time, and the opportunity to respond directly on a map, there were still distinct regions in the estimates, gaps between regions, and biases in the estimates. The data provided support for the idea that participants have a regionalized representation of global-scale geography and in both numeric and purely spatial estimate tasks their estimates reflect having to combine these regional beliefs with item information that is inexact or nonexistent.

**11:20–11:35 (300)**

**Memory for Location: Influence of Surrounding Shape on Spatial Categories.** DOUGLAS H. WEDELL, SYLVIA FITTING, & GARY L.

ALLEN, *University of South Carolina, Columbia*—Participants were 40 students who were briefly presented 32 dot locations, one at a time, and attempted to reproduce each location after a short delay. Half the participants completed the task with surrounding shapes being a circle, a horizontal ellipse, and a vertical ellipse; the other half with surrounding shapes being a square, a triangle, and a pentagon. Elongation of the task field along an axis led to exaggerated bias along that axis, but the pattern of bias was fairly constant across the shapes. The data were modeled by assuming that bias in estimation was due to the weighting of spatial category prototypes. Modeling indicated that shape affected spacing of prototypes, but there was no evidence that it affected number of prototypes. These results were consistent with use of a viewer-based frame of reference, with prototypes reflecting four spatial quadrants generated by left–right and up–down distinctions from the viewer’s perspective.

**11:40–11:55 (301)**

**Memory for Known Objects When Moving Through Space.** GABRIEL A. RADVANSKY & ANDREA K. TAMPLIN, *University of Notre Dame*—In four experiments, people memorized a map of a building, including the locations of critical 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. This follows from a procedure developed in research on text comprehension (e.g., Bower & Morrow, 1990; Rinck & Bower, 1993). In text comprehension, a spatial gradient is observed such that objects that are further from the story protagonist’s current location are less available. It is possible that a similar sort of spatial gradient could be observed with interactive environments. However, no such effect was observed in our experiments. Instead, a transient decrease in availability was observed for objects in rooms that a person had recently entered. This decreased availability was largely absent 2 sec later, with information being relatively equally available across all spatial locations.

**Attentional Capture****Brown Convention Ctr. Rm. 306, Sunday Morning, 9:40–12:00***Chaired by Clark G. Ohnesorge, Jr., Carleton College***9:40–9:55 (302)**

**Paying Attention to Arousal: Emotional Valence Alone Is Not Enough.** CLARK G. OHNESORGE, JR. & JULIANA HOUSTON, *Carleton College*, JUSTIN JONAS, *University of Minnesota, Twin Cities*, & ALISTAIR JOHNSTON, *Carleton College*—The emotional valence evoked by visual stimuli has been shown to influence performance across a large range of cognitive and perceptual tasks. Generally the concept of attention is invoked in developing theoretical explanations for this phenomenon, with a conclusion that negative stimuli attract or receive more attention than do positive or neutral stimuli. In prior research using lexical stimuli, we demonstrated the temporal unfolding of an attentional window that differed with the valence of the eliciting stimulus and that opened and closed within a time envelope of about 500 msec. In the present research, we extend our manipulation to include arousal as well as valence using pictorial stimuli (the International Affective Picture System) to further address the phenomenon of attentional modulation. We find strong support for the claim that arousal also exerts considerable influence on the capture of visual attention, as well as other interesting attentional differences between pictures and words.

**10:00–10:15 (303)**

**Angry Face Is Detected Faster but Not Approachable.** SOWON HAHN, EDWARD NGUYEN, ANDREW JEON, & TIM LORAT, *University of Oklahoma*—A number of studies using a visual search paradigm reported that angry faces were detected more efficiently than were happy or neutral faces. In the present study, participants searched for a discrepant facial expression in a display which included a number of faces, either by pressing a key or by touching the touch-screen monitor. In Experiment 1, when participants were instructed to press

a key, we found that angry faces were detected faster and that response time (RT) slope was smaller. However, in Experiment 2, when participants were instructed to respond by touching the touch-screen monitor, we found that angry face detection was slower and that RT slope was larger than in happy or neutral face search. The present study suggests that angry faces are detected faster, but are not approachable.

#### 10:20–10:35 (304)

**Positive Affect Enhances Working Memory via Improvement in Controlled Processing.** HWAJIN YANG & ALICE M. ISEN, *Cornell University* (sponsored by Alice M. Isen)—The effects of positive affect on working memory (WM) and short-term memory (STM) were examined. Given that WM engages controlled processing, whereas STM does not, we hypothesized that if positive affect improves controlled processing, it should improve WM but not STM. As hypothesized, we found that positive affect, compared with neutral affect, significantly enhanced WM as measured by the operation span task, but did not influence STM. In Experiment 2, we conceptually replicated these findings using a different WM task, the vowel-counting span task. This suggests that the beneficial effects of positive affect on WM are applicable to a range of quite complex tasks. Analyses of recall and processing times and accuracy revealed no differences between the two affect conditions. These results demonstrate that improved WM under positive affect is not attributable to motivational differences but to facilitated controlled processing, compatible with the flexibility model of positive affect (Isen, 2000).

#### 10:40–10:55 (305)

**Undetected Changes Capture Attention: A Dissociation Between Awareness and Attention.** DOMINIQUE LAMY & AMIT YASHAR, *Tel Aviv University*—Can events not consciously perceived draw attention? We explored this question in a change blindness experiment. Participants viewed two displays separated in time by a blank screen (change displays) and immediately followed by a probe. Participants first responded to the probe and then reported whether or not they had noticed a change between the change displays. When the probe was a new object, responses to it were faster near the change than far away from it, but only for undetected changes, not for changes that had been consciously perceived. When the probe occurred in an existing object, probes appearing in the same object as the change were responded to faster, whether or not the change had been detected. These findings suggest that (1) there is implicit change detection, (2) an undetected change captures attention, and (3) the cost of disengaging attention from an object occurs only for consciously perceived objects.

#### 11:00–11:15 (306)

**Involuntary Capture of Attention by Line Intersections, Both Real and “Imagined.”** BRYAN R. BURNHAM & JAMES H. NEELY, *SUNY, Albany* (read by James H. Neely)—Response times (RTs) are faster when a target appears near an object’s corner rather than along one of its sides (Cole, Gellatly, & Blurton, 2001). Our experiments were designed to determine whether this corner enhancement effect could be found for line intersections that were not corners of an enclosed object. We found that when two intersecting lines appeared and offset before a circular target array appeared, RTs were faster when the target appeared (1) at the intersection location rather than along one of the lines and (2) where one line would have intersected with the circular percept created by the circular target array, had the lines appeared simultaneously with the target array. Hence, an “imaginary” intersection also captured attention. These capture effects were non-contingent and involuntary, because the intersections were not useful for locating the target. Apparently, intersecting lines automatically capture attention, even when they are not corners of enclosed objects.

#### 11:20–11:35 (307)

**What Causes Auditory Distraction?** BILL MACKEN, FIONA G. PHELPS, & DYLAN M. JONES, *Cardiff University* (sponsored by Robert Arthur Johnston)—Task-irrelevant background sound sub-

stantially interferes with short-term memory. Degree of distraction is not related to factors such as working memory capacity, executive function, habituation, or the particular content of the sound. The critical characteristic of distracting sounds is acoustic change over time between segmented entities, and short-term memory tasks that involve order processing are those that are susceptible to disruption. We tested the hypothesis that the automatic processing of auditory sequences causes distraction. We compared the relationship between two types of auditory sequence-matching tasks and distractibility. Performance on a sequence-matching task that could be accomplished on an automatic basis predicted how distractible participants were when presented with task-irrelevant sound during serial recall. Sequence-processing tasks that required recoding of auditory input (labeling, transposition) predicted serial recall performance, but not disruptability. The facility with which auditory sequences are automatically (but not deliberately) processed determines the extent to which auditory distraction occurs.

#### 11:40–11:55 (308)

**Production of Concurrent Color in Synesthesia: Automatic or Attention-Demanding?** AMY L. RAMOS, *Willamette University* (sponsored by Veronica J. Dark)—*Synesthesia* refers to the involuntary physical experience of cross-sensory associations (Cytowic, 2002). For individuals with grapheme–color synesthesia, processing of alphanumeric stimuli results in perception of colors, called concurrents. One explanation is that concurrents arise from direct cross-activation between cortical language and color processing areas. Whether the binding of color and alphanumeric form that produces concurrents is an automatic or an attention-demanding process was examined using an attentional blink procedure with a strong synesthete. Targets and distractors were black letters with the targets (T1 and T2) indicated by a red box. No target’s concurrent was black, so concurrent color and physical color were incongruent. Identification of T2 given T1 identification showed a U-shaped pattern; however, recovery did not begin until after 500 msec. It appears that the binding process occurs involuntarily, but that it is resource demanding. “Automatic” activation of concurrent color in synesthesia is an attention-demanding (stage 2) process.

#### False Memories

#### Grand Ballroom F, Sunday Morning, 10:00–12:00

Chaired by Linda A. Henkel, *Fairfield University*

#### 10:00–10:15 (309)

**Memory Attributions for Choices: How Beliefs Shape Our Memories.** LINDA A. HENKEL, *Fairfield University*, & MARA MATHER, *University of California, Santa Cruz*—People choosing one option over another later show biases toward attributing positive features to their chosen option and negative features to the rejected option. The present experiments show the important role that beliefs play in memory reconstruction about choices. In Experiment 1, participants who misremembered which option they had chosen favored the believed choice in their memory attributions more than the actual choice. In Experiment 2, beliefs were directly manipulated by providing false reminders for some choices in which participants were told that they had chosen an option they had actually rejected. Results showed that attributions of features favored the option that participants believed they had chosen, both when that belief was correct and when it was erroneous. Furthermore, features attributed in a fashion favoring believed choices were more vividly remembered than non-choice-supportive features. Thus, beliefs about a choice at the time of retrieval lead to biases about both the valence and the vividness of remembered choice option features.

#### 10:20–10:35 (310)

**Recognizing Stimuli Never Experienced.** RENÉ ZEELBERG, *Erasmus Universiteit Rotterdam*—Participants studied lists of non-

words (e.g., *frost*, *floost*, *stoost*, etc.) that were orthographically and phonologically similar to a nonpresented critical lure, which was also a nonword (e.g., *ploost*). Replicating our earlier results (Zeelenberg, Boot, & Pecher, 2005), a large false recognition effect was obtained, even though an over-rehearsal procedure showed that the proportion of critical lures rehearsed during study was very low. Moreover, false recognition of critical lures was associated with high confidence ratings. These findings are consistent with global familiarity models of recognition memory.

#### 10:40–10:55 (311)

**Knowledge Types Underlying False Recall in the Deese/Roediger–McDermott Paradigm.** DAVID R. CANN, KEN McRAE, & ALBERT N. KATZ, *University of Western Ontario* (read by Ken McRae)—Backward associative strength is a strong predictor of false recall in the Deese/Roediger–McDermott (DRM) paradigm. However, other than defining this variable as a measure of association between studied list words and the nonpresented critical words that are falsely recalled, there is little understanding of this variable. We employed a knowledge type taxonomy to classify the semantic relations that exist in the DRM stimuli. These knowledge types predict the probability of false recall in DRM lists, and backward associative strength. The knowledge types that are most important to understanding both false recall and backward associative strength are synonyms, situational features, taxonomic relations, and entity features. Our results add insight into the factors underlying the activation/monitoring framework (Roediger et al., 2001). Crucially, they also suggest how the knowledge types that underlie the semantic relations between list and critical words lead to a better understanding of gist formation (Brainerd & Reyna, 2002).

#### 11:00–11:15 (312)

**Modeling False Recall: Semantic Encoding and Retrieval in Associative Memory Models.** DANIEL R. KIMBALL & TROY A. SMITH, *University of Texas, Arlington*, & MICHAEL J. KAHANA, *University of Pennsylvania*—Using new models that build upon existing associative memory models, we simulated recall in the Deese/Roediger–McDermott paradigm, in which participants frequently intrude unstudied critical words while recalling lists comprising their strongest semantic associates, but infrequently produce other extralist and prior-list intrusions. We tested versions of encoding and retrieval mechanisms using semantic associations conjunctively or nonconjunctively. During encoding, unstudied words' associations to list context strengthen in proportion to their strength of semantic association to either each studied word or all corehearsed words. During retrieval, words receive preference in proportion to their strength of semantic association to either the last recalled word or multiple recalled words. We simulated all intrusion types and veridical recall for lists varying in average semantic association strength among studied words, and between studied and critical words. Results showed better fits for conjunctive than for nonconjunctive mechanisms, and for retrieval than for encoding mechanisms, especially for critical word data.

#### 11:20–11:35 (313)

**Separating Fact From Fiction in Stories.** ELIZABETH J. MARSH & LISA K. FAZIO, *Duke University*—People's knowledge about the world comes from many sources, including less accurate ones such as novels and short stories. To simulate this in the lab, participants read short stories that contained true and false information about the real world. Story reading led to robust production of the false facts on a later general knowledge test. In contrast to many false memory paradigms, suggestibility was greater in older children than younger, and increased when the material was presented more slowly. These results are related to source monitoring theory and to material-appropriate processing.

#### 11:40–11:55 (314)

**Sleep Increases Veridical and False Recall of Semantically Related Words.** JESSICA D. PAYNE, *Harvard University*, RUTH PROPPER,

*Merrimack College*, MATTHEW P. WALKER, *Harvard Medical School*, DANIEL L. SCHACTER, *Harvard University*, & ROBERT STICKGOLD, *Harvard Medical School*—Several studies have suggested that sleep plays a role in declarative memory consolidation (Pihl & Born, 1997), but few have shown facilitation across an entire night of sleep. Here we studied the impact of a night of sleep on the ability to accurately recall semantically related word lists in the Deese/Roediger–McDermott false memory paradigm. Participants studied eight 12-word lists at either 9 a.m. or 9 p.m. They recalled these words (1) after 12 daytime hours spent awake, (2) after 12 nighttime hours containing sleep, (3) 20 min after learning in the morning, or (4) 20 min after learning in the evening. The sleep group recalled more presented words (13.3 vs. 9.1,  $p = .027$ ) and falsely recalled more critical lure words (3.6 vs. 2.7,  $p = .04$ ) than did the wake group. The fact that such “false memories” increased preferentially after sleep suggests a role for sleep in the consolidation of memory for gist.

#### Free Recall

#### Grand Ballroom I, Sunday Morning, 9:40–11:20

Chaired by Marc W. Howard, *Syracuse University*

#### 9:40–9:55 (315)

**Properties of Episodic Association.** MARC W. HOWARD, *Syracuse University*—The temporal context model (TCM) hypothesizes that episodic recall is a consequence of cuing with a distributed representation of temporal context that changes gradually over time. Item–context binding enables items to recover contextual states. Three sets of findings are described that are consistent with the predictions of TCM. First, in an immediate free recall experiment, we observed temporally defined associations between items in recall initiation. Second, in an experiment in which words from multiple lists were recalled, we observed recency and contiguity effects across lists—on the scale of hundreds of seconds. Finally, in a paired associate task, we observed associations across linked pairs (e.g., A–B B–C). Taken together, these findings indicate that temporally defined associations are observed in immediate recall, are also observed across several hundred seconds, and may be mediated by the similarity of the contexts in which items are experienced rather than by temporal contiguity per se.

#### 10:00–10:15 (316)

**Ratings of Nondominant Associations: Implications for Models of Associative Judgments.** WILLIAM S. MAKI, *Texas Tech University*—The rated association between cue and response words (JAM) is a linear function of free association probability,  $pF$  (Maki, 2004, 2005). But, as the probability for the dominant associate ( $pF1$ ) increases, the probability for the 2nd-rank associate ( $pF2$ ) increases and then decreases. In the experiment reported, JAM was found to track both functions, so JAM linearly tracks  $pF$  regardless of associative rank. The strength sampling model of free association (Nelson, McEvoy, & Dennis, 2000) can be extended to cover associative judgments. The relation between JAM and  $pF$  is accurately reproduced when JAM is a power function of strength in which theoretical strength is computed from the strength sampling model. Implications for other models are discussed.

#### 10:20–10:35 (317)

**Memory as Discrimination: A Challenge to the Encoding–Retrieval Match Principle?** MARIE POIRIER, *City University London*, JAMES S. NAIRNE, *Purdue University*, CAROLINE MORIN, *Warwick University*, & REEMA SHARMA, *City University London*—We present the results of a series of experiments designed to contrast the predictions of Tulving's encoding–retrieval match hypothesis and Nairne's proposal of memory as discrimination. In these studies, participants first had to learn to associate to-be-recalled nonwords with simple geometric shapes. They then completed a cued recall task in which the cue was one or more of these shapes. The critical factor was whether or not each cue was uniquely associated with the to-be-recalled tar-

get. This allowed us to manipulate orthogonally (1) how discriminative the cue was, and (2) the degree of overlap between the cues present during learning and those present at retrieval. The results call into question the idea that the determining factor in successful retrieval is the degree of overlap between the cues present at encoding and at retrieval.

**10:40–10:55 (318)**

**Task Effects on Memory Accessibility in Free Recall.** SEAN M. POLYN & DOV M. KOGEN, *University of Pennsylvania*, KENNETH A. NORMAN, *Princeton University*, & MICHAEL J. KAHANA, *University of Pennsylvania*—A series of free-recall experiments investigated the role of task information in guiding memory retrieval. Words were encoded using one of three judgments: pleasantness, size, or living/nonliving. In some lists, the encoding task was consistent throughout, whereas in others the task switched within the list. Analyses of recall transitions and serial position effects suggest that the context of the encoding task exerts a strong influence on the organization of memory. Specifically, subjects were more likely to make transitions during recall among items encoded in the same manner. In certain cases,

a shift in encoding task caused enhanced recall of succeeding items, suggesting a reduction in proactive interference from items studied before the shift. This pattern of results suggests that the encoding task contributes strongly to subjects' inner mental context and—through this—influences how memories are accessed during retrieval.

**11:00–11:15 (319)**

**Just Say Yes: Better Memory for Chosen Than for Unchosen Traits.** W. SCOTT TERRY, *University of North Carolina, Charlotte*—When asked to make a hypothetical choice between two traits (“would you rather be more intelligent or more attractive?”), participants both recalled and recognized more of the chosen alternatives than they did the unchosen items. Participants did not necessarily remember more positive choices (“more . . . more”) than negative choices (“would you rather be less intelligent or less attractive?”), even though negative decisions took longer to make. Similar findings occurred when the decisions were phrased as actual attributes (“are you more intelligent or more attractive” and “are you less . . . or less . . .”). The results are discussed in terms of elaboration, self-memory, and memory for positive information.

## POSTER SESSION I

Ballroom of the Americas, Thursday Evening, 6:00–7:30

## • SPATIAL COGNITION •

(1001)

**Body- and Environment-Stabilized Processing of Spatial Knowledge During Locomotion.** WEIMIN MOU & XIAOOU LI, *Chinese Academy of Sciences*, & TIMOTHY P. McNAMARA, *Vanderbilt University* (sponsored by Weimin Mou)—Three experiments examined the activation of body- or environment-stabilized modules to process objects' locations during locomotion. Participants learned the locations of nine objects on the floor or on a turntable from a single viewpoint. They pointed to objects from the learning heading or a novel heading after turning. Two corresponding imagined headings were used at each of the actual headings. Pointing judgments were faster at the imagined heading parallel to the actual heading, which indicated the activation of environment-stabilized modules, when the objects were placed on the floor or an unrotatable table. Such actual heading facilitation disappeared when the table was shown to be rotatable and the participants were required to use body-stabilized modules. These results suggest that the activation of body- or environment-stabilized modules is determined by the perception of the consequences of locomotion.

(1002)

**Scene Recognition at Novel Viewpoints Relies on Recovery of the Learning Viewpoint.** WEIMIN MOU & HUI ZHANG, *Chinese Academy of Sciences*, & TIMOTHY P. McNAMARA, *Vanderbilt University*—Simons and Wang (1998) reported that detections of an object's movement on a table at a novel viewpoint were more accurate when the novel viewpoint was caused by observer locomotion than when caused by table rotation. We hypothesized that the facilitation of locomotion was due to improved recovery of the learning viewpoint after observer locomotion. Experiment 1 replicated Simons and Wang's experiments and showed that change detection at the novel view was facilitated but change detection at the familiar view was inhibited by locomotion. In Experiments 2 and 3, a stick on the table indicated the to-be-tested viewpoint in the learning phase or the learning viewpoint in the testing phase. The facilitation by locomotion at the novel view was eliminated, but the interference from locomotion at the familiar view remained. A new model of location change detection is proposed to explain these findings.

(1003)

**Spatial Representation of Object Layout Depends on Object Properties.** GEORGE S. W. CHAN, MARK BAILEY, & HONG-JIN SUN, *McMaster University* (sponsored by David I. Shore)—Scene recognition performance is better when changes in viewpoint are due to an observer's movement than when such changes are due to layout movement. We evaluated whether this effect would be differentially manifested for specific properties of the layout (object position and identity). Subjects viewed an array of five or seven objects on a rotatable table. A change was made by either (1) moving the position of one object in an array of identical objects or (2) replacing one object with a novel one in an array of different objects. The subjects then viewed the objects from a novel viewpoint (due to observer's movement or table rotation) and identified the change. The results demonstrated improved performance when viewpoint change was due to the observer's own movement. Importantly, the magnitude of this difference depended on the spatial properties and the number of objects. This suggests that the contributions of object position and identity are dissociable.

(1004)

**Sensorimotor Alignment Effects When Reasoning About Immediate and Nonimmediate Environments.** JONATHAN W. KELLY, *University of California, Santa Barbara*, MARIOS N. AVRAAMIDES, *University of Cyprus*, & JACK M. LOOMIS, *University of California, Santa Bar-*

*bara* (sponsored by Jack M. Loomis)—The presence of sensorimotor effects in a spatial memory task was investigated in three experiments using virtual reality. Participants learned the locations of eight objects arranged around a room (learning room) and later made egocentric pointing judgments from imagined perspectives aligned or misaligned with their body orientation at test. Prior to testing, the participants either stayed in the learning room or walked into a neighboring room (novel room). Experiment 1 provided evidence of a sensorimotor alignment effect (aligned trials were faster than misaligned trials), but only when testing occurred in the learning room. In Experiment 2, the sensorimotor alignment effect returned when the participants walked back into the learning room after being tested in the novel room. These experiments suggest that body orientation affects retrieval only when testing occurs in the learning environment. Experiment 3 showed that instructional manipulations can produce a strong sensorimotor alignment effect, even in the novel room.

(1005)

**The Role of Topological Place Structure in Active Navigation.** HUIYING ZHONG, MARIANNE C. HARRISON, & WILLIAM H. WARREN, *Brown University*—Our previous studies have shown that humans depend on topological, rather than metric, spatial knowledge when navigating on foot in a virtual maze. Here, we investigated this topological knowledge by testing whether the ordinal structure of environmental places is used to guide novel shortcuts. The maze contained five pairs of places marked by distinctive objects. During learning, the participants freely explored and were trained on each pair by walking from a home location to Place A and, then, to Place B. During testing, the participants walked from home to Place A, the maze was removed, and they took a shortcut to Place B. On control trials, all the objects were removed. On probe trials, all the objects except the target remained visible. If the participants relied on the ordinal structure of places, shortcut accuracy and precision should have improved with more remaining objects. The results allowed us to determine whether topological place structure contributes to active navigation.

(1006)

**Path Integration is Not Always Limited by Error Accumulation.** XIAOANG IRENE WAN, RANXIAO FRANCES WANG, & JAMES A. CROWELL, *University of Illinois, Urbana-Champaign*—Path integration is the ability to integrate self-motion information to estimate one's current position and orientation relative to the point of origin. We investigated the mechanism of path integration error in humans, using a virtual reality maze. In a homing task, participants traveled along hallway segments and then were asked to return directly to the origin. Information about distance traveled was purely visual, whereas turning angles were specified both visually and through body senses. The number and length of the hallways and the turning angles were manipulated. In contrast to the classical hypothesis that homing errors are due to perceptual error accumulation during encoding, our results indicate that position errors are not predicted by the whole path length in some conditions. These results suggest that alternative models are needed to explain human path integration behavior.

(1007)

**Representational Momentum in a Scene: Camera or Object Motion?** MARGARET P. MUNGER, TRAVIS A. BROWN, AMANDA L. GEIGER, HONNA L. HOUSLEY, ALEXANDER R. H. LIBSON, & LAURA H. SOMMER, *Davidson College*—Representational momentum (RM) is a forward distortion of a moving object's position, and it has been observed for objects (e.g., Hubbard, 2005) and complex scenes (e.g., Hayes & Thornton, 2004). Motion in a scene can occur when objects move, when the camera moves, or both. Larger RM is often found with object motion to the right (Halpern & Kelly, 1993), and this asymmetry may help identify whether RM in a scene depends on object motion or reflects an understanding that the camera is moving. We examined RM when camera rotations brought objects across the view to the left and right. If perceived object motion is critical,

larger RM should occur for camera motion to the left (which presents rightward object motion). We found the opposite, with larger RM for rightward camera motion, suggesting that the participants were considering the camera motion, not simply that of objects within the scene.

• PERCEPTUAL PROCESSES •

(1008)

**A Blink Is Not a Blank, but It Can Be a Saccade.** J. STEPHEN HIGGINS, DAVID E. IRWIN, RANXIAO FRANCES WANG, & LAURA E. THOMAS, *University of Illinois, Urbana-Champaign*—When a visual target is displaced during a saccade, it is usually detected only if the displacement is large. Suppression of displacement can be eliminated by introducing a blank period after the saccade and before the target reappears. This has been termed the “blinking effect” and has been attributed to the use of extra-retinal signals to compare the old location of the target with the new. We examined whether similar effects occur with eye blinks. We found that perception of displacement is suppressed by a blink and that introducing a blank period after the blink eliminates the displacement suppression in much the same way as after a saccade. We argue that the blanking effect is not likely related to access of proprioceptive information from an eye movement but, instead, has to do with the initiation of eye or eyelid movements.

(1009)

**Configural Superiority and Configural Inferiority Effects in Vision: A Startling Crossover.** AMI EIDELS, JAMES T. TOWNSEND, & JASON GOLD, *Indiana University, Bloomington* (sponsored by James T. Townsend)—In visual search, adding context can dramatically facilitate target detection latencies. Pomerantz, Sager, and Stoeber (1977) displayed four diagonal lines and asked participants to indicate the location of the odd line, which differed from the other three by orientation. Then a fixed context was added to each of the lines: an L shape that created a triangle when combined with the odd line, but not when combined with the other diagonals. Localizing the odd item in the with-context condition was much faster than in the original condition (configural superiority effect [CSE]). Presumably, novel properties such as closure may emerge when we combine distinct features (lines) into a unified configuration (triangle). In the present study, we showed CSE for speeded detection but a reversed accuracy effect when Gaussian noise was added to the displays. An “ideal observer” performed equally well with and without context, suggesting that the addition of fixed context did not contribute diagnostic information.

(1010)

**A Dynamic, Hebbian Model of Configural Learning.** LESLIE M. BLAHA & JAMES T. TOWNSEND, *Indiana University, Bloomington* (sponsored by James T. Townsend)—Configural learning is the process of developing a configural or holistic visual object representation. Experimental findings (Blaha & Townsend, in preparation) support the process of perceptual unitization as a potential mechanism underlying configural learning; such a process has the potential to support the development of configural face-processing mechanisms. Learning results in qualitative shifts in processing commensurate with the configural information-processing model proposed by Wenger and Townsend (2001): interactive parallel processing with facilitatory channel interactions resulting in super-capacity processing. We constructed a Hebbian-style learning model, employing a recursive learning rule to develop interactions within a parallel linear system. Simulations exhibit a qualitative shift from extreme limited to extreme super-capacity by transforming negative interactions into positive interactions. This qualitative shift can also be captured by a learning model that incorporates a change in processing architecture. Implications for distinguishing model differences via further experimental work are discussed.

(1011)

**Processing Small, High-Contrast Letters Reduces Face Recognition Performance.** PETER J. HILLS & MICHAEL B. LEWIS, *Cardiff Uni-*

*versity* (sponsored by Michael B. Lewis)—Five minutes of processing the local feature of a Navon letter causes a detriment in face-recognition performance (Macrae & Lewis, 2002), sometimes explained in terms of a transfer-inappropriate processing shift. Replications of this effect have been variable in their results. We hypothesize a perceptual aftereffect explanation of the Navon effect in which discriminations are less accurate after adapting to certain contrast and/or spatial frequencies (Webster & Miyahara, 1997). Experiment 1 showed that reducing contrast of Navon stimuli removed the Navon effect. Experiment 2 showed that blurring them did the same. Experiment 3 tested simple letters at different contrasts and perceptual sizes. Consistent with the perceptual aftereffect explanation, a small, high-contrast letter produced an effect equivalent to local processing of Navon letters. These results are difficult to explain in terms of the transfer-inappropriate processing shift explanation but do account for the variability in the replications of the Navon effect.

(1012)

**A Repetition Priming Test of the Objective-Threshold/Strategic Model of Unconscious Perception.** GARY D. FISK, *Georgia Southwestern State University*, & STEVEN J. HAASE, *Shippensburg University*—The objective-threshold/strategic (OT/S) model of unconscious perception (Snodgrass et al., *P&P*, 2004) proposes that the objective identification threshold (OIT; where identification  $d' = 0$ ) forms a boundary between conscious and unconscious perception. Priming effects obtained below the OIT are indicative of unconscious perception. Two repetition priming experiments were performed in which prime stimuli were presented either above or below the OIT. Robust repetition priming effects were obtained for primes presented above the OIT, but not for primes presented below the OIT. However, liberal statistical-testing approaches yielded some evidence in support of the OT/S model (a small priming effect at the shortest prime duration in mean RT, but not in median RT). Thus, the inconsistency across analyses leads us to question a strong version of this model.

(1013)

**Multidimensional Scaling of Commonplace Objects by the Blind.** KANAV KAHOL, DONALD HOMA, LAURA BRATTON, & SETHURAMAN PANCHANATHAN, *Arizona State University*—How blind subjects represent commonplace objects was explored. Thirty-six objects drawn from three related categories (*bowls, cups, glasses*) were multidimensionally scaled. Three other groups—sighted-blindfolded (SB), sighted without touching (S only), and sighted-touching (S&T)—were also studied. Each subject was randomly presented two objects from the set and provided a similarity judgment. The four sets were individually scaled (MDS), and contrasts among the four groups were accomplished using Congru. The results revealed that blind subjects provided a cognitive space similar to sighted controls, and all the groups clearly separated the three subordinate categories (S&T = .70; SB = .69; B = .68); the sighted-only group having the least structure (S = .60). The Congru analysis revealed a strong similarity among the four groups (.80+ in each case), suggesting that for these objects, haptic information alone provided nearly full information for their cognitive representation. The primary dimensions appeared to be texture, size, and curvature.

(1014)

**Learning to Identify Acoustic Environments From Reflected Sound.** ANGELIQUE A. SCHARINE, TIMOTHY MERMAGEN, & TOMASZ R. LETOWSKI, *Army Research Laboratory*—Reverberation is often treated as an acoustic problem, since it adds false localization cues to an environment and decreases speech intelligibility. However, it also is shaped by the configuration and absorptiveness of the environment in which it occurs and, therefore, is a potential source of information about that environment. The objective of this study was to determine whether listeners are sensitive to this information and are able to use it to enhance their auditory “situational awareness.” Twelve listeners participated in an auditory training task in which they learned to identify three environments on the basis of a limited subset of sounds and

then were tested to determine the degree to which they could identify those environments when hearing new, unfamiliar sounds. Results showed that significant learning occurred despite the task difficulty. An analysis of stimulus attributes supports the argument that familiarity with reverberant environments increases situational awareness.

(1015)

**Effects of Contrast on Responses to Subliminal Stimuli During Driving Simulations.** ROBERT D. MATHER & PATRICIA R. DeLUCIA, *Texas Tech University*—Ethnic minorities are overrepresented in pedestrian–vehicle collisions (USDOT, 1999). Is this due to drivers' racial attitudes or to the contrast of a pedestrian's skin color against the background? Participants viewed computer simulations of self-motion along a road. At an unpredictable time, a stimulus consisting of a person (White or Black race) or square control (white or black hue) was presented subliminally, followed by an obstacle. Contrast between stimulus and background varied. The participants pressed a button as soon as they saw the obstacle. Response time was measured. Although our person stimuli had been used previously to demonstrate effects of racial attitudes on performance in weapon identification tasks (Greenwald et al., 2003), such effects did not occur here. We obtained significant effects of stimulus contrast, even though the stimuli were subliminal. The results have implications for the design of traffic safety aids and for previous studies that have reported effects of racial attitudes without controlling for contrast.

(1016)

**A Spin on Categorical Perception in Object Recognition.** JEREMY R. ATHY & DALE S. KLOPFER, *Bowling Green State University*—This research investigated how individuals perceive the angular separation between two parts of the same object. The objects, modeled after those used by Rosielle and Cooper (2001), consisted of a horizontal base and an arm that made an angle with the base that varied in 15° increments. Using objects that varied in 30° increments, Rosielle and Cooper found evidence for categorical perception of angular separation, with horizontal (<30°), vertical (>60°), and oblique categories (between 30° and 60°). Experiment 1 replicated Rosielle and Cooper's general findings, but category sizes differed. When the objects were rotated 30° (Experiment 2), there was no evidence of categorical perception. In Experiment 3, the rotated objects were placed within a rotated rectangular frame (after Kopferman, 1930), and categorical perception was once again obtained, albeit somewhat weaker than in Experiment 1. The importance of perceptual reference frames is discussed.

• FACE PROCESSING •

(1017)

**The Importance of Facial Features in Emotion Vary With Familiarity.** CHRISTOPHER KOCH, LINDSAY BLANKENSHIP, AMANDA DAVIS, AMBER LINKH, RYAN STICKA, & SOLOMON WANG, *George Fox University*—Koch (2005, 2006) occluded the eyes or mouth of faces expressing different emotions in a Stroop-like task. It was found that different facial features may be important under different conditions for recognizing facially expressed emotions. For instance, the eyes may be most important when there is more uncertainty about an emotion, and the mouth may be most important when confirming an emotion. The present study was conducted to determine whether facial features were also examined differently under familiar and unfamiliar conditions. Using a Stroop paradigm, participants viewed the faces of students in their class or students from Germany. The eyes or mouth were removed on random trials. Although there were no significant RT differences between the familiar and the unfamiliar conditions, there were significant differences in regard to accuracy, indicating that different facial features are used to determine the facially expressed emotion of familiar and unfamiliar people.

(1018)

**Effect of Affect on Perceptual Learning.** NOAH SULMAN &

THOMAS SANOCKI, *University of South Florida*—The influence of emotion on perceptual learning (PL) was tested in a primed PL paradigm. Observers were presented with a peripheral acuity stimulus over 120 trials with feedback regarding their performance. Just before each acuity stimulus, the observers were primed by central photographs containing threatening, neutral, or positively valenced images. Threat-primed observers exhibited a faster rate of PL (greater increases in acuity) than did the observers in either of the other two prime conditions.

(1019)

**Defining the Parameters of Beneficial Effects of Verbalization on Remembering and Knowing Faces.** TOBY J. LLOYD-JONES, *University of Kent*, CHARITY BROWN, *University of Leeds*, & JUERGEN GEHRKE & JASON LAUDER, *University of Kent*—We examined the effects of verbally describing a face on face memory as assessed in an old/new recognition task. There are several possible sources of verbal facilitation in this paradigm, including (1) increased global or local visual processing, (2) increased attention or rehearsal, and (3) the formation of richer semantic associations with the face. In order to localize the effects of verbalization, we manipulated (1) face orientation at test, (2) attentional resources at encoding, (3) face familiarity, and (4) the nature of the description task. We also used the remember/know procedure as a measure of recognition performance. Finally, we also describe some additional evidence from the analysis of eye movements. We argue that verbalization enhances the processing of item-specific features that differentiate a particular face from other faces that are encountered. These features correspond to visually derived semantic information, which may be supplemented by preexisting visual, person identity, or semantic information.

(1020)

**Using Individual Differences to Investigate the Independence of Face-Processing Skills.** ROBERT A. JOHNSTON, *University of Kent*—Bruce and Young's (1986) model of face recognition proposed that different face-processing skills (e.g., determining familiarity, judging expression, matching unfamiliar faces) were carried out via independent pathways. However, more recent research has questioned whether this proposed independence is correct. The present study compared the performance of 96 participants on four separate face-processing tasks. First, each task was analyzed to confirm that the participants had performed the activity in an unimpaired way, as predicted by the stimuli and the decision required. Subsequently, performance across all tasks was analyzed to examine how the level of performance on one task predicted performance on the others. The findings support the proposal of independent routes for familiar face processing and expression judgment but cast doubt on the independence of familiar face processing from both matching unfamiliar faces and classifying the sex of faces. These experimental data are discussed in relation to findings from recent cognitive neuropsychological studies.

(1021)

**Eye Movements in Face Learning: The Other-Race Effect.** YI HE, *Yale University*, & STEPHEN D. GOLDINGER, *Arizona State University* (sponsored by Stephen D. Goldinger)—The other-race effect (ORE) is a well-documented phenomenon wherein people are better at learning and recognizing faces from their own race, relative to cross-race faces. We examined eye movements while people studied faces for later recognition and related those eye movements to the ORE. Caucasian participants studied Caucasian and Asian faces with different expressions (neutral and mixed emotional). Face memory was later tested in a recognition task. Eye movements were continuously recorded during learning and test. In the memory data, well-known effects of race and emotion were replicated. During learning, different fixation patterns were used to memorize faces from different races, even when later recognition performance was equated. When studying own-race faces, people made more fixations, moved their eyes greater distances, and spent less time focusing on single features. These race differences were generally reduced among emotional

faces. The results suggest that people have more efficient feature selection for own-race faces.

(1022)

**Remembering an Infant's Face.** SHELIA M. KENNISON, KIMBERLY D. BATES, & ANA C. VAQUEIRO, *Oklahoma State University*—The research investigated young adults' ability to remember the faces of newborn infants. In the study, participants initially viewed pictures of 25 boys and 25 girls and judged the sex of each infant. They then viewed the same 50 photos, intermixed with 50 new photos, again, this time indicating which infants had been viewed before. Two counterbalancing lists were used to ensure that the photos were old and new equally often across participants. The results showed that overall, women were more accurate than men in both judging infants' sex and remembering infants' faces. Men remembered boys' faces better than girls' faces; women remembered boys' and girls' faces equally well. The results add to a growing number of studies from our lab demonstrating that men remember faces of females less well than faces of males. Implications for theories of face memory are discussed.

(1023)

**Symmetrical Faces Are Most Pleasing, No Matter If Ranked or Chosen.** SUSAN T. DAVIS, DEBORAH BAKOWSKI, SUSAN ODENWELLER, & KAREN SARMIR, *University of Dayton*—Research (e.g., Grammer & Thornhill, 1994) shows that facial symmetry increases ratings of facial attractiveness. However, there is a debate over the best method for measuring attractiveness. The present research compared rating and forced-choice methods for assessing the pleasingness of facial symmetry. Photographs of faces were digitally transformed to create symmetrical representations of each face—one a mirror of the left, and the other a mirror of the right side of the face. First, the participants rated the relative pleasingness of the original and the two symmetrical representations of each face presented as a set and then chose from these the representation they found to be most pleasing. Second, the participants rated each representation of each face, in isolation from the others in its set. Symmetrical faces, particularly the mirrored right, were chosen more often as pleasing than was the original. Furthermore, forced-choice results correlated highly with ratings of pleasingness.

• WORKING MEMORY •

(1024)

**Short-Term Memory and Chunking in Infants.** CAITLIN C. BREZ & LESLIE B. COHEN, *University of Texas, Austin*—Prior research in infants has identified a significant increase in visual short-term memory (STM) capacity from 6.5 to 10 months of age (increasing from one item to as many as four). The present set of experiments was designed to study infants' ability to use chunking (perceptual grouping) to increase STM capacity. Using a preferential-looking paradigm, 4- and 6-month-old infants were tested with both "chunked" (perceptually grouped together) and "not chunked" (randomly arranged) stimuli. Six-month-olds, but not 4-month-olds, were able to hold both the chunked and the not chunked items in STM, which suggests that they can chunk information and that this can aid in STM capacity. Two additional control studies of this basic paradigm are currently being conducted that will provide more information regarding the presentation of stimuli in this task and 4-month-olds' inability to maintain the "not chunked" stimuli in STM. These studies will be completed by the fall.

(1025)

**Does Time Spent Fixating Contribute to Serial Recall for Visuospatial Information?** KATHERINE GUÉRARD, *Université Laval*, ANNIE JALBERT & JEAN SAINT-AUBIN, *Université de Moncton*, & SÉBASTIEN TREMBLAY, *Université Laval*—This research investigated the nature of encoding and its contribution to serial recall for visuospatial information. In order to do so, we examined the relationship between fixation duration and recall performance. Using the

dot task—a series of seven dots spatially distributed on a monitor screen is presented sequentially for immediate recall—performance and eyetracking data were recorded during the presentation of the to-be-remembered items. When the participants were free to move their eyes at their will, both fixation durations and the probability of correct recall decreased as a function of serial position. Imposing constant durations of fixation across all serial positions had a beneficial impact (although relatively small) on item, but not order, recall. Great care was taken to isolate the effect of fixation duration from that of presentation duration. Although eye movement at encoding contributes to immediate memory, it does not seem decisive in shaping serial recall performance.

(1026)

**The Role of Working Memory Capacity and Time Perspective in Older Adults' Memory for News Events.** RALUCA PETRICAN & MORRIS MOSCOVITCH, *University of Toronto*—Our study investigates the role of emotion, time perspective, and working memory capacity in older adults' ability to recall and become "transported" (engaged) by news stories. Seventy-four participants completed a time perspective scale, two working memory tasks, and a remember/know test involving 20 news stories (preselected for familiarity level). The participants rated their transportation and the valence of each news story. The self-rated valence of the news story predicted both recollection and transportation, such that positive stories had the highest recollection and transportation rate, whereas neutral stories elicited the lowest transportation and recollection rate. Additionally, working memory and time perspective moderated the relationship between transportation and valence, such that high working memory capacity and an infinite time perspective predicted increased transportation in positive stories (relative to negative and neutral stories). We discuss how our findings could further our understanding of the interaction of cognition, emotion, and psychosocial factors on memory.

(1027)

**Testing Exceptions to the Inhibitory Deficit Hypothesis.** LISA A. FARLEY, *Purdue University*, & IAN NEATH & AIMÉE M. SURPRENANT, *Memorial University of Newfoundland*—According to the inhibitory deficit hypothesis (Hasher & Zacks, 1988), older adults are more susceptible to interference from irrelevant information in working memory because of a decline in inhibitory ability. However, this view predicts no age-related difference if the target and distracting items are "easily distinguishable on the basis of salient perceptual cues (e.g., color or spatial location)" (Hasher, Zacks, & May, 1999). Three experiments examine this claim that salient perceptual cues may enable older adults to perform at the same level as younger adults in working memory tasks. In three experiments, eight-item lists of words were presented, with four relevant and four irrelevant items. The subjects were asked to recall only the four relevant items. Experiments 1 and 2 used font color to indicate relevance; Experiment 3 used spatial location of auditorily presented items. Significant age-related differences were observed in all the experiments.

(1028)

**The Effects of Skill Level and Presentation Rate on Immediate Serial Recall of Musical Notes.** VIRPI KALAKOSKI, *University of Helsinki*, & ELISABET SERVICE, *University of Helsinki and Dalhousie University* (sponsored by Elisabet Service)—A slow presentation rate may lead to trace degradation in immediate serial recall of visually presented musical notes, whereas a fast one may limit access to skill-related long-term memory knowledge. Our study showed that higher expertise and slower presentation rate increased the number of perfectly recalled lists, implying a contribution of long-term memory knowledge. The level of expertise did not affect variables reflecting mainly short-term memory processes and degradation of the memory trace, such as the mean recall of items in degraded lists and the position of the first error. However, there was a qualitative difference in the nature of recall errors between the two skill groups. The propor-

tion of single-item errors was larger in the low-skill than in the high-skill group, suggesting differences in encoding and constructing chunks from individual items. The proportion of errors moving whole chunks of notes was greater in the high-skill than in the low-skill group.

(1029)

**Demonstrating a Semantic Contribution to Immediate Serial Recall Using a Novel-Object-Learning Paradigm.** VICTORIA E. EDKINS & SIMON FARRELL, *University of Bristol* (sponsored by Stephan Lewandowsky)—Previous research using Anderson, Bjork, and Bjork's (1994) retrieval-induced forgetting paradigm has demonstrated that it is possible to manipulate the relative availability of members of the same semantic category. Experiment 1 replicated retrieval-induced forgetting in an adaptation of this paradigm. A novel-object-learning procedure was adopted that allowed the prior specification of individual items' availability and the strength of the association between the items and their category cues. The pattern of item inhibition observed informed an account of the precise dynamics of the relationships between items differing in retrieval practice status. Experiment 2 provided evidence that these retrieval-induced fluctuations in novel items' long-term memory activations had a sustained effect on the accessibility of the items in an immediate serial recall task. This experiment provides further evidence for the role of semantic memory representations in working memory performance and, more specifically, how long-term inhibitory processes influence item accessibility over the short term.

(1030)

**Exploring Part-Set Cuing Inhibition and Facilitation of Order Information.** MATTHEW R. KELLEY & JOANNA C. BOVEE, *Lake Forest College*—Over the past 2 decades, researchers have proposed nearly a dozen distinct models of serial order memory. Although the underlying processes and mechanisms are often quite different, each model has successfully accounted for a wide variety of serial order accuracy and error data. The challenge for researchers, then, is to evaluate these models by testing their predictions against new empirical data. The present study provided critical new data as it explored how part-set cuing affects immediate order retention. Using reconstruction of order and serial recall measures, two experiments examined the influences of cue type (consistent, inconsistent, control), cue location (before, after, surround), and list length (8, 16). In addition, the serial recall data permitted fine-grained analyses of error patterns (i.e., transpositions, omissions, within-list intrusion, out-of-experiment intrusions). The results suggest that participants can use interitem associative information to facilitate order performance, which poses problems for purely position-based models of order memory.

(1031)

**Writing Tasks Influence Fan Effect Performance for Low and High Working Memory Capacity Individuals.** KATE PARR, TRACY LINDERHOLM, & LISE ABRAMS, *University of Florida*—Performance on the operation span task has been shown to improve after writing about sad, personal events (Klein & Boals, 2001). This study determined whether these findings generalize to other writing tasks, other cognitive tasks, and low and high working memory capacity (WMC) individuals. Low- and high-WMC participants wrote about a sad, personally experienced event, created and wrote a sad story using predetermined sentences, or solved math problems. Then the participants learned and recognized target sentences, using a fan effect paradigm, where a subject was paired with multiple locations. The results showed that the participants in the two writing conditions took fewer cycles to learn target sentences, relative to the nonwriting condition. In addition, low-WMC participants more accurately recognized targets/foils after one of the two writing conditions. These results suggest that self-reference is not necessary for writing to facilitate cognitive performance and that individual differences influence these facilitation effects.

(1032)

**Laboratory Versus Psychometric Assessment of Working Memory: Are We Measuring the Same Thing?** JILL A. SHELTON, EMILY M. ELLIOTT, BEN D. HILL, & WILLIAM D. GOUVIER, *Louisiana State University*—Psychologists conducting research in both basic and applied settings define working memory (WM) in the same way, yet use different methods to assess WM function. This research examines the relationship between laboratory and psychometric indices of WM and their relationship to a criterion construct known to be highly related to WM performance, fluid intelligence. The sample includes 114 participants who have completed the WM subscales of the Wechsler Adult Intelligence Scale III and the Wechsler Memory Scale III, three laboratory measures of WM (automatic operation span, *n*-back, and listening span tasks), and a measure of fluid intelligence (Raven's). The preliminary results revealed that although most of the laboratory and psychometric WM tests share a significant correlation with one another, a composite index of performance on the laboratory tests shares a stronger relationship with the measure of fluid intelligence than does either of the psychometric WM indices.

• AUTOMATIC PROCESSING •

(1033)

**An Examination of Word Reading Using the Task Choice Procedure.** TODD A. KAHAN & KEITH B. HENGEN, *Bates College*—The task choice procedure provides a way of assessing whether stimuli are processed involuntarily and in parallel with other cognitive operations. In this procedure, a participant's task changes on a trial-by-trial basis, and the cue informing the participant about the task appears either before or simultaneously with the target, which is either degraded or clear. Of interest is whether the effect of stimulus quality will disappear when the cue is presented simultaneously with the target, suggesting that the two are processed in parallel, or whether the effect of stimulus quality will remain, suggesting that target processing is delayed until the task is deciphered. Besner and Care (2003) developed this procedure using nonword targets; their results are inconsistent with parallel processing and suggest that phonological information is not automatically extracted from text. The present experiment examined word, rather than nonword, stimuli. The results do not mirror the nonword data. Implications for the automaticity of word reading are discussed.

(1034)

**Lexical Pop-Out: The Effect of Emotion on Automatic Attention to Words.** JOSEPH M. BAKER & STEPHEN R. SCHMIDT, *Middle Tennessee State University* (sponsored by Stephen R. Schmidt)—Research shows that emotional stimuli (snakes) pop out from backgrounds of neutral stimuli (mushrooms). We attempted to generalize this effect to word-based stimuli. Emotional (taboo) words and neutral words were presented as targets within a background grid of nonemotional neutral words. Students were instructed to scan the grids for the presence of the target word. Word type (emotional or neutral) was a significant predictor of reaction time, with emotional words being responded to more quickly than neutral words. Presentation (present or not present within the grid) was also a significant predictor of reaction time, with present targets being responded to more quickly than not present targets. There was not a significant interaction between word type and presentation. These results do not support evidence for a lexical pop-out effect; however, they do support evidence for a self-terminating serial search for the presence of target words.

(1035)

**Color-Related Emotion Words Produce Stroop Interference Effects.** TINA M. SUTTON & JEANETTE ALTARRIBA, *SUNY, Albany*—The Stroop paradigm has recently been used to investigate automaticity in the processing of emotion words. However, the present study used a novel approach in this domain; a particular set of emotional words that were either congruent or incongruent with the color they were presented in (e.g., *envy* in green ink or red ink) was used, much like stan-

dard Stroop stimuli (e.g., *red* in red ink or green ink). The results revealed that emotional stimuli can be studied in the same manner as color words and color-related words, such as *fire*. In fact, the amount of interference produced by incongruent emotion items (e.g., *envy* in red ink) was equal to that of incongruent color-related items (e.g., *frog* in red ink). The present study provides a new manner in which to study the emotional Stroop effect.

(1036)

**Reading Rate and Word Unitization.** JOANNA MARINO, RIC FERRARO, AMY BREN, & JOANNE HEICH, *University of North Dakota*—Fast (338 words per minute [wpm]) and slow (152 wpm) readers participated in a letter detection experiment (*f* in *of*, *h* in *the*), with the prediction that fast readers would show greater word unitization. For the letter *h*, slow readers made more errors overall than did fast readers ( $p < .03$ ), and both fast and slow readers made more errors detecting *h* in *the* than in other words ( $p < .01$ ), but no interaction emerged ( $p > .89$ ). For the letter *f*, slow readers again made more errors overall than did fast readers ( $p < .06$ ), and both fast and slow readers made more errors detecting *f* in *of* than in other words, but no interaction emerged ( $p > .14$ ). Reading rate apparently does not impact word unitization.

(1037)

**Stereoscopic Semantic Activation Reveals Unconscious Influence on Word Stem Completion.** LUCAS E. CANTU & LAUREN V. SCHARFF, *Stephen F. Austin State University*—Conscious and unconscious systems were manipulated in order to examine their interacting influences on human choice. Using stereoscopic settings, a modification of Jacoby's (1991) word stem completion task was constructed where pairs of target words (instead of a single word) were stereoscopically presented, one to each eye, below the threshold of conscious perception. Target pairs had either neutral or emotionally charged valence and were identical words (nondichotomous), semantically and emotionally disparate words (dichotomous), or letter string pairs. Each target pair was consciously premasked with either a semantically related primer word pair, a semantically unrelated primer word pair, or an unpronounceable letter string. Regardless of priming, nondichotomous, emotionally charged conditions led to significantly higher accuracy (word stem completed with the target word), supporting theories of unconscious influence on conscious human choice. However, emotionally charged target words with consciously presented, related primers led to the highest accuracy and shortest response times, illustrating that conscious processes also influence choice.

(1038)

**An Anger Inferiority Effect With Sequential Stimuli.** DEAN G. PURCELL, *Oakland University*, & ALAN L. STEWART, *Stevens Institute of Technology*—In this experiment, observers were presented with a sequence of two affectively toned visual stimuli that were either affectively congruent or incongruent. The first stimulus was either a happy/angry face or the words *happy/angry*, whereas the second stimulus was only a happy/angry face. The observers had to attend to both stimuli in order to judge their congruency. Our study showed that the speed of response was largely determined by the affect of the first stimulus: Angry first stimuli produced slower responses, whereas happy first stimuli produced fast responses, regardless of the affect of the second stimulus. These results show that response tendencies produced by an initial affective stimulus persist even in the presence of an opposite-affect second stimulus. First stimulus effects are amplified when it is a word. This leads us to conjecture that words transmit affective tone more efficiently than do faces.

• RECALL PROCESSES •

(1039)

**What Do Elephants (and Donkeys) Never Forget? Political Attitudes and Directed Forgetting.** EMILY WALDUM, LILI SAHAKYAN, &

EDWARD J. WISNIEWSKI, *University of North Carolina, Greensboro*—In two list method directed-forgetting experiments, we examined intentional forgetting of self-relevant information. Participants were presented statements reflecting either politically liberal or conservative attitudes. In the first experiment, the type of statement was varied within subjects, with each participant studying a mixture of conservative or liberal statements on each list. The results showed that politically conservative participants did not show directed forgetting of conservative statements but showed forgetting of liberal statements. Likewise, politically liberal participants did not show directed forgetting of liberal statements but showed forgetting of conservative statements. Presenting two types of statements on each list created a recall disadvantage for attitudinally congruent statements. Therefore, the lack of directed forgetting of congruent statements could be driven by low recall in the remember condition, rather than reflecting an inability to forget. In the second experiment, we used a pure list design to eliminate the memory bias favoring incongruent statements.

(1040)

**An Auditory Picture Superiority Effect.** ROBERT J. CRUTCHER & JENAY M. BEER, *University of Dayton*—The picture superiority effect (Paivio & Csapo, 1973) has shown repeatedly that visual pictures of objects (e.g., a picture of a house) are recalled or recognized better than their corresponding verbal labels (e.g., the word *house*). The present investigation sought to extend this finding to the auditory domain. The stimuli were recorded sounds (e.g., the sound of someone coughing) or the corresponding spoken verbal labels for these sounds (e.g., the word *coughing*). An auditory “picture” advantage was found: The sounds were recalled better than the verbal labels. A second study extended this finding by investigating the effect of auditory imagery instructions on learning these same verbal stimuli: Participants listened to spoken verbal labels only (e.g., someone saying “coughing”) or listened to the verbal label and imagined the corresponding physical sound. As was anticipated, recall was greater for the verbal label plus auditory image condition than for the verbal label alone condition.

(1041)

**The Role of Expertise in Collaborative Memory.** MICHELLE L. MEADE, *Montana State University*, & TIMOTHY J. NOKES & DANIEL G. MORROW, *University of Illinois, Urbana-Champaign*—We examined the effect of domain expertise on collaborative memory performance. Expert pilots (flight instructors) and novice pilots (first-year aviation students) were presented with simple and complex versions of aviation-relevant scenarios. The subjects were asked to recall the scenarios alone or in collaboration with another subject with the same level of expertise. The novices obtained no benefit from collaboration; however, collaborating experts recalled more than did individuals (even when the individuals were pooled to form a nominal group). This effect of collaborative facilitation in experts was especially pronounced for complex problems. Analyses of verbal protocols collected during recall suggest that the components of domain knowledge and collaborative skill differentially impacted the experts' performance on the collaborative memory task.

(1042)

**Stimulating Episodic Memory: Initial Explorations Using SensCam.** EMMA BERRY, *Microsoft Research, Cambridge*, MARTIN A. CONWAY, CHRIS MOULIN, & HELEN WILLIAMS, *University of Leeds*, & STEVE HODGES, LYNDSEY WILLIAMS, KEN WOOD, & GAVIN SMITH, *Microsoft Research, Cambridge* (sponsored by Martin A. Conway)—SensCam is a camera that takes pictures in response to sensory changes. The resulting “movies” show a series of stills in a few minutes that cover several hours of activities. SensCam movies have remarkable similarities with episodic memory; for example, they are fragmentary, time compressed, temporally ordered, have a “field perspective” formed outside awareness, and are visual. In preliminary, Galtonesque investigations with co-workers at Microsoft Cambridge,

Addenbrookes Hospital, Cambridge, U.K, we found that SenseCam movies stimulate episodic memory. The effects are powerful, and an organic amnesic patient was able to recall events she could not previously recall; normal healthy participants recalled the trivia of routines as well as vividly recalling the minutiae of important events. One possibility we consider is that SenseCam pictures stimulate neural networks, possibly hippocampal, that cannot otherwise be easily accessed. It seems that the potential of SenseCam to stimulate episodic memory in many different groups is considerable.

(1043)

**Serial Position and Output Order in the von Restorff Effect.** KELLY M. ADDIS, *Indiana University, Bloomington*, MARK STEYVERS, *University of California, Irvine*, & RICHARD M. SHIFFRIN, *Indiana University, Bloomington*—Although much empirical work has been done on the isolation (or von Restorff) effect, few formal models have been proposed to explain the diverse range of results. Here, we present data from two recall experiments using lists of semantically related items that contained a single unrelated item. The serial position of the unrelated item was manipulated across lists. The results indicate that the direction and magnitude of the isolation effect vary with both the serial position of the unrelated item and the order in which items are recalled at test. To interpret these data, we turn to SAM (search of associative memory), a model that has previously accounted for a wide range of behavioral phenomena. By decreasing interitem associations between the unrelated item and all the other list items and increasing the probability that the unrelated item remains active in short-term memory, we can account for this complex pattern of recall dynamics.

(1044)

**Retrieval Strategy Affects Long-Term Recency in Memory for College Courses.** ALEXANDRA ROACH & IRA E. HYMAN, *Western Washington University*—Long-term recency was manipulated by varying the retrieval strategy used. Participants were asked to record course name, number, and grade using one of two retrieval strategies: time based or category based. The participants asked to record information using a time based strategy showed a pronounced recency effect, whereas the participants asked to record information by category dramatically reduced the size of the recency effect. Using different retrieval cues shows that recency is caused by cue overload.

(1045)

**Stopping Memory Search: When and Why Is Memory Search Halted?** J. ISAIAH HARBISON, *University of Maryland, College Park*, EDDY J. DAVELAAR, *University of California, San Diego*, & MICHAEL R. P. DOUGHERTY, *University of Maryland, College Park*—An important factor in memory use is when and how the decision is made to stop memory search. Although all memory searches are at some point halted, this has not been a topic of research within the memory area. A cued recall design was modified by giving the participants the option to stop search at any time during recall. Participant motivation was both manipulated and measured. The critical dependent variables included cumulative retrieval, retrieval latencies, and the time between the generation of the final word and the decision to give up search (exit latency). Motivation was a significant predictor of exit latency. Across participants, lower exit latencies corresponded to fewer words being generated. However, within participants, there was a strong negative correlation between words generated and exit latency. Several memory-sampling models, including SAM, equipped with a variety of stopping rules, were tested against the experimental results.

(1046)

**Does Moving Your Eyes Before a Memory Test Enhance Performance?** KEITH B. LYLE, JESSICA M. LOGAN, & HENRY L. ROEDIGER III, *Washington University* (sponsored by Henry L. Roediger III)—Recent studies by Christman and colleagues (e.g., Christman, Garvey, Propper, & Phaneuf, 2003) have shown that performance on a variety

of memory tests is enhanced by making horizontal saccadic eye movements for several seconds prior to test, relative to a no-eye-movement condition. These benefits have been attributed to increased synchrony or coherence of neural activity in the two cerebral hemispheres, resulting from bilateral eye movements. We attempted to replicate and extend these findings in a repeated measures procedure. Subjects studied and recalled two word lists sequentially and performed eye movements before recalling one, both, or neither of the lists. Finally, the subjects took a recognition test for the studied words. Evidence of beneficial effects of eye movements was obtained on both the recall and the recognition measures. These findings confirm, and further characterize the nature of, eye movement effects on memory.

(1047)

**Gender Modulates Effects of Hemispheric Connectivity on Verbal Episodic Memory.** VERA KEMPE, *University of Stirling*, PATRICIA J. BROOKS, *City University of New York*, & STEPHEN D. CHRISTMAN, *University of Toledo*—We examined correlations between verbal episodic memory and hemispheric connectivity, operationalized as strong versus weak handedness [Edinburgh Handedness Inventory score  $>(+70)$  or  $<(-70)$  for strong handedness], using pooled data of five studies that investigated L2 acquisition ( $N = 240$ ). We measured participants' short-term verbal episodic memory (using the reading span task), long-term verbal episodic memory (using vocabulary test scores after several L2-learning sessions), short-term phonological storage capacity (using *same-different* judgments of strings of unfamiliar syllables), and nonverbal IQ (using Cattell's Culture Fair test). Results demonstrate an interaction between gender and handedness strength for the two verbal episodic memory tasks, so that strong handedness (low hemispheric connectivity) was associated with decreased performance in men, but had no effect in women. This interaction was not found for phonological storage capacity and nonverbal IQ, suggesting that verbal episodic memory is facilitated by ease of access to the right hemisphere in men, but not in women.

(1048)

**Left Hemisphere Activation Enhances Encoding of Episodic Memories in Females but Not Males.** STEPHEN D. CHRISTMAN, *University of Toledo*—Engaging in bilateral eye movements (EMs) enhances retrieval of episodic memories (Christman et al., 2003; Christman, Propper, & Dion, 2004), whereas engaging in the same EMs impairs encoding of episodic memories (Christman & Butler, 2005). Since bilateral EMs induce bilateral cortical activation and the encoding versus retrieval of episodic memories relies on left- (LH) versus right-hemisphere (RH) activation, respectively, these results were interpreted as reflecting EM-induced increased access to RH processing, enhancing retrieval but impairing encoding. In the present study, the subjects wore goggles inducing unilateral deviations of gaze, thereby activating the contralateral hemisphere. Unilateral hemispheric activation had no effect on episodic retrieval. Activation of the LH at encoding led to improved versus impaired performance in females versus males, respectively, consistent with reports of greater LH versus RH activation in females versus males, respectively, during episodic encoding (Cahill et al., 2001; Canli et al., 2002; Ragland et al., 2000).

(1049)

**Preexposure, Generation, and JOLs in Memory for Swahili-English Word Pairs.** DOMINIC A. SIMON & GINA HAMILTON, *New Mexico State University*—Participants studied 64 Swahili-English word pairs. Half the Swahili words were preexposed alone in Phase 1. During Phase 2, word pairs were studied in one of two conditions: read or generate (two capitalized letters had to be exchanged between each of the items). To ensure the participants' attention to the procedures, in preexposure and study, all items had to be typed correctly before continuing. Judgments of learning (JOLs) were also collected for each item. Delayed cued recall of English words occurred after a distraction task. Preexposed cue words had a significant recall advantage

over no preexposure ( $p = .001$ ). Unexpectedly, recall of generated words was significantly lower than that for read words ( $p = .02$ ). There was no significant interaction between preexposure and generation manipulations. Consistent with the recall data, mean JOLS were higher for preexposed than for nonpreexposed items. However, mean ratings for generate and read pairs did not differ.

• RECOGNITION MEMORY •

(1050)

**Divorcing Familiarity From Encoding: Recollection, but Not Familiarity, Recapitulates Encoding Processes.** YONATAN GOSHEN-GOTTSTEIN & EYAL ROSEN, *Tel Aviv University*—Dual-process theories argue that recognition memory is mediated by both recollection and familiarity. Although unintuitive, we argue that only recollection is affected by the processing that information undergoes during encoding. To date, manipulations shown to influence recollection, although designed to affect the levels of processing (LoP), have been carried out at encoding. In contrast, manipulations shown to influence familiarity, although designed to affect familiarity, have been consistently carried out at retrieval. Two experiments were performed to deconfound type of processing (LoP, fluency) and memory stage (encoding, retrieval). We found that, regardless of the type of processing, recollection was affected only by manipulations carried out at encoding. In contrast, familiarity was affected only by a manipulation carried out at retrieval. These findings suggest an inherent dependency between recollection and the encoding stage. We interpret our findings in terms of the encoding specificity principle.

(1051)

**The Effects of Unitization on Item and Associative Recognition.** COLLEEN M. PARKS, LINDA J. MURRAY, & ANDREW P. YONELINAS, *University of California, Davis*, & ANDERSON D. SMITH, *Georgia Institute of Technology*—Associative recognition is supported primarily by recollection but can be supported by familiarity when pairs are encoded as single conceptual units (i.e., they are “unitized”). The present experiment was designed to determine whether unitizing differs from deep encoding. In the unitization condition, participants judged the appropriateness of novel definitions for concepts constructed from word pairs; in the control condition, they judged the fit of each item in the pair to a sentence frame. The participants were tested immediately or after a 2-day delay on both item and associative recognition. A crossover interaction was found between encoding and test for familiarity estimates, with unitization producing higher estimates for associative recognition and the control condition producing higher estimates for item recognition. After 2 days, this pattern persisted for associative recognition, but estimates were equivalent across conditions in item recognition. These patterns indicate that unitizing is, indeed, different from deep levels of processing.

(1052)

**Strength-Based Mirror Effects for Item, Associative, and Picture Recognition: Evidence for Within-List Criterion Changes.** WILLIAM E. HOCKLEY, *Wilfrid Laurier University*, MARTY W. NIEWIADOMSKI, *University of Toronto*, & AIMÉE CARON, *Wilfrid Laurier University*—Strength-based mirror effects occur when the hit rate is higher and the false alarm rate is lower for more strongly encoded events than for more weakly encoded events. Strength-based mirror effects were observed in both separate tests of single-item and associative recognition (Experiment 1) and when item and associative recognition were tested together (Experiment 2). In Experiment 3, opposing strength-based mirror effects were observed for both item and associative recognition when individual words and word pairs were presented at different rates in the same study lists. Three additional experiments demonstrated both separate and opposing strength-based mirror effects for pictures versus words. If strength-based mirror effects result from subjects’ adopting a more conservative decision criterion for strong than for weak events, these results show that subjects

can adopt different decision criteria for different recognition tasks and alternate between them on a trial-by-trial basis.

(1053)

**The Consequences of Differentiation in Episodic Memory: Similarity and the Strength-Based Mirror Effect.** AMY H. CRISS, *Carnegie Mellon University*—When items on one list are studied longer than items on another list, the improvement in performance typically manifests as an increase in the hit rate and a decrease in the false alarm rate (FAR). This finding is referred to as the *strength-based mirror effect* and has been accounted for by assuming that participants adopt a more strict criterion following a list containing items studied several times (e.g., Cary & Reder, 2003; Stretch & Wixted, 1998). Differentiation models offer an alternate account where longer study leads to a more accurate memory representation for the studied item, rendering it less confusable with an unrelated foil (McClelland & Chappell, 1998; Shiffrin & Steyvers, 1997). Differentiation models make additional predictions about reversals in FARs to foils similar to a single studied item as a function of the composition of the study list. These predictions were empirically tested and confirmed.

(1054)

**The Time Course of Word Frequency and Repetition Effects in Source Recognition.** JENNIFER H. COANE & DAVID A. BALOTA, *Washington University* (sponsored by Janet Duchek)—The temporal dynamics of the influence of repetition and word frequency were examined in Jacoby’s two-list exclusion paradigm. High- and low-frequency words were presented visually (once or thrice) or aurally (once). The source recognition test instructed the subjects to respond “old” only to aurally presented items. During retrieval, four response tempos (500, 800, 1,000, and 1,500 msec) were imposed to modulate the relative influence of familiarity and recollection on recognition judgments. At the more familiarity-driven fast tempos, visually presented low-frequency words produced higher false alarm rates than did high-frequency words, whereas the influence of repetition was relatively small. In contrast, at the more recollection-based slower tempos, thrice-repeated words were more likely to be rejected than once-presented words, whereas the influence of frequency was relatively small. The results suggest that extralist and intralist familiarity manipulations produce distinct time courses in source recognition judgments.

(1055)

**Effects of Orthographic Distinctiveness on Item and Associative Recognition.** GINA A. GLANC & ROBERT L. GREENE, *Case Western Reserve University*—The effects of orthographic distinctiveness (as measured by orthographic neighborhood size) on memory are analyzed. In item recognition, an advantage for words with small orthographic neighborhoods was found. In associative recognition, accuracy was better for words with large neighborhoods than for words with small neighborhoods. In both cases, the results showed a mirror effect pattern, in which the stimulus class with the higher hit rate had the lower false alarm rate. The effects of orthographic distinctiveness on recognition parallel effects found when word frequency is manipulated.

(1056)

**The Effect of Study Task on Recognition of Words and Nonwords.** EMILY E. BOHLSCHIED, KERRY A. CHALMERS, & ANDREW HEATHCOTE, *University of Newcastle*, & WILLIAM E. HOCKLEY, *Wilfrid Laurier University* (sponsored by Kerry A. Chalmers)—Recognition memory for words and nonwords was examined using either a lexical decision (word/nonword discrimination; Experiment 1) or a naming (Experiment 2) task at study. In Experiment 1, words had higher hit and false alarm rates than did nonwords, whereas in Experiment 2, hit and false alarm rates were higher for nonwords than for words (i.e., opposing concordant patterns). To determine the source of these differences, separate analyses comparing low- and high-frequency words with low- and high-pronounceable nonwords were performed. The concordant pattern was maintained for each compar-

ison in Experiment 1. In Experiment 2, low-pronounceable nonwords had higher hit and false alarm rates than did low- and high-frequency words (i.e., concordant patterns). High-pronounceable nonwords had higher hit and lower false alarm rates than did high-frequency words (i.e., a mirror effect), but recognition for high-pronounceable nonwords and low-frequency words was equivalent. These findings demonstrate the importance of study task and lexical characteristics in producing mirror effects.

(1057)

**Conceptual Processing and Conjunction Lure Errors in Recognition Memory.** JASON ARNDT, *Middlebury College*, & TODD C. JONES, *Victoria University, Wellington*—Two experiments examined the influence of conceptual processing during encoding on recognition memory conjunction lure errors. Participants copied study items, generated properties for compound words as a whole at study (e.g., generate a property for “haywire”), or generated a property for each portion of a compound word (e.g., generate a property for “hay” and a property for “wire”). Test words were presented in their exact studied form (old words), or portions of two study words were recombined to form conjunction lures on the recognition memory test. Generating properties for compound words as a whole increased old word recognition, relative to copying study items, but did not affect conjunction lure error rates. However, generating a property for each component of a compound study item increased both old word recognition and conjunction lure error rates dramatically, in comparison with copying study items. Results are interpreted within a dual-process theory framework.

(1058)

**Recognition, Explicit Identification, and Avoidance of “Cheaters”:** Does an Adaptive Bias Exist? DANIEL L. BOYLL & SONYA M. SHEFFERT, *Central Michigan University*—The idea that human reasoning about social situations is biased to seek out “free-loaders” or “cheaters” (e.g., those who accept benefits without paying required costs) has received much attention in evolutionary psychology. Recently, a Japanese laboratory has reported data consistent with an evolved “cheater recognition bias”; these researchers suggested, on the basis of their finding that the faces of “cheaters” were recognized more accurately than the faces of “noncheaters,” that cheaters’ faces may actually look different from noncheaters’ faces in ways that are perceivable by humans. However, traditional recognition tests are not adequate in determining whether such a bias in facial perception could be adaptive, since they fail to address the key issue of cheater avoidance. The present study therefore investigated whether subjects could, after recognizing faces, explicitly identify them as “cheaters” or “noncheaters.” The results shed light on the nature and adaptive value of any true “cheater recognition bias.”

(1059)

**Simultaneous Misinformation Effect.** IN-KYEONG KIM, JILLIAN C. BROWN, & JOHN E. RAZZOUK, *La Sierra University*—This study examined the effects of simultaneous misinformation on memory. One hundred twenty-nine college students participated. In one condition, participants viewed a video of a simulated crime simultaneously presented with consistent, inconsistent, or neutral audio narrations. In the other condition, participants read consistent, inconsistent, or neutral narratives after viewing the video. One week later, the participants had a recognition memory test. The results showed that the misled, inconsistent group was significantly less accurate and less confident about their memory than was the consistent or the neutral group, for both conditions. Overall memory accuracy and the rate of choice for the misleading information were not different between postevent and simultaneous conditions, and perpetrator-related information was more accurately remembered than environment-related information. The results indicated the negative effects of simultaneous misinformation on memory with the change of timing, modality, and attention from the postevent misinformation research. Applicability to juror memory and behavior is discussed.

(1060)

**Context Is a Key Element in the Recall of Minimally Counterintuitive Concepts.** LAUREN O. GONCE, *Bowling Green State University* (sponsored by Ryan D. Tweney)—Counterintuitive concepts are important in religious belief. Their distinctiveness and memorability are used to explain the retention and transmission of such beliefs. We conducted three experiments to study the effect of context on recall of such concepts. The results showed that the presence of a contradictory context was found to be able to change minimally counterintuitive items into the functional equivalents of intuitive items (and vice versa). With a relevant context present, minimally counterintuitive concepts were recalled significantly better than intuitive concepts (consistent with Barrett & Nyhof, 2001). For items without a context, intuitive items were recalled better (consistent with Bartlett, 1932, and Norenzayan & Atran, 2004). Thus, context was the key element affecting recall, and the discrepancy among prior studies was resolved. The results imply that the nature of the surrounding context must be included in any account of the formation and transmission of religious concepts.

• IMPROVING MEMORY •

(1061)

**Recency, Recovery, and the Efficiency of Relearning.** JOHN F. NESTOJKO, JERI LITTLE, ROBERT A. BJORK, & ELIZABETH L. BJORK, *UCLA* (sponsored by Elizabeth L. Bjork)—Increasing the delay between the learning of two lists (L1, L2) and a recall test for one or both lists often yields a shift from recency to primacy (Bjork, 2001): whereas L2 recall exceeds L1 recall on an immediate test, L1 recall exceeds L2 recall on a delayed test. In a first experiment, results consistent with this expected shift were obtained with delay of test (i.e., immediate vs. 18 min), implying a change in the retrieval access of L1 and L2 items with delay. In a second experiment, we examined how the change in accessibility of L1 and L2 with delay influenced the relearning of L1 and L2, the goal being to test an unintuitive prediction of the new theory of disuse (Bjork & Bjork, 1992)—namely, that relearning should be most effective when retrieval strength (accessibility) is lowest.

(1062)

**When Intended Remembering Leads to Unintended Forgetting.** BENJAMIN C. STORM, ROBERT A. BJORK, & ELIZABETH L. BJORK, *UCLA*—For a memory system to be efficient and adaptive, it must have mechanisms to suppress or set aside information that has become outdated or irrelevant. One possible way in which this adaptive form of forgetting is accomplished is through retrieval-induced forgetting. During attempts to retrieve a target item from memory, inhibitory processes are assumed to keep competing items from interfering with those attempts to retrieve. Furthermore, the extent to which inhibition is elicited is believed to depend on the extent to which the competing items interfere. Using a new variant of the paradigm used to study retrieval-induced forgetting, we explore whether manipulations that make it more likely for competing items to come to mind (e.g., leading participants to expect a test for such items) or already to be in mind (e.g., requiring participants to rehearse such items) also make it more likely for those competing items to be inhibited.

(1063)

**Forgetting Rate and the Optimization of Retrieval Practice.** MATTHEW J. HAYS, KERRY YOUNG, & ROBERT A. BJORK, *UCLA* (sponsored by Robert A. Bjork)—The more difficult the act of (successfully) retrieving information from memory, the more potent it is in supporting subsequent long-term recall. With respect to how a sequence of retrieval efforts should be scheduled, Landauer and Bjork (1978) concluded that expanding-interval retrieval practice is optimal—because it fosters retrieval success while making the act of retrieval gradually more difficult. Recently, however, several researchers (e.g., Balota et al., in press; Karpicke & Roediger, 2005) have reported evidence that a uniform schedule can sometimes optimize long-term recall. The

materials employed in these studies (e.g., synonyms) differed markedly from those used by Landauer and Bjork (e.g., arbitrary pairings of faces and names) in forgetting rate, which may provide a key to reconciling these apparently conflicting results. The present research tests the hypothesis that expanding-interval practice is indeed optimal but that particular optimal sequences will differ depending on how rapidly to-be-remembered materials are forgotten.

## (1064)

**The Benefit of Being Forgotten.** BENJAMIN C. STORM, BETHANY J. CAUGHEY, & ELIZABETH L. BJORK, *UCLA*, IAN M. McDONOUGH, *University of Chicago*, & THOMAS D. WICKENS, *University of California, Berkeley*—There are generally two consequences of retrieving a target item from memory: Future attempts to recall the target item are facilitated, and future attempts to recall competing items are impaired. This second consequence, often referred to as *retrieval-induced forgetting*, is believed to reflect inhibitory control processes that help to resolve interference during attempts to retrieve items from memory. In the present study, we explore whether the reexposure to items that have already been inhibited through retrieval-induced forgetting can lead to the release of that inhibition. The results indicate that the inhibition can be released and, furthermore, that initially inhibited items may actually benefit more from re-learning than do items that were not initially inhibited. These findings are consistent with the unintuitive prediction offered by the new theory of disuse (Bjork & Bjork, 1992) that opportunities to relearn are most effective when an item's accessibility is reduced.

## (1065)

**Do the Effects of Feedback Timing Depend on Test Timing?** SHANA K. CARPENTER & HAL PASHLER, *University of California, San Diego*, & ED VUL, *Massachusetts Institute of Technology*—Previous research indicates that delayed feedback can be more effective than immediate feedback for learning verbal materials. However, there is a paucity of research aimed at investigating the effects of feedback when it is delayed by 1 day or longer and whether the effects of feedback timing depend on whether the test itself is immediate or delayed. Subjects learned 30 obscure facts by taking a cued recall test either immediately after encoding or 1 day after encoding. On both the immediate and the delayed tests, correct answer feedback was either given immediately or delayed by 1 day. Two weeks later, all the subjects received a final cued recall test over all 30 facts. Delayed feedback was significantly more beneficial than immediate feedback, and this was true regardless of whether the test itself was immediate or delayed.

## (1066)

**Reduced Cuing as an Alternative to Improving Memory Using Expanding Retrieval Practice.** PETER E. MORRIS & CATHERINE O. FRITZ, *Lancaster University*—Expanding retrieval practice is an effective method of improving learning. If expanding the retrieval schedule is successful because it maintains a suitable level of difficulty, can the benefits from expansion be achieved by otherwise maintaining the difficulty of retrieval? The encoding variability ensuing from varying cues could provide additional improvement in memory. Experiment 1 showed better recall of concrete words after uniformly spaced practice with cues that became less specific than following expanding practice with consistent cues. Experiment 2 manipulated both cue specificity and practice schedule in a factorial design. Practice involved tests with either uniformly moderate cues or increasingly degraded cues; tests followed either a uniform schedule or one with expanding lags matched for total lag. Recall improved with both decreasing cue content and expanding lags, and the methods produced similar sized, additive improvements. For the greatest benefit to learning, therefore, the combination of the two strategies is recommended.

## (1067)

**Memory Improvement for the Nonstrategic Learner.** CATHERINE O. FRITZ & PETER E. MORRIS, *Lancaster University*—Retrieval practice

and self-explaining are mnemonic activities that improve memory among adults. These activities are simple for the learner when someone else elicits the retrieval efforts or explanations, so their benefits might not require strategic engagement. To investigate this hypothesis, both activities were tested with preschool children learners (3–4 years). When children were taught the names of plush toys, retrieval practice was substantially and significantly more effective than spaced review on a matched schedule after a few minutes, 1 day, and 2 days. In another experiment, children watched an unfamiliar, age-appropriate video and were tested after 2 h; the children who were asked to explain the content during brief pauses in the video demonstrated far better memory for the contents than did the children who explained at the end of the video or did not explain during study. We conclude that these activities provide relatively automatic, nonstrategic benefits.

## (1068)

**Schedules of Retrieval Practice for Improving Learning: Less Is More?** MARY A. PYC & KATHERINE A. RAWSON, *Kent State University* (sponsored by O. K. Rawson)—Although savings-of-learning studies have used dropout schedules (i.e., repeatedly testing to-be-learned items until one correct recall is achieved) to measure trials to criterion, dropout has not been systematically studied as a competitor to more conventional schedules of repetition used in research on spacing and testing effects. Our hypothesis was that dropout would lead to more efficient learning, in that the same level of performance could be achieved in fewer trials. Two experiments pitted dropout schedules against traditional schedules (either fixed or expanding intervals between repeated test trials) for learning a list of Swahili–English word pairs. The results showed that dropout led to the same or a higher level of performance than did fixed or expanding schedules of practice, in significantly fewer trials.

## • JUDGMENTS OF LEARNING •

## (1069)

**The Effect of Performance Feedback on Metacomprehension Accuracy in Cognitive Skill Acquisition.** ANIQUE DE BRUIN, REMY M. J. P. RIKERS, HENK G. SCHMIDT, & JAN VAN STRIEN, *Erasmus Universiteit Rotterdam*—Prior research has established the positive effect of activating cues predictive of future performance on metacomprehension accuracy (Koriat, 1997). Particularly in cognitive skill acquisition, where working memory demands usually are high, learners are in need of external guidance to optimize metacomprehension accuracy. Therefore, we provided novice chess players with performance feedback immediately after providing judgments of learning (JOLs) to help them evaluate the accuracy of these JOLs. We hypothesized that the feedback would foster the development of metacomprehension monitoring over several learning trials. Contrary to our expectations, metacomprehension accuracy developed only to a small extent, although learning in general and performance on a transfer task did improve. These results suggest that performance feedback influences problem-solving skills rather than self-evaluative skills (cf. Mathan & Koedinger, 2005). Furthermore, the results indicated that, within the cue utilization framework (Koriat, 1997), self-generation of cues is imperative.

## (1070)

**Learning About Serial Position Effects Via Judgments of Learning.** ALAN D. CASTEL, *UCLA*—Memory researchers have long known about serial position effects, but how well do students know about primacy and recency effects? The present research shows that participants do not use extrinsic serial position information when making judgments of learning (JOLs) after studying each item (standard “post”-JOLs), suggesting that JOLs are not highly sensitive to serial position. However, when the participants were asked to make JOLs prior to studying each item (pre-JOLs), these JOLs were well calibrated with actual memory performance, since both showed strong serial position effects. JOLs and recall best matched when the participants were given serial position information at study and learned

about primacy and recency effects via their own performance during multiple study–test cycles, thus displaying “experience-based” metacognitive skills. These findings indicate that participants learn about serial position effects with practice and the use of extrinsic cues and that, under some conditions, pre-JOLs can be good indicators of later memory performance.

(1071)

**Memory for Past Test Heuristic in Multitrial Judgments of Learning.** BRIDGID FINN & JANET METCALFE, *Columbia University* (sponsored by Janet Metcalfe)—In the absence of better predictors, people may base their judgments of learning (JOLs) on their memory for whether they correctly answered an item on a previous test and may underweight new learning. We call this the memory for past test (MPT) heuristic. Reliance on this heuristic should lead to systematic underconfidence. We explored its use as a cause of the underconfidence with practice (UWP) effect (Koriat, Sheffer, & Ma’ayan, 2002), in which, with immediate JOLs, first-trial overconfidence switches to systematic underconfidence on the second trial and beyond. We contrasted immediate and delayed JOLs because, whereas the former show the UWP effect, the latter do not. A simultaneous regression analysis provided evidence that people used the MPT heuristic in the immediate, but not the delayed condition, providing an explanation for the underconfidence shown selectively in that condition.

(1072)

**The Effects of Training, Test Type, and Transfer on Metacognitive Judgments.** JAMES Z. SPEAGLE & DAYNA R. TOURON, *Appalachian State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (sponsored by Dayna R. Touron)—Although previous research (e.g., Koriat, Sheffer, & Ma’ayan, 2002) has shown underconfidence for judgments of learning (JOLs) with practice for paired associate (PA) recall, Touron and Hertzog (2004) found overconfidence for JOLs with PA recall after transfer from hundreds of associative recognition trials. Given these divergent outcomes, we evaluated the extent to which training and the memory test format influence metacognitive judgments. Each participant completed four PA study–test trials, with or without transferring test type midway, in one of four conditions: (1) recognition then recall, (2) recall then recognition, (3) recognition throughout, or (4) recall throughout. Global judgments were made prestudy, poststudy, and posttest for each trial; JOLs and confidence judgments were also collected. The results suggest that the dynamics of metacognitive judgment accuracy vary by memory test type. Judgments were also sensitive to transfer but did not fully account for the effects of transfer on test accuracy.

(1073)

**On the Relation Between Judgment of Learning and Study Time: Evidence From a Proactive Interference Task.** DIEGO FERNANDEZ-DUQUE, *Villanova University*, & MICHAEL DIAZ & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—What drives the amount of time we devote to learning something? Is it necessarily related to our beliefs on how well we know it, or can study time, instead, be driven by task properties that do not influence metacognitive judgment? To study this question, we capitalized on the finding that certain task properties, such as release from proactive interference (PI), do not seem to influence judgments of learning (JOLs) (Diaz & Benjamin, 2005). In a self-paced learning paradigm, subjects made JOLs for each word pair and completed a cued recall test at the end of the block. Across blocks, cues were repeated, with new targets leading to decreased recall (PI). In the final block, new cues were displayed, substantially enhancing recall (release from PI). Despite its effect on performance, release from PI failed to modulate either study times or JOLs, thus highlighting the close link between metacognitive judgment and regulation.

(1074)

**Metacognitive Monitoring for Proactive Interference at Encoding and Retrieval.** TINA M. MIYAKE & MICHAEL J. KANE, *Univer-*

*sity of North Carolina, Greensboro*—People must monitor for conflict to effectively deploy control, and limited research suggests that subjects can monitor for memory interference, at least at retrieval. Here, subjects made immediate or delayed judgments of learning (JOLs) for lists of paired associates and completed a cued-recall test 2 days later. Interference subjects, who learned two related lists (of AB/AD and AB/CD items), showed significant proactive interference (PI) on List 2 recall and gave lower JOLs to List 2 than did control subjects, who learned only one list (AD and CD items). Also, before recalling each item, the subjects made speeded predictions of knowing (POKs) based on the cue. The interference subjects gave lower POKs than did the controls but higher POKs for interference (AB/AD) than for control (AB/CD) items, suggesting that they were influenced by cue familiarity. The interference subjects thus seemed aware of PI at encoding and retrieval, but they were also fooled at retrieval by cue familiarity.

(1075)

**Self-Testing: A Metacognitive Disconnect Between Memory Monitoring and Study Choice.** NATE KORNEILL, *UCLA*, & LISA K. SON, *Barnard College*—Self-testing is a very common and effective study technique. Recent research shows that when given the option, people choose self-testing strategies (e.g., ST) over pure study strategies (e.g., SS) (Kornell, in preparation; Son, 2005). By contrast, judgments of learning (JOLs) after pure study are subject to overconfidence, whereas JOLs after self-testing are accurate and calibrated. Thus, we tested the hypothesis that what students choose to do (self-test) is the opposite of what they judge to be most effective (pure study). In one experiment, participants were asked to choose between pure study and self-testing; in another, otherwise identical experiment, instead of choosing, the participants were assigned either self-testing or pure study strategies and were asked to rate the effectiveness of each. We hypothesize a disconnect between metacognitive monitoring and study choice in the context of self testing results from the fact that self-testing is rewarding.

(1076)

**Is the Influence of Test Trials on Judgments of Learning Analytic?** JOHN DUNLOSKY & MICHAEL J. SERRA, *Kent State University*—Test trials have a substantial influence on subsequent judgments of learning (JOLs), which produces persistent underconfidence yet improves judgment resolution. A common, yet untested assumption is that these effects are mnemonic in nature (Koriat, 1997) and, hence, result from nonanalytic processes. Our contention is that the effect of test trials also involves analytic processes in which people explicitly use episodic memories for past performance to update subsequent judgments. To evaluate this possibility, we had participants study paired associates and make immediate JOLs during two study–test trials. On the second trial (i.e., after the initial test trials), the participants explicitly reported how they made each judgment (Experiment 1), or they reported whether each response had been recalled during the first test trials (Experiment 2). The results from both experiments implicate the influence of an analytic process in making JOLs and will be discussed in the context of current theory of JOLs.

(1077)

**Judgments of Learning: Beyond Gamma.** YOONHEE JANG & DAVID E. HUBER, *University of California, San Diego*, & THOMAS S. WALLSTEN, *University of Maryland, College Park* (sponsored by Thomas S. Wallsten)—Judgments of learning (JOLs) are metacognitive responses for the probability of subsequently recalling previously studied items. The JOLs under consideration were collected with a 6-point scale under both immediate and delayed conditions, yielding separate distributions for subsequently recalled and nonrecalled items in each case. Consistent with other results, gamma, a nonparametric correlation coefficient was greater for delayed JOLs than for immediate JOLs: the well-known delayed-JOL effect. We present a family of stochastic models to account for the overall pattern of results and use it to compare various mechanisms designed to explain JOL accu-

racy and scale use. Although we use this family of models to test competing metacognitive theories, more generally, it is widely applicable to any situation examining the nature of confidence distributions conditioned on accuracy.

(1078)

**To Recall or To Forget: Which is the Better Question?** MICHAEL J. MCGUIRE, CHELSEA E. PATTON, & SCOTT M. MORELAND, *Washburn University*—Prior research has demonstrated that retention interval has a minimal effect on JOLs when using a between-groups design. Koriat et al. (2004) reported findings indicating that framing of JOL queries in terms of forgetting, rather than recall, resulted in an effect of retention interval on JOL ratings. We attempted to replicate and extend this finding to measures of JOL accuracy (relative and absolute). In Experiment 1, participants studied 36 word pairs, made JOLs before and after retention interval, and received a cued-recall test. We manipulated retention interval (15 min, 48 h, 1 week), which was also reflected in the JOL queries. Experiment 2 was identical to Experiment 1, with the exception of the JOL queries, which were framed in terms of forgetting, rather than recall. Major dependent variables analyzed included JOL means, gammas, bias scores, and recall accuracy. The results suggest an interaction between type of query and JOL outcome variables.

• PROSPECTIVE MEMORY •

(1079)

**The Specificity of OCD-Related Prospective Memory Impairments.** CARRIE CUTTLER & PETER GRAF, *University of British Columbia* (sponsored by Eric Eich)—Obsessive-compulsive disorder (OCD) manifests itself in different ways, the most common being checking and washing compulsions. Checkers worry about failing to perform common tasks (e.g., turn off the stove) and feel compelled to check whether they have been completed. Washers worry about contamination and feel compelled to clean. We hypothesize that compulsive checking, but not compulsive washing, is a reaction to a deficit in prospective memory (ProM), the ability to remember to perform future-oriented tasks (e.g., locking the door upon leaving). We examined this hypothesis by means of the data from two recent studies with undergraduate student checkers and washers. The results revealed a link between checking and ProM performance, but not between washing and ProM performance. Our findings support the theoretical claim that the ProM deficits of checkers do not reflect extraneous factors characteristic of all individuals with OCD (e.g., anxiety, depression).

(1080)

**Prospective Memory Retrieval: Searching for Clues About Attention for Cues.** DANIEL SIU, MICHAEL D. DODD, & PETER GRAF, *University of British Columbia* (sponsored by Peter Graf)—Prospective memory is the ability we use to execute previously formed plans upon encountering designated retrieval cues. According to one prominent theory, prospective remembering depends on an attention-demanding monitoring process, a systematic visual search of the environment for plan-relevant retrieval cues. To test this theoretical claim, we investigated the visual-scanning patterns of undergraduate volunteers who either were or were not assigned a prospective memory task. One critical retrieval cue was an image of popcorn, and this cue was displayed during an ongoing activity where subjects viewed scenes selected from a popular Disney movie (*A Bug's Life*). On each trial, three scenes were displayed, and the subjects' task was to decide whether or not they were shown in the same order as in the original movie. The visual-scanning results showed that the subjects who were assigned the prospective task examined each scene more globally and for a longer duration.

(1081)

**The Attentional Demands of Time-Based Prospective Memory and Time Interval Productions.** LAURENT GAGNÉ-ROY & MARC-

ANTOINE LABELLE, *Université Laval*, PETER GRAF, *University of British Columbia*, & SIMON GRONDIN, *Université Laval*—Time-based prospective memory tasks require the retrieval of previously formed plans (e.g., call me on my cell) either at a specified time (e.g., at 3 p.m.) or after a specified period of time has elapsed (e.g., in 20 min). According to a prominent theory, time perception is attention demanding. In the present study, we compared the attentional resources required for the time-related processes that are recruited for a time-based prospective memory task and for a time interval production task. In a dual-task paradigm, we required undergraduate students to make category membership decisions while they were simultaneously engaged either in a time-based prospective memory task or in a time interval production task. Under one set of conditions, the subjects were instructed to allocate attention equally to the two tasks, whereas in another set of conditions, they were directed to pay more attention to the time-relevant tasks. The attention instruction manipulation affected performance on the category membership task, but not on the concurrent time-related tasks, thus suggesting that the same type of time-related processes are recruited for both time-based prospective memory and time interval production.

(1082)

**Linking Prospective Memory and Time Management.** JANET M. GIBSON, *Grinnell College*, & THERESE HOFF MACAN & JENNIFER CUNNINGHAM, *University of Missouri, St. Louis*—Time management and prospective memory share a variety of concepts and goals—namely, attend to the time it takes to complete current tasks and remember later to complete intended tasks. In the present study, ratings of over 400 participants on scales that measure the components and behavior of time management were correlated with those for prospective memory. As was expected, significant correlations were found that indicate that people who manage their time well have successful prospective memory. Most important, those who engage in time management goal setting and have a preference for organization reported better prospective memory than did those who do not. Implications for Macan's process model of time management and for research in prospective memory are discussed.

(1083)

**From Episodic Memory to Autoegetic Consciousness: What Is the Relationship Between the Personal Past and Future?** KARL K. SZPUNAR & KATHLEEN B. McDERMOTT, *Washington University* (sponsored by Kathleen B. McDermott)—In recent years, the concept of episodic memory has evolved into a more general conceptual system thought to underlie the ability to mentally travel both backward and forward in subjective time to relive past happenings and to pre-experience future events (Tulving, 2002). This ability has been dubbed *autoegetic consciousness*, and several lines of research have provided evidence with regard to its validity. However, there is, as of yet, no evidence pointing to the precise nature of the relationship between the personal past and future, only that they are related in some way. The present study was aimed at elucidating the nature of this relationship. Our data reveal that relative to a nonpersonal (semantic) control condition, imagining oneself in the future is likely to reactivate previously experienced contextual information, making the experience of thinking about the future phenomenologically similar to thinking about the past.

(1084)

**Modeling Prospective Memory in Children.** REBEKAH E. SMITH, *University of Texas, San Antonio*, UTE J. BAYEN, *University of North Carolina, Chapel Hill*, CLAUDIA MARTIN, *Universität Würzburg*, & KATHRIN METZROTH, *Universität Mannheim*—Event-based prospective memory involves remembering to perform an action in response to a particular future event—for example, to buy milk when you see a store. In our experiment 7-year-olds and 10-year-olds performed an event-based prospective memory task that was embedded in a computer-based ongoing task. The older children showed better

prospective memory performance than did the younger children. We applied a formal multinomial processing tree model of prospective memory (Smith & Bayen, 2004) to disentangle age differences in the prospective component (remembering that you have to do something) and the retrospective component (remembering when to perform the action) of prospective memory performance. Application of the formal model complements more traditional measures to provide information about how underlying cognitive processes develop in children's prospective memory in the elementary school years. Model-based analyses indicated age differences in the retrospective component only.

(1085)

**Focal Processing of Salient Target Events Does Not Eliminate Cost Associated With Prospective Memory.** REBEKAH E. SMITH & R. REED HUNT, *University of Texas, San Antonio*, & JENNIFER C. LITTLE & MELISSA D. McCONNELL, *University of North Carolina, Greensboro*—Event-based prospective memory involves performing an intended action when a target event occurs in the future, such as giving someone a message when you see them. Numerous studies have demonstrated a cost to ongoing activities when a prospective memory task is embedded in the ongoing task relative to when the ongoing task is performed alone (e.g., Marsh et al., 2003, 2005; Smith, 2003; West et al., 2005). Unlike past research, the present study investigated prospective memory, using a task that simultaneously involved a salient prospective memory target, an ongoing task that involved focal processing of the relevant dimensions of the target, and a simple action that was associated with the target event. A cost to the ongoing task was demonstrated, and furthermore, this cost was not attributable to the memory load imposed by remembering the target and action.

• ATTENTION •

(1086)

**Temporal Properties of Memory and Inhibition in Visual Marking.** J. DEVIN LAND, JONNY BEBER, CHELSEA DAVIDSON, RACHEL McCLAIN, JAKOB McKEE, & JAMES F. JUOLA, *University of Kansas*—Visual marking can aid visual search through de-prioritization of a previously viewed subset of a display. A series of experiments examined how the temporal characteristics of the display sequence mediate inhibitory or memory processes leading to the preview benefit in visual marking. A preview benefit was defined by the absence of an effect of the number of previewed items on target search times. When blank screen ISIs of varying intervals separated the preview and the search displays, the magnitude of the preview benefit decreased with increasing ISI through 600 msec but was reliable through 300 msec. With two sequential preview displays, a preview benefit was sometimes found for both of them, even when the first subset disappeared when the second subset was added to the display. The results are interpreted in terms of the relationship of visual marking to IOR and memory for distinct temporal events.

(1087)

**Can Words Be Worth a Thousand Pictures? Exploring Change Blindness Research Using Written Text.** CHRISTINE L. BELZ & WILLIAM P. WALLACE, *University of Nevada, Reno* (sponsored by William P. Wallace)—Most previous change blindness research has used pictures or simple objects as stimuli in the flicker paradigm. These materials make it difficult to examine the role of semantics in the phenomenon. The experiment presented here used sentences as stimuli in an effort to determine whether they can produce change blindness effects similar to those of pictures and to determine how the context of those sentences affects change blindness. This study shows that these stimuli are effective in producing change blindness and that context actually seems to facilitate change detection. As would be expected, the position of the change in the sentence also plays a role in response times. These results indicate that sentences may be used in future change blindness research and should be examined further.

(1088)

**The Role of Competition in Repetition Blindness.** MARY L. STILL & ALISON L. MORRIS, *Iowa State University*—Repetition blindness (RB) is the failure to report two identical items displayed within a short time. A new account of RB, the object competition hypothesis, states that items in brief displays compete for access to conscious awareness based on neural activity; repeated items are associated with less activity and are often out-competed by nonrepeated items. Two experiments investigated RB, using simultaneous displays of three to four letters. In Experiment 1, the participants were instructed to report all the letters. RB was found when two letters were identical, but there was no corresponding increase in the report of other letters. In Experiment 2, priority of report was manipulated by displaying two letters in color. When one repeated letter was colored and one was not, RB was found, and report of the nonrepeated colored letter increased. Results are explained by assuming that spatial attention and repetition status affect an item's ability to compete for access to awareness.

(1089)

**Long- and Short-Term Negative and Positive Priming.** MICHAEL A. ERICKSON, *University of California, Riverside*, JEN SHANG, *University of Pennsylvania*, ELIZABETH E. BUCHANAN, *University of California, Riverside*, & LYNNE M. REDER, *Carnegie Mellon University*—Negative priming is a selective attention phenomenon that refers to impaired performance to a target when the target appeared as a distractor in a previous trial. Although DeSchepper and Treisman (1996) demonstrated long-term negative priming, a number of researchers have failed to replicate their findings (cf. Grison, Tipper, & Hewitt, 2005). We present two empirical studies that demonstrate robust and general long-term negative priming without multiple stimulus repetitions. We also show that repetition increases and delay decreases the magnitude of the negative priming effect. These findings conform to predictions of associative accounts of negative priming. Thus, negative priming may be seen not only as a product of selective attention, but also as an instance of general learning.

(1090)

**Inhibition of Return With Endogenous Cues.** ULRICH W. WEGER, NASEEM AL-AIDROOS, & JAY PRATT, *University of Toronto* (sponsored by Jay Pratt)—Inhibition of return (IOR) is widely known as an attentional phenomenon that is found under conditions of exogenous (reflexive) control. In contrast, IOR has proven elusive when attention is controlled endogenously (volitionally). Here, we hypothesize that the latter effect may be due to a continuing attentional bias toward the cued location. Two experiments investigated whether endogenous attention can trigger IOR when such a bias is prevented. Experiment 1 used arrows to cue one end of an object. Attention radiated through the object, and although facilitation occurred at the predicted location, IOR later developed at the nonpredicted end. In Experiment 2, endogenous attention was directed to a dynamic object. Although attention moved with the object and continued to produce facilitation there, IOR later occurred at the object's original location. Together, the two studies show that IOR can occur using endogenous cues.

• TASK SWITCHING •

(1091)

**Evidence for Task-Specific Resolution of Response Conflict.** ANDREA KIESEL, *Universität Würzburg*, WILFRIED KUNDE, *Martin-Luther-Universität Halle-Wittenberg*, & JOACHIM HOFFMANN, *Universität Würzburg*—In task-switching paradigms, targets that require different responses to the relevant and to the irrelevant task cause response conflict. This target-induced response conflict was combined with conflict caused by a subliminally presented prime presented prior to the target. We found that target-related response conflict reduced prime-induced conflict effects within the same trial. However, target-related response conflict modified prime-related conflict effects according to the irrelevant S–R rule, but not according to the relevant

S–R rule. Moreover, trial-to-trial modulations of the target congruency effect were observed in task repetition trials (i.e., when the conflict in subsequent trials referred to the same task), but not in task switch trials (i.e., when the conflict in subsequent trials referred to different tasks). These results indicate that conflict resolution mechanisms, at least under the present circumstances, operate in a strictly task-specific manner.

(1092)

**Cue–Task Associations and Their Impact on Task-Switching Performance.** MIRIAM GADE, *Max Planck Institute for Human Cognitive and Brain Sciences*, & IRING KOCH, *RWTH Aachen*—Recent theories of cognitive control state that prior experiences and learning contribute to cognitive control. One paradigm thought to study cognitive control is the task-switching paradigm. In this paradigm, subjects are required to flexibly switch between two or more tasks, as indicated by a cue. In three experiments, we explored the contribution of cue–task associations to subjects' performance in a task-switching paradigm. We found that formerly learned associations interfere with changes in cue–task mappings as long as they incorporate experienced cues. Furthermore, this interference is not due to a neglect of change in the cue–task mapping, nor can it be overcome by prolonged preparation time. We conclude from these results that associative learning contributes to cognitive flexibility as studied in the task-switching paradigm.

(1093)

**Effects of No-Go Stimuli on Preparatory Control in a Cued Go/No-Go Task-Switching Paradigm.** AGATHA LENARTOWICZ & JONATHAN D. COHEN, *Princeton University* (sponsored by Sam Glucksberg)—We combined task switching with a go/no-go manipulation to examine whether actively withholding a response is more damaging to task-specific preparedness than is passive decay. Participants alternated between two object judgments (i.e., big/small, living/nonliving). On 30% of all trials, responses were either actively withheld (i.e., active no-go trials) or not required (i.e., passive no-go trials). Effectiveness of preparation was measured by switch costs following no-go trials. Switch costs were larger, reflecting more carryover from preparation on the previous trial, after passive no-go trials. We additionally manipulated the proportion of active and passive no-go trials within a session (i.e., .5/.5 vs. 1/0). Including active and passive no-go trials within one session resulted in comparably variable switch costs across conditions. In sum, our results suggest that no-go stimuli result in more damage to preparation than does passive decay and that this effect can further modify preparatory control during passive no-go trials.

(1094)

**Switches That Stick: Perseveration Increases When Switching From Weaker to Stronger Response Sets.** DAWN A. MORALES, *University of South Carolina, Aiken*, & H. BRANCH COSLETT & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Older observers' tendency to perseverate was measured as they were required to switch from sorting cards (in a variant of the Wisconsin card sorting task) by one rule, such as by the color of the item on the card, to another rule, such as by the number of items on the card. They inferred the current sorting rule from the feedback given after each card was sorted. The cards to be sorted varied along several dimensions (e.g., color, number); these dimensions varied in strength, defined as the associated prepotency of the sorting response. Two measures of perseveration indicate that probability of perseveration varies as a function of the relative strength of the dimensions of the current and the immediately prior sorting rules, so that people perseverate most when switching from sorting on weaker dimensions to sorting on stronger dimensions. This finding, although counterintuitive, is consistent with results in the task-switching literature.

(1095)

**Item-Specific Control of Task Switch Costs.** JADY WONG & JASON P. LEBOE, *University of Manitoba*, MATTHEW J. CRUMP, *McMaster*

*University*, & KAILYN STOBBE, *University of Manitoba*—Research indicates that performance is often impaired by the need to switch from one task to another. According to an “episodic retrieval” view, these task switch costs result from retrieval of earlier inappropriate processes at the time of the current “probe” task. Alternatively, a “task set inhibition” view suggests that switch costs result from prior inhibition of the now-relevant task during the “prime” event. In the present study, participants either repeated the same task or switched between two tasks on each of a series of trials. In separate experiments, we made the identity and location of the probe stimulus predictive of the requirement for the participants to either switch tasks or repeat the same task. The results showed that switch costs can be reduced when a feature of the probe display is predictive of a change in task. Our results implicate a retrieval process over an inhibition process as the basis for task switch costs.

(1096)

**Priming Operations With Nonrepeating Primes.** PADMANABHAN SUDEVAN, JOHN HOLMES, MEGAN GOLLA, AUTUMN HENSEL, & JENNIFER ROSKOPF, *University of Wisconsin, Stevens Point*—An advance cue or prime can be used to direct attention to one of two cognitive operations or tasks required of participants. Such a cue or prime might have a repetition effect that adds to the task preparation benefit when it physically matches the actual task cue accompanying the stimulus. Using task-switching paradigms, Arrington and Logan (2005) and Logan and Bundesen (2003) found that benefits from the cue are almost entirely due to cue repetition. They concluded that the task cue creates only an encoding advantage and not actual task preparation. Using an operation-priming paradigm, we demonstrate significant benefits from operation primes even when they do not match the task cue physically. This finding indicates that there may be both cue repetition effects and task preparation effects that are produced by operation primes.

(1097)

**RT Costs of Shifting Spatial Attention and Task Set.** YU-CHIN CHIU & STEVEN YANTIS, *Johns Hopkins University* (sponsored by Steven Yantis)—Cognitive control is required to reconfigure task sets at various levels of information processing, from perceptual input to motor output, in order to achieve behavioral goals. We investigated the mechanisms of cognitive control in two distinct domains. Subjects attended to one of two RSVP streams (left or right side) and prepared to categorize occasional digit targets as high/low or even/odd. Letter cues within the attended stream instructed subjects to (1) shift attention to the other stream, (2) switch to the other categorization task, or (3) maintain the attended location and task. Responses to targets following either a shift-attention cue or a switch-task cue were slower than those to targets following a hold cue. Furthermore, switching task produced a significantly larger cost than did switching attention. The results suggest that although a common cognitive control mechanism may operate in both domains, the efficiency of control may vary at different levels of task set.

(1098)

**Short Cue Presentations Fully Optimize Advance Task Preparation.** BAPTIST LIEFOOGHE, FREDERICK VERBRUGGEN, ANDRÉ VANDIERENDONCK, & ROB HARTSUIKER, *Universiteit Gent* (sponsored by Robert Hartsuiker)—In the task-switching literature, it has frequently been demonstrated that although advance task preparation reduces the switch cost, it never really eliminates the switch cost. In the present study, the role of task cue presentation in the establishment of the residual switch cost was investigated. In four experiments, the cue was removed during the preparation interval, and it was hypothesized that this would encourage the participants to complete advance task preparation. The results of all four experiments provided support for this hypothesis: When the cue was presented for a short time and then removed, the residual switch cost completely disappeared. This was found for different cue types. Furthermore, Ex-

periment 3 demonstrated that it was not the presence of the cue itself but merely differences in advance task preparation that caused the effects. This suggests that advance task preparation is not as restricted in nature as previously has been assumed.

(1099)

**Investigating Task Switch Costs Using Univalent, Neutral, and Bivalent Stimuli.** RUSSELL COSTA & FRANCES J. FRIEDRICH, *University of Utah*—Most task-switching experiments use only bivalent stimuli containing features relevant to both tasks. In principle, the participant must not only activate the new task but must also ignore the irrelevant information. The effects of these processes may be confounded if only bivalent stimuli are used. Two experiments were conducted using stimuli designed to separate these processes. First, we varied the proportion of univalent stimuli (relevant to only one task) and found that (1) their inclusion influenced the amount of interference that occurred and (2) the interference created by the irrelevant information was separable from the cost of switching between tasks. In the second experiment, we included stimuli that contained information that was perceptually relevant to both tasks but response relevant to only one task. We found that these stimuli created interference similar to that of bivalent stimuli, suggesting that much of the interference from irrelevant information occurs during perceptual analysis.

(1100)

**Defining Task Set Reconfiguration: The Case of Reference Point Switching.** DARRYL W. SCHNEIDER & GORDON D. LOGAN, *Vanderbilt University*—Some researchers argue that task switching involves task set reconfiguration: changing the existing task set to perform a different task. Although this idea is intriguing, it is often unclear what is being reconfigured and which processes are involved in reconfiguration. We addressed this issue by defining task set, identifying differences between task sets, and obtaining diagnostic evidence of reconfiguration. In two experiments, subjects performed tasks that involved comparing a target with a reference point that repeated or switched across trials. The task was the same on every trial, but the task set was not, because a task set parameter—the reference point—had to be changed. Target–reference-point distance effects that changed with the reference point provided evidence that reconfiguration occurred and that this reconfiguration led to switch costs. Defining reconfiguration more explicitly in related situations may allow for better insight into task switching and executive control.

• PRIMING WORD RECOGNITION •

(1101)

**When Semantic Priming Survives Letter Search.** CHI-SHING TSE & JAMES H. NEELY, *SUNY, Albany* (sponsored by James H. Neely)—Searching for a letter within a prime often eliminates semantic priming in lexical decisions. In two experiments, we tested whether semantic priming from letter-searched primes (LS priming) depends on the target's word frequency (high vs. low) and the associative symmetry of the prime–target pairs (symmetric vs. forward asymmetric). We replicated the null LS priming effect for high-frequency targets but found significant LS priming for low-frequency targets, whether the prime–target pairs were associated symmetrically or forward asymmetrically and whether the target's word frequency was manipulated within or between participants. The implications of these findings for Stolz and Besner's (1996) semantic blocking, Mari-Beffa et al.'s (2000) semantic inhibition, and Neely and Kahan's (2001) visual disintegration accounts of LS priming are discussed.

(1102)

**Automatic Semantic Feedback During Visual Word Recognition: When Tulip Primes Flowed.** JASON F. REIMER, *California State University, San Bernardino*, THOMAS C. LORSBACH, *University of Nebraska*, & DANA M. BLEAKNEY, *California State University, San Bernardino*—Multiple models of visual word recognition incor-

porate an interactive-activation framework. In such models, word recognition is considered to be a highly interactive process whereby activation not only spreads from orthographic and phonological units to semantic units, but may spread from semantic units back to phonological and orthographic units as well. The present research tested whether semantic feedback automatically spreads to both orthographic and phonological units during visual word recognition. Using a three-field masked priming paradigm, prime and target words were associatively related (e.g., *tulip–flower*), phonologically mediated (e.g., *tulip–flour*), or orthographically mediated (e.g., *tulip–flowed*). Priming effects were found only in the associatively related and orthographically mediated priming conditions using both brief (53 msec) and long (413 msec) prime durations. These results suggest that (1) semantic feedback may spread only to orthographic units and (2) such feedback occurs automatically and begins during the initial stages of lexical processing.

(1103)

**The Influence of Long SOA and Verbal Ability on Mediated Priming.** KAY L. LIVESAY, SETH DAVIS, & MATTHEW ATKINSON, *Linfield College*—Previous research (Livesay & Burgess, 1998, 1999) has shown the mediated priming effect to be a reliable effect, but one that is sensitive to item and subject effects. Livesay and Burgess (1998) previously found that low verbal ability participants are not sensitive to the mediated priming effect, whereas high verbal ability participants maintain the mediated priming effect. It has been suggested that perhaps the low verbal ability individuals simply need more time to allow activation to spread through the mediator to the target. The present experiment increased the prime–target SOA from 350 msec (used in previous experiments) to 750 msec and showed that the low verbal ability participants were still not sensitive to the mediated priming effect. These results are discussed in relation to localist spreading activation models and more global high-dimensional space models of semantic representation (e.g., HAL).

(1104)

**Priming of Homographs: The Effect of Context Location.** DAVID S. GORFEIN, *University of Texas, Arlington*, VINCENT R. BROWN, *Hofstra University*, & HARRIETT AMSTER, *University of Texas, Arlington*—Theories of ambiguity processing offer different predictions regarding the effect of the locus of semantic context on the accessibility of alternative meanings of a homograph. Two experiments were performed to test these predictions. One experiment presented balanced homographs in which the baseline frequencies of dominant and secondary meanings were relatively equal, whereas the second experiment presented homographs in which the baseline frequency of the dominant meaning was much higher than that of the secondary meaning. Context location was manipulated by placing a word related to a given meaning of the homograph either before or after the homograph. Transfer to same or different meaning pairs was tested at long lags following the initial homograph presentation. The results indicate that when the related word occurs first, there is a greater instantiation of the appropriate-to-the-context meaning. The results are discussed in relation to several models of homograph processing, including Gorfein and Brown's (2006) activation selection model.

(1105)

**Priming Reveals Differential Coding of Symbolic and Nonsymbolic Quantities.** CHANTAL ROGGEMAN, TOM VERGUTS, & WIM FIAS, *Universiteit Gent* (sponsored by Tom Verguts)—Quantities are commonly assumed to be represented on a “mental number line.” This representation can be implemented as place coding or as magnitude/numerosity coding. Place coding entails that the given quantity activates a specific set of units from the mental number line. Quantities that are close together activate overlapping sets of units (e.g., 5 activates number 4 and 6 as well, but more weakly). Magnitude coding refers to the idea that for a given quantity, all units that would be activated by all smaller quantities, are activated as well (e.g., 5 activates

also 1, 2, 3, and 4). We performed a primed naming study to differentiate between these representations. Both prime and target could vary between two input modalities: Arabic digits versus dot patterns. The results showed that the priming pattern evoked by digit primes originates in a place-coding representation, whereas dot primes activated number representations of the magnitude-coding type.

(1106)

**Relative Position Priming With Absolute Letter Coding: The Fuzzy Interactive Activation Model.** TOM VERGUTS, WENDY DE MOOR, & WOUTER DUYCK, *Universiteit Gent*—A simple and intuitive way to code letters in a word is by means of absolute coding. This entails that there is one set of detectors to code for the first letter of a word, one set for the second letter, and so on (e.g., McClelland & Rumelhart, 1981). However, recent years have witnessed a number of studies questioning the validity of this coding scheme. For instance, Peressotti and Grainger (1999) argued that repetition priming (e.g., priming from *grdn* to GARDEN) cannot be accounted for by absolute letter coding. However, a small and realistic extension to the absolute letter coding scheme, that letters are initially not always coded in the correct position, allows one to account for these and other data that are taken as evidence against absolute letter coding. We present a word recognition model based on this fuzzy coding principle and discuss simulation data.

• REPRESENTATIONS IN REASONING AND PROBLEM SOLVING •

(1107)

**Strategies for Improving Learning Through Increased Support for Structural Comparisons.** LINDSEY E. RICHLAND & IAN M. McDONOUGH, *University of California, Irvine*—Mathematics teachers in the U.S., Hong Kong, and Japan regularly use structural comparisons in classroom instruction, although U.S. teachers provide fewer supportive cues. These cues include (1) making analogues concurrently visually available, (2) using comparative gesture, and (3) embedding comparisons within familiar source contexts. Comparisons can focus learners' attention on relevant structural properties of concepts (Gentner & Lowenstein, 2002). However, laboratory studies demonstrate that without explicit cues, novices frequently fail to notice and learn from structural comparisons (Gick & Holyoak, 1983). Thus, U.S. practices may leave students unlikely to derive long-term benefits. We present two experiments testing the impact of the cues above in order to better understand the implications for encoding and transfer. Findings from structurally similar and structurally dissimilar comparisons revealed that these cues improved encoding for the target mathematical structure and increased far transfer. These data suggest recommendations for improving the likelihood that U.S. students will benefit from explicit structural comparisons.

(1108)

**Strategic Processing of Spatial Descriptions: Resource Economy in Spatial Reasoning.** GEORG JAHN & JOSEF F. KREMS, *Technische Universität Chemnitz*—Texts that convey a series of connected spatial relations can be conceived of as instructions to construct an integrated situation model of the described scene. For certain sequences of spatial assertions, lexical knowledge is sufficient to decide whether the assertions can be integrated—for instance, lexical knowledge about which spatial prepositions form converse pairs (A below B, B above A). However, to decide on other sequences of assertions, a comprehensive situation model is necessary. This is the case if knowledge about the related entities affects the interpretation and integration of spatial prepositions, such as the size of entities and known distances between entities. We report two experiments in which both kinds of sequences were presented in sentence verification tasks. The results show that participants responded adaptively to the respective processing demands. If lexical knowledge was sufficient to decide whether assertions could be integrated, the participants tended not to construct comprehensive situation models.

(1109)

**Dynamic Emergence of a New Cognitive Structure.** DAMIAN G. STEPHEN, JAMES A. DIXON, & ROBERT W. ISENHOWER, *University of Connecticut*—Dynamic approaches to cognitive science propose that cognitive structures are self-organizing attractors. However, demonstrating self-organization in cognition has been a major challenge. In the present study, we used dynamical analyses of participants' actions during problem solving to predict the spontaneous emergence of a new representation. The participants initially solved gear system problems by manually tracing the force across the system (i.e., simulating the turning and pushing of the gears) but then discovered that the gears formed an alternating sequence, demonstrating a representational change. Recurrence quantification analysis (RQA) was used to assess the degree of self-organization in the participants' force-tracing motions. Event history analysis showed that self-organization of force tracing predicted the shift to explicit use of the alternating sequence. Specifically, the RQA measure of Shannon entropy decreased to a minimum over the trials prior to the discovery of alternation. Self-organization of perception–action predicts the emergence of a new cognitive structure.

(1110)

**Spontaneous Transfer of Problem Solution Without a Hint.** BRENDAN A. HANNON & KRISTY JOHNSON, *University of Texas, San Antonio*—To date, many studies have demonstrated that spontaneous analogical problem solving rarely occurs across different domains of knowledge (e.g., Gick & Holyoak, 1980). However, this research has largely overlooked how the qualities of participants' mental representations of the analogous source problem and target problem might influence the frequency of spontaneous analogical problem solving. The present study attempted to increase the frequency of spontaneous analogical problem solving transfer across different domains of knowledge by enhancing the qualities of participants' mental representations of both the source problems and the target problems. The results showed increases in spontaneous analogical problem solving across different domains of knowledge to a level that was equivalent to a nonspontaneous hint condition. We interpreted our findings within Kintsch's (1988) construction-integration framework for comprehension.

(1111)

**The Effect of Analogy on Memory: Testing the Micro-Category Account.** ADAM E. GREEN, *Dartmouth College*, JONATHAN A. FUGELANG, *University of Waterloo*, & DAVID J. M. KRAEMER & KEVIN N. DUNBAR, *Dartmouth College* (sponsored by Kevin N. Dunbar)—The micro-category account of analogy (Green et al., in press) posits that reasoners spontaneously activate category relations when reasoning analogically. A key prediction of this account, based in part on prior research (e.g., Blanchette & Dunbar 2002; Roediger & McDermott, 1995), is that reasoners will falsely remember non-presented words when those words are members of categories that occur within presented analogies. In order to test this prediction and examine how analogical reasoning affects memory, we presented participants with a memory list following an analogical task. A subset of this list was made up of nonpresented words that were members of categories that occurred within presented analogies. Consistent with our predictions, category member words were falsely recognized more frequently than distractor words for both within-domain and cross-domain analogies. These data elucidate the effect of analogy on memory and indicate that the micro-category account of analogy can be extended to cross-domain analogies.

(1112)

**Variability and Belief Revision Involving Stereotypical and Non-stereotypical Attributes.** BRETT K. HAYES & LAUREN KEARNEY, *University of New South Wales*—Two experiments examined the way that the variability of group attributes influenced responses to subsequent disconfirming information. Participants were exposed to numerical group attributes drawn from low- or high-variability distribu-

tions and were asked to estimate the central tendency for each group. They were then shown test exemplars from the same groups, but drawn from a different distribution, and were asked to judge whether the central tendency of attributes in the target groups had changed. Some attributes were unfamiliar to the participants, whereas others were consistent with their stereotypes. Those trained with highly variable attributes were less likely to revise their beliefs about the central tendency of group attributes in response to disconfirming data. This effect was found for both stereotype-neutral and stereotypical attributes. The results are consistent with normative models of belief revision and challenge the view that stereotypical beliefs operate in a manner qualitatively different from that of nonstereotypical beliefs.

(1113)

**Impact of Differentiating Between Critical and Distorted Terms**

**on Semantic Illusions.** KARLA M. BATRES, *SUNY, Stony Brook*, & MARYELLEN HAMILTON, *St. Peter's College*—The failure to detect distortions in a question is known as a semantic illusion. When asked, “How many animals of each kind did Moses take on the ark?” people answer “two,” although most know that it was Noah who brought animals onto the ark. A series of experiments was conducted to attempt to increase participants’ accuracy in detecting distortions by having them see or generate the distorted (e.g., Moses) and/or critical (e.g., Noah) terms prior to the target questions. We found that accuracy in detecting distortions actually decreased when the participants had to choose between distorted and critical terms in a preliminary task. However, when the participants generated responses in the preliminary task, this decrease was seen only for generating the distorted items, and not when they generated the critical items. Implications of these findings for the partial match hypothesis will be discussed.

## POSTER SESSION II

Ballroom of the Americas, Friday Noon, 12:00–1:30

## • ANIMAL COGNITION •

(2001)

**Domain Specificity in Inhibition of Responding by Macaques.** DAVID A. WASHBURN, MICHAEL J. BERAN, THEODORE A. EVANS, & ERIC J. VANMAN, *Georgia State University*—One might predict that the mechanisms for self-regulation are constant across domains; that is, that organisms that are good at inhibiting responding to emotional or arousing stimuli might also be good at regulating responsiveness on cognitive tests of inhibition. We examined this hypothesis by comparing reactivity ratings, delay-of-gratification performance, and computer-based cognitive-inhibition performance for 9 rhesus monkeys. The independent raters were familiar with the animals but were unaware of the animals' task-based performance levels. Although performance was generally correlated within a domain (i.e., the animals who showed the best inhibition skills on the Stroop task tended to be the ones with the best inhibition performance on a stop-signal task), there was surprisingly little correspondence in performance across domains (i.e., the animals that showed best inhibition on the cognitive tasks were not necessarily those that were least reactive to emotional stimuli, or in turn that manifested best delay-of-gratification performance).

(2002)

**Comparative Study of Pictorial Depth Perception: Size Constancy Illusions From Texture Gradient Cues in Humans and New World Monkeys.** AYUMI SAKAI & KAZUO FUJITA, *Kyoto University* (sponsored by Kazuo Fujita)—The present study investigated how ecological factors may influence perception of depth from texture gradients. We compared terrestrial humans and arboreal New World monkeys for their perception of size constancy illusions. A total of 7 humans, 2 squirrel monkeys (*Saimiri sciureus*), and 2 capuchin monkeys (*Cebus apella*) participated. Participants' task was to classify red disks of different sizes (the sample) into two size categories: large and small. The sample was presented on the background texture frame that depicted "ground" or "ceiling." The results revealed that humans and New World monkeys had 3-D scene perception and a size constancy system in common, but that ground dominance might be a special characteristic of humans. These results suggest that visual systems in different species may have evolved their sensitivity to various pictorial depth cues in response to their lifestyles and accompanying changes in the visual environment.

(2003)

**Episodic-Like Memory in the Rat.** STEPHANIE J. BABB & JONATHON D. CRYSTAL, *University of Georgia* (sponsored by Jonathon D. Crystal)—A fundamental question in comparative cognition is whether animals remember unique, personal past experiences. It has been argued that memories for specific events (episodic memory) are unique to humans. We show that rats have a detailed representation of remembered events and meet behavioral criteria for episodic-like memory. We provided rats with access to locations baited with distinctive (e.g., grape and raspberry) or nondistinctive (regular chow) flavors. Locations with a distinctive flavor replenished after a long but not a short delay, and locations with the nondistinctive flavor never replenished. One distinctive flavor was devalued after rats had encoded its location, either by prefeeding that flavor (satiation) or by pairing it with lithium chloride (acquired taste aversion), but the other distinctive flavor was not devalued. The rats selectively decreased revisits to the devalued distinctive flavor but not to the nondevalued distinctive flavor. The present studies demonstrate that rats selectively encode the content of episodic-like memories.

(2004)

**Set Size Expansion and Abstract Concept Learning.** KENT D. BODILY & JEFFREY S. KATZ, *Auburn University*, ANTHONY A.

WRIGHT, *University of Texas Medical School, Houston*, & BRADLEY R. STURZ, *Auburn University*—Two groups of pigeons were trained on one of two procedures: matching to sample or same-different. In both tasks, training began with a small training set size and was successively doubled until a high level of concept learning occurred. Transfer tests, consisting of novel stimuli, tested for concept learning after each set size increase was acquired. Transfer performance increased with set size until it equaled baseline performance and both were >80%. Both tasks showed the same effect of set size on transfer performance. To compare procedures transfer performance was plotted as a function of the total number of baseline configurations at each set size. Set size functions were similar for both tasks. It is argued that, despite the procedural differences, the mechanism of concept learning is the same in both tasks.

(2005)

**Training Delays Reduce the Choose-Short Effect With Keylight, but Not Food, Durations.** DOUGLAS S. GRANT, *University of Alberta*—A number of studies have trained pigeons to discriminate between short (e.g., 2-sec) and long (e.g., 8-sec) durations of stimulation (e.g., keylight or food presentation). Following training with a 0-sec delay, testing at longer delays revealed a choose-short effect (CSE). That is, at longer delays pigeons tend to report both short and long durations as being short. In the present experiment, pigeons were trained with both keylight and food duration samples mapped to different sets of comparison stimuli. Relative to a group trained with a 0-sec delay, groups trained with a fixed or variable 5-sec delay showed a reduced CSE during extended-delay testing when the samples were keylight durations but not when they were food durations. Hence, it would appear that duration tasks using keylight and food durations are not identical and involve processes that are at least somewhat different.

(2006)

**A Test of Inequity Aversion in Cotton Top Tamarins (*Saguinus oedipus*).** JULIE J. NEIWORTH, ELIZABETH T. JOHNSON, & KATIE WHILLOCK, *Carleton College*—Brosnan and de Waal (2003) found that capuchin monkeys rejected a trading game if partners were given a preferred reward. They claimed this showed that monkeys assess a sense of fairness in a social context. Critiques have found that capuchins reject accepting a less preferred reward infrequently and independent of the food received by a partner (Roma, Silberberg, Ruggiero, & Suomi, 2006). We tested tamarins in conditions in which a trading game like Brosnan and de Waal's was used, and the subjects could reject playing in response to their partner receiving (1) the same reward, (2) the same reward for no work, (3) a preferred reward, (4) a preferred reward for no work, (5) a preferred reward for a different response, and (6) nothing, but the preferred food was present and unavailable. The conditions separated out the effects of work, of expectancy of food, and of social awareness in the study.

(2007)

**Utilizing Caffeine Dependence in a Conditioned Flavor Avoidance Paradigm.** SARAH E. DREUMONT-BOUDREAU & VINCENT M. LOLORDO, *Dalhousie University* (sponsored by Vincent M. Lolordo)—The role of caffeine dependence in conditioned flavor learning was explored using a flavor avoidance paradigm. Rats were given chronic exposure to caffeinated drinking water for 21 days to establish caffeine dependence. They were then given daily 30-min trials with a Kool-Aid/saccharin flavor (maintenance CS), after each of which the caffeinated drinking water was returned. Rats were then given daily 30-min access to a different Kool-Aid/saccharin flavor (withdrawal CS), followed by water, allowing the rats to go into caffeine withdrawal. In a subsequent 24-h two-bottle test pitting the maintenance and withdrawal CSs against each other, the rats overwhelmingly avoided the Kool-Aid/saccharin flavor paired with caffeine withdrawal symptoms. The avoidance did not occur in a second experiment with only 4 days' chronic caffeine exposure. On the basis of

these results, we can conclude that caffeine dependence was established in this experiment and can be used to condition an avoidance to a flavor paired with caffeine withdrawal.

(2008)

**Extinction of Running-Induced Taste Aversion in Rats.** SADAHIKO NAKAJIMA, *Kwansei Gakuin University*—It is now well established that voluntary running in an activity wheel after intake of taste solution endows rats with aversion to that taste (Baysari & Boakes, 2004; Hayashi et al., 2002; Heth et al., 2001; Lett & Grant, 1996; Lett et al., 1998, 2001; Masaki & Nakajima, 2006; Nakajima et al., 2000, 2006; Nakajima, 2004; Salvy et al., 2002, 2003, 2004; Sparkes et al., 2003). This phenomenon has been discussed in the framework of Pavlovian conditioning. A target taste is a conditioned stimulus (CS), and running is an unconditioned stimulus (US). The present series of experiments explored extinction of the endowed taste aversion. The conventional procedure (i.e., the CS-postexposure technique) was effective in extinguishing the running-induced taste aversion, though it was hard to obtain a reliable spontaneous recovery effect. The US-postexposure technique was less effective, but it partially extinguished the running-induced taste aversion with a proper setting.

(2009)

**Interrupting the Internal Clock: Location Break Effects.** MARINA MENEZ & FLORENTE LÓPEZ, *Universidad Nacional Autónoma de México* (sponsored by Eduardo Mercado III)—The internal clock is an essential component of timing interval theories. Apparently, the clock works like a stopwatch: It can be started and stopped arbitrarily. Previous research has shown that the break location in peak trials determines how the clock operates. Early breaks in the first half of the peak trials stop the internal clock, whereas late breaks reset it. To examine this phenomenon, the present study manipulated break location during the peak trial (first half, middle, and second half of peak trial), in two groups of rats. Breaks in the first half of the peak trial changed the peak time, as predicted by the stop–reset continuum location hypothesis. Breaks in the second half of the peak trial did not change the operation mode of the internal clock but significantly reduced the response rate. Breaks in the middle of the interval affected both peak time and response rate. These results suggest that response rate influences internal clock operation and that theories of timing should take this variable into account.

• REASONING AND PROBLEM SOLVING •

(2010)

**Assessing Students' Learning of Skills and Concepts From "New" Math Lessons.** PATRICIA BAGGETT, *New Mexico State University*, & ANDRZEJ EHRENFUCHT, *University of Colorado, Boulder*—The mathematics tests that students in K–12 schools are given provide a general answer to the question of how well the students learn some topics, but not to the question of which parts of the topics they master. In addition, the spiral character of school curricula often makes it impossible to pinpoint the time when learning actually occurs. During one semester, four groups of sixth graders in a school in the southwestern United States learned a series of mathematical topics that were new to them. All topics had a large hands-on component. Later the students were tested both for the skills they acquired and for their understanding of specific math concepts. The poster presents the material they were learning, the results of the tests, and general comments on the nonspiral method of teaching and on task-specific testing.

(2011)

**The Influence of External Representations on Chemistry Problem Solving.** JODI L. DAVENPORT, DAVID KLAHR, & KENNETH R. KOEDINGER, *Carnegie Mellon University*—Because atoms and molecules cannot be directly observed, chemistry instruction relies on visual representations (diagrams, equations, and graphs) to commu-

nicate key concepts. This study explores how different representations affect problem-solving performance by chemistry experts and novices. Participants were asked to think aloud as they completed a series of problems on chemical equilibrium. All problems addressed the same core concepts but were presented in different representational contexts (e.g., in one problem equilibrium concentrations were calculated, in another the correct equilibrium concentration was selected among diagrams representing molecules in vessels). Experts were more accurate than novices and were more likely to invoke relevant chemical concepts across representations. However, both novices and experts showed significant variability in performance across problem types, suggesting that problem representation affects the access of relevant prior knowledge. Furthermore, problems that required solvers to integrate information across representations revealed that novices often have simultaneous, conflicting chemistry conceptions.

(2012)

**Reading Time Index of Sensitivity to Alignment of Mathematical and Semantic Relations.** AMY M. GUTHORMSEN & MIRIAM BASSOK, *University of Washington*—People tend to align the symmetry of mathematical and semantic relations. For example, college students prefer to add taxonomically related objects (tulips + roses) and divide thematically related objects (tulips/vases), but not vice versa. Previous research using event-related potentials (ERPs) has shown that sensitivity to alignment can affect online processing during comprehension. This research has also suggested the possibilities that alignment sensitivity may be stronger in addition than in division and may be subject to individual differences. Here, we examined differences in time spent reading aligned (3 tulips + 5 roses) and misaligned (3 tulips + 5 vases) problems, using both addition and division, that participants solved. Participants spent longer reading misaligned than aligned problems, and though this effect was significant for both addition and division, it was more pronounced for addition. The data show that sensitivity to alignment is very common in the college population sampled (roughly 80% show sensitivity).

(2013)

**Combining Causal and Similarity-Based Reasoning.** CHARLES KEMP, PATRICK SHAFTO, & JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology* (sponsored by Joshua B. Tenenbaum)—Everyday inductive reasoning is supported both by knowledge about causal relationships between properties (if animal  $X$  has wings, it is likely to fly) and by knowledge about similarity relationships between objects (if my pet goose has property  $Y$ , my pet duck probably shares this property). Most accounts of inductive reasoning focus on one kind of knowledge: Models of causal reasoning often focus on relationships between properties, and models of property induction often focus on similarity. We present a model of inductive reasoning that incorporates both kinds of knowledge. Unlike previous accounts of causal reasoning, our model uses similarity to constrain inferences about the effects of unknown but causally relevant variables. Unlike previous accounts of property induction, our model handles novel properties that are causally linked to known properties. Two experiments show that our model accounts well for human performance on a task that draws on both causal knowledge and similarity.

(2014)

**Exploring the Relationship Between Confidence and Accuracy in Deductive Reasoning.** JAMIE A. PROWSE & VALERIE A. THOMPSON, *University of Saskatchewan*—Recent research has shown that there is little or no relation between confidence and accuracy in deductive reasoning (e.g., Shynkaruk & Thompson, in press). Thus, the goal of this study was to examine the variables that may improve this relationship. Four groups of participants solved a series of syllogistic problems under training and reason justification conditions, which were varied orthogonally. We observed that both training and reason justification improved accuracy but did not affect confidence. However, training

did improve the calibration of confidence and accuracy. Thus, the poor relationship between confidence and accuracy observed in prior studies may be due to a lack of skill in syllogistic reasoning.

(2015)

**Hierarchical Problem Solving in the Tower of Hanoi Is Independent of Goals: A Selective Attention Model.** ELENA G. PATSENKO & ERIK M. ALTMANN, *Michigan State University* (sponsored by Erik M. Altmann)—The question addressed here is whether hierarchical problem solving in the Tower of Hanoi puzzle is supported by specific, move-related goals stored in memory, as existing models assume. Two kinds of goal-based models are tested, those positing ordered goal storage (on a stack or list) and one positing unordered goal storage. These are compared with a new selective attention model in which problem solving is based on a few general (variabilized) rules, instantiated online for each move with information from the environment. Relevant information is indicated by attentional indexes (FINSTs) that identify a subset of disks and pegs and allow the rest to be ignored; thus, selective attention plays a key role in limiting problem space search. In three experiments, disks were added or deleted or their positions changed using a saccade-contingent display-updating paradigm. Latencies, move sequences following changes, and verbal reports support the selective attention model over goal-based models.

(2016)

**Fortune Favors the Prepared Mind: Encoding of Contextual Cues Following Warning of an Interruption.** HELEN M. HODGETTS, PHILLIP L. MORGAN, & DYLAN M. JONES, *Cardiff University* (sponsored by Dylan M. Jones)—Three experiments introduced interruptions during the execution phase of nine-move Tower of Hanoi problems and investigated how prior warning of interruption may reduce the time cost at resumption. A visual alert (a blinking dot) presented 2 sec before interruption onset was of little benefit to performance on the primary task, but an auditory alert (a short tone) significantly reduced task resumption times compared to no warning. There was no greater advantage for participants receiving the auditory alert 4 sec rather than 2 sec in advance of interruption. Results are discussed in terms of the goal activation model (Altmann & Trafton, 2002) and support the idea that the brief period between the warning for an interruption and its actual onset (termed the *interruption lag*) is a critical time during which contextual cues can be encoded to help prime subsequent retrieval of the suspended task goal.

(2017)

**The Role of Premise Versus Conclusion Content Type in Conditional Reasoning.** SHARON LEE ARMSTRONG, *La Salle University*—Previous studies have shown that neutral content produces superior performance over emotional content in evaluating conditional arguments and that prior belief about a conclusion also affects performance. But studies have not investigated the relative contribution of the emotional content of premises in contributing to reasoning errors. In standard conditional reasoning syllogisms, the conclusion is contained in the conditional premise as one of the clauses. Thus, we do not know whether reasoning errors are driven by the conclusion itself or by its relationship to the other clause in the conditional premise. Consider: (1) If I am good, then I will be punished; (2) I am good; (3) Therefore, I will be punished. This study investigated the roles of believability and emotional content of syllogism statements in reasoning performance and found that subjects' evaluation of the conditional premise affected reasoning errors in some conceptual domains.

(2018)

**Aging and Information Use in Contingency Judgment.** SHARON MUTTER, LESLIE PLUMLEE, SARAH REEDER, & COURTNEY ORTZ, *Western Kentucky University*—Research suggests that age-related decline in contingency judgment could be due to older adults' poor memory for the event state frequencies in the four cells of the contingency table and to their use of simpler, less effective strategies to

integrate this information. We used a feature-analytic procedure to examine young and older adults' contingency judgment strategies when event state frequencies were presented in summary form. Even though memory for these frequencies was not required, older adults used simpler strategies and showed a greater positivity bias in their judgments. These effects were related to age differences in the cell weight inequality effect; that is, older adults were more likely to overweight the frequency in Cell A and underweight the frequencies in Cells B and C of the contingency table. These findings are discussed in terms of age-related changes in cognitive resources that reduce the amount of information older adults use for contingency judgment.

(2019)

**Individual Differences Lead to Increased Context Sensitivity in Causal Induction.** LISA R. NARVAEZ & ARTHUR B. MARKMAN, *University of Texas, Austin*—The covariation view of causal induction assumes that people make judgments of causal efficacy, given experience with pairings of causes and effects, by using contingency information between causes and an effect. We explored the degree to which individual difference variables affect causal judgments for one cause by changing people's sensitivity to alternate causes. We examined the conditions under which individuals use conditional contingency information in causal induction by focusing on discounting, which occurs when the perceived efficacy of a cause is reduced in the presence of a second, stronger cause. In Experiment 1, individuals primed with an interdependent self-construal discounted, whereas control and independence-primed participants did not. In Experiment 2, men did not discount, but women increased their efficacy ratings for a cause in the presence of a stronger one (the opposite of discounting) when primed with fear of isolation. These data suggest that individual differences affect causal judgments.

(2020)

**Creative Style and Achievement in Adults With Attention Deficit Hyperactivity Disorder.** HOLLY A. WHITE, *University of Memphis*, & PRITI SHAH, *University of Michigan*—Attention deficit hyperactivity disorder (ADHD) is a relatively common disorder, characterized by inattentiveness, impulsivity, and hyperactivity, that affects children and adults. ADHD may have negative consequences for academics, employment, and social relationships; however, one positive consequence of ADHD may be enhanced creativity. This study replicates previous findings using a standardized measure of creativity (ATTA) and investigates real-world achievement and creative style among adults with and without ADHD. Results indicate that original creative thinking and real-world creative achievement are significantly greater in adults with ADHD. In addition, comparison of creative styles found that adults with ADHD are more likely to be idea generators, and adults without ADHD are more likely to be idea developers. These results have implications for the real-life application of ADHD-related creativity.

(2021)

**Strategy Choice on an *n*-Armed Bandit Problem by Pigeons.** DENNIS GARLICK & AARON P. BLAISDELL, *UCLA* (sponsored by Aaron P. Blaisdell)—The *n*-armed bandit problem involves a choice between *n* options or actions, and the probability of reward varies on the basis of the option or action chosen. In a situation in which the perceived distribution of probabilities is uncertain, an optimal strategy to maximize reward must both exploit existing knowledge of reward values to select the action that currently possesses the highest, and explore other options to increase knowledge of the probability distribution as a whole. Pigeons were presented with this task on a touch screen in which disks of different colors were associated with different probabilities of reward. The association between color and reward was consistent across trials within a single session, but was varied across sessions. We assessed the rate and ability of the pigeons to adapt to changing distributions and identify the most rewarded option. Individual differences in performance may reflect differences in perseveration, memory, or problem-solving skills.

## • LANGUAGE PRODUCTION •

(2022)

**Effects of Distractor Modality on Semantic Between-Level Effects in the Picture–Word Interference Paradigm.** ANSGAR HANTSCH & JÖRG D. JESCHENIAK, *Universität Leipzig*, HERBERT SCHRIEFERS, *Radboud Universiteit Nijmegen*, & SUSANNE ABMANN, *Universität Leipzig*—In the picture–word interference paradigm, semantic same-category distractor words (e.g., the target *dog* with the distractor *fish*) lead to longer naming latencies than do unrelated distractors. This semantic within-level interference effect is thought to indicate lexical competition. It is reliably obtained with visual and auditory distractor words alike (e.g., Damian & Martin, 1999). For semantic between-level distractors (e.g., the target *carp* with the distractor *fish*), facilitation effects (e.g., Vitkovitch & Tyrell, 1999) as well as interference effects (Hantsch, Jescheniak, & Schriefers, 2005) have been reported. In the present experiments, we examined whether differences in distractor modality contribute to the contradictory findings in the latter case. Our results showed semantic between-level interference effects consistently for auditory distractors, but—under certain constraints—visual distractors led to semantic between-level facilitation. The data suggest that the general lexical interference effect can be overridden by a possibly nonlexical facilitation effect if target and distractor are presented in the same modality.

(2023)

**Is There a Length Effect in Spoken Word Production?** HANS STADTHAGEN-GONZALEZ, MARKUS F. DAMIAN, & JEFF S. BOWERS, *University of Bristol* (sponsored by Dinkar Sharma)—Most current models of single-word spoken production predict that the articulation of shorter words should be initiated faster than that for longer ones. Previous studies on this issue using picture naming have often failed to take into account age of acquisition (AoA) and/or have used suboptimal techniques for controlling for nonlexical aspects of the picture-naming task. In the present study, we carefully matched stimuli of differing lengths for AoA and other relevant variables, and used a word–picture matching paradigm instead of the more commonly used subjective visual complexity ratings. Under these conditions, we failed to obtain a significant word length effect, either in English when comparing words with two and three syllables, or in Spanish when comparing words with two and four syllables. We discuss the implications of these results for current theories of phonological encoding in spoken production.

(2024)

**Event-Related Potentials of Correct and Errorful Speech Production.** SCOTT WATTER, BRYAN W. HERECHUK, JUDITH M. SHEDDEN, & KARIN R. HUMPHREYS, *McMaster University*—Speakers must be able to monitor their own speech. However, the extent and specific functions of a monitor/editor remain controversial. In order to investigate the mechanisms underlying monitoring in language production, we recorded ERPs during a task designed to elicit phonological speech errors. This experiment demonstrated first that clean ERPs can be obtained from an overt speech production task. Furthermore, a discrete bilateral prefrontal positivity occurring approximately 100 msec after speech onset was observed for trials in which participants made overt speech errors. This component was not present for correct trials. On trials in which participants withheld a response, this component was observed several hundred milliseconds earlier, peaking just prior to mean speech onset latency. This speech-error-related signal is a plausible marker of a monitor/editor in action. Implications for theories of monitoring in language production are also discussed.

(2025)

**First In, First Out: Working Memory Effects on Syntactic Production.** L. ROBERT SLEVC & VICTOR S. FERREIRA, *University of California, San Diego*—Speakers choose syntactic structures so that more accessible information—the information that comes to mind

first—is mentioned before less accessible information. Such accessibility effects might result from working memory (WM) demands, whereby speakers discharge accessible information from WM as soon as possible. In two experiments, speakers described pictures in response to questions that manipulated accessibility. Accessibility effects were sensitive to standard WM factors (span and sentence-internal and -external load), confirming that WM underlies such effects. A more communicative influence on syntactic choice is given–new ordering: Speakers use structures in which given precedes new information. Given–new ordering effects might reduce to accessibility effects, because given information is usually accessible. Two additional experiments manipulated givenness and found the same pattern of sensitivity to WM factors, suggesting that WM underlies givenness and accessibility effects similarly. Thus, syntactic production, both as motivated cognitively (accessibility) and communicatively (givenness), depends crucially on domain-general WM mechanisms.

(2026)

**Exaggeration and Accommodation in Conversation: The Role of Gender and Familiarity.** KAREN A. HUSSEY & ALBERT N. KATZ, *University of Western Ontario* (sponsored by Albert N. Katz)—Mainly on the basis of expository corpora, Mulac, Bradac, and Gibbons (2001) tested the gender-as-culture hypothesis (Maltz & Borker, 1982) and observed gender differences in the degree to which various language elements were used, such as hedges, intensive adverbs, dependent clauses, and the like. In contrast, we examined the same elements, but for dyads involved in interactive conversation, examining production both for friends and strangers and for conversations between people of the same or opposite genders. We found that we replicated the gender effects reported by Mulac et al. for a number of the language elements studied, but, importantly, this replication was largely limited to same-gender conversations and depended on whether the conversation partner was a stranger or a friend. We discuss the implications of these findings within the framework of communication accommodation theory (e.g., Giles, Coupland, & Coupland, 1991).

(2027)

**Individual Differences in Syntactic Alignment.** WILLIAM S. HORTON, *Northwestern University*—Speakers in dialogue often repeat back the same syntactic structures just produced by an interlocutor. Although this may emerge from relatively low-level alignment mechanisms (Pickering & Garrod, 2004), sociocognitive factors like affiliation goals and individual processing styles have also been shown to influence the degree to which interlocutors mirror each other's behavior more generally (van Baaren, Horgan, Chartrand, & Dijkmans, 2004). Using the scripted dialogue paradigm of Branigan, Pickering, and Cleland (2000), the present study examined whether social and interindividual factors similarly influence syntactic priming. Speakers alternated describing pictures of simple actions with a confederate, who primed critical items with either prepositional-object or double-object constructions. Speakers who are relatively context dependent, as measured by the Embedded Figures Test (Witkin, 1976), and those who rate themselves as more prone to social perspective taking, as indicated by the Interpersonal Reactivity Index (Davis, 1980), may show more evidence of syntactic alignment.

(2028)

**Spelling Monitoring and Translating: Temporal Analysis of Writing in Children With Typical or Atypical Language Development.** LIESBETH M. VAN BEIJSTERVELDT & JANET G. VAN HELL, *Radboud Universiteit Nijmegen*—In learning to write connected discourse, developing writers must learn to translate a conceptualized message into a linguistic structure and to self-monitor their writing process, including monitoring the spelling of words. Using a real-time approach, we examined translating and spelling monitoring during story writing in children with typical language development; bilingual children; and children with dyslexia, hearing impairment, or SLI. Spelling moni-

toring was examined by comparing pause duration before writing incorrectly and correctly spelled words. Results show that only children with typical language development and bilingual children paused longer before writing incorrectly spelled words. All five groups of children did pause longer before clause-linking conjunctions, which functioned as connective devices for linking thoughts, than before words from other grammatical classes. The combined results suggest that all children engage in higher level translating activities in writing, but only children without language problems adapt their rhythm of production before writing difficult words.

• METAPHORS •

(2029)

**Comparing Markedness and Metaphor Explanations of the Spatialization of Concepts.** WILLIAM LANGSTON & FRANK CARPENTER, *Middle Tennessee State University*—Lakoff and Johnson (1980) proposed that orientational metaphors give concepts a direction (e.g., good is up). Others (Clark, 1969; Jones, 1970) have proposed a markedness explanation (marked term is down). We compared these two explanations. Antonymous pairs with one marked and one unmarked term were classified as consistent or inconsistent with a physical dimension, consistent or inconsistent with good is up, metaphors with explicit direction words, metaphors with a physical basis, or metaphors without a physical basis. Participants circled which of a set of names fit a term (e.g., who is best?). For markedness, participants' selections demonstrated that consistency mattered. There were more "marked term is down" selections when that fit the underlying physical dimension or would be consistent with good is up. For metaphors, participants' selections demonstrated that most were classified according to Lakoff and Johnson's orientational metaphors, regardless of type.

(2030)

**Figurative Meanings Are Not More Difficult to Integrate Into Sentence Contexts Than Literal Meanings: Evidence From ERPs.** NATALIE A. KACINIK, LARA R. POLSE, KATHLEEN BAYNES, & TAMARA Y. SWAAB, *University of California, Davis*—Normative studies indicate that the figurative sense of words like SWEET, BRIGHT, and GRASP is less frequent and subordinate to their dominant literal meaning (Kacirik & Chiarello, in press). We conducted two ERP experiments investigating how the literal and figurative meanings of such words are integrated into consistent and inconsistent sentence contexts of increasing constraint. Results showed that subordinate figurative meanings were no more difficult to integrate than the dominant literal meanings, even in ambiguous contexts, although there was some indication that more constraining unambiguous contexts facilitated the integration of figurative meanings to a greater extent than literal meanings. In general, our findings support the notion that such polysemous words are processed differently than typical homonyms (e.g., BAT), whose incompatible meanings engender competition and semantic selection processes. Since figurative meanings are generally extended from the literal sense, they may share a common underspecified meaning compatible with both senses.

(2031)

**Processing Novel Metaphoric Sentences Taken From Poetry: An fMRI Study.** NIRA MASHAL & MIRIAM FAUST, *Bar-Ilan University*, TALMA HENDLER, *Tel Aviv University and Sourasky Medical Center*, & MARK JUNG-BEEMAN, *Northwestern University*—The neural networks associated with processing novel metaphoric, literal, and nonsensical sentences were studied in a group of 15 normal adults using fMRI. Participants read the three types of sentences and decided whether the sentences had either a positive or a negative meaning. Across subjects, several left-lateralized brain regions showed stronger activation for the novel metaphoric sentences than for the nonsensical sentences, including the posterior temporal gyrus, left inferior frontal gyrus, and left and right anterior superior temporal gyri. Moreover, the left middle frontal gyrus was activated more for the metaphoric than for

the literal sentences. However, the left fusiform gyrus showed stronger activation for both the metaphoric and the nonsensical sentences than for the literal sentences. These findings suggest that whereas posterior brain regions are sensitive to the level of familiarity of the linguistic stimuli, more anterior brain regions are more sensitive to meaningfulness.

(2032)

**Executive Functions of Working Memory Predict Quality of Metaphors Produced.** DAN L. CHIAPPE, RUSSELL S. PIERCE, VANESSA CHAMBERS, & KELLY McCULLOCH, *California State University, Long Beach*—We examined the role of working memory (WM) mechanisms in metaphor production. We administered to 207 participants the retrieval fluency, listening span, digit span forward, and digit span reverse tasks as measures of WM. We also administered the PPVT, a verbal IQ test. For the metaphor production task, participants were given topics (e.g., "billboards \_\_\_\_") plus a property that had to be attributed (e.g., "billboards are something noticeable and unattractive"). For each item, they had to provide a vehicle term (e.g., "warts") that could be used to attribute the property. The resulting metaphors were rated for aptness. We found that, though verbal IQ predicted the quality of metaphors produced, measures of WM predicted variance in metaphor quality independent of verbal IQ. Moreover, only WM tasks that require extensive executive functioning predicted metaphor quality. Results thus suggest that it is the executive functions of WM that are most important in metaphor production.

• LANGUAGE DEVELOPMENT •

(2033)

**Infant Label Learning: Influences of Prior Experience and Prior Label Possession.** KEITH M. GORA, JASON BRUNT, & LESLIE B. COHEN, *University of Texas, Austin* (sponsored by Leslie B. Cohen)—Numerous experimenters have documented 14-month-olds' ability to learn object-label pairs. Few have adequately explored the influence of prior experience and prior label possession. The baby label, object, and category knowledge inventory (BLOCK) is offered as a solution. Two label learning experiments were conducted in which the BLOCK was used to guide stimulus selection. Fourteen-month-olds were taught labels for objects for which they had either extensive or minimal prior experience and for which they did or did not possess a label. Results indicated that only infants with extensive experience with an object and a label for the object would readily learn new labels for that object. Furthermore, only these infants attended to both the object and the label of object-label pairs. The findings suggest that prior category experience and label possession facilitate infants' learning of new labels and that accounting for prior knowledge of objects and their labels is critical.

(2034)

**An Input-Driven Model of Early Syntactic Development.** DAN G. HUFNAGLE & SUZANNE L. CURTIN, *University of Calgary*—Models of syntax acquisition generally assume that syntax learning begins in earnest after form-meaning relationships are firmly established. However, recent evidence from natural language and artificial grammar research has prompted new proposals, which argue that the foundations of syntax are laid before many form-meaning pairings are acquired (Gómez & Gerken, 2000; Naigles, 2002). Extending a model of phonology and word learning in which abstractions arise from representations of stored exemplars (Werker & Curtin, 2005), this model argues that representations of nonreferential word forms initially drive syntactic associations. Early on, little organization exists among newly segmented word forms. Then, individual forms build relationships based on co-occurrence patterns. Organization in the lexicon around various distributional characteristics results in coalescence into categories that relate to individual forms. Once categories are established, patterns among categories emerge, and the primary relationships shift to those between categories rather than those between individual word forms.

(2035)

**Vowel Harmony, Feature-Based Generalization, and Implicit Language Learning.** SARA FINLEY & WILLIAM BADECKER, *Johns Hopkins University*—Abstract representations such as distinctive features and natural classes play a vital role in explaining phonological processes. This reliance on abstract representations has led many to take it for granted that these representations play an equally prominent role in the learning process. This assumption is tested in three artificial grammar experiments involving a mini-language with pseudomorphophonological alternations based on front/back (palatal) vowel harmony (Experiments 1 and 2) and height harmony (Experiment 3). In each experiment, adult participants were trained using positive data from four vowels in a six-vowel inventory: The two remaining vowels appeared at test only. If participants use features and natural classes, they should generalize to the novel test segments. Results show positive evidence for feature-based rule learning that is sensitive to the inventory of the native language and is constrained by principles governing cross-linguistic vowel harmony typologies.

(2036)

**Subsyllabic Unit Preference in Young Chinese Children.** MIN WANG & CHENXI CHENG, *University of Maryland, College Park*—We report three experiments investigating subsyllabic unit preference in young Chinese children. Experiment 1 was a sound similarity judgment task (SSJ) in Chinese. We presented 48 pairs of stimuli that varied in terms of shared subsyllabic units (i.e., vowel, body, rime, and onset-coda). Both preschool and grade 1 Chinese monolingual children judged pairs shared with body units as more similar than those shared with rime units when the tones of the syllables were matched. In Experiment 2, an SSJ task in Chinese and English, grade 1 Chinese-English bilingual children judged body-shared pairs as more similar in Chinese and rime-shared pairs as more similar in English. In Experiment 3, a sound matching task in Chinese and English, grade 1 bilingual children showed a preference for matching body units in Chinese, and a preference for matching rime units in English. These results together point to cross-linguistic differences and the influence of literacy experience in subsyllabic unit processing in spoken words.

## • WORD PROCESSING •

(2037)

**Time Course of Color Information for High Color Diagnostic Objects.** WILLIAM STURGILL & LYNNE F. CLURE, *Rockhurst University*—Color diagnosticity theory (Tanaka & Presnell, 1999) posits that a color symptomatic of a particular object facilitates identification of the object. The present experiment used a priming paradigm to assess the time course of the availability of color information for high or low color diagnostic (HCD or LCD) object names. Participants' task was to name the color of a patch. Preceding the color patch was an HCD or LCD object name for 100 msec and then an SOA of 100, 200, 400, 600, or 800 msec. HCD primes preceded a congruent color on one-half of the trials and an incongruent color otherwise. LCD words and a string of Xs were controls. Results showed that HCD primes facilitated congruent color identification and inhibited incongruent color identification at 400 and 600 SOA. Control primes did not affect color-naming time.

(2038)

**Affective Processing and Lexical Decisions: The Positive-Priority Effect.** MICHELLE VERGES, *Indiana University, South Bend*, & ZACHARY ESTES, *University of Warwick*—We tested the evolutionary claim that negative words (e.g., *shark*) are processed faster and with greater accuracy than positive words (e.g., *kitten*). Participants were asked to make lexical decisions about positive, negative, and neutral words. In Experiment 1, positive words were judged reliably faster than were negative words. In Experiment 2, positive words were judged with greater accuracy than were negative words. Results from

these two experiments did not support the evolutionary claim that negative stimuli are apprehended faster and with greater accuracy than positive stimuli. Instead, results suggest that a positive-priority effect obtains when evaluative responses are considered irrelevant in a lexical decision task.

(2039)

**Emotion Word Processing: Evidence From Eye Movements.** GRAHAM G. SCOTT, PATRICK J. O'DONNELL, & SARA C. SERENO, *University of Glasgow* (sponsored by Sara C. Sereno)—Emotion words have high arousal and positive (e.g., “cash”) or negative (e.g., “fire”) valence. Neutral words have low arousal and neither positive nor negative valence (e.g., “book”). Emotion words have been investigated in various word recognition paradigms, but not in the context of normal reading. In this experiment, eye movements were monitored as participants read sentences containing positive, negative, and neutral words. Target word frequency was also manipulated: Half were high frequency (HF), half were low frequency (LF). Analyses of fixation times revealed significant main effects of word type and frequency as well as an interaction. Fixation times on HF and LF positive words and HF negative words were shorter than their neutral counterparts. No difference, however, was obtained when comparing HF negative and neutral words. Results are discussed in terms of the time course and role of emotionality in word recognition.

(2040)

**What's in a Nonword? Linguistic Factors That Distinguish Nonwords From Lists.** BRANDON ABBS, PRAHLAD GUPTA, ELIZABETH JOCHEM, & BRIAN ARMOGAN, *University of Iowa* (sponsored by Prahlad Gupta)—Nonwords and lists are both novel serial orderings of linguistic units (i.e., phonemes, syllables, or words), and performance in immediate repetition of these two stimuli is reliably correlated. Within-nonword serial position effects have also been documented, similar to classic within-list serial position effects, suggesting that nonwords may be akin to lists. But what determines whether a particular sequence of linguistic units is a “list” or a “nonword”? Lists, unlike nonwords, traditionally (1) contain pauses between each item, (2) have a uniform stress contour, and (3) have no coarticulation between items. Two experiments examined the role of these variables in distinguishing nonwords from lists, by studying participants' immediate repetition of sequences of English syllables that incorporated various combinations of the three variables. Stress contour and pauses did not affect repetition performance, but coarticulation had a clear effect, suggesting that coarticulation may be the critical variable distinguishing nonwords from lists.

(2041)

**Differences in Hemispheric Processing for Low and High Age of Acquisition (AoA) Words.** J. MICHAEL BOWERS & SHELIA M. KENNISON, *Oklahoma State University* (sponsored by Shelia M. Kennison)—The present research investigated the possibility that because of biological processes related to the critical period, there would be greater left hemisphere involvement in the processing of words learned early in childhood (i.e., low AoA words) than of words learned later in childhood (high AoA words). The hypothesis was confirmed in a divided visual field experiment in which participants viewed low and high AoA words presented either in the left visual field (LVF) or right visual field (RVF). Words were either blocked by semantic category or presented in random order. The results showed that there was an RVF advantage for low AoA words, but not for high AoA words. The RVF advantage for low AoA words was larger when words were blocked by semantic category than when words were presented in random order. Implications for models of hemispheric processing are then discussed.

(2042)

**Integration of Perceptual Information in Lexical Access.** TOBIAS RICHTER & ROLF A. ZWAAN, *Florida State University*—A funda-

mental question for experiential accounts of language comprehension is how different types of perceptual information, such as color and shape, are combined during lexical access. One possibility is that word meanings are based on schematic perceptual representations. This view implies additive priming effects of color and shape. Exemplar models, in contrast, assume that word meanings are based on representations of specific experiences with a word's referent. This view implies a multiplicative integration of color and shape information. In three experiments, participants performed a classification task, a lexical decision task, or a word naming task on names of fruits and vegetables. The names were presented with a background picture that matched or mismatched the color or shape of the words' referents. Consistent with an exemplar view, responses were facilitated only when both color and shape information matched. Response times correlated negatively with similarity ratings and with the consistency of these ratings.

• ATTENTION AND ACTION •

(2043)

**Does Compatibility Interference Generalize to Distractor Stimuli in a Selection Task?** PAUL S. MATTSON & LISA R. FOURNIER, *Washington State University* (sponsored by John M. Hinson)—Withholding actions to one stimulus (A) can delay responses to a second stimulus (B) if A and B share similar response codes (e.g., response hands). This study examined whether this compatibility interference (CI) generalizes to distractor stimuli in a selection task. Two stimuli (A and B) occurred sequentially. First, a response was planned and withheld to stimulus A. Then stimulus B occurred, and immediate, speeded responding was required to a target presented alone or flanked by response-compatible or -incompatible distractors. Afterward, the response to stimulus A was executed. Results showed both CI and flanker compatibility effects for stimulus B targets. However, similar response codes between stimulus A and stimulus B flankers did not impact flanker compatibility effects for stimulus B targets. These results contrast with the code occupation hypothesis, which predicts reduced flanker compatibility effects when response codes for the flankers are occupied in memory, making the flanker response temporarily unavailable.

(2044)

**Aftereffects of Response Inhibition in the Stop Signal Paradigm.** FREDERICK VERBRUGGEN, BAPTIST LIEFOOGHE, & ANDRÉ VANDIERENDONCK, *Universiteit Gent* (sponsored by André Vandierendonck)—A topical issue within cognitive psychology is how participants continuously adjust their performance. In the stop signal task, in which participants have to suppress a motor response, it has been found that after the presentation of a stop signal, responses on the subsequent trial are slowed down. This slowing down was interpreted by Rieger and Gauggel (1999) as evidence for strategic adjustments. Our study investigated the determinants of this effect. Four experiments are presented, in which we demonstrated that the slowing down after successful stopping was primarily driven from the bottom up, without much top-down involvement. When the stimulus was repeated, the slowing down was strongest. In line with Pashler and Baylis (1991), response repetition effects were only found when the stimuli were categorizable. Finally, in a selective stop task it was demonstrated that part of the effect was caused by the stop signal presentation and not by response inhibition.

(2045)

**The Sharing of Codes Between Actions in Memory and Actions Requiring Immediate Execution.** LISA R. FOURNIER, RYAN MCMEANS, & MATTHEW WIEDIGER, *Washington State University*—If an action being executed shares an “action component” with a sequence of planned actions held in memory, execution of the former is delayed. This compatibility interference (CI) is assumed to occur because the action code required for immediate execution is oc-

cupied in memory, and thus is temporarily unavailable. We determined whether CI is due to compatible action or cognitive codes. Two stimuli (A and B) occurred in sequence. Participants held in memory a planned response sequence to A with their left or right hand. When B occurred, a vocal response “left” or “right” was immediately executed based on the stimulus's color. Only the verbal (not physical) response codes were compatible or incompatible between stimuli. Results showed that the vocal response to B was delayed when its verbal description (“left”) was compatible with the motor response (left hand) to A. Thus, cognitive code compatibility is sufficient for CI.

(2046)

**Informative Anticipatory Cue in Tennis Serve Motion: Racket and/or Racket-Arm?** HIROFUMI IDA, TETSURI INOUE, & KAZUTAKE UEHIRA, *Kanagawa Institute of Technology*, & KAZUNOBU FUKUHARA & MOTONOBU ISHII, *Tokyo Institute of Technology*—We developed a novel methodology to examine the functional link between the opponent's motion and anticipatory performance in tennis by using a virtual reality environment. This system displays tennis stroke motion that is arbitrarily modulated at the racket-arm joints and reconstructed with a human computer graphic model. By using this, it was revealed that the skilled players utilized the racket kinematic information for anticipation more than did novices. The racket information, however, was not sufficient to explain the total anticipatory performance at all, since complicated information about racket-arm motion is also necessary for anticipation, as well as the racket kinematics. Then, we further investigated by comparing three types of display model: (1) a complete model, consisting of a normal tennis serve, including server body and racket; (2) a racket-erased model, in which only the server body was visible; and (3) a racket-alone model, in which only the racket was visible. We hypothesize that the complete model generates significantly higher performance.

(2047)

**Interference Mechanisms for Working Memory and Response Production.** PATRICK G. BISSETT, DEREK E. NEE, & JOHN JONIDES, *University of Michigan* (sponsored by John Jonides)—Irrelevant or distracting information often bombards our lives, and the ability to resolve this interference is vital to intelligent behavior. However, it is unclear whether a single function underlies the ability to resolve interference, or whether multiple distinct mechanisms are at work. Here we investigated the proposal that interference resolution mechanisms can be dissociated by the stage of processing at which they operate. Experiment 1 compared interference acting upon working memory representations versus response execution within a single paradigm, and we demonstrated that the two forms of interference do not interact, suggesting their separability. Experiment 2 demonstrated how two tasks acting upon the same stage of information processing (response execution) exacerbate the effects of interference, exposing their shared mechanism. These results suggest that there are different distinct mechanisms at work in resolving interference and that combining well-documented interference resolution tasks into a single paradigm may be useful for future work investigating interference resolution.

(2048)

**Does Subliminal Priming of “Free” Responses Depend on Task Set or S-R Compatibility?** PATRICK A. O'CONNOR & W. TRAMMELL NEILL, *SUNY, Albany* (sponsored by Laurie B. Feldman)—In a task requiring speeded directional responses to arrow symbols (<<, >>), “free choice” responses to interspersed bidirectional stimuli (<>) are influenced by masked directional primes (e.g., Schlaghecken & Eimer, 2004). We tested whether this priming effect is mediated by the conscious instructional set, or instead by the preexisting directional associations of the symbols, by varying stimulus-response (S-R) compatibility. In two experiments, one group of subjects was instructed to respond with the hand consistent with the implied direction of the arrow symbols, and another group was instructed to make the spatially opposite response. Both groups showed priming of “free

choice” responses. However, such priming was always biased according to the instructional set rather than the preexisting associations. Subliminal priming of “free choices” therefore depends on conscious task goals.

• EMOTION AND ATTENTION •

(2049)

**Anger and the Attentional Blink in Human Vision.** MATTHEW I. ISAAK & MEGHNA UTHAIYA, *University of Louisiana, Lafayette*—We investigated the effect of state anger and anger-related T1s (first targets) on the accuracy with which participants detected neutral T2s (second targets) in dual-task RSVP. State anger was manipulated using a focused imagery and writing task. Although the manipulation was effective, it did not influence T2 detection accuracy. When T1 was anger-related, T2 was detected less accurately than when T1 was neutral. This was true even when participants were instructed to ignore T1. Not only do anger-related T1s magnify the attentional blink, they appear difficult to ignore.

(2050)

**Negative (but Not Positive) Emotional Conversations Are the Worst.** PAUL ATCHLEY & JEFF DRESSEL, *University of Kansas*—In previous work, we have demonstrated that attention (specifically the functional field of view) is reduced by a concurrent conversational task. This effect increases as the language task becomes more complex, or if the words a participant hears and responds to are emotional in content. In the present work, we investigated whether producing emotional speech in response to emotional words further reduces the functional field of view. Groups of participants produced semantically related words in response to either emotionally positive or emotionally negative words of equivalent arousal while performing a task measuring their functional field of view. Although both conditions led to decrements in performance, only negative word production yielded larger decrements than did listening to nonvalent words and making a semantic response. The results offer additional support for the idea that the effect of emotional content on visual attention is more than just an effect of arousal.

(2051)

**The Effect of Negative Mood Induction on Attentional Bias.** YI-HSING HSIEH, *National Changhua University of Education*, & HUEI-CHEN KO, *National Cheng-Kung University*—This study investigated whether attentional bias to negative information could be suppressed in women with anxiety and depression while a negative mood was induced. Ninety-two participants from a subject pool originally established for postpartum research were divided into three groups, including major depression, anxiety, and normal controls, according to the lifetime version of the Modified Schedule of Affective Disorders and Schizophrenia. After the mood induction procedure, with either an anxious or a depressive state induced, attentional bias was measured using a deployment-of-attention task. As a result, attentional bias for sad faces was suppressed in individuals with depression when their sad mood was elevated. When an anticipating anxiety was raised, participants with anxiety showed an attentional bias for happy faces. The results suggest that while in a negative mood, individuals with anxiety use a different coping strategy than individuals with depression do. We propose a model to account for the results.

(2052)

**Accentuate the Negative, Eliminate the Positive? Individual Differences in Attentional Bias to Positive and Negative Information.** HADAS SHINTEL, JOHN T. CACIOPPO, & HOWARD C. NUSBAUM, *University of Chicago* (sponsored by Howard C. Nusbaum)—In Stroop tasks, color naming slows down to the extent that the word grabs attention. Previous research using emotional Stroop tasks has generally found greater interference for negative words, suggesting an

attentional bias toward negative information, particularly for concern-related threat stimuli. How is this attention bias modulated by individual differences? We examined this question using an emotional Stroop task with emotional-, social-, and religion-related positive and negative words. Loneliness was associated with greater interference for social relative to nonsocial negative words. Religious attitudes were associated with greater interference for religious relative to non-religious positive words, but not for religious-neutral and religious-negative words. Results suggest that social and attitudinal factors can affect unintentional attentional biases in cognitive processing. Although there was a general attentional bias toward negative words, results show that attitudes can increase attention to positive information, suggesting that the emotional Stroop effect is not limited to negative information.

(2053)

**Avoiding Threat: The Attentional and Emotional Consequences of Inhibition.** HELENA J. V. RUTHERFORD & JANE E. RAYMOND, *University of Wales, Bangor*—Inhibition of return (IOR) enables efficient visual search by biasing attention to novel locations. We examined whether threatening cues (spider images) and manual avoid versus approach responses would modulate IOR and whether IOR has evaluative consequences for cues. Spiders validly or invalidly cued the presentation of a target (circle); detection was indicated by an approach or avoid response. Previously seen and novel spiders were then rated for how threatening they were (5-point scale). Response mode affected both IOR and ratings. IOR was weak in the approach condition, but robust in the avoid condition. Moreover, response mode affected how valid versus invalid cues were subsequently rated, even though cues were rated as less threatening than novel spiders overall. These results suggest that attentional inhibition depends on response mode and that, when invoked, IOR has consequences for the emotional evaluation of emotionally valenced stimuli.

(2054)

**Oculomotor System Prepares Involuntary Saccades Toward Emotional Scenes.** LAURI NUMMENMAA & JUKKA HYÖNÄ, *University of Turku*, & MANUEL G. CALVO, *Universidad de La Laguna* (sponsored by Jukka Hyönä)—We examined whether visual attention, as indexed by eye movements, is captured by emotional pictures depicting pleasant or unpleasant scenes. In Experiment 1, a pleasant, neutral, or unpleasant picture (involving humans) was presented with a neutral control picture (involving objects), and participants were asked to judge the emotionality of the pictures while their eye movements were recorded. In Experiment 2, participants were asked to either look at an emotional or a neutral picture when two other pictures (emotional and neutral) were presented peripherally. In Experiment 3, an endogenous color cue presented either 150 msec prior to or 150 msec after the presentation of the target picture pair determined to which of the two parafoveally presented pictures (emotional and neutral) the participant had to make an eye movement. The results showed that visual attention is captured by emotional pictures and that this capture is basically automatic in nature.

(2055)

**Effect of Emotion on an Image-Based AX-Continuous Performance Task (AX-CPT).** PAUL HAERICH, GREGORY E. DEVORE, & JENNIFER A. TUCKER, *Loma Linda University*—The AX-CPT task has been employed to measure cognitive control and the impact of context on processing mechanisms. In the task, attention to the cue (A or B) is required to select the correct response to the target (X). We present data from a modified version of the AX-CPT in which images from the International Affective Picture System are presented in place of letters and the emotional valence of the cue stimuli is manipulated across trials. Using a neutral target image, the effect of emotional valence was observed as a relative benefit in performance on AX trials for negative valence versus positive valence cues. These data are commensurate with the notion of a rapid alerting system for threat infor-

mation and suggest that an emotional AX-CPT might be a useful tool for examining the mechanisms of cognitive control in emotional contexts.

(2056)

**How Stress Affects Task Set Reconfiguration in Task Shifting.** MARCO STEINHAUSER, MARTIN MAIER, & RONALD HÜBNER, *Universität Konstanz* (sponsored by Ronald Hübner)—It is frequently assumed that stress depletes available resources. This might result either in an impairment of cognitive processes or the induction of compensatory strategies. The present study investigated the influence of stress on task set reconfiguration in task shifting. Participants alternated randomly between two tasks. The relevant task was indicated by a cue on each trial. Shift costs (i.e., performance decrements on task-shift trials relative to task-repetition trials) were measured for a short and a long cue–stimulus interval (CSI). Stress was varied by manipulating the difficulty of a previously administered intelligence scale. In the low-stress group, the shift costs were reduced with a long CSI, indicating anticipatory and shift-specific reconfiguration. In the high-stress group, the shift costs were independent of the CSI, implying that reconfiguration was either not anticipatory or not shift-specific. Our results suggest that participants adapted to the stress-induced resource reduction by adopting a suboptimal reconfiguration strategy.

• WORKING MEMORY •

(2057)

**Working Memory, Stroop Performance, and Attentional Load.** JOEL GREGOR & CHRISTOPHER J. KOCH, *George Fox University* (sponsored by Christopher J. Koch)—The ability to inhibit a response, as in the Stroop task, has been linked to executive functioning and working memory (WM). Four studies were conducted to determine whether responding to a nonsemantic Stroop task is related to WM in the same way as the traditional color–word version of the task. In the first study, color–word and color–block versions of the Stroop task were presented with forward and reverse digit span tasks. The second study replicated the first, with the addition of an operation span task. The third study compared verbal with visual versions of the digit span tasks. Color–block Stroop interference was not related to WM in any of the three studies. Load was manipulated in the fourth study by varying the proportion of congruent and incongruent trials. It was found that Stroop performance was not related to WM under low-load conditions but was associated with WM under high-load conditions.

(2058)

**Attentional Modulation of Social–Emotional Judgments of Faces Depends on Working Memory Capacity.** BRIAN A. GOOLSBY, JANE E. RAYMOND, & KIMRON L. SHAPIRO, *University of Wales, Bangor* (sponsored by Kimron L. Shapiro)—Emotional evaluations of stimuli that were previously ignored in a selective attention task are more negative than evaluations of previously attended stimuli. Raymond and colleagues (Fenske et al., 2004, 2005; Raymond et al., 2003, 2005) proposed an attentional inhibition account to explain this distractor devaluation (DD) effect. This theory states that inhibition applied to the distractor (to reduce response competition with the target) becomes associated and stored with the object representation and is reinstated (with negative consequences) when emotionally evaluating that object. We investigated how loading working memory interferes with this process. Participants performed a selective attention task with faces followed by an evaluation of the target, the distractor, or a novel face. These tasks were flanked by a delayed matching-to-sample task with up to two additional faces. As working memory load increased, devaluation of distractors relative to targets decreased. We discuss the locus of interference by WM load.

(2059)

**Individual Differences in Brain Responses to Attentional Interference.** DAWN G. BLASKO & VICTORIA A. KAZMERSKI, *Pennsyl-*

*vania State University*, & HOLLY A. BLASKO-DRABIK, *University of Central Florida*—Stroop-like tasks have been a mainstream component of research on attentional processes. They create situations in which responses are required to one dimension of a stimulus while another is ignored, and this is usually reflected in slower and more effortful processing. In the present research, we recorded event-related brain potentials while young adults were subjected to attentional interference in visual and auditory attention tasks. We found that individual differences in working memory capacity and experience with similar stimuli during musical training impacted on the results. Source localization analysis was used to begin to separate the impacts of cognitive and experiential factors on attention.

(2060)

**Working Memory Capacity, Processing Speed, and Fluid Intelligence: An Eye Movement Analysis.** THOMAS S. REDICK & RICHARD P. HEITZ, *Georgia Institute of Technology*, AIDA AGUILERA MARTINEZ, *Universitat Oberta de Catalunya*, & RANDALL W. ENGLE, *Georgia Institute of Technology*—Fluid intelligence (Gf) research has focused on discovering and understanding the underlying factors of human cognitive abilities. Two separate areas of experimental psychology have focused on the relative importance of two such constructs: working memory capacity (WMC) and processing speed (PS). This study aimed to further clarify the relationship between WMC, PS, and Gf in a combined experimental and differential framework. Because many PS tests vary in the memory and attention demands required, individual differences in WMC may instead be responsible for the relationship between PS and Gf. Participants completed paper-and-pencil and computerized measures of WMC, PS, and Gf. In addition, eye movements were recorded during performance of the computerized PS tasks. The results showed that these constructs were related, as has been previously reported, but eye movement analyses suggested that WMC differences on PS measures are due to memory and attention processes instead of to basic speed of processing.

(2061)

**Retrieval Dynamics in Working Memory: The Role of Predictability and Positional Binding.** ELKE B. LANGE, JOHN CERELLA, & PAUL VERHAEGHEN, *Syracuse University* (sponsored by Paul Verhaeghen)—In two experiments, we investigated which factors influenced selection of the required item from short-term memory. In the study phase, 2–5 items were presented visually in different locations on a screen. In the test phase, each item was probed once. It was more difficult to match on specific locations (local recognition task) than to do a global match on the complete memory set (Sternberg paradigm); thus, location cues did not expedite item access. In local recognition, the predictability of the serial order of probe locations did not speed item recovery. But a probe order corresponding to the study order had a strong beneficial effect. In addition, with corresponding order, access times did not increase with memory set size. In all other conditions, a linear set size effect was obtained. The results suggest that items in short-term memory are not immediately addressable by location. Input order may be encoded automatically.

(2062)

**A Double Dissociation of Maintaining Phonology and Semantics in Working Memory.** GEETA SHIVDE, *West Chester University*, & ZACHARY TIGERT & MICHAEL C. ANDERSON, *University of Oregon*—Previous research has shown that maintaining the meaning of a word slows responding to semantically related probe words in a concurrent lexical decision task. This semantic relatedness effect does not occur when participants maintain the sound of the word, which demonstrates a dissociation between semantic and phonological working memory. In the present study, participants were given a single word and asked to maintain either its sound or meaning over a delay, after which they made either a synonym judgment or a phonological judgment on a target item. During the maintenance interval, partici-

pants performed a lexical decision task. In the series of lexical decision trials were words that rhymed with the maintained words. Participants were slower in responding to rhyming probes during phonological, but not during semantic, maintenance. Together with previous experiments, this supports an independent component of working memory for the maintenance of semantics.

(2063)

**The Effects of Stimulus Complexity and Aging on Working Memory Inside and Outside the Focus of Attention.** LESLIE VAUGHAN & MARILYN HARTMAN, *University of North Carolina, Chapel Hill*, & PAUL VERHAEGHEN, *Syracuse University*—Older and younger adults performed a self-paced *n*-back task (*n* ranging from 1 to 4); stimulus complexity was manipulated by varying the number of digits per stimulus. There was a large reduction in performance as *n* increased from 1 to 2 (focus-switching cost), but smaller increases in RT with further increases in *n*, suggesting a focus of attention (FOA) size of one, and serial search outside the FOA. Increased stimulus complexity reduced overall performance, increased focus-switching costs, and reduced accuracy outside the FOA. Older adults were less accurate and slower than younger adults, and showed increased focus-switching costs as well as greater loss of accuracy with increased *n* outside the FOA. Contrary to expectation, stimulus complexity did not negatively impact older more than younger adults. Taken together, the results suggest the importance of stimulus characteristics to working memory, but argue against stimulus complexity as the locus of age differences.

(2064)

**Working Memory, Strategy, and Controlled Allocation of Time.** HEATHER M. THOMPSON & KANDI J. TURLEY-AMES, *Idaho State University*—Strategy training has been shown to enhance working memory (WM) performance and the relationship between WM and higher cognitive functioning (HCF; Turley-Ames & Whitfield, 2003). However, enhancement of WM performance and the relationship between WM and HCF might be a function of time spent on the to-be-remembered information rather than strategy training. Therefore, the present study examined how controlling time spent on the to-be-remembered information and strategy training influences WM performance and the relationship between WM and HCF. Results indicate differences in how strategy training and controlling for time impact WM performance and the correlation between WM and HCF. Specifically, strategy training enhanced WM performance more than did controlling for time. Importantly, strategy training enhanced the correlation between WM and reading comprehension, whereas controlling for time enhanced the correlation between WM and reasoning ability.

(2065)

**Working Memory Capacity and Signal Detection Theory.** ALLISON R. HOLLINGSWORTH, M. KATHRYN BLECKLEY, & ROMAN TARABAN, *Texas Tech University* (sponsored by Roman Taraban)—This study examined whether working memory (WM) capacity influences the performance on a signal detection task. Two experiments were performed in a between-WM-spans design. Experiment 1 consisted of a go/no-go response, and Experiment 2 of a two-option forced choice response paradigm. Although the high and low spans showed equal overall performance for Experiment 1, high spans had significantly fewer false alarms and significantly more correct rejections. Criterion (*c*) measures were marginally significant. In Experiment 2, high spans significantly outperformed low spans overall, with the same pattern of differences in Experiment 1. *d'* and response criterion (*c*) were significant between groups with high spans more sensitive. *c'* was marginally significant for low spans, suggesting a pattern of negative response bias. Results suggest that response criterion and sensitivity are influenced by WM span.

(2066)

**Effects of Stimuli Presentation and Strategy on Working Memory Performance.** CINDY J. DIMMER & KANDI J. TURLEY-AMES,

*Idaho State University* (sponsored by Paul Whitney)—Past research has indicated that variations in both the presentation of working memory (WM) stimuli and strategy training influence WM span scores, and subsequently, those scores' ability to predict higher order cognitive functioning (HCF). To investigate these relationships, participants were presented with WM stimuli in either an ascending or random format, and half of the participants used a rehearsal strategy. Analyses indicated that although WM span scores did not differ as a function of presentation format, their ability to predict HCF did. Specifically, when the WM stimuli were presented in an ascending format, scores were more predictive of HCF than when WM stimuli were presented in a random format. Furthermore, analyses indicated that although strategy training significantly increased WM span scores, presentation format contributed unique variance in the prediction of HCF. Specifically, those in the ascending no-strategy condition obtained scores that were more predictive of HCF than did those in all other conditions.

(2067)

**The Influence of Semantic Relatedness Depends on the Specific Processes Engaged.** JULIE A. HIGGINS & MARCIA K. JOHNSON, *Yale University*—Refreshing is thinking of a just-activated representation. We examined how semantic relatedness influences refreshing. Young adult participants read three related or unrelated words presented simultaneously. Then they read one of the words again (repeat) or refreshed one of the words (refresh). In the single presentation condition, participants then refreshed another word from the set or read a new word (read). In the double presentation condition, participants saw the original three words a second time, followed by refreshing or reading. Compared with those in the double presentation condition, participants in the single presentation condition were slower to repeat and refresh following the first presentation of the three words, suggesting additional processing was engaged in anticipation of later task requirements. Additionally, semantic relatedness facilitated refresh response times in the single but not the double presentation condition, suggesting that the impact of semantic relatedness in the "same" task depends on the specific processes engaged.

• MEMORY DEVELOPMENT •

(2068)

**Developmental Rates Differentiate Children's Memory Processes in the Serial Position Effect.** JOEL MYERSON & DUNEESHA DEALWIS, *Washington University*, TAMARA HERSHEY & TASSY HAYDEN, *Washington University School of Medicine*, & SANDRA HALE, *Washington University*—Examination of immediate recall of a 14-word list by 51 children (ages 6–16) revealed that the developmental increase in recall of the initial portion of the list was three times the increase in recall of the middle and end portions. Thus, the primacy effect increased markedly with age, whereas the recency effect remained constant. As expected, there was no recency effect in 30-min delayed recall at any age, and delayed recall of all portions of the list improved at a rate similar to that of immediate recall of the initial portion. Thus, development of immediate recall of the middle and end portions appears to reflect improvement in short-term memory, whereas immediate recall of the initial portion and delayed recall of all portions reflect improvement in long-term memory. In addition, comparison of performance before and after an interfering list revealed that resistance to interference in this paradigm did not increase with age.

(2069)

**Changes in Feature and Binding Memory Across Childhood.** STACIE L. KOVACS, *Temple University*, JULIA SLUZENSKI, *Richard Stockton College*, & MARIANNE E. LLOYD & NORA S. NEWCOMBE, *Temple University*—Previous work on the development of binding processes has shown that when memory for separate features is equivocal, there is improvement in memory for feature

combinations between the ages of 4 and 6 (Sluzenski, Newcombe, & Kovacs, 2006). Two studies are presented that test the role of encoding instructions and the delay between study and test. In both working memory and long-term memory paradigms, 6-year-olds showed superior memory for features and feature combinations relative to younger children. Age differences in memory for both features and feature combinations may depend on specific task demands (e.g., incidental or intentional encoding). Implications for the development of binding memory and strategy use are discussed.

(2070)

**Von Restorff Effects in Older and Younger Adults.** TAMRA J. BIRETA, *College of New Jersey* (sponsored by Aimée Surprenant)—Memory improves for isolated items relative to control items in lists of homogenous background items, which is known as the von Restorff or isolation effect. Cimbalo and Brink (1982) observed this effect for younger, but not older, adults. Naveh-Benjamin's (2000) associative-deficit hypothesis (ADH) attributes this age-related difference to a reduced ability to bind information. Experiment 1 used a color manipulation and found an isolation effect for both younger and older adults. Moreover, faster presentation rates led to a smaller effect for older adults, as predicted by the ADH, whereas slower presentation rates yielded isolation effects for older adults equivalent to those of younger adults. However, Experiments 2 and 3 failed to find an isolation effect in older adults when a semantic manipulation was used, disconfirming a prediction of the ADH. Thus, the data yield mixed support for the ADH and suggest that older adults may sometimes view the isolate as a distraction.

(2071)

**Aging and Memory for Proper Names: Comparing Recall and Recognition Tests.** LORIE JAMES, SARAH TAUBER, & KETHERA A. FOGLER, *University of Colorado, Colorado Springs*—No previous study has tested whether the specific age-related deficit in name memory identified in recall tasks also occurs for recognition. We tested young and older participants' ability to learn proper names versus occupations while we manipulated the type of memory test (recall vs. recognition). Participants learned a name and occupation for each of 12 pictured people, with memory tested until a criterion was met. A 2 (young vs. older adults)  $\times$  2 (recall vs. recognition)  $\times$  2 (name vs. occupation) mixed factorial ANOVA on percent correct indicated that the specific difficulty older adults experience in learning proper names is obtained for both types of memory measures. These findings increase understanding of the causes underlying age-related declines in name memory.

(2072)

**Age-Related Differences in Memory for People and Their Actions.** SUSAN R. OLD & MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia* (sponsored by Moshe Naveh-Benjamin)—The present experiments extend the associative-deficit hypothesis (ADH; Naveh-Benjamin, 2000), which attributes age-related memory deficits to the inability to bind information together, to relatively dynamic stimuli. Participants viewed brief video clips of people performing simple actions. Recognition of individual people or actions comprised a component memory measure, and the associative test required the binding of a person with an action. The experiments revealed an associative deficit of older adults, especially when encoding took place intentionally; young adults under divided attention at both encoding and retrieval also exhibited a small associative deficit. These groups' associative deficits, however, stemmed from different patterns of hits and false alarms. Results suggest that the age-related associative deficit is partially due to a decline in strategic processing and to problems that occur during the retrieval processes of older adults.

(2073)

**The Developmental Progress of Memory and the Emergence of Autobiographical Memory.** JALE KAZEZ & SAMI GÜLGÖZ, *Koc*

*University* (sponsored by Sami Gülgöz)—The present study tries to confirm the predicted developmental progress for memory. The predicted developmental progress of memory is expected to involve seven levels, and each level necessitates the completion of the preceding level. In order for autobiographical memory to emerge, an individual has to reach to the sixth and seventh levels. However, there are inconsistencies about the fact that the first five levels have to be completed in order to pass to the sixth and seventh levels. Therefore, the present study tries to find out if it is possible to develop autobiographical memory without the completion of the first five levels. On the basis of the consistencies observed across children of the same age group and their differences from other age groups, the present study draws important conclusions about the development of memory and the emergence of autobiographical memory in children between the ages of 2 and 6.

• MOVEMENT •

(2074)

**Compensatory Properties of Visual Information Isometric Force Control.** S. LEE HONG, AMBER J. BROWN, & KARL M. NEWELL, *Pennsylvania State University* (sponsored by Karl M. Newell)—This experiment investigated the effects of spatial (gain) and temporal (frequency) properties of visual feedback on the control of isometric force output. Participants performed an index finger isometric force production task with five different levels of visual gain and four feedback frequencies. There was a significant effect of gain on mean and standard deviation (SD) of the force output, and feedback frequency significantly affected the force SD and root mean square error. Significant effects of gain and frequency and a gain  $\times$  frequency interaction on the approximate entropy (ApEn) of the force revealed the effect of visual feedback uncertainty on the force fluctuation dynamics. The combined effects of the spatial and temporal properties of visual feedback on ApEn were approximated by a sum of quadratic functions, indicating their compensatory effect on the informational content of the dynamics of isometric force.

(2075)

**Imitation Difficulties in Autism: Observation or Execution?** EMILY K. KEES, NICOLE A. KRAUSE, JENNIFER L. FRYMIARE, H. HILL GOLDSMITH, & MORTON ANN GERNSBACHER, *University of Wisconsin, Madison*—Imitation difficulties exhibited by autistic individuals have been attributed to an impaired mirror neuron system, suggesting deficits in the perception of others' actions. The present study compared autistic children's abilities to observe actions with their abilities to execute those actions. Two groups of autistic children, one with severe early oral and manual motor delays and one without, were tested on their ability to produce on command, to imitate, to visually identify, and to visually match 20 different gestures and pantomimes (e.g., wave goodbye, indicate too hot, pretend to use binoculars). The identification task required selecting the correct action, given the oral command; the visual matching task required distinguishing the correct action from a lure. All children performed better on the observation (visual identification and matching) tasks than on the execution (action to command and imitation) tasks, suggesting that imitation difficulties are more likely to result from execution difficulties than observation deficits.

(2076)

**Observing Others' Tool-Use Actions.** CRISTINA MASSEN & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Visually perceiving an action may activate corresponding motor programs. It has been suggested that the function of this covert imitation is a facilitation of overt imitation learning and/or understanding the goal of an action. In two experiments, we tried to experimentally dissociate priming effects for observing the target, the movement or the target–movement mapping of a tool-use action. Two subjects were taking turns in acting, observing the tool-use action of another person in trial  $n-1$  and then executing an action in trial  $n$ .

Trial transitions from  $n-1$  to  $n$  were manipulated in four conditions, with either (1) mapping repeated, movement and target changed; (2) target repeated, movement and mapping changed; (3) movement repeated, target and mapping changed; or (4) all components repeated. Results indicated the largest priming effect for repeating the target–movement mapping of a tool-use action and pointed to the importance of understanding how an action is performed.

(2077)

**The Loading of Motor Imagery.** ANDREW B. SLIFKIN, *Cleveland State University*—Actual and imagined action are said to be governed by common information and neural processes. Such a statement has found strong support from a range of chronometric studies showing that it takes the same amount of time to actually move and to imagine moving. However, exceptions have sometimes been observed when actual and imagined movements were made under conditions of inertial loading. The present study tested the hypothesis that the appearance and magnitude of actual – imagined movement duration (MD) differences depends on the level of load relative to the maximum loading capacity of the involved effector system [the maximum voluntary load (MVL)]. The experiment required 12 young, healthy humans to actually produce and to imagine producing single-degree-of-freedom index finger movements under a range of loads (0%–80% MVL). As predicted, actual – imagined differences were absent at lower loads, but differences appeared and increased in magnitude with further increases in %MVL.

(2078)

**Action Generating and Action Evaluating Function of Action-Effects in Typewriting.** MARTINA RIEGER, *Max Planck Institute for Human Cognitive and Brain Sciences*—In the present study, action–(visual) effect associations in typists and control participants were investigated. Following responses to colored squares, participants were presented with response-congruent or -incongruent letters. Participants responded either on a keyboard or on an external response device. In Experiment 1, using constant action effects, evidence for the anticipation of experimental action-effects and the activation of corresponding typing-related actions was found (function: action generation). In Experiment 2, using random action effects, evidence that actions can activate the corresponding typing-related action-effects was obtained (function: monitoring action outcome, action evaluation). The latter effect is only apparent in an appropriate context—that is, when participants respond on a keyboard—and it dissipates with time on task. These results provide evidence for bidirectional action–effect associations in expert typists.

(2079)

**Transfer of Implicitly Learned Regularities of Spatial Movement Sequences.** SIEN HU & CHARLES E. WRIGHT, *University of California, Irvine*—We report an experiment investigating the transfer of implicitly learned regularities of motor sequences. Six participants (24 in total) practiced sequences with either the left/right hand or the left/right arm for 10 days and then transferred to all four effectors in 2 final days. Sequences of 50 transitions composed of six response locations were generated randomly with a six-state grammar network. Regression was used to control for biomechanical effects while estimating the movement time difference between grammatical and ungrammatical transitions. This difference reflects participants' knowledge of the sequence structure. Results showed strong transfer of the implicitly learned grammar to other effectors. Prespecified contrasts assessed the effects on transfer of learning side/effector, transfer side/effector, and the relational effects of laterality (ipsi-/contralateral transfer) and homology (homo-/heterologous effectors). A comparison of these results and those of an earlier experiment assessing the transfer of explicitly learned sequences suggests both similarities and differences in learning/transfer mechanisms.

(2080)

**An Anti-Hick's Effect in Monkey and Human Saccade Reaction Times.** BONNIE M. LAWRENCE, *Case Western Reserve University*,

ALEX ST. JOHN & RICHARD A. ABRAMS, *Washington University*, & LAWRENCE H. SNYDER, *Washington University School of Medicine*—In order to execute movements to targets in the environment, we must first select a target to move to, generally from an array of alternatives. Hick's Law states that reaction time (RT) increases as the number of response alternatives increases. There are, however, noteworthy "violations" of this law. Kveraga et al. (2002), for example, found that saccades to visible targets violate Hick's Law. To examine this violation further, we measured saccade RTs in humans and monkeys and found that saccade RTs decreased as the number of potential target locations increased. We hypothesize that this arises because subjects must actively inhibit premature saccades, and that the required inhibition increases as the certainty of a movement to a particular location increases. With increased inhibition, saccade onset is delayed, resulting in an anti-Hick's effect.

(2081)

**About the Relationship Between Perception and Action: A Signal Detection Analysis.** FLORIAN WASZAK, PEDRO CARDOSO-LEITE, & ANDREI GOREA, *CNRS, Paris*—A visual stimulus may affect a motor response even though its visibility is prevented by a mask. We report experiments in which the observer's perceptual state related to the presence/absence of a masked stimulus and the motor behavior elicited by the same stimulus were jointly assessed on a trial-by-trial basis. The data show that masked visual stimulation has two types of effect on the motor system. When the physical energy of the stimulus is weak, it affects the motor response only if it exceeds the observer's perceptual response criterion. It is only when the energy of the stimulus is relatively strong that its impact on the motor response is independent of the state of the perceptual system. This indicates that the motor system has a fixed energy threshold, whereas the perceptual system has a variable criterion that can either be higher or lower than the motor threshold—depending on the particular conditions.

(2082)

**Stimuli Presented During Action Planning Affect the Planning Process Depending on Their Compatibility With Arbitrary Action Effects.** MICHAEL ZIESSLER, *University of Sunderland*, DIETER NATTKEMPER, *Humboldt-Universität zu Berlin*, STEFAN VOGT, *University of Lancaster*, & SAMUEL ELLSWORTH & JONATHAN SAYERS, *University of Sunderland*—The presentation of learned effects during response preparation facilitates the response. This is taken as evidence for the inclusion of effect codes in response planning. However, participants might use the presented effects just for an additional activation of the response. In a new paradigm, we created interference between the assumed activation of effect codes during response planning and additional stimuli. In Experiment 1, participants learned that their keypresses produced objects on the screen. In the test phase, the stimulus determining the response was followed by a hand posture that was compatible or incompatible with the object associated with the response an effect. In Experiment 2, effects were the hand postures, and effect-compatible or -incompatible objects were presented during response planning. Responses were faster in the compatible conditions. This strongly suggests that effect codes are activated during response planning. Otherwise, the interfering stimuli should be neutral to the response.

(2083)

**Response Preparation With Static Versus Moving Hands.** JOS J. ADAM & SOFIE MORESI, *Universiteit Maastricht* (sponsored by Jos J. Adam)—This research tested the response inhibition account of the hand advantage found in the finger precuing task. According to this account, the advantage of preparing two fingers on one hand (represented in one hemisphere) as opposed to preparing two fingers on two hands (represented in two hemispheres) is due, in part, to a response inhibition process that operates more efficiently within than between hemispheres. In this view, supplying extra activation to both hemispheres by moving the hands should decrease the within-hemisphere

inhibition advantage. Twelve participants performed the finger pre-cueing task with static and moving hands in six sessions. As predicted by the response inhibition account, the hand advantage present with the hands at rest decreased with the hands moving.

• SKILL ACQUISITION •

(2084)

**Dissociation of Verbal–Associative and Visual–Semantic Arithmetic.** ARRON W. METCALFE & JAMIE I. D. CAMPBELL, *University of Saskatchewan* (sponsored by Jamie I. D. Campbell)—Neuropsychological case studies, behavioral observation, and neuroimaging research have provided converging evidence that performance of simple multiplication ( $3 \times 4$ ) relies on verbal–associative memory, whereas simple addition ( $3 + 4$ ) often relies on visual–semantic processes. To pursue this, we tested adults' performance of simple multiplication and addition with problems presented either in auditory or in visual (Arabic) format. If multiplication is based on verbal processes and addition based on visual–semantic processes, then the problem size effect (PSE; i.e., problem difficulty increases with numerical size) ought to be attenuated when presentation format directly maps to the appropriate internal representation. As expected, the multiplication PSE was smaller with the auditory than with the Arabic format, whereas the addition PSE was smaller with Arabic than with auditory format.

(2085)

**Facilitative Interactions of Model- and Experience-Based Processes.** THOMAS WATKINS, SEAN LANE, ROBERT MATHEWS, BILL SALLAS, & ROBERT PRATTINI, *Louisiana State University, Baton Rouge*—A series of experiments used a dynamic control task (Berry & Broadbent, 1984) to examine the interaction of model- and experience-based knowledge acquisition. This task has a number of characteristics that make it a good vehicle for studying the development of expertise, and there is evidence it can be learned primarily with experience-based processes. Our results demonstrate a facilitative effect of providing model-based knowledge on task performance, and they call into question the assumption that participants acquire a situation-specific “lookup” table while learning this task. We also show that it is possible for experientially acquired knowledge to show greater transfer to a new task situation than model-based knowledge. Although we find that model- and experience-based processes can be fruitfully combined, the resulting knowledge appears compartmentalized rather than integrated. We discuss the implications of these findings for theories of human learning.

(2086)

**A Reduction in Total Study Time Can Eliminate the Spacing Effect.** DOUG ROHRER, *University of South Florida*—If a given amount of study time is not massed in a single session but instead distributed across multiple study sessions, there is typically a boost in subsequent test performance known as the spacing effect. The present experiment examined whether the size of the spacing effect depends on the total amount of study time. College students learned concrete facts during 10 or 20 study trials that were either massed in one session or distributed across two sessions separated by 2 weeks. All subjects were tested 2 weeks after their last study trial. The spacing effect was large when subjects completed 20 study trials but virtually nonexistent when subjects completed just 10 study trials. This finding is not readily explained by so-called encoding variability theories of the spacing effect.

(2087)

**Evaluating Learning Complexity in Implicit Serial Learning Tasks.** TODD M. GURECKIS, *Indiana University, Bloomington*, & BRADLEY C. LOVE, *University of Texas, Austin* (sponsored by Robert L. Goldstone)—Theories concerning the type knowledge acquired in implicit learning tasks have ranged in complexity from abstract rules (Reber, 1967) to simple event frequencies (Perruchet et al., 1990). Two studies are presented that explore the speed at which participants learn se-

quential patterns in a serial reaction time (SRT) task. Individuals are able to rapidly adapt to sequences that require inhibiting recent responses. In contrast, learning with sequences composed of second-order conditional transitions is considerably slower and accompanied by explicit knowledge. The results are evaluated in light of a number of models of sequential learning. We find that recurrent network architectures (e.g., Elman, 1990) predict the opposite pattern of results, even when assumptions are made concerning biases in the task. The results suggest that the types of learning tapped by the SRT might be best characterized as a simple, limited process, which trades representational flexibility in favor of rapid learning and adaptation.

(2088)

**Sleep Consolidation of Motor Learning in Golf Putting.** KIMBERLY M. FENN, SIAN L. BEILOCK, & HOWARD C. NUSBAUM, *University of Chicago*—Sleep is important for consolidating rote procedural skills in which performance improvement is restricted to the specific trained stimuli. However, we found that generalized learning in a speech task is consolidated by sleep; sleep protects learning from subsequent interference and restores learning that was lost during a waking day. Here we show consolidation during sleep of bilateral transfer of motor learning in golf putting. Participants were tested and trained either at 10:00 a.m. or 10:00 p.m. and returned for two subsequent tests at 12-h intervals. Half were trained on their dominant (right) hand and half were trained on their nondominant hand. All participants were tested on both dominant and nondominant hands. Results suggest that when trained on the nondominant hand, performance on the dominant hand does not improve until after a night of sleep, suggesting that sleep functions to create an abstract skill representation that allows for bilateral transfer of learning.

(2089)

**Study Strategies and Academic Performance: An Expert Performance Approach Using Diaries.** KIRUTHIGA NANDAGOPAL & K. ANDERS ERICSSON, *Florida State University*—Previous research has explained individual differences in high school grades by emphasizing differences in knowledge and use of self-regulated study strategies as assessed by questionnaires and single-session interviews. The same methods have had more modest success in describing differences in academic performance at the college level. The present investigation applies methods typically used to examine expert performance. Sixty upper-level bioscience college students completed daily diaries for 3 weeks at different points during the semester. From the diaries, differences in frequency and duration of study activities associated with self-regulated learning and deliberate practice were assessed with high interrater reliability. These strategy differences differed across weeks and explained more variance in semester GPA ( $= .53$ ) than did the ability measures ( $R_{SAT}^2 < .14$ ) and traditional interview methods used in prior investigations. Implications for future investigations and potential interventions are discussed.

(2090)

**Can Mental Workload During Training Explain Test Performance After Training?** BRIAN D. GANE & RICHARD CATRAMBONE, *Georgia Institute of Technology*—Two instructional methods were used to teach students to solve probability word problems. We hypothesized that these methods would differ in working memory load and would yield differences in subjective mental workload ratings (NASA-TLX; Hart & Staveland, 1988). We tested one prediction of cognitive load theory (Sweller, van Merriënboer, & Paas, 1998), that mental workload mediates the effect of instructional design on learning. Multiple regression analyses revealed that subjective mental workload partially mediated the effect of instructional method on performance. However, when prior domain knowledge was added to the model, subjective mental workload no longer accounted for a significant proportion of variance in performance. This suggests that subjective mental workload was associated with test performance because domain knowledge and instructional method affected both workload and performance. This find-

ing demonstrates that researchers must be careful when using subjective mental workload to explain performance differences after training.

(2091)

**Cognitive Effort in Skill Acquisition: Pupillometric Correlates of Workload and Capacity.** SCOTT R. HINZE & JAMES W. PELLEGRINO, *University of Illinois, Chicago*, & MICHAEL F. BUNTING, *University of Maryland, College Park*—Previous research has shown that greater working memory capacity (WMC) is related to better performance on skill acquisition tasks, especially under a memory load and during early stages of skill learning. But it is unclear whether this WMC advantage is due to more efficient, less effortful processing or to greater resource allocation. Changes in pupil dilation during a logic-gate learning task were obtained as a correlate for effortful processing to address this question. Other variables were task difficulty, practice, and trait motivation. Preliminary results showed an increase in pupil diameter during the task relative to baseline. Also, greater WMC appeared to be associated with larger pupil responses, indicating that those with higher WMC may have allocated more resources to the task than those with lower WMC. More sophisticated analyses will follow to confirm this finding and to explore the influence of task difficulty, practice, and trait motivation.

(2092)

**Dissociating Performance and Anxiety: Practice Effects During Reading and Verb Generation.** HEATHER M. LUGAR & E. DARCY BURGUND, *Rice University*—Previous research suggests that performance and anxiety are closely related. The present study examined whether the two may be dissociated. Subjects performed single-word reading and verb generation at three stages of practice: a naive stage, when tasks were performed for the first time; a practiced stage, when tasks were repeated with the same words; and a novel stage, when tasks were repeated with a new set of words. Response times were measured and subjective anxiety ratings were obtained after each stage. Analyses revealed similar effects in response times and anxiety at the group level. Both were greater during verb generation than during reading, and both were greater during the naive and novel stages than during the practiced stage. At the individual level, however, changes in response time and anxiety with practice were not correlated. Thus, performance and anxiety may be dissociated using regression techniques that preserve individual variation.

• EVENT COGNITION •

(2093)

**Hierarchical Grouping of Events Revealed by Eye Movements.** KHENA M. SWALLOW & JEFFREY M. ZACKS, *Washington University* (sponsored by Jeffrey M. Zacks)—To understand others' activities, people segment them into meaningful events. Recent neurophysiological data suggest that this segmentation occurs online as a part of normal perception. In addition, behavioral data suggest that events are hierarchically structured so that fine-grained events are grouped into larger-grained events. This study provides evidence that hierarchical grouping also occurs online, as people attend to events at one particular grain. Participants' eyes were monitored while they segmented movies of everyday activities. As participants segmented the activities into fine-grained events, their eye movements showed evidence of hierarchical grouping: Points in time that were likely to be identified as coarse-grained boundaries showed larger saccadic eye movements than did fine-grained boundaries. Pupillary responses provided additional data characterizing the online properties of event segmentation. Together, these data indicate that the human oculomotor control system tracks the structure of events as they unfold, including relations between parts and larger wholes.

(2094)

**Temporal Order Representation in Scripts.** ELKE E. VAN DER MEER, SUSANNE RAISIG, & HERBERT HAGENDORF, *Humboldt-*

*Universität zu Berlin*—Prefrontal patients have repeatedly shown sequencing errors when asked to plan and execute daily activities. These errors are not due to a motor deficit but already occur on the conceptual level. How temporal structure is represented in conceptual memory is not yet understood. Humphreys and Forde (1998) hypothesized that event knowledge, including its temporal order, is represented hierarchically (activation gradient), yet Shank and Abelson (1977) assumed a linear representation. So far, empirical results are inconsistent. In the present experiment, we tested for these opposing assumptions. Healthy subjects were presented with triplets of script events, and the order in which events were presented was manipulated. Subjects had to decide whether the given sequence was in the correct temporal order. Reaction times and pupil dilation were recorded as indicators of consumption of cognitive resources. The results are discussed in relation to the above-mentioned models.

(2095)

**Are All Third-Person-Perspective Memories Created Equal? An Examination of Visual Perspective Use During Autobiographical Memory Retrieval.** HEATHER J. RICE & DAVID C. RUBIN, *Duke University* (sponsored by David C. Rubin)—Previous investigations of visual perspective have focused primarily on categorizing memories in a dichotomous manner, as either field (i.e., first-person perspective) or observer (i.e., third-person perspective). However, theories explaining the significance of visual perspective suggest that the location from which observer-perspective memories originate may vary across events. Such differences may affect other properties of these memories, making a dichotomous distinction inappropriate. To investigate these possibilities, we asked participants to recall autobiographical events and describe the visual perspective used when recalling each event. As expected, the distribution of perspective origin varied across events. For example, memories of a group performance led to more memories originating from in front of the individual than did other events, such as engaging in a conversation. Differences in memory phenomenology across perspective locations were also examined in order to determine the implications of distinct observer memory locations.

(2096)

**“Ready, Set, Go—NO!” Views of Consent in Sexual Encounters.** M. DIANE CLARK, *Gallaudet University*, & MARJORIE CARROLL, *United States Military Academy*—The traditional sexual script (TSS) depicts men as being motivated to exploit any opportunity to engage in sexual behaviors and women as the sexual limiter (Byers, 1996). This view of sexuality does not clearly define consent and suggests that consent may be viewed differently between men and women. Given this possibility, acquaintance rape scripts were elicited from male and female participants. Content analyses of the scripts revealed that, although common themes regarding what constitutes acquaintance rape were evident, there were also clear differences in how men and women conceptualize acquaintance rape. In particular, the issue of consent appears as a key area of difference. Women's latent structures clearly point to a lack of consent at various levels within sexual encounters. In contrast, men were more likely to include themes that placed the responsibility on the woman, appearing to assume that once the sexual encounter started, full consent had been obtained.

(2097)

**Are Concrete and Abstract Sentences Understood in Terms of Underlying Force Patterns?** CAROL J. MADDEN & DIANE PECHER, *Erasmus Universiteit Rotterdam*—Many events can be broken down into patterns of forces in opposition (Talm, 1988). Our ability to understand these patterns relies heavily on our own physical experiences with forces in the environment as well as our psychosocial tendencies toward action or rest in the face of opposing forces. Two experiments test the idea that we understand sentences like “The bulldozer pushed the dirt across the lot” and “Jenny convinced her husband to confess” by representing their underlying force patterns and relating them to

our own physical and psychosocial experiences. In the first experiment, abstract and concrete event descriptions were preceded by event descriptions with matching or mismatching patterns of force dynamics. In the second experiment, abstract and concrete event descriptions were preceded by animations of events (two shapes interacting) with matching or mismatching patterns of force dynamics. The results are discussed in terms of embodied theories of language comprehension.

(2098)

**Investigation Into Real and Imagined Childhood Reports: Does Production Modality Matter?** HEATHER K. MERTZ & RONALD T. KELLOGG, *St. Louis University* (sponsored by Ronald T. Kellogg)—Little research has investigated the similarities and differences between real and imagined childhood reports when they are written versus spoken. It is likely that production modality influences what individuals choose to report and what emotions they choose to express. Within this study, participants under either a cognitive load or no load completed a childhood events survey from which events that had been experienced (real) and had not (imagined) were selected. Participants then wrote/talked about these events (including a control event, for a total of six events) and provided memory quality ratings for each event. Prior to reporting imagined events, participants were given time to imagine the event. Content, speech, and writing analyses were carried out. Overall, real and imagined events were quite similar across dependent measures; however, a few differences did emerge between production modalities. The results shed light on the ease with which inaccurate memories can be created and why they are so deceptive.

(2099)

**Perceptual and Semantic Influences on Change Detection.** ANDREA WEBB, KRISTIN SWENSON, & ANNE E. COOK, *University of Utah*, & BARBARA J. JUHASZ, *Wesleyan University*—Previous experiments on change detection have often confounded perceptual and semantic variables. The separate and combined influences of these variables were examined in three experiments. Three factors were manipulated: the category of background objects, the color of changed objects, and the category of changed objects. The background consisted of objects from the same or different semantic categories. A target object was changed into an object of either the same or different color and/or the same or different category. The display alternated between the original and the changed display until the change was noticed. When the display changed quickly (Experiment 1A), only color impacted change detection. When the display changed more slowly (Experiments 1B and 2), color, category, and background interacted to impact change detection. Overall, these results suggest that it is important to consider the separate and interactive effects of perceptual and semantic variables when designing change detection experiments.

(2100)

**Individual Differences in Interrogative Suggestibility: The Role of Processing Resources.** SERENA MASTROBERARDINO & FRANCESCO S. MARUCCI, *Università di Roma, La Sapienza*, & MARIA S. ZARAGOZA, *Kent State University*—The Gudjonsson suggestibility scale (GSS2) is a commonly used measure of interrogative suggestibility. Research using the GSS2 has focused on the role of individual differences on interrogative suggestibility. The goal of this study is to examine whether individual differences in cognitive processing resources might play a role in suggestibility, as measured by the GSS2. To this end, this study used the generation effect paradigm to assess whether a divided attention task would differentially affect the magnitude of the generation effect for high- and low-suggestible participants. In two experiments, the divided attention task selectively impaired the performance of high-suggestible participants in generation tasks involving nonsemantic generation cues. The results are consistent with the hypothesis that processing resources play a role in interrogative suggestibility.

• SPATIAL COGNITION •

(2101)

**Transfer of Orthogonal and Parallel Incompatible Mappings to an Orthogonal Simon Task.** GI YEUL BAE & YANG SEOK CHO, *Korea University*, & ROBERT W. PROCTOR, *Purdue University* (sponsored by Robert W. Proctor)—Three experiments investigated the influence of practice with incompatible mappings for an orthogonal stimulus–response compatibility task (Experiments 1 and 3) and a parallel stimulus–response compatibility task (Experiment 2) on performance of a subsequent orthogonal Simon task after a delay of 5 min. In Experiment 1, the orthogonal Simon effect was reversed when the mapping in the practice session was incompatible (up–left/down–right). When subjects practiced with an incompatible parallel mapping in Experiment 2, a normal orthogonal Simon effect was obtained. These results suggest that short-term stimulus–response associations remain active only when the orientation of the stimulus dimension in the practice task is the same as in the subsequent task. When response eccentricity was varied in the transfer session of Experiment 3, the response eccentricity effect was uninfluenced by the prior practice. This result implies that practice influences processes distinct from those that cause the response eccentricity effect.

(2102)

**Organization of Spatial Memories Acquired From Unimodal and Multimodal Experiences.** NAOHIDE YAMAMOTO & AMY L. SHELTON, *Johns Hopkins University*—When a spatial layout is viewed from multiple orientations, spatial information appears to be preferentially represented in long-term memory within a single reference system; that is, one orientation is preferred during retrieval (Shelton & McNamara, 2001). By contrast, when the multiple orientations are experienced in different modalities, the results support multiple preferred orientations or multiple reference systems (Yamamoto & Shelton, 2005). This discrepancy raises important questions about the integration of spatial information into a single or multiple reference systems within versus across modalities. The present study addressed this issue by having participants learn a spatial layout from single or multiple orientations, either through single or multiple modalities. Results suggested that spatial information from the same modality is generally integrated (preference for a single orientation), whereas spatial information from different modalities can be represented in multiple reference systems (multiple preferred orientations).

(2103)

**Object Grouping in Spatial Representations Over Updating.** JESSE Q. SARGENT, STEPHEN C. DOPKINS, & JOHN PHILBECK, *George Washington University*—Participants learned the location of seven objects around them in a room and practiced pointing to them using a fixed pointer. Four of the objects were like-colored balloons labeled with the names of characters from a popular television program, and the other three objects were a pipe, a tripod, and a cone. Blindfolded participants pointed to the objects from the learning heading, after being rotated 70°, and again after disorientation. Analyses of the pointing errors showed that after rotation, participants were less accurate in locating the balloons relative to each other than in locating the balloons relative to the other objects or the other objects relative to each other. Apparently, certain “grouped” objects were associated with more object–object (allocentric) information than other objects within the same representation, suggesting a possible conception of how spatial representations can be partly egocentric and partly allocentric.

(2104)

**Toward an Embodied Theory of Spatial Language: Evidence for Shared Dynamic Processes in Linguistic and Nonlinguistic Tasks.** JOHN LIPINSKI, JOHN P. SPENCER, & LARISSA K. SAMUELSON, *University of Iowa*, & GREGOR SCHÖNER, *Ruhr-Universität Bochum* (sponsored by John P. Spencer)—Previous theoretical and empirical work (e.g., Bridgeman, 1999; Bridgeman et al., 2000; Brungart et al.,

2000; Crawford et al., 2000) has argued for a strong division between linguistic and nonlinguistic spatial cognition. Recent work by Lipinski et al. (2005, 2006), however, suggests that linguistic and nonlinguistic spatial cognition depend on shared underlying processes. In two experiments, we provided additional tests of this claim. Experiment 1 showed that longer-term memories established in a nonlinguistic spatial working memory task systematically change subsequent spatial language performance. Experiment 2 showed a reciprocal effect of language on spatial memory: Lexically categorizing a spatial relation as an example of “above,” “left,” or “right” systematically biased subsequent spatial recall in the direction of the lexical “prototype.” We account for these findings with a new model that extends the dynamic field theory of spatial cognition (Spencer et al., 2006).

(2105)

**Directional Representations of Concrete and Abstract Verbs: Spatial and Sensorimotor Based?** CHRISTOPHER A. KURBY, KATJA WIEMER-HASTINGS, & JOSEPH P. MAGLIANO, *Northern Illinois University* (sponsored by Joseph P. Magliano)—This study examined whether spatial directionality (upward, downward, leftward, rightward) is a salient feature of verb representations and whether sensorimotor processes play a role in this directionality. The role of concreteness on direction salience was also tested. Verbs were classified a priori with respect to spatial directionality (e.g., “lifting”—upward). In Experiment 1, participants produced line angles that would “best represent the meaning of the verbs.” The produced angles corresponded highly with the a priori predictions of direction (except for leftward verbs). Concreteness influenced the salience of this directionality with respect to judgment time and confidence. Experiment 2 tested the role of sensorimotor processing in the representation of verb direction. Participants looked up or down while performing lexical decisions. Head direction interacted with verb direction differently (facilitation or interference) depending on whether or not head movements were associated with the verbs. Results are discussed in the context of sensorimotor resource competition.

(2106)

**The Role of External Cues in Memory for Location in a Fixed-Orientation Environment.** SYLVIA FITTING, DOUGLAS H. WEDELL, & GARY L. ALLEN, *University of South Carolina, Columbia* (sponsored by David E. Clement)—Previous research demonstrated that including one to three external spatial cues surrounding a circular field had no effect on spatial memory performance when the field’s orientation was constant on all trials, but had very large and systematic effects when the field’s orientation varied from trial to trial (Fitting, Wedell, & Allen, 2005). In the present set of experiments, we increased the number of external reference cues (4, 8, and 24 cues) and manipulated presentation and delay times to examine boundary conditions on the use of external cues in the fixed-orientation environment. Overall, results indicated effects on accuracy, indexed by absolute error, and on radial bias that were most stable with long delays. However, results generally supported the maintenance of a viewer-based frame of reference defined by geometrically fixed categories rather than cue-based categories.

(2107)

**Age, Gender, and Spatial Abilities: A Meta-Analysis.** CHERYL TECHENTIN & DANIEL VOYER, *University of New Brunswick* (sponsored by Daniel Voyer)—The present study examined the age-related decline of spatial abilities as well as the possibility of differential decline in males and females. A meta-analysis of 132 effect sizes, drawn from 67 studies, revealed a significant age-related decline. Heterogeneous effect sizes were initially partitioned by specific test. Further partitioning by age range of the sample, age difference between the youngest and oldest groups, scoring procedure, type of task, and education level was required to obtain homogeneous clusters. Despite several levels of partitioning, homogeneity was difficult to achieve in many cases. No significant effect for the gender  $\times$  age interaction was found. However, issues related to the report of statistical information

made accurate estimation of this interaction difficult. Results are discussed in terms of methodological and statistical issues that may have contributed to the variability of the effect sizes and their implications for the future study of age-related decline in spatial ability.

• PERCEPTUAL PROCESSES •

(2108)

**Functional Organization of the Haptic Perceptual System: Transfer of Attunement and Calibration.** ALAN HAJNAL & CLAIRE F. MICHAELS, *University of Connecticut*—The dynamic touch paradigm of perceiving spatial extent by wielding unseen objects was used to investigate the functional organization of the haptic perceptual system. Improvement in the perception of spatial extent by one kind of limb (foot, hand) or object (rod, rope, or whip) differentially benefited performance of another, untrained limb or object. Transfer was used as a measure of the degree of generalization that a particular training regime permits. To test symmetry, transfer from trained hands to untrained feet was compared with transfer in the opposite direction. Performance was assessed in two ways: Transfer of calibration revealed how perception was scaled, whereas transfer of attunement uncovered what information was used to perceive spatial extent haptically. An attempt was made to organize seemingly different tasks into functional equivalence classes based on the presence of symmetry and transitivity of transfer. Implications for the notion of motor equivalence and neuroplasticity are discussed.

(2109)

**Combining Tactile and Proprioceptive Information in Haptic Search.** KRISTA E. OVERVLIET, JEROEN B. J. SMEETS, & ELI BRENNER, *Vrije Universiteit Amsterdam*—To investigate how well people are able to combine tactile and proprioceptive information, we conducted a haptic search task. Participants had to search for either a cylinder, a bar, or a rotated cube among cubes. The cubes were placed on a grid. The starting object was outside the grid and had the same shape as the target. To detect a cylinder only tactile information was needed, but for detecting a bar or an oriented cube both tactile and proprioceptive information was needed. The bar and the rotated cube were most difficult to find: The search times were higher and more errors were made for those objects than for the cylinder. A high percentage of these errors consisted of indicating that the target was found, but instead the participant had found the starting object. This indicates that combining proprioceptive and tactile information is more difficult than using only tactile information in haptic search.

(2110)

**Haptic Viewpoint Effects Depend on Surface Detail and Visual Experience.** MORTON A. HELLER, LINDSAY J. WEMPLE, TARA RIDDLE, ERIN FULKERSON, CRYSTAL L. KRANZ, & ANNE D. MCCLURE, *Eastern Illinois University*—Haptic viewpoint dependence was tested in sighted and in 32 visually impaired subjects (early blind, late blind, and very low vision). Subjects felt complex objects and matched haptic pictures to them in Experiment 1. Blindfolded sighted subjects had lower performance for 3-D views. A second experiment examined the effect of surface details on viewpoint effects. The presence of surface details lowered performance for the sighted but not the visually impaired subjects. The visually impaired subjects, especially the early blind ones, had lower accuracy for top views. Viewpoint effects were altered by visual experience and object complexity. Overall, the sighted and early blind subjects had comparable performance, but both had lower performance than the other groups. The results suggest that visual experience is not necessary for the interpretation of haptic pictures.

(2111)

**Differences in Pressure Sensitivity and Tactile Discrimination Among Individuals As a Function of Gender and Body Surface Area.** SOMER M. GIVENS & DAVID B. BOLES, *University of Alabama* (sponsored by David B. Boles)—We attempt to explain the gender ef-

fects on tactile and pressure thresholds by examining individual differences associated with gender, body surface area (BSA), body fat ratios (BFR), and laterality. Two point discrimination thresholds were measured with calipers and Disk-Criminator instruments; pressure sensitivity thresholds were measured using Von Frey filaments. Thresholds were obtained for the little finger, palm, and forehead on both the right and left sides of the body. Significant gender effects were found on the pressure sensitivity task. The significant overall effects of BSA and BFR on both tasks diminished once gender effects were removed. Trends toward a left side advantage were found for both tasks and for all body parts (except the forehead). We concluded that individual differences in pressure sensitivity thresholds can be predicted by gender but not by BSA or BFR. Some laterality effects are also apparent in tactile discrimination, but less so in pressure sensitivity.

## (2112)

**Effects of Orienting Tasks on Explicit and Implicit Remembering of Melodies.** ESRA MUNGAN & ZEHRRA F. PEYNIRCIOĞLU, *American University*—Musicians and nonmusicians studied highly familiar melodies using a conceptually driven (judging the conveyed mood) or data-driven (counting the number of long notes) orienting task for each melody. Half of the melodies were presented both aurally and visually, and the other half were presented only aurally. Within each of these conditions, half of the melodies were tested by an incidental free choice recognition test, and the other half were tested by a perceptual identification test in which the items were presented among decreasing levels of white noise. Findings showed higher levels of recognition for musicians, but, unlike the findings from our previous studies, there were no orienting task effects for either group in either type of test. The findings are discussed within the transfer-appropriate processing framework as well as for other approaches.

## (2113)

**Effects of Temporal Manipulations on Identification of Familiar**

**Melodies.** BRIAN E. RABINOVITZ & ZEHRRA F. PEYNIRCIOĞLU, *American University* (sponsored by Scott Parker)—Pairs of snippets from highly familiar songs were presented. Half of the participants determined whether the second snippet (target) was from the same song as the first snippet (prime) (cf. Halpern, 1988), and the other half determined whether the target was from a familiar song (cf. Peretz, Radeau, & Arguin, 2004). ISI between primes and targets was varied as well as the direction of priming, in that the target was either the “beginning” or the “continuation” of a melody. Performance was influenced in many ways by type of task when the target was not from the same song as the prime (unmatched condition). In addition, although in both tasks performance was higher in the matched condition, the identification of a “beginning” was less accurate than of a “continuation” in the familiarity task, but not in the same/different task. There was also an ISI  $\times$  direction interaction.

## (2114)

**An ERP Study of Major–Minor Classification in Music.** ANDREA R. HALPERN, *Bucknell University*, & JEFFREY S. MARTIN & TARA D. REED, *University of Texas, Dallas*—Composers commonly use major or minor scales to create different moods in music. Nonmusicians in particular show poor discrimination and classification of this musical dimension; however, they succeed if the decision is phrased as happy versus sad. We created pairs of melodies identical except for mode; the first major or minor third was the critical note that distinguished major from minor mode. Musicians and nonmusicians judged each melody as major versus minor (half of each group) or happy versus sad. We collected ERP waveforms, triggered to the onset of the critical note. Musicians showed a late positive component (P3) to the critical note only for the minor melodies, and in both tasks. Nonmusicians could classify the melodies as happy or sad but showed little evidence that the critical note was meaningful to them. Major appears to be the default mode in music, and musicians and nonmusicians apparently process mode differently.

## POSTER SESSION III

Ballroom of the Americas, Friday Evening, 5:30–7:00

## • CONCEPTS •

## (3001)

**Semantic Flexibility.** VARALAKSHMI SONTAM, STEPHEN D. CHRISTMAN, & JOHN D. JASPER, *University of Toledo*—Research shows that the left hemisphere is responsible for maintaining stable mental representations, whereas the right hemisphere is more flexible and shows greater readiness to switch between mental representations. This hemispheric asymmetry generalizes to handedness differences (as mixed-handers have greater access to right hemisphere processing), such that mixed-handers show greater flexibility in switching between representations. The present study considers this notion of flexibility in the context of access to semantic networks. A semantic fluency task was used in which participants were asked to produce as many animal names as possible in a 1-min period. Results showed that in the course of producing animal names, mixed-handers switched between different animal subcategories (e.g., pets, African animals, water dwelling animals, etc.) more frequently than strong-handers. Mixed-handers also produced smaller clusters (animals belonging to the same subcategory). Thus, mixed-handers show greater semantic flexibility when compared to strong-handers.

## (3002)

**Feedback Interference and Dissociations of Classification: Evidence Against the Multiple-Learning-Systems Hypothesis.** ROGER D. STANTON & ROBERT M. NOSOFSKY, *Indiana University, Bloomington* (sponsored by Robert M. Nosofsky)—Researchers have argued that different categorization problems are learned by separate and distinct cognitive systems. They propose that an explicit system is responsible for learning rule-based categories and that a separate implicit system learns information integration categories. One source of supporting evidence involves experiments in which observers perform a concurrent memory-scanning task that interferes with the processing of feedback. Researchers have reported a dissociation in which this manipulation impairs learning of a rule-based category but not of an information integration category. In the present research, we test the hypothesis that the dissociation was the result of lowered perceptual discriminability in the rule-based structure compared to the information integration one. We demonstrate examples of two alternate rule-based categories with easy-to-discriminate stimuli in which performance is unaffected by the interfering memory scanning task. Furthermore, we demonstrate that learning of an information integration category with low perceptual discriminability is impaired by the memory scanning task. These demonstrations of the reverse dissociation strongly challenge the interpretation that rule-based and information integration category structures are learned by separate cognitive systems.

## (3003)

**Implicit Attitudes Test: Gender and Emotion.** LESLIE A. VALDES, *St. Cloud State University*—Often women are perceived as more emotionally expressive than men. To test this hypothesis, the implicit attitudes test (IAT) paradigm was used. The IAT paradigm involves assigning two levels of classification, such as women and men, with either a compatible concept such as “emotional” or an incompatible concept, “nonemotional.” This paradigm permits the investigation of attitudes that the participants may not even be completely aware they have. See Fazio and Olson (2003) for a review. In general, participants classified female names assigned to the same response as emotional words faster and more accurately than female names paired with non-emotional words. The converse was true for the assignment of male names and nonemotional words. However, participants were best able to do the classification when the rule was between categories (names or nonnames) rather than across categories. The implications for the complexity of a semantic category are discussed.

## (3004)

**What Do You Mean I Missed the Meeting?** COURTNEY B. STEIN & GEORGE L. WOLFORD, *Dartmouth College*, & HOLLY A. TAYLOR, *Tufts University* (sponsored by George L. Wolford)—The way abstract domains are represented in the human conceptual system has received less attention than have concrete domains. Most current theories of object concept formation are unable to adequately explain abstract concept formation. A theory of metaphoric representation has been proposed as a possible approach to understanding how abstract concepts are structured: Metaphors are used to help organize information within abstract domains by importing relational structure from concrete domains. The present series of studies addresses more specifically the relationship between abstract and concrete concepts and evaluates a theory of metaphoric representation. Further investigation of one of the most commonly studied metaphors, TIME is SPACE, suggests consistent individual differences in people’s metaphoric representations of time. The results of the present studies provide, at best, mixed support for the metaphoric view and bring into question previous studies of the metaphoric structuring hypothesis, further reducing the evidence in support of this theory.

## (3005)

**Object Naming and Later Lexical Development.** EEF AMEEL, *Katholieke Universiteit Leuven*, BARBARA MALT, *Lehigh University*, & GERT STORMS, *Katholieke Universiteit Leuven*—Learning to name objects is no sinecure. Despite arguments for the relative ease of learning the meanings of common nouns, we found considerable evolution in their use well past the early years of language acquisition. Children between 5 and 14 years of age gradually converged on the adult uses of names for common household objects such as bottles and jars. This evolution resulted from reorganization of existing lexical categories rather than from addition of new words to the vocabulary. Overextended words narrowed in use, and underextended ones broadened. We used features to predict naming patterns at different ages. The features that were attended to and the weights they received shifted toward adult values across ages.

## (3006)

**Distance Effects in a Numerical Comparison.** MICHAEL S. FRANKLIN & JOHN JONIDES, *University of Michigan*, & EDWARD E. SMITH, *Columbia University* (sponsored by Edward E. Smith)—Distance effects are commonly found when probing performance in mental comparison tasks (larger distances are compared faster). This is true also for numerical comparison in which subjects are required to choose the larger or smaller of two numbers. In the present study, we investigated performance on two tasks to learn whether it is possible to obtain reverse distance effects in numerical comparison as well. We chose an “order” task, in which subjects had to decide whether three numbers were in the correct order, and a “smallest” task, in which subjects had to identify the smallest of three numbers. The results revealed a distance effect for the “smallest” task and a reverse distance effect for the “order” task. There are other variables as well that may influence the types of processes involved in numerical comparison.

## (3007)

**Fitting the Parallel Race Network to Dot-Pattern Classification Data.** GYSLAIN GIGUÈRE, *Université du Québec, Montréal*, DENIS COUSINEAU, *Université de Montréal*, GUY L. LACROIX, *Carleton University*, & SERGE LAROCHELLE, *Université de Montréal*—Numerous models have been proposed to explain and predict accuracy data in category learning experiments. With the exception of Nosofsky and Palmeri’s (1997) exemplar-based random walk (EBRW) model, however, few have been proposed to account for both accuracy and response time data simultaneously. In this poster, we present the parallel race network (PRN; Cousineau, 2004). The PRN is formally similar to PDP models (McClelland & Rumelhart, 1986) and learns autonomously via feedback-driven error reduction. Yet the PRN’s con-

nections represent abstract units of time rather than strengths of association, and its decisions are based on the result of a race between competing outputs. Simulation data show that the PRN captured human performance for both accuracy rates and response times in a classic dot-pattern classification experiment. These results suggest that the PRN is a viable model of category learning.

• LANGUAGE PRODUCTION •

(3008)

**Processing of Extrafoveal Objects During Multiple-Object Naming Effects of Foveal Load and Aging.** LINDA MORTENSEN, *Rice University*, & ANTJE S. MEYER & GLYN W. HUMPHREYS, *University of Birmingham*—Two experiments investigated the effects of foveal processing load and aging on processing of extrafoveal objects. In a multiple-object naming task, the object to the right changed during the saccade toward it, either in its orientation or identity (replacement by an unrelated object). In Experiment 1, participants viewed a fixation mark until the right object appeared. Right-object processing was faster when the object changed orientation rather than identity, demonstrating extrafoveal processing. In Experiment 2, participants viewed and prepared to name a left object presented without or with a distractor while viewing the right object. In young participants, left-object processing was faster without rather than with a distractor and faster when the distractor was phonologically related rather than unrelated. The effect of right-object change was similar across distractor conditions, demonstrating that extrafoveal processing was unaffected by foveal load, consistent with serial object processing. Right-object processing was slower with related than with unrelated distractors, demonstrating that a distractor that facilitates processing of an object may interfere with processing of the following object, possibly because the distractor is reactivated during speech monitoring. In older participants, all effects were similar, except that with related distractors, the effect of right-object change disappeared, possibly because monitoring interfered with their visual object processing.

(3009)

**Semantic Access With English Compounds.** JOANA CHOLIN & JEREMIAH BERTZ, *Johns Hopkins University*, & MICHELE MIOZZO, *University of Cambridge and Johns Hopkins University*—We used the picture–word interference paradigm to examine the access to the meaning of English compounds. Compounds appeared as written distractors at the 0-msec SOA. A semantic interference effect was found when compound heads were categorically related to the pictures; no effect was found with categorically related modifiers. We also investigated the effect of distractor frequency. Miozzo and Caramazza (2003) showed that this effect arises at a processing level following semantic access. Thus, this effect can indicate what semantic information is accessed with compounds. A distractor frequency effect was found when we manipulated the frequency of the compound heads: Responses were longer for snowflake (low frequency) than snowshoe (high frequency). Although the effect of modifier frequency was absent at the 0-msec SOA, it did appear when we presented the distractor before picture onset (–100-msec SOA). Overall, our findings indicate that (1) visually presented compounds are automatically decomposed into their constituents and (2) semantic access takes place first for heads, and then for modifiers.

(3010)

**Task Dependency of Semantic Retrieval in Language Production: An fMRI Study.** KATHARINA SPALEK, *University of Pennsylvania*, HERBERT SCHRIEFERS, *Radboud Universiteit Nijmegen*, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—We investigated whether accessing the meaning of a pictured object always activates the same network of semantic associates, independent of the task performed on the object. Participants in an fMRI study had to describe black-and-white pictures with their object names or their typical color.

The pictures were followed by a word that was either the same as the picture name, related to the picture name, or unrelated. We hypothesized that the neural activation on the word would be reduced if it was already activated during the presentation of the picture (fMRI adaptation). We found lesser activation for the “same” condition in object naming, but the same pattern did not occur anywhere for color naming, suggesting that the underlying semantic network is fundamentally different when an object has to be named, as opposed to when a property has to be extracted from the object representation.

(3011)

**Semantic Retrieval Versus Selection in Verb Generation: An fMRI Investigation.** PHILIP C. BURTON & RANDI C. MARTIN, *Rice University* (sponsored by Randi C. Martin)—The involvement of left inferior prefrontal cortex (LIPC) in semantic retrieval is well documented (e.g., Poldrack et al., 1999; Badre & Wagner, 2002). However, the specific role played by LIPC is under debate. Thompson-Schill (e.g., Thompson-Schill et al., 1997) proposed that this region subserves selection among competing alternatives rather than retrieval more generally. However, in Thompson-Schill et al.’s experiments, selection demands were confounded with association strength. Martin and Chen (2006) manipulated selection demands and association strength independently in a verb generation task otherwise identical to that of Thompson-Schill et al. and found that only when verbs were weakly associated with nouns were they more difficult for subjects to produce, irrespective of selection demands. The fMRI experiment reported here measured hemodynamic activity while subjects performed the verb generation task. Activity observed in LIPC increased when association strength was low but not as a result of high selection demands.

(3012)

**Capacity Demands of Phonological Encoding: A Masked Priming Study.** ANTJE S. MEYER & AMY E. COOK, *University of Birmingham*—In the speech production literature, it is often assumed that only the conceptual planning of utterances, but not the following linguistic planning processes, require processing capacity (Levelt, 1989, *Speaking*). However, Ferreira and Pashler (*JEP:LMC*, 2002) showed that lexical selection processes are capacity demanding, and the results obtained by Meyer and Cook (2005) suggest that phonological encoding may also require some processing capacity. We report further evidence supporting this view. In Experiment 1, participants named pictures that were preceded by masked phonologically related or unrelated word or syllable primes. Phonological facilitation was obtained from word and syllable primes. In Experiment 2, this primed picture naming task was combined with a simultaneous tone discrimination task. Phonological priming effects of a similar size were found for the naming and tone discrimination latencies. This effect of phonological relatedness on the performance in the secondary task strongly suggests that phonological encoding requires processing capacity.

(3013)

**Effects of Distractor Modality on Semantic Interference and Associative Priming in the Picture–Word Interference Task.** PATRICIA J. BROOKS, *CUNY*, & KEVIN SAILOR, *Lehman College, CUNY*—The picture–word interference task is a widely used technique for exploring effects of semantic context on lexical access. In this task, associates (“carrot” for rabbit) typically produce facilitation (decrease latencies), whereas coordinates (“chipmunk” for rabbit) produce inhibition (increase latencies) in picture naming. Two experiments ( $N = 96$ ) explored how distractor modality (auditory vs. visual) affects the time course of these semantic effects. Robust associative priming was observed with auditory or visual distractors, with facilitation peaking at SOAs from –450 to –300. Importantly, associative priming was not restricted to early SOAs, and was observed at an SOA of +150. Coordinate inhibition, in contrast, was more strongly affected by distractor modality, with auditory distractors producing strongest inter-

ference at SOAs of  $-450$  to  $-300$ , and visual distractors producing strongest interference at an SOA of 0 (simultaneous presentation of picture and distractor). This modality effect on semantic interference is indicative of attention allocation demands in dual-task performance.

• WORD PROCESSING •

(3014)

**Neurobiological Correlates of Phonological, Orthographic, and Semantic Priming in Visual Word Recognition.** STEPHEN J. FROST, W. EINAR MENCL, NICOLE LANDI, & REBECCA SANDAK, *Haskins Laboratories*, JAY G. RUECKL, *Haskins Laboratories and University of Connecticut*, & KENNETH R. PUGH, *Haskins Laboratories and Yale University School of Medicine*—We examined orthographic, phonological, and semantic priming using event-related fMRI. Eighteen adolescent readers performed a primed lexical decision task in which critical prime–target word pairs were orthographically + phonologically similar (BRIBE–TRIBE), orthographically similar + phonologically dissimilar (COUCH–TOUCH), and semantically related (POND–LAKE). Behaviorally, BRIBE–TRIBE and POND–LAKE pairs yielded faster and more accurate responses relative to unrelated control pairs (CAPE–GLUE); responses to COUCH–TOUCH pairs were slower and less accurate relative to unrelated pairs. Neurobiologically, COUCH–TOUCH pairs produced higher activation (increased effort) relative to BRIBE–TRIBE and unrelated pairs in left hemisphere (LH) reading-related areas, including the inferior frontal gyrus, the supramarginal gyrus, and the putative visual word form area, suggesting that these regions are phonologically attuned. A distinct set of LH regions was sensitive to effects of semantic priming, particularly the insula/superior temporal gyrus. The results provide a more fine-grained characterization of the division of labor across the LH reading circuit.

(3015)

**Effects of Printed Word Repetition in Good and Poor Readers: An fMRI Study.** W. EINAR MENCL, STEPHEN J. FROST, REBECCA SANDAK, & NICOLE LANDI, *Haskins Laboratories*, JAY RUECKL, *University of Connecticut and Haskins Laboratories*, & KENNETH R. PUGH, *Yale University and Haskins Laboratories*—Repetition of printed words in good readers results in faster reaction times as measured behaviorally, and reduced brain activations as measured with fMRI. Areas include the inferior frontal gyrus, the supramarginal gyrus, and the fusiform gyrus, areas strongly implicated in skilled reading. We hypothesized that this modulation may relate to individual differences in reading ability, and we investigated these effects in skilled versus dyslexic readers. Groups of 12 good and 12 dyslexic adolescent readers participated in an event-related fMRI study. Subjects made animacy judgments to a large list of printed real words; a subset was repeated six times. Good readers showed repetition-induced reductions at the frontal, parietal, and fusiform sites. Dyslexic readers showed interactions at each site, with activity levels remaining constant or even increasing with repetition. Such findings corroborate the notion that the cortical sites associated with dyslexia are not fundamentally dysfunctional, but do show modulation under the proper conditions.

(3016)

**Localizing the N400 Semantic Cloze Effect: Parametric ERP and fMRI Analyses.** JOSEPH DIEN, *University of Kansas*, MICHAEL S. FRANKLIN, *University of Michigan*, CHARLES A. MICHELSON, *University of Texas, Austin*, LISA C. LEMEN, *Louisiana State University Medical Center, New Orleans*, CHRISTY L. ADAMS, *University of Northern Colorado*, & KENT A. KIEHL, *Yale University School of Medicine*—Event-related potentials (ERPs) can index semantic processing in real time but are difficult to localize. High-density, 128-channel ERP data were recorded from 28 participants while they read sentences presented one word at a time, half of which ended with a semantically incongruent ending. An N400 effect and a P600 effect were observed; only the N400 effect were correlated with cloze probability. 1.5T fMRI data were collected from 11 participants in an effort

to localize the source of these two effects. The pattern of effects suggests that the N400 emanates from the left inferior temporal region (BA 20), whereas the P600 effect may possibly be associated with the left prefrontal region, although the ERP source modeling effort was inconclusive. The results also provide evidence regarding the level at which semantic context may begin to influence visual lexical semantic processing.

(3017)

**The Neural Correlates of Concreteness and Ambiguity in a Semantic Categorization Task.** PENNY M. PEXMAN, JODI D. EDWARDS, IAN S. HARGREAVES, LUKE C. HENRY, & BRADLEY GOOD-YEAR, *University of Calgary*—Concrete words (CARROT) are typically recognized more readily than are abstract words (TRUTH). This has historically been explained by two theories of semantic representation: dual coding (Paivio, 1991) and context availability (Schwanenflugel, 1991). Past efforts to adjudicate between these theories using fMRI have produced mixed results. Using event-related fMRI, we reexamined this issue with a task that allowed uniform semantic judgments for concrete and abstract words and that allowed comparison of activation associated with concrete and abstract meanings of unambiguous and ambiguous words. Results showed that abstract meanings were associated with more widespread cortical activation than were concrete meanings in numerous regions, including temporal, parietal, and frontal cortices. Similarly, ambiguity was associated with greater activation in several regions. These results are inconsistent with both the dual coding and context availability theories, since these propose that the representations of abstract concepts are relatively impoverished. Our results suggest, instead, that retrieval of abstract concepts involves a rich network of association areas.

(3018)

**Semantic-Relatedness Effects Revealed by Reaction Times: Extending the Refractory Access Paradigm.** A. CRIS HAMILTON & H. BRANCH COSLETT, *University of Pennsylvania*—Recent studies by Crutch and Warrington (2005, 2006) have demonstrated remarkable sensitivity to semantic similarity in patients with “refractory access deficits.” These deficits are attributed to abnormally persistent synaptic depression among representations organized in semantic networks, with more closely related representations demonstrating greater interference effects. Previously, these interference effects have been identified in the performance accuracy of globally aphasic patients. We report data from 2 patients, both less profoundly aphasic than previous cases, who make few overt errors in refractory access paradigms, but nonetheless demonstrate significant semantic relatedness effects when reaction times are considered. These data suggest that the semantic relatedness effects reported by Crutch and Warrington might also be apparent in reaction time data of patients with milder aphasia and, perhaps, with healthy subjects. Of further interest, both patients reported here have lesions of the inferior frontal lobe, suggesting that exaggerated interference effects may reflect abnormal top-down executive control processes.

(3019)

**Body-Based Semantics in Visual Word Recognition.** LAURA AGUILERA & PAUL D. SIAKALUK, *University of Northern British Columbia*, PENNY M. PEXMAN, *University of Calgary*, WILLIAM J. OWEN, *University of Northern British Columbia*, & CHRISTOPHER R. SEARS, *University of Calgary*—Embodied cognition is the viewpoint that sensorimotor interaction with the environment is integral to cognitive processing. In visual word recognition, facilitatory imageability and concreteness effects could thus be understood as embodied cognition effects (via sensory interaction). To date, little research has examined whether motor interaction influences visual word recognition processes. We collected ease of body–object interaction ratings in which judgments were made regarding how easily a human body can physically interact with a word’s referent (all words were nouns). Importantly, words rated as high (e.g., *mask*) or low (e.g., *ship*) on this

measure were matched on imageability and concreteness. We observed facilitatory ease of body–object interaction effects in both lexical decision and phonological lexical decision tasks. We discuss how our findings may be accounted for by Barsalou's (1999) perceptual symbol systems theory, which outlines how conceptual knowledge may be grounded in sensorimotor interaction with the world.

(3020)

**Location, Location, Location: Contrasting Effects of Near and Distant Semantic Neighbors on Semantic Access.** DANIEL MIRMAN & JAMES S. MAGNUSON, *University of Connecticut*—Studying the effects of neighborhood size and density can elucidate the activation of and competition among linguistic representations. Studies have shown both cooperative and competitive effects of semantic neighborhood density. One possible explanation for these contrasting patterns is that near neighbors exert competitive effects during word processing, and distant neighbors exert cooperative effects. We tested semantic access (based on concreteness judgments) for four groups of visually presented words, manipulating near and distant neighborhood size independently. The results revealed that semantic access was slower for words with many near semantic neighbors, that access was faster for words with many distant neighbors, and that near and distant neighborhood size effects interact. The contrasting and interacting effects of near and distant neighbors provide a complex pattern of data that can inform the development of models of word processing and semantic cognition.

## • BILINGUALISM •

(3021)

**¿Correcto o Incorrecto? Reading Times and Grammaticality Judgments of Beginning L2 Learners.** NATASHA TOKOWICZ, TESSA WARREN, & ÁNGELS RUSIÑOL, *University of Pittsburgh*—Some theories hold that a high level of proficiency is necessary before adult second language (L2) learners process their L2 grammar implicitly. The present word-by-word self-paced reading study examined the influence of first language (L1) and L2 similarity on violation detection in beginning learners. Reading times and end-of-sentence judgments provided measures of implicit versus explicit processing as well as indications of the time course of violation detection. Students in the first four semesters of college-level Spanish read and judged the grammaticality of sentences in Spanish and rated their confidence in each judgment. Critical words were read slower when they induced a grammatical violation than when they did not, but this effect was modulated by the similarity of the violated rule to grammatical rules in the students' L1, suggesting L1/L2 similarity may facilitate implicit L2 processing. The role of silent versus aloud reading in violation detection was also investigated.

(3022)

**Bilingualism and Inhibitory Control: A Cross-Linguistic Comparison.** JARED A. LINCK, SUSAN C. BOBB, NORIKO HOSHINO, KANG CHENG, & JUDITH F. KROLL, *Pennsylvania State University* (sponsored by Janet G. van Hell)—Speaking a second language (L2) imposes demands on working memory beyond those necessary for the first language (L1) and has been hypothesized to require inhibitory control to negotiate apparent cross-language competition (e.g., Green, 1998). There is emerging evidence that bilingualism confers cognitive benefits to such control processes (Bialystok et al., 2004). However, the extent to which characteristics of the bilingual's languages are related to the development of inhibitory control is unclear. In the present study, performance on the Simon task was examined for bilinguals whose two languages differed in their similarity and for whom the context of language use was either the L1 or L2. Initial results suggest no overall benefits for young adult bilinguals relative to their monolingual counterparts, but a clear benefit for those bilinguals whose languages are more distinct. We discuss the implications of these results for the role of inhibitory control in bilingual cognition.

(3023)

**The Consequences of Bilingualism for Lexical Access in Spoken Word Production.** NORIKO HOSHINO & JUDITH F. KROLL, *Pennsylvania State University*—Although bilingualism appears to confer benefits to bilinguals in the realm of inhibitory control (Bialystok et al., 2004), studies of language production suggest that under some circumstances the use of two languages imposes processing costs (Gollan et al., 2005). At issue is whether those costs are a reflection of reduced availability of words in each language (the weak link hypothesis) or by the modulation of activity associated with the two languages as a function of potential competition between them (the competition hypothesis). In the present study, Spanish–English and Japanese–English bilinguals named pictures in each of their languages. We asked whether the consequence of bilingualism on picture naming would be modulated by the external linguistic context (L1 vs. L2 environment) and the relation between the two languages (similar vs. dissimilar). The results provide support for both factors in modulating a bilingual processing cost. We discuss the implications for models of bilingual production.

(3024)

**The Role of Word Class and Translation Probability in Two Translation Tasks.** ANAT PRIOR, *Carnegie Mellon University*, JUDITH F. KROLL, *Pennsylvania State University*, & BRIAN MACWHINNEY, *Carnegie Mellon University*—The effects of word class and number of translations were examined in two bilingual tasks—translation production and translation recognition. The stimuli used included English and Spanish nouns, verbs, and class-ambiguous words. The translation patterns of all items had been previously normed; half had a single translation, and half had several possible translations of various probabilities. Spanish–English bilinguals performed forward and backward translation production and recognition. In both tasks, translation probability was a significant predictor of reaction times and accuracy rates, so that lower probability translations took longer to produce and verify. Word class was also found to significantly impact performance, with verbs and class-ambiguous items leading to a reduction in performance when compared with nouns. We consider the implications of these results for models of bilingual conceptual representation, which have been developed predominantly on the basis of data from experiments using single-translation nouns.

(3025)

**Associative Memory in English–Spanish Bilinguals.** YVONNE WAKEFORD, *Tufts University*, MICHAEL T. CARLIN, *University of Massachusetts Medical School*, & MICHAEL P. TOGLIA, *SUNY, Cortland*—Associative memory in English–Spanish bilinguals was investigated using the DRM paradigm (Deese, 1959; Roediger & McDermott, 1995). Two experiments explored the effect of actively invoking two languages at acquisition through (1) a translation task and (2) the utilization of mixed-language acquisition lists. The process of translation significantly reduced recall and recognition rates for critical items and significantly increased the recognition rate for old items. These results are discussed in relation to levels of processing and the generation effect. A source-monitoring task was completed following mixed-language acquisition and recognition testing. Participants were able to correctly identify the language source of old items with high levels of accuracy. Critical items were attributed to English and Spanish as the language source in equal proportions. Overall, the results are consistent with spreading activation theory (Collins & Loftus, 1975) and the concept that activation spreads across lexicons.

(3026)

**Bilingual Language Production: Contextual Factors and Their Impact on Picture Naming in English–Spanish Bilinguals.** AIMEE C. KNUPSKY, *Allegheny College* (sponsored by Paul C. Amrhein)—Bilingual theories differ in the extent of interaction between languages during production. The present study examined the influence of con-

textual factors on the degree of such interaction. English–Spanish bilinguals named pictures (in English or Spanish) presented with distractors (in English or Spanish). Response context was blocked (naming in one language only) or mixed (naming in both languages). Stimulus context was also blocked (distractors from one language only) or mixed (distractors from both languages). Of interest was the generation of same- and cross-language identity, semantic, and phonological through-translation effects across four different contextual conditions. Limited interaction was identified in completely blocked contexts: Cross-language effects were small or nonsignificant, with no through-translation facilitation. In contrast, a high degree of interaction was identified in completely mixed contexts: Cross-language effects were significant and often comparable with same-language effects, with significant through-translation facilitation. Implications for the process of bilingual production are considered.

(3027)

**Phonological Memory and Second-Language Speech Production in Children.** LEIF FRENCH, *Concordia University*, & IRENA O'BRIEN, *McGill University*—We investigated the relationship between phonological memory (PM) and second language (L2) speech production in native French-speaking preadolescent children enrolled in a 5-month intensive English-language program ( $N = 56$ ). PM was operationalized as nonword repetition, and English speech production was assessed at the beginning and end of the program using the Frog Story (Mayer, 1986). The participants gained in the total number of English words they produced, in the length of their longest run, and in the number of English words they produced between filled pauses. The ability to repeat nonwords made a significant contribution to such L2 oral fluency gains independently of age and nonverbal skills (partial  $r$ s between .31 and .37). These data extend previous findings that PM is implicated in children's L1 speech production (e.g., Adams & Gathercole, 2000) and suggest that PM is also related to children's L2 oral fluency development.

(3028)

**Asymmetries in Speed and Accuracy of Bilingual Comprehension and Production Processes.** WENDY S. FRANCIS, PILAR REGALADO, SILVIA P. SÁENZ, & GABRIELA DURÁN, *University of Texas, El Paso*—Picture-naming and translation response times and language background information were collected from 645 fluent Spanish–English bilinguals in individual testing sessions. As in previous research with fluent bilinguals, translation took longer and elicited more errors than did picture naming. Picture naming was faster and more accurate in the self-reported dominant language, and translation was more accurate when responses were given in the dominant language. A linear model was used to derive comprehension and production asymmetries in response time, and a multiplicative model was used to derive asymmetries in accuracy. Response times, error rates, and the derived comprehension and production asymmetry measures varied systematically with self-reported relative proficiency, years of experience, and current language usage. The observed patterns indicate that for fluent bilinguals, differences across languages in picture-naming or translation performance reflect quantitative differences in speed or accuracy of processing, not qualitative differences in processing routes used.

(3029)

**Word and Pseudoword Superiority Effects in Italian–English Bilinguals.** GIORDANA GROSSI, JEREMY MURPHY, & JOSH BOGGAN, *SUNY, New Paltz* (sponsored by William Prinzmetal)—Previous research has shown that individuals are more accurate at recognizing letters within real words than letters within pseudowords (i.e., *drope*) or nonwords (i.e., *chsvn*) and are more accurate at recognizing letters within pseudowords than letters within nonwords. These effects, called the *word superiority effect* and *pseudoword superiority effect*, respectively, are interpreted as indices of automatic orthographic processing. In the present experiment, two groups of participants performed a forced choice letter identification task: 14 native Italian

speakers who learned English as a second language during or after puberty, and 14 native English speakers unfamiliar with Italian. Stimuli comprised Italian words and pseudowords, English words and pseudowords, and nonwords. Native Italian speakers showed superiority effects for both languages, whereas native English speakers showed superiority effects only for English. These results suggest that orthographic processing can become automatic with extensive training in late bilinguals.

(3030)

**Is the MOP the Cleanest Way? Word Segmentation in Hindi–English Readers.** JYOTSNA VAID, CHAITRA RAO, & HSIN-CHIN CHEN, *Texas A&M University* (sponsored by Jyotsna Vaid)—In spoken word recognition, the maximum onset principle (MOP) is typically relied on to determine syllable breaks (e.g., DOC + TOR). By contrast, written word recognition, at least in English, appears to be influenced by a coda-maximizing segmentation strategy (e.g., DOCT + OR). Neither of these strategies may be optimal for languages, such as Hindi, that allow consonant clusters to appear in onset positions. The present research examined visual recognition of polysyllabic words by skilled Hindi–English bilingual readers on a lexical decision task. Per language, syllables were segmented by color at four possible breaks in the words. The findings suggest that lexical decision was fastest for Hindi words segmented at MOP–1 positions (e.g., DO + CTOR) and that this segmentation preference generalized to the recognition of English in these readers. Further work should examine the relative contribution of specific orthographic properties of Hindi versus properties of the spoken language in influencing the observed segmentation preferences.

(3031)

**Neural Substrates for Diversity in Language Experience.** RACHEL HULL & HEATHER BORTFELD, *Texas A&M University*, DAVID BOAS, *Harvard University*, & SUSAN KOONS, *Texas A&M University*—Recent behavioral work has indicated a systematic difference in hemispheric involvement for language processing, depending on whether individuals learned one or multiple languages during early childhood. The present research used an optical neuroimaging technique to evaluate the neural correlates of overt speech production that arise under specific circumstances of language experience. Changes in cerebral blood volume were tracked in bilateral temporal areas while monolingual and bilingual participants overtly produced words in either English or Spanish. The results support behavioral findings for differences based on early language experience and help advance our understanding of the neurological bases of language development in populations with variable language-learning histories.

(3032)

**Phonological Priming Effects in Bilinguals.** CORINNE A. HAIGH & DEBRA JARED, *University of Western Ontario* (sponsored by Debra Jared)—We investigated whether bilinguals activate phonological representations from both of their languages when reading silently in one. Previous evidence indicates that bilinguals activate phonological representations from their first language when reading in their second, but few studies have examined whether bilinguals activate phonological representations from their second language when reading in their first. Both French–English and English–French bilinguals were tested in three priming tasks. Two were lexical decision, in which the prime durations were 45 and 250 msec, and the third was a perceptual identification task. The critical stimuli were English target words that were preceded either by French-derived pseudohomophone primes (e.g., *tis*–TEA; “tis” pronounced in French sounds like TEA) or unrelated primes (e.g., *taf*–TEA). Results provided clear evidence that French participants activated French phonological representations of the prime, but no such evidence was found for English participants. These results indicate that the activation of phonological representations can appear to be both language selective and nonselective, depending on whether a bilingual is reading in their weaker or stronger language.

(3033)

**Bilingual Sentence Processing: Comprehension of Normal Spoken Versus Accented Language by Spanish–English Bilinguals.** ROBERTO R. HEREDIA, *Texas A&M International University*, & STEPHANIE J. TUTTLE, *Central Michigan University*—A cross-modal lexical decision task was used to measure cross-language priming. Spanish–English bilinguals listened to Spanish sentences spoken in standard Spanish (Experiment 1) or with an English accent (Experiment 2), and simultaneously made lexical decisions to related/unrelated targets in Spanish or English. Facilitatory priming was found for both language targets. However, the priming effect was greater for the Spanish targets. Surprisingly, lexical decisions to English targets were faster than those for Spanish targets, even when the language of the sentences was in Spanish. Experiment 2 followed the same patterns as Experiment 1. A comparison between Experiments 1 and 2 suggested that bilinguals took longer to process accented rather than standard spoken language. Results are discussed in relation to bilingual language processing models and the possibility that bilingualism is yet another expression of lexical ambiguity.

• READING •

(3034)

**Parafoveal Information Use Differs When Reading Silently and When Reading Out Loud.** ALBRECHT W. INHOFF & MATTHEW SOLOMON, *SUNY, Binghamton*, & RALPH R. RADACH, *Florida State University*—Reading out loud is generally slower and less practiced than silent reading. This study examined whether and how reading out loud influences eye movements of skilled readers and whether it alters the acquisition of visual information. Eye movements during reading were monitored, and an eye-movement-contingent display change technique was used to delay the availability of useful information from a target word by 0, 50, 100, or 150 msec while the pre-target word was fixated. During silent reading, target viewing durations increased linearly as a function of the previous target delay. When reading out loud, however, only the relatively long preview delay of 150 msec increased subsequent target viewing duration. Reading out loud thus confined processing to individual words for longer durations, and this delayed the uptake of parafoveal information from the next word. Implications for models of information processing and oculomotor control in reading are discussed.

(3035)

**The Influence of Transposed-Letter Neighbors: Eye Movements and Parafoveal Processing.** REBECCA L. JOHNSON & KEITH RAYNER, *University of Massachusetts, Amherst*—Previous research using response time tasks has found that when a word like “clam” is presented in the fovea, its transposed-letter (TL) neighbor “calm” is also activated and causes interference. Here, we employ a boundary change paradigm to explore TL neighborhood effects in normal silent reading. Specifically, we asked whether such TL neighborhood interference effects appear at the parafoveal level (i.e., before the word is directly fixated). Fixation durations on target words (e.g., “clam”) were significantly longer after receiving a substituted-letter preview (e.g., “chem”) rather than a TL neighbor preview (e.g., “calm”). These results suggest that parafoveal TL neighbors facilitate word recognition rather than inhibit processing. These findings support previous research suggesting that semantic information is not activated from the lexicon prior to fixation. Readers are, however, able to extract abstract letter identity information from the parafoveal word and use it to facilitate complete activation of the word, once it is fixated.

(3036)

**The Effect of Embedded Words on Eye Movements During Reading.** KRISTIN M. WEINGARTNER, *Hofstra University*, BARBARA J. JUHASZ, *Wesleyan University*, & EMMA HORTON & KEITH RAYNER, *University of Massachusetts, Amherst*—Many words in the English language contain semantically and morphologically unrelated

smaller words (e.g., *room* in *groom*). Recent findings indicate that a high-frequency embedded word interferes with visual word identification (Bowers, Davis, & Hanley, 2005; Davis & Taft, 2005). In two experiments, we asked whether a high-frequency embedded word influences word identification during reading. In both experiments, a target word containing a high-frequency embedded word was inserted into a sentence. Fixation durations on the target word were compared with those on a control word that appeared in the same sentence as the target word but contained either a low-frequency embedded word (Experiment 1) or no embedded word (Experiment 2). In both experiments, the high-frequency embedded word significantly influenced reading times. The results are discussed in the context of the E-Z Reader model of eye movement control and in relation to definitions of orthographic similarity.

(3037)

**Reading Compound Words in Context: An Eye Movement Investigation.** BARBARA J. JUHASZ, *Wesleyan University* (sponsored by Jerome L. Myers)—Compound words are long words composed of two shorter lexemes (e.g., *farmhouse*). In two experiments, English compound words were embedded in sentences and readers’ eye movements were recorded as they read. The beginning sentence context was either predictive or neutral with respect to the compound words. In order to assess whether the compound words were decomposed into their two lexemes during reading, either the beginning-lexeme frequency (Experiment 1) or the ending-lexeme frequency (Experiment 2) was manipulated while controlling other relevant variables. Fixation times on the compound words were recorded. Contextual constraint removed early beginning-lexeme frequency effects (in first-fixation duration), but did not influence later lexeme frequency effects (in gaze duration). These results suggest that morphology is present at two different levels in the English lexicon. A new framework in which morphology is organized hierarchically in the English lexicon is presented.

(3038)

**Time Course of Parafoveal Word Processing in Reading Chinese Sentences.** MIAO-HSUAN YEN, JIE-LI TSAI, DAISY L. HUNG, & OVID J.-L. TZENG, *National Yang-Ming University, Taiwan* (sponsored by Ovid J.-L. Tzeng)—Twenty-four participants read Chinese sentences for comprehension with their eye movements monitored and recorded. A pretarget–target word pair was embedded in each presented sentence. Visibility of a parafoveal two-character target word was manipulated during the reader’s fixation at the pretarget word. Together with a technique of eye-movement-contingent display change, the target word was either visible or masked by two low-frequency characters at the beginning period (0–140 msec after fixation onset) or the ending period (141 msec until end of fixation) of pretarget viewing. Although both beginning- and end-of-fixation visibility effects on the probability of fixating the target were observed, there was only an end-of-fixation visibility effect on fixation duration at the target. The results suggested that although lack of physical cues for word boundaries might result in late parafoveal word processing, characters within the perceptual span were processed early to determine the attractiveness of those characters.

(3039)

**Effects of Word Frequency and Irrelevant Speech on Visual Word Recognition.** BRIANNA M. EITER, *Hofstra University*—Two experiments were conducted to determine whether visual word frequency interacted with the lexical properties of irrelevant speech during visual word recognition. In Experiment 1, a lexical decision task was performed, with high- and low-frequency visual items presented with an irrelevant spoken word (ISW) that was either a high- or low-frequency phonologically similar word or dissimilar word. Visual word frequency affected target identification, but ISW type did not. In Experiment 2, sentences containing the same visual targets and ISWs were read while eye-movements were monitored. The effect pat-

tern for target reading was analogous to the one in Experiment 1. Post-target reading times, however, revealed longer fixation durations following a phonologically similar ISW, but no effect of ISW frequency. These findings suggest that the lexical properties of irrelevant speech have no additional influence on posttarget reading. This suggests that the speech-like phonological representation interacts with a perceptual but not a lexical representation.

(3040)

**Is Word Detection Better Than Letter Detection While Reading Prose?** THOMAS F. CUNNINGHAM, *St. Lawrence University*, & ALICE F. HEALY, *University of Colorado, Boulder*—College students searched for either the target letter “h” or the target word “the” in one of three versions of a prose passage in which every instance of the letter “h” occurred in the word “the.” The passage versions differed only in that 14 subject and 14 object noun phrases consisted of either the word “the” alone, the phrase “the word the” or the phrase “the definite article.” Target condition (letter or word) and passage version (“the” alone, “the word the,” or “the definite article”) were both manipulated between subjects, whereas type of noun phrase (subject or object) was manipulated within subjects. More than twice as many detection errors occurred for letter targets as for word targets, and this difference was greatest by far with “the definite article” passage. There were no effects involving type of noun phrase. These findings provide strong support for the role of unitization in letter and word processing.

(3041)

**Reversing the Missing-Letter Effect in Reading With a Minus Sign Probe.** JEAN SAINT-AUBIN, *Université de Moncton*, & RAYMOND M. KLEIN, *Dalhousie University*—When participants search for a target letter while reading, they make more omissions if the target letter is embedded in function rather than in content words, and in frequent rather than in rare words. Here, 32 subjects read two texts for comprehension while searching for a probe adjacent to the text. Above and below each line of text a continuous line of “÷” signs was displayed. Either 25 or 170 msec after the eyes crossed an invisible boundary located on the first letter of the critical word, the “÷” sign at that location was changed for 30 msec to a “-” sign by the deletion of the two dots. As with the letter detection task, subjects made more omissions on high- than on low-frequency content words, but at 25 msec they made more omissions on content than on function words. Implications for models of reading and the missing-letter effect are discussed.

(3042)

**Predictors of English Reading Abilities in Young Deaf Signers of American Sign Language.** KATHY MAXWELL, MARC F. JOANISSE, & CATHY CHOVAZ MCKINNON, *University of Western Ontario*—We examined the psycholinguistic, cognitive, and environmental factors influencing English reading achievement in 22 young deaf signers, ages 7–19. Language proficiency tests assessed a range of receptive American Sign Language (ASL) and English abilities, including vocabulary, lexical decision, and story comprehension. Cognitive abilities were assessed using the TONI 3. Finally, we obtained information from parents about environmental factors, including age of first exposure to ASL and to written English. As observed previously, we found a strong positive correlation between ASL and English reading abilities. More detailed analyses also revealed that ASL vocabulary scores were the strongest indicator of overall English reading ability, and English lexical decision scores explained the most variance in overall ASL ability. We also examined whether degree of hearing loss, nonverbal deficits, and age of ASL acquisition play mediating roles in this regard. The results are discussed with respect to theories of reading acquisition in deaf individuals.

• VISUAL SEARCH •

(3043)

**Ongoing Cognitive Processing in Visual Search.** CARRICK C.

WILLIAMS, *Mississippi State University*, & ALEXANDER POLLATSEK, *University of Massachusetts, Amherst*—We investigated how ongoing cognitive processes guide eye movements during visual search. Participants searched for an *O* in eight clusters of Landolt Cs (four characters per cluster, arranged like words in text). Search difficulty was manipulated by varying the gap size of the Cs; gap size was held constant within a cluster but differed across clusters. We compared search performance in the text-like search and the search of a single cluster of Landolt Cs. We found that gaze durations in the text-like search were almost completely a function of the difficulty of the currently fixated cluster. In addition, the effect of gap size on gaze durations in the text-like search was just about the same as the effect of gap size on response times in the single-cluster search. Thus, it appears that eye movements in the search task are determined almost exclusively by the ongoing cognitive processing of a cluster.

(3044)

**Time Course of Auditory Distractor Effects During Visual Search.** DONALD J. TELLINGHUISEN & RYAN G. HAMELINCK, *Calvin College*—Irrelevant auditory distractors can influence response time (RT) and error rate during visual search (Tellinghuisen & Nowak, 2003). Response-incompatible auditory distractors have a greater influence during high perceptual load (target-similar) than during low perceptual load (target-dissimilar) searches of letter-circle arrays. We investigated whether this load effect was due to the time course of processing distractors. Auditory distractors may have a greater influence in the high-load condition, because target detection RTs were longer than in the low-load condition, effectively resulting in longer temporal overlap of target and distractor processing. We varied SOA between auditory distractor and visual array presentation, including conditions in which distractor onset preceded search array onset by 50–500 msec. Incompatible distractors consistently yielded greater influence in high-load than in low-load searches when distractors preceded visual target onset. These findings indicate a robust influence of auditory distractors during visual search, particularly when perceptual load is high.

(3045)

**The Perceptual Span Hypothesis Explains Distance-From-Target Search Dynamics.** HAROLD H. GREENE, *University of Detroit Mercy*—A Monte Carlo simulation is described that demonstrates distance-from-target dynamics of eye fixations as they move toward the target during visual search. The simulation was able to replicate existing human search data without any assumption of knowledge-driven mechanisms. It is proposed that the perceptual span hypothesis explains multifixation distance-from-target dynamics. However, given the 50% miss rate of the simulated search trials, knowledge-driven mechanisms must not be discounted in human visual search.

(3046)

**Efficient Visual Search Leads to Underestimation of Display Size.** THOMAS G. GHIRARDELLI, *Goucher College*, & DANIEL N. CASSENTI & TROY D. KELLEY, *U.S. Army Research Laboratory*—In the latest in a series of experiments, we show that memory for the number of items in a visual search display is inversely related to the efficiency of the search of that display. Participants performed a conjunction search and a spatial configuration search and, following some displays, answered questions about different properties of the search display. Search performance was characteristic of conjunction or spatial configuration search, but when participants estimated the number of items in the display, they reliably underestimated, particularly for larger displays. The amount of underestimation was significantly less than was found with feature (i.e., efficient) search for both search tasks, and there was less underestimation in the spatial configuration search than in the conjunction search. We conclude that observers retain some knowledge of unattended items, but because they are irrelevant to the search task, their numbers are underestimated, and that the degree of underestimation indexes search efficiency.

## (3047)

**The Time Course of Subset Selection on the Basis of Onset and Color.** FRANK AGTER & MIEKE DONK, *Vrije Universiteit Amsterdam* (sponsored by Mieke Donk)—In visual search, observers can prioritize selection of one subset over another subset of elements. We utilized a new data analyzing method to investigate time courses of prioritized selection on the basis of onset and color. Three experiments are discussed in which we found that one subset can be prioritized over another subset of elements when the subsets are separated by luminance onset or color, but not when the subsets only differ in their temporal onset. Selectivity on the basis of luminance onsets is transient, but selectivity on the basis of color builds up rapidly and is sustained. Finally, the results do not point to a qualitative difference in the search process between subset selection on the basis of color only and subset selection on the basis of color and onset.

## (3048)

**When Pop-Out Targets Do Not Pop Out.** ANDREW B. LEBER & MARVIN M. CHUN, *Yale University*—Much research has shown that salient visual stimuli (i.e., singletons) need not gain processing priority when they do not match the observer's attentional set (e.g., Folk, Remington, & Johnston, 1992). However when the salient stimuli are targets, they are widely assumed to always "pop out" (i.e., response time should not increase as the number of display items increases). Here, we questioned this assumption by manipulating the role of expectancy. In our study, observers were cued to perform a task that was difficult on 80% of trials (e.g., a vertical bar among 10°-rotated distractors). On the remaining trials, however, the target was a singleton (e.g., the same vertical bar among 45°-rotated distractors). In both conditions, response times significantly increased with display size, revealing inefficient search even for the singletons. Evidently, known targets only pop out when observers expect them to.

## (3049)

**Learning of Attentional Set Transfers Between Spatial Visual Search and RSVP Identification Tasks.** JUN I. KAWAHARA, *National Institute of Advanced Industrial Science and Technology, Japan*, & YUJI GABARI, *Hiroshima University*—How does past experience guide observers' attentional sets? Leber and Egeth (in press) found that, given the option to use more than one strategy in a test phase, observers consistently used the strategy established in a preceding training phase. However, it is unclear whether observers learned task- and feature-specific strategies or acquired an abstract knowledge of the attentional set. We examined these alternatives by introducing two different test tasks: visual search and RSVP target identification. In the RSVP training, half of the observers searched for singleton color letters, and the other half searched for letters of a specific, consistent color. In the test, all observers searched for a consistent color singleton; therefore, both the singleton and specific-feature search strategies were available. The results showed that observers used the same strategy in a new untrained task, suggesting that abstract knowledge of an attentional set can be learned.

## • SYNTACTIC PROCESSING •

## (3050)

**Processing Coordination Ambiguity in the Visual World: Frequency and Context Do Not Override the Preference for Syntactic Simplicity.** PAUL E. ENGELHARDT, *Michigan State University*, & FERNANDA FERREIRA, *University of Edinburgh* (sponsored by Fernanda Ferreira)—Two experiments investigated the processing of coordination structures. Participants heard ambiguous utterances such as "put the frogs in the box and the bowl on the towel" and were required to execute the instructions by moving physical objects. Minimal attachment predicts that the parser will initially interpret the ambiguous noun phrase (i.e., "the bowl") as coordinating with the previous noun phrase. Constraint-based theories assume that interpretations are the result of a constraint-satisfaction process; con-

straints such as frequency or context can bias the parser to initially pursue a more complex interpretation. The results of Experiment 1 showed that participants initially interpreted the ambiguous noun phrase as a noun phrase coordination, resulting in a garden path interpretation. In Experiment 2, we manipulated topic structure to determine whether a two-topic context could override the preference for noun phrase coordination. Results showed that topic structure affected performance primarily in the unambiguous condition. These experiments are consistent with a strong initial preference for simplicity, and that context does not influence ambiguity resolution.

## (3051)

**Zero-Pronoun Resolution in Japanese.** DANIEL SLATEN & WILLIAM H. LEVINE, *University of Arkansas*, SHELIA M. KENNISON, *Oklahoma State University*, & JOEL A. HAGAMAN, *University of Arkansas*—This experiment investigated the interpretation of zero pronouns (i.e., implicit, unexpressed pronouns) in Japanese to discover whether there is a preference for singular or plural antecedents, depending on whether the prior sentence has a double topic (e.g., *Tanaka and Yamada went to Kyoto*) or a single topic (e.g., *Tanaka, along with Yamada, went to Kyoto*). Participants read double- and single-topic sentences that were followed by a sentence featuring a zero pronoun, then chose who they thought the referent of the pronoun was. Participants showed a strong preference for plural responses in the double-topic condition and a preference for singular responses in the single-topic condition. These findings provide support for centering theory as a model for the cognitive representation of entities in discourse; this theory states that the referent for a pronoun is identified by searching through a list of ranked entities, the highest ranked of which is (in Japanese) a sentence's topic.

## (3052)

**Insensitivity to Changes in Garden Path Sentences.** KIEL CHRISTIANSON, *University of Illinois, Urbana-Champaign*—Christianson et al. (2001) reported regular misinterpretations of garden path sentences, such as *While the man hunted the deer ran into the woods*. They attributed these misinterpretations to incomplete syntactic reanalysis. Two change-detection experiments were conducted to determine whether there was a difference in the sensitivity to changes in garden path sentences versus sentences disambiguated with a comma. The changes consisted of inclusions (Experiment 1) and deletions (Experiment 2) of *it* in the object position of the subordinate clause. Change-detection and RT results showed that people were more sensitive to changes in garden path sentences overall, suggesting that misinterpretations do not stem from inattention. However, when *it* was changed in precisely the position that was predicted by Christianson et al. to be unrevised, sensitivity to the change was not as high relative to changes in other positions. These results are interpreted in the context of "good enough" language processing.

## (3053)

**Mental Representation of Verb Argument Structure.** PING LI, SHUXIA LIU, & ALLISON MCCARTHY, *University of Richmond*, & HUA SHU, *Beijing Normal University*—The nature of the mental representation of verbs and verb argument structure has long been debated. In this study, we examined the selectional restrictions (SR) that hold between a verb and its object, with particular reference to the specific semantic features of the object (e.g., animateness, humanness, and specificity). Subjects named a visual word (the object) after listening to an auditory verb, and the object was either semantically appropriate or inappropriate, varying in its degree of fit to the verb. The verb-object pair either appeared in isolation or in sentence contexts. Results indicated that the word-naming speed reflects the degrees of fit between the verb and the object in terms of SR. These results suggest that the semantic information of verb arguments is an integral part of the mental representation of verbs, and such information for the verb is accessed and used online during sentence processing.

## • PSYCHOLINGUISTICS •

(3054)

**Graded Constraints in Goodness Judgments of Auditorily Presented Nonwords.** BRENT C. VANDER WYK & JAMES L. McCLELLAND, *Carnegie Mellon University* (sponsored by James L. McClelland)—Elsewhere we have described the graded constraint theory (GCT) of the rhyme structure of simple English words (e.g., *hit*, *dump*, and *paint*). The GCT linearly accumulates penalties for each violated constraint (noncoronal articulation, vowel length, coda voicing, and embellishments such as nasality). It accounts for most of the variance in occurrence rates among rhymes in the CELEX English lemma corpus. Here we investigate whether native English speakers ratings of the goodness of nonword forms (e.g., *ket*, *veelg*) can be accounted for by the GCT. We compare its predictions to other measures using multiple regression. The GCT, lexical similarity, phonotactic probability (Bailey & Hahn, 2001), and each item's rated familiarity all correlated with rated goodness, but the GCT was the strongest and most consistently significant predictor. In several analyses, the contribution of lexical similarity was subsumed by the GCT. Whether the rhyme occurs at all accounted for little unique variance.

(3055)

**Semantic Activation of Rhyming Words During Spoken Word Recognition.** EILING YEE & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Most prior work suggests that hearing a real word does not activate semantic information about rhyming words (e.g., “blank” does not prime “wood” via “plank”). We tracked eye movements of participants as they selected a named (target) object from a four-picture array. One picture was a “null” symbol which participants selected if the target was absent. For each critical target word (e.g., “pear”) there existed a rhyming competitor word (“bear”). Critical displays did not contain the target or the rhyme competitor, but did contain an object semantically related to the rhyme competitor (e.g., given the target “pear,” the rhyme “bear,” and the semantically related object tiger, the display was: null, tiger, lock, mirror). Participants were more likely to fixate on related than on unrelated objects (e.g., given “pear” listeners preferentially fixated on the tiger). These findings indicate that listeners activate semantic information about words that rhyme with a heard word.

(3056)

**fMRI Comparisons of Multimodal Semantic and Phonological Processing in Reading Disabled and Nonimpaired Adolescent Readers.** NICOLE LANDI, W. EINAR MENCL, STEPHEN J. FROST, REBECCA SANDAK, & HELEN CHEN, *Haskins Laboratories*, & KENNETH R. PUGH, *Haskins Laboratories and Yale University School of Medicine*—Behavioral research suggests that word identification in reading disability is associated with heightened reliance on semantics, potentially to offset weak phonological assembly skills. Using fMRI, we examined the neurobiological signatures of semantic and phonological processing in reading-disabled and nonimpaired adolescent readers in a picture–word rhyme judgment task and in a picture–word semantic categorization task. In the rhyme judgment, words were presented auditorily and visually to examine how presentation modality modulated group differences. Initial analyses of rhyme judgment and semantic categorization revealed skill-related differences in task performance and in activation of reading-related regions (e.g., IFG, STG, OT), suggesting that the two groups differentially activate semantic and phonological processing regions. Further comparisons investigate the relationship between group and presentation modality. Findings are discussed within the framework of current neurobiological models of reading and reading disability.

(3057)

**Blocked Versus Mixed: An ERP Investigation of the Concrete-Word Advantage.** LEIDA C. TOLENTINO & NATASHA TOKOWICZ, *University of Pittsburgh*—Concrete words are generally more easily re-

membered and comprehended than abstract words. Several theories have been proposed to explain this concrete-word advantage. However, abstract and concrete words are sometimes processed with equal speed, such as when lexical decisions are made to a block of abstract words followed by a block of concrete words (Kroll & Merves, 1986). We investigated the alternative hypotheses that concrete and abstract words in this blocked design are (1) processed similarly with respect to lexical decision latency but not to initial comprehension, or (2) processed similarly with respect to both lexical decision latency and initial comprehension. Participants made lexical decisions to a mixed block of concrete and abstract words, to concrete words and then abstract words, or to abstract words and then concrete words. To measure initial comprehension, we recorded event-related brain potentials in response to the stimuli. We discuss the results with respect to theories of word concreteness.

(3058)

**Costs and Benefits of Using a Speaker's Eye Gaze in Face-to-Face Referential Communication.** JOY E. HANNA, *Oberlin College*, & SUSAN E. BRENNAN, *SUNY, Stony Brook*—In face-to-face referential communication, a speaker's eye gaze to the object being described can provide disambiguating information. Our previous work showed that addressees can use this information rapidly and flexibly. We examined whether there are also costs to using a speaker's eye gaze in spoken dialogue. Pairs of naive directors and matchers sat across a table separated by a barrier so they could not see each other's mirror-image displays. Directors followed nonverbal cards indicating the objects matchers should move, causing them to look at targets that were either next to or far away from a competitor. Either the directors' eyes were visible to the matcher; their eyes were hidden by mirrored sunglasses (allowing matchers to observe head orientation); or the directors were completely hidden by a tall barrier. Matchers' eye movements revealed the relative costs and benefits of attending to and coordinating the use of directors' disambiguating eye and head movements during language comprehension.

(3059)

**Automatic Contextualization Versus Egocentricity in Early Utterance Planning.** TIMOTHY M. GANN & DALE J. BARR, *University of California, Riverside*—Previous research has suggested that speakers initially plan their utterances “egocentrically” (Horton & Keysar, 1996), and only consider the listener's perspective during a later monitoring stage. Supporting this hypothesis, speakers under time pressure tend to include private information in their descriptions of target objects. We argue that this effect reflects the “automatic contextualization” of referents rather than egocentrism. To distinguish these hypotheses, we conducted a referential communication task in which we manipulated the relationship between the target (e.g., a circle) and a contrasting object, using contrasts that were either conventional (small circle) or unconventional (a circle with a squiggle). Consistent with both hypotheses, we found that speakers included private information in their descriptions of targets with a conventional contrast. However, consistent with automatic contextualization, they did not do so when they described targets with an unconventional contrast. These results imply that the initial design of utterances reflects automatic contextualization rather than egocentrism.

(3060)

**The Effect of Listener Confusion on Speakers' Nonlinguistic Communicative Behavior.** ANNE J. OLMSTEAD & CAROL A. FOWLER, *University of Connecticut and Haskins Laboratories* (sponsored by Carol A. Fowler)—We examined the effect of listener confusion on speakers' communicative behavior. Participants (speakers) narrated a story to a confederate of the experimenter (listener) who expressed confusion and asked the speaker to repeat what s/he had just said. We evaluated the effect of confusion on speakers' hand gesturing behavior. Speakers' assumptions about what their listener knows affect the descriptive expressions they use in cooperative tasks (Fussell & Krauss, 1992). We predicted that nonlinguistic communicative behavior would be similarly affected. Specifically, we hypothesized that

if speakers use hand gestures for communication, then their gesturing will change when their listener requires them to clarify or elaborate old information. The data support this hypothesis.

• ATTENTIONAL PROCESSES •

(3061)

**Cultural Differences in Attentional Allocation in Visual Information Processing.** AYSECAN BODUROĞLU, PRITI SHAH, & RICHARD NISBETT, *University of Michigan*—Previous research demonstrated that cultural background strongly influences how attention is distributed when viewing scenes. Specifically, in a scene change detection task, Japanese participants were more likely to detect peripheral versus focal changes than were Americans, and vice versa (Masuda & Nisbett, 2006). Since detection of peripheral versus focal changes is moderated by attentional breadth differences (e.g., Pringle et al., 2001), we hypothesized that there may be cultural differences in attentional breadth. To test this hypothesis, we employed a visual change detection paradigm involving simple abstract stimuli, and we demonstrated that East Asians were better than Americans at detecting color changes when the layout of a set of colored blocks was expanded to cover a wider region, and worse when it was shrunk. Furthermore, East Asians were slower than Americans at detecting changes in the center of the screen, suggesting that East Asians allocate their attention more broadly than Americans.

(3062)

**Integrating Faces, Houses, Motion, and Action: Spontaneous Binding Across Ventral and Dorsal Processing Streams.** ANDRÉ W. KEIZER, LORENZA S. COLZATO, & BERNHARD HOMMEL, *Universiteit Leiden* (sponsored by Gezinus Wolters)—Perceiving an event requires the integration of its features across numerous brain maps and modules. Visual object perception is thought to be mediated by a ventral processing stream, whereas most spatial processing and action control is attributed to the dorsal stream. Using a prime–probe reviewing design in which stimulus features and responses were repeated or alternated in an orthogonal fashion, we showed that integration operates not only on ventral features and objects, such as faces and houses, but also across ventral and dorsal pathways, binding faces and houses to motion and manual action. Findings suggest that interactions between the ventral and dorsal processing streams are more pronounced than previously thought.

(3063)

**Cerebral Blood Flow Velocity Correlates of Factors of Attention.** NATASHA BARRETT & DAVID A. WASHBURN, *Georgia State University* (sponsored by David A. Washburn)—Factors or components of attention have been identified through experimental, psychometric, and neuropsychological studies. We examined whether psychophysiological data would show patterns of hemispheric differences reflecting latent variables of attention. Functional transcranial Doppler sonography allowed continuous, noninvasive monitoring of blood flow velocity to the left and right cerebral hemispheres as participants completed a battery of attention tasks. Although these hemovelocities were highly intercorrelated across tasks, exploratory analyses of these measures suggested a factor structure similar to that previously reported for response time and accuracy data (i.e., with factors for attention focusing, shifting, and sustaining). Moreover, difficult tasks that required cognitive control generally resulted in higher blood flow velocities relative to relatively automatic tasks. These findings support the general conclusion that the construct of attention actually combines multiple independent but interrelated cognitive operations or skills, and validate a new method for investigating brain–behavior relations for attention control and performance.

(3064)

**Electrophysiological Correlates of Object Substitution Masking.** JESSICA J. GREEN, JOHN J. McDONALD, & VINCENT DI LOLLO,

*Simon Fraser University*—In metacontrast masking (MM), the visibility of a brief target stimulus is reduced if a nonoverlapping masking stimulus is presented shortly afterward. In object substitution masking (OSM), target and masking stimuli have a common onset, but the mask remains on view after target offset. If masking occurs in early vision, it should be evidenced in the corresponding early components of the target-elicited event-related potential (ERP). Previous evidence that MM does not affect early ERP components is problematic, because the ERPs were time-locked to the onsets of the target and the mask overlap. We overcame this problem by using an OSM paradigm. Targets were outline shapes with a gap in a cardinal orientation, to be reported. Masks were either continuous rings or four dots surrounding the target. The early ERP components (P1 and N1) were unaffected. Ring masks but not four-dot masks led to a suppression of a late posterior contralateral negativity associated with spatial attention.

(3065)

**Lower Blood Pressure Correlates With Poorer Performance on Visuospatial Attention Tasks in Young Adults.** WHITNEY WHARTON & ELLIOT HIRSHMAN, *George Washington University*, PAUL MERRITT, *Texas A&M University, Corpus Christi*, & BETHANY STANGL, *George Washington University*—We examined the relationship between blood pressure and cognitive function in young adults. Although a number of studies have examined hypertensive and hypotensive individuals, particularly in older populations, little attention has been devoted to healthy young adults. We tested 105 healthy young adults whose blood pressure levels naturally fell in the below-normal to normal range. Our primary finding was a positive relation between blood pressure and performance on two visuospatial attention tasks. This relation appears to be specific to visuospatial skills, since no relationship was observed between blood pressure and memory. We discuss potential neural mechanisms, as well as implications for the overall blood pressure–cognition relationship.

(3066)

**Examining Attention in Postconcussion University-Aged Athletes Using the Attention Network Test (ANT).** ANNAMARIA T. SOVIERO & JIM E. MCAULIFFE, *Lakehead University* (sponsored by Jim E. McAuliffe)—Athletes who suffer a concussion (mild traumatic brain injury) experience acute and chronic changes in neurocognitive functions, including attention. In a previous study using the ANT, concussed athletes experienced deficits in orienting and the executive function of attention when assessed within 48 h after the time of injury. The deficits found in orienting of attention recovered within 7 days; however, deficits in the executive function persisted for at least 1 month. Using the ANT, the present study explored whether lingering attention deficits in previously concussed university-aged athletes persist beyond 1 month. In comparison with a matched control group, post-concussion athletes had slower mean RTs in the executive function component of ANT. There were no differences in alerting or orienting of attention. The results suggest that in post-concussion athletes, the systems involved in the executive function of attention are altered, and the changes may persist for some time.

(3067)

**Cross-Cultural Differences in Multitasking by East Asians and North Americans.** JONATHON KOPECKY, SHINOBU KITAYAMA, & DAVID E. MEYER, *University of Michigan*, & JUN SAIKI, *University of Kyoto*—We compared performance on multitasking by matched groups of young-adult East Asians and North Americans in two complementary experimental procedures: simultaneous task overlapping and sequential task switching. For task overlapping, participants tried to perform both visual–manual and auditory–vocal choice reaction tasks concurrently. Here, East Asians had reliably lower mean dual-task time and error costs, more closely approximating perfect time sharing than did North Americans. For task switching, participants alternated back and forth between two visual–manual tasks that involved bivalent stimuli and responses. Here, as before, East Asians

had lower mean switching-time costs and error rates than did North Americans, again manifesting less between-task interference. Taken overall, our results support recent theories about systematic cross-cultural differences in cognition based on distributed synthetic information processing by East Asians versus focused analytic information processing by North Americans.

• ATTENTIONAL BLINK •

(3068)

**Linear Changes in the Spatial Extent of the Focus of Attention Across Time.** LISA N. JEFFERIES, *University of British Columbia*, & DANIEL J. WEEKS & VINCENT DI LOLLO, *Simon Fraser University*—The present study employed two well-established phenomena, the attentional blink (AB) and lag-1 sparing, to examine the spatiotemporal modulations of attention. When two sequential targets are inserted in an RSVP stream of distractors, perception of the second target is impaired at short intertarget lags (AB deficit). Paradoxically, this deficit disappears when the second target immediately follows the first (lag-1 sparing). Two main findings emerged: When the second target was presented directly after the first, there was a progressive transition from lag-1 sparing to AB deficit as the SOA between successive RSVP items was increased. Second, the change from lag-1 sparing to AB deficit was related linearly to SOA. This suggests that the spatial extent of the focus of attention varies linearly over time. A qualitative model is proposed that accounts for the modulation of the spatial extent of attention across time.

(3069)

**Target Detection in RSVP Affects Memory for Nontargets.** MING MENG & MARY C. POTTER, *Massachusetts Institute of Technology*—In a typical attentional blink (AB) experiment viewers try to detect two target items among distractors in rapid serial visual presentation (RSVP): Processing of the first target impairs participants' ability to recall a subsequent target at short SOAs. However, little is known about whether target detection interferes with memory for nontarget items. In a dual-task procedure, participants searched for a word target (e.g., "a four-footed animal") at presentation durations of 120 or 240 msec and then were tested for recognition of nontarget words. The target was present on half the trials. When present, a standard AB effect was obtained for memory of nontarget words, with lag-1 sparing followed by an AB at longer lags. Interestingly, at 120 msec memory for the word immediately preceding the target was also worse than on no-target trials. Thus, target processing can negatively affect memory for immediately preceding as well as for subsequent nontargets.

(3070)

**The Relation Between Semantic Memory and the Attentional Blink.** GUY L. LACROIX, *Carleton University*, & NORMAN SEGALOWITZ, IOANA CONSTANTINESCU, ROBERTO DE ALMEIDA, & MICHAEL VON GRÜNAU, *Concordia University*—Previous experiments have suggested that semantic processing impacts the magnitude of the attentional blink (AB) (e.g., Lacroix et al., 2005). The goal of this experiment was to show a more direct link between semantic memory and the AB. We assessed 38 adolescent participants with measures of semantic memory, nonverbal ability, phonological and visual short-term memory, and reading ability. They were then tested in an RSVP experiment (based on Visser et al., 2004) using counterbalanced blocks of nonlinguistic and linguistic stimuli. The results showed that participants who had high semantic memory scores showed significantly deeper ABs than did participants who had low scores, even when nonverbal and reading ability were controlled for. This experiment suggests that ballistic, semantic processing is related to the magnitude of the AB for both nonlinguistic and linguistic stimuli.

(3071)

**What a Second Response Tells Us About Illusory Conjunctions in RSVP?** JUAN BOTELLA, MARIA NARVAEZ, & MANUEL SUERO,

*Universidad Autónoma de Madrid*, & JAMES F. JUOLA, *University of Kansas*—When observers are asked to report a feature of a single target displayed in RSVP, they frequently make errors. Most frequently, a feature from the to-be-reported dimension pertaining to a stimulus presented near the target is reported. From Botella, Barriopedro, and Suero's model (2001), it is proposed that during the presentation of the series, the response features of the stimuli are extracted. If a high rate of presentation does not enable proper binding processes, the system could base its response on sophisticated guessing based on the relative levels of activation of the response features. Two experiments are reported in which the observers had to report their first and second response candidates. The application of the constant ratio rule to the first responses allows predictions for the ratios between choices of the items for the second responses. The correlations between the observed and the predicted response proportions were .80 and .88 in the two experiments. This high predictive capacity indicates that the observers have available more than one response among which to choose, and that the choice among responses is determined largely in the same way for both first and second responses.

(3072)

**Scene Analysis and the Auditory Attentional Blink.** LAUNA C. LEBOE & TODD A. MONDOR, *University of Manitoba*—The influence of auditory scene analysis on the emergence of the auditory attentional blink was examined. Listeners were presented with a sequence of distractor sounds within which could be embedded predefined target and probe sounds. The likelihood that the distractors would be grouped together into a single stream was manipulated, as was the likelihood that the target and probe would be incorporated into the same stream. The results of the experiments provide an insight into the interaction between perceptual grouping mechanisms and voluntary selection.

(3073)

**Attenuating the Attentional Blink by Including Salient Temporal Events in the RSVP Stream.** WAH PHEOW TAN, JEREMIAH D. STILL, & VERONICA J. DARK, *Iowa State University*—We examined the effect on the attentional blink (AB) of changes in temporal dynamics among items presented in a rapid serial visual presentation (RSVP) stream. Manipulation of interstimulus intervals produced faster item presentation rates at different points in the stream. AB did not attenuate when the change occurred just prior to the onset of either the first target (T1) or the second (T2), or just after T2 offset. AB was attenuated when the change occurred just after T1 offset. AB attenuation did not vary with changes in T1 identification rate, although the latter varied with changes in item presentation rate. These findings are inconsistent with two-stage processing models of AB; however, they are consistent with attentional control models, in which AB occurs when transference of attentional control from T1 to T2 is inefficient. AB attenuation produced by rate change after T1 offset may indicate that the change facilitated disengagement of attention from T1.

• AGE AND ATTENTIONAL CONTROL •

(3074)

**Predicting Cognitive Control From Preschool to Young Adulthood.** INGE-MARIE EIGSTI, *University of Connecticut*, VIVIAN ZAYAS, *Cornell University*, WALTER MISCHEL, *Columbia University*, YUICHI SHODA, *University of Washington*, & B. J. CASEY, *Sackler Institute of Weill Medical College, Cornell University* (sponsored by Richard N. Aslin)—In this longitudinal study, preschoolers who spent a greater proportion of the time directing their attention away from rewarding stimuli during a delay of gratification task were more efficient (faster without making more errors) at responding to targets in a go/no-go task over 10 years later. The overall findings suggest that preschoolers' ability to effectively direct their attention away from tempting aspects of the rewards in a delay of gratification task may be a developmental precursor for the ability to perform inhibitory tasks such as the go/no-go task years later. Because performance on

the go/no-go task has previously been characterized as involving activation of fronto-striatal regions, the present findings also suggest that the delay of gratification task may serve as an early marker of individual differences in the functional integrity of this circuitry.

(3075)

**Are Developmental Changes in Asymmetrical Switch Costs Domain Dependent?** MICHELLE R. ELLEFSON, *University of Pittsburgh*, NICK CHATER, *University College London*, & ELISABETH BLAGROVE & EMMA L. JOHNSTONE, *University of Warwick*—Traditionally, a *switch cost* is defined as an increased response time after switching between two tasks rather than repeating the first task. Asymmetrical switch costs occur when the cost of switching is smaller for the more complex of two tasks. Previously, we have found that young children exhibit asymmetrical switch costs at both general and specific levels—that is, in block and trial statistics, respectively. However, the patterns of these asymmetries are remarkably different across task domains. The present project identifies the developmental changes between 7-year-olds, 10-year-olds, 13-year-olds, and adults across a variety of task domains: figure matching, arithmetic, and reading. The results indicated that the developmental patterns of asymmetrical switch costs vary greatly depending on the domain of the tasks that are being switched. These results suggest that development, experience, and knowledge acquisition drive age-related changes in asymmetrical switch costs.

(3076)

**Adult Age Difference in Intertrial Modulations of the Simon Effect.** YUKO HIBI & TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology, Japan*—The Simon effect (SE) is faster responses to a reporting attribute of spatially corresponding rather than noncorresponding stimuli. The SE was found to be reduced after noncorresponding trials. We examined whether the sequential modulation of the SE was affected by aging. Participants' task was to identify the color of a rectangle at the left or right of fixation (spatial Simon task), or to identify the color of an arrow pointing to the left or right on the fixation (symbolic Simon task). Younger adults showed SEs as well as the sequential modulations in both tasks. In older adults, the sequential modulations were observed for the spatial and symbolic tasks, although the symbolic SE was not found. These results suggest that the SE in the current trial occurred in a different process than did the SE modulation. Aging may impact only on the process of the symbolic SE.

(3077)

**Effects of Age and Attention Shifts on Intra-Individual Variability in Response Times.** SHANNON ROBERTSON, JOEL MYERSON, & SANDRA HALE, *Washington University* (sponsored by Sandra Hale)—Older individuals typically perform more variably on speeded cognitive tasks than do younger individuals. Some researchers have suggested that this age-related increase in intra-individual variability is a reflection of changes in aspects of frontal lobe function. If this is correct, then age differences in intra-individual variability should be greater on tasks that place greater demands on executive control or working memory. To test this hypothesis, older and younger adults were administered visual search tasks that varied in the extent to which attention shifts or working memory were required. RTs were longer on tasks that required more attention shifts or had a larger working memory requirement. In addition, older adults were more variable than young adults, but intra-individual variability was not related to age on any of the tasks, regardless of the extent to which they required attention shifts or working memory, once differences in RT were statistically controlled.

(3078)

**Cognitive Aging and Error Repetitions: The Roles of Attention.** ETSUKO T. HARADA, *Hosei University*, & SATORU SUTO, *Chuo University*—Elder users of IT-based equipment often show continual

repetitions of the same erroneous operations in daily lives and also in the usability testing labs. In this study, we have tried to identify the roles of attention for this error repetition phenomenon, using a simple kanji-selection task, because we have found error repetitions under divided attention even with young participants (undergraduate students). With young adults, Experiment 1 showed that error repetition did not occur when task complexity needed more attention resources ("selecting the wrong one" condition). However, in Experiment 2 the result under the task-switching condition showed error repetitions, implying that attention loads for maintaining multiple goals were important factors for error repetition. In Experiments 3 and 4, old participants showed the same result patterns and also showed some specific effects of task complexity or pure attention loads on elder adults' performance.

• IMPLICIT MEMORY •

(3079)

**Implicit Associations Underlying Self-Esteem in Latina/o University Students.** ROGER DUNN, THIERRY DEVOS, KARLA BLANCO, CYNTHIA MUÑOZ, & EMILIO ULLOA, *San Diego State University*—Latina/o university students were asked to report their attitudes toward family versus school and their identification with these concepts. They also completed two implicit association tests (IATs) measuring the same two constructs, as well as a third IAT measuring self-esteem. Results revealed a more positive attitude toward family (relative to school) and a stronger identification with family on both the explicit and implicit measures. In line with theories of cognitive-affective consistencies (Greenwald et al., 2002), implicit self-esteem was a multiplicative function of identification with and liking for the target concepts. The more participants valued family over school and identified with family rather than school, the higher their self-esteem. Implicit attitude and identification were not the product of deliberate responses to normative demands or conscious attempts to convey a particular self-image.

(3080)

**Differences in Implicit and Explicit Memory for Flanker Stimuli.** JOHN JONES, *Florida State University*, & MARTIN BINK, *Western Kentucky University*—The flanker effect suggests that unattended stimuli are processed in real time, but there is no suggestion about the degree to which these unattended stimuli are available to subsequent memory processes. The goal of the present study was to explore the degree to which unattended stimuli could be "remembered" in subsequent tests of implicit and explicit memory. Flanker stimuli were presented along with target stimuli that required low- or high-level conceptual processing. Also, the semantic relevance between target and flanker was either low or high. Across two experiments, memory for the distractor items was tested using naming latencies to visually degraded stimuli (implicit test) and an old-new recognition (explicit test). There were minor, nonsignificant explicit memory effects when flanker and target were related. However, the results indicated that the flanker stimuli were nonetheless available to implicit memory processes in the subsequent memory tests.

(3081)

**Response Time Differences Between True and False Memories.** MINE MISIRLISOY & KATINKA DIJKSTRA, *Florida State University* (sponsored by Hasan Gürkan Tekman)—In the present study, response time (RT) of false memories (false alarms to critical nonpresented words) in the Deese/Roediger-McDermott (DRM) paradigm was compared with RT of true memories (hits to presented list items), and with the RT of false alarms to unrelated foils. Proportions of true memories, false memories, and false alarms to foils were 72%, 78%, and 15%, respectively. The RT of false memories was significantly shorter than that of the false alarms to the unrelated foils. However, contrary to Jou, Matus, Aldridge, Rogers, and Zimmerman (2004), RT for false memories was not significantly longer than RT for true memories. Shorter RT during retrieval suggests more automatic decision

processes for false alarms to critical lures. The results fit well with previous findings on high confidence ratings and “remember” judgments accompanying false memories in the DRM paradigm.

(3082)

**False Memory for DRM and Homograph Lists: The Effects of Presentation Duration and Warning Instructions.** ANN E. LAMBERT, ZACH M. SHIPSTEAD, & KEITH A. HUTCHISON, *Montana State University* (sponsored by Keith A. Hutchison)—Effects of forewarning and presentation duration on veridical and false recall were examined. Lists in which 12 words converged onto a single meaning of an unambiguous critical item (CI; e.g., SLEEP) or 6 words converged onto one meaning and 6 words converged onto another meaning of a lexically ambiguous CI (e.g., FALL) were presented for 1 or 3 sec. In addition, participants were given no forewarning (Experiment 1), were asked to guess the CI (Experiment 2), or were given either a standard or CI identification warning to reduce false recall (Experiment 3). Longer presentation duration and forewarning conditions additively reduced false recall for all CIs, suggesting that they work via separate processes. Moreover, the CI identification warning was more effective than the standard warning, especially for unambiguous CIs, which were demonstrated to be easier to identify. Further analyses revealed that participants do not use a CI identification strategy under standard forewarning instructions.

(3083)

**Assessing the Validity of Posttest Awareness Questionnaires.** TERENCE M. BARNHARDT & LISA GERACI, *Texas A&M University*—Two experiments—one employing a perceptual implicit memory test and the other a conceptual implicit test—investigated the validity of posttest questionnaires for determining the incidence of awareness in implicit memory tests. In both experiments, a condition in which none of the studied words could be used as test responses (i.e., the none-studied condition) was compared with a standard implicit test condition. Results in both experiments showed that reports of awareness on the posttest questionnaire were much less frequent in the none-studied condition than in the standard condition. In both experiments, 83% of participants in the none-studied condition stated they were unaware, even though there were strong demands for claiming awareness. Although there was a small bias in the questionnaire (i.e., 17% of participants in the none-studied condition stated they were aware), overall there was strong support for the validity of awareness questionnaires.

(3084)

**Effects of Marathon-Induced Acute Stress on Implicit and Explicit Memory.** TEAL S. EICH & JANET METCALFE, *Columbia University* (sponsored by Janet Metcalfe)—The effects of acute stress on memory were investigated by comparing the performance of runners on an implicit word stem completion test and an equivalent explicit memory test before and after the New York City and the Boston marathons. Salivary cortisol levels reached up to 87.9 nmol/l after a marathon, nearly nine times the level reported in laboratory-induced stress studies such as the Trier social stress test. Previous studies have indicated that glucocorticoid production associated with the stress response has a debilitating effect on the hippocampus, associated with explicit memory, but that implicit memory is spared. The results of our study showed a significant group (unstressed premarathon/stressed post-marathon)  $\times$  test type (implicit/explicit) interaction. The difference in performance between implicit versus explicit memory was greater for the unstressed than for the stressed runners, supporting the claim that high levels of acute stress impact differentially on the implicit and explicit memory systems.

• FACE PROCESSING AND EYEWITNESS MEMORY •

(3085)

**Memory for Pairs of Faces: An Associative Memory Impairment?** MATTHEW G. RHODES, *Colorado State University*, ALAN D.

CASTEL, *UCLA*, & LARRY L. JACOBY, *Washington University*—Although previous research suggests that memory for faces is often very good, relatively little research has examined associative memory for pairs of faces. The present research showed that after studying pairs of faces, participants were successful at recognizing previously presented pairs but were highly likely to make associative memory errors by falsely endorsing rearranged pairs (i.e., two previously presented faces that were not paired at study). Thus, participants only displayed moderate levels of discriminability between old and rearranged pairs, an effect that was magnified when the pairs were outside the age range of the participants (e.g., younger participants studying older face pairs). This associative false recognition effect occurred even when participants were given relational encoding instructions or permitted to self-pace their study time. Such data suggest that memory for pairs of faces relies largely on the familiarity of each face and not on a more precise recollection of associative information.

(3086)

**Memory for Faces: The Interaction of Race and Age.** JEFFREY S. ANASTASI, *Sam Houston State University*, TODD M. HODGES, *Arizona State University*, & MATTHEW G. RHODES, *Colorado State University*—Several previous studies have demonstrated that individuals are better at remembering in-group rather than out-group faces. Although previous work has evaluated the impact of either race or age on face recognition, the present study manipulated both dimensions. Specifically, participants studied same- and other-race faces that came from their own or other age groups. Participants exhibited superior recognition memory for faces from their own race in comparison with other-race faces (i.e., an own-race bias). However, participants also exhibited superior recognition for faces from their own age group (i.e., own-age bias) but only if those faces were from their own race. No such own-age bias was apparent for other-race faces. Results are discussed with regard to Sporer’s in-group/out-group model (IOM).

(3087)

**Effective Size Regulates the Sequential Lineup Advantage.** CURT A. CARLSON & SCOTT D. GRONLUND, *University of Oklahoma*, & STEVEN E. CLARK, *University of California, Riverside*—Lindsay and Wells (1985) found a sequential lineup advantage, such that participants had fewer false alarms to an innocent suspect in a sequential, in comparison with a simultaneous, lineup. After failing to replicate this result, we hypothesized that the effective size of the lineup may interact with simultaneous versus sequential lineup accuracy. In support of this hypothesis, a sequential lineup advantage was found only when one lineup member matched the physical description of the perpetrator; a simultaneous advantage was found for a mid-range effective size; and there was no difference for a high effective size lineup. Given that lineups created in the real world are unlikely to be extremely biased (of very low effective size), it may be premature to advocate the sequential lineup as superior to the simultaneous lineup. In fact, a simultaneous advantage was found for lineups of mid-range effective size, which may be more ecologically valid.

(3088)

**What Have We Learned Since *Neil v. Biggers* (1972) About the Description–Identification Accuracy Relationship in Memory for Faces?** KYLE J. SUSA, *University of Texas, El Paso*, SIEGFRIED L. SPORER, *Universität Giessen*, & CHRISTIAN A. MEISSNER, *University of Texas, El Paso*—In *Neil v. Biggers* (1972), the U.S. Supreme Court postulated, among other things, that the quality of a witness’s description could be used as a basis for assessing the veracity of their identification. Since this decision, a host of research has explored the relationship between eyewitness description quality and lineup identification accuracy. In this presentation, we provide a review of the cognitive mechanisms underlying this relationship and present a meta-analytic review of research on this topic since the *Biggers* decision. Description quality and the presence of incorrect feature descriptors were both found to be moderately correlated with identifica-

cation accuracy. A series of moderator analyses is presented, and the theoretical implications of the findings are discussed.

(3089)

**Taking an Immediate Test Exacerbates Later Eyewitness Misinformation Susceptibility: The Reversed Testing Effect.** JASON C. CHAN, *Washington University*, & AYANNA K. THOMAS & JOHN B. BULEVICH, *Colby College* (sponsored by Jason M. Watson)—Eyewitness misinformation experiments typically have three phases: a witnessed event, a misinformation phase, and a memory test. This procedure omits an important event that typically occurs in “real world” situations—an initial recall (to a 911 operator and police officers at the crime scene). The testing effect suggests that taking an immediate test would enhance retention of the witnessed details and thus reduce subjects’ susceptibility to the misinformation effect. We compared the final recall performance between subjects who took an immediate recall test before being exposed to misinformation and subjects who did not take such an immediate test. Counter to the prediction generated from the testing effect, subjects who had taken the immediate test showed greatly exaggerated misinformation susceptibility. This surprising pattern was also observed among both younger and older adults. In an additional experiment, we replicated this pattern even in a condition in which a warning was included.

(3090)

**Application of the Perturbation Model in a Face Space Framework.** SARAH B. DAILEY & SCOTT D. GRONLUND, *University of Oklahoma* (sponsored by Frank Durso)—This experiment utilized the framework of a multidimensional face space model applied to facial recognition, and introduced the application of the perturbation model (Estes, 1997) to describe the correct identifications and patterns of memory errors made along various dimensions in face space. Using the example of the race dimension in face space, the skin tone of faces was manipulated (five skin tones ranging from darker to lighter) during the encoding phase, and participants were required to choose the correct skin tone from seven possible standardized choices. The data were aggregated into a superparticipant, and the distribution of choices was fit using the perturbation model. The pattern of results for each of the studied skin tones was predicted well by the perturbation process, although there was variation in the parameter values across the five skin tones. The implications of modeling errors for facial recognition, as well as practical applications for eyewitness identification, are discussed.

• EMOTION AND MEMORY •

(3091)

**Recognition of Emotion Words: A Result of Processing Fluency?** PAULA HERTEL, *Trinity University*, CARISSA A. ZIMMERMAN, *Florida State University*, & REBECCA GRIDER, *Trinity University*—We report three experiments on recognition of emotionally negative or neutral words. Single words, studied alone in Phase 1, completed sentence stems presented in the recognition test; the stems varied in the extent to which they predicted the words (as in Whittlesea, 2002) and in their degree of negative emotion. In two experiments, the “effects” of emotion and predictability were associated more clearly with “remember” than with “familiar” judgments. We also asked whether the recognition advantage for emotion results from a misattribution of processing fluency by instructing half of the subjects to judge emotional valence before judging recognition on each trial. Awareness of valence should discourage fluency misattribution, but it did not dilute the advantage for emotion.

(3092)

**Effects of Age and Emotional Valence on Recognition Memory: A Diffusion Model Analysis.** JULIA SPANIOL, *Rotman Research Institute*, ANDREAS VOSS, *Albert-Ludwigs-Universität Freiburg*, & CHERYL L. GRADY, *Rotman Research Institute*—Several studies have reported age differences in valence effects on memory performance

(e.g., Charles, Mather, & Carstensen, 2003). One recurring pattern is selective age-related decline in memory performance for negative information. The present study examined the mechanisms underlying effects of age and emotional valence on recognition memory performance for faces, pictures, and words. Fits of Ratcliff’s (1978) diffusion model revealed age-related increases in nondirectional response time components and conservative boundary settings. Response bias varied as a function of stimulus material and valence, but these effects were similar in both age groups. Drift rate (rate of information accumulation) showed a crossover age  $\times$  valence interaction: For younger adults, drift was highest for negative information, whereas for older adults, drift was highest for positive information. These findings suggest that age differences in valence effects on recognition emerge at the level of information accumulation and are not due to differences in response bias.

(3093)

**Emotion and False Memory.** CAGLA AYDIN, CHARLES J. BRAINERD, & VALERIE F. REYNA, *Cornell University* (sponsored by Charles J. Brainerd)—We investigated the influence of emotion on false memory for meaning-preserving distractors using the Deese/Roediger-McDermott (DRM) paradigm. Previous research has suggested that positive emotion may foment false memories and negative emotion may suppress them, but little is known about the storage and retrieval mechanisms that are responsible for these effects. A positive, negative, or neutral mood was induced in subjects, using an emotion-rating task. These moods were induced either just before (Experiment 1) or just after (Experiment 2) DRM lists were studied. In both experiments, subjects responded to immediate and delayed recognition tests that implemented conjoint-recognition procedures. The conjoint-recognition model was then used to parse the effects of emotion on three false-memory processes: recollection rejection, phantom recollection, and similarity judgment. The model was also used to parse the effects of emotion on three true-memory processes: identity judgment, erroneous recollection rejection, and similarity judgment.

(3094)

**Retrieval-Induced Forgetting Does Not Occur for Emotional Stimuli.** LARS DEHLI, *University of Oslo* (sponsored by John F. Kihlstrom)—Retrieval-induced forgetting (RIF) is a phenomenon in which the retrieval of an item impairs memory for items associated with the retrieved item. The present study investigated whether, as predicted by some approaches to the study of emotional memory, RIF would be observed for emotional material. The RIF effect was observed both on measures of accuracy and response time with neutral words, but no RIF was observed for words of negative and positive emotional valence. In addition, the inclusion of nonstudied semantically related words in the test phase revealed that RIF was observed only for studied neutral words, suggesting that RIF operates on episodic, rather than semantic, memory.

• COGNITIVE SKILL ACQUISITION •

(3095)

**Aging and Effects of Videogame Training on Cognitive Abilities.** CHANDRAMALLIKA BASAK, WALTER R. BOOT, MICHELLE WEBB, & ARTHUR F. KRAMER, *Beckman Institute, University of Illinois, Urbana-Champaign* (sponsored by Arthur F. Kramer)—A substantial body of literature suggests that the transfer of training is often fairly narrow. However, recent work suggests that video game training can engender broad transfer and is capable of improving a number of visual and attentional skills. The present research seeks to extend these results by examining whether video game training can improve a variety of cognitive abilities, including executive control. The participants were either trained in a commercial integrative video game (training group) or not (control group). Participants were trained on “Rise of Nations,” a complex real-time strategy game that incorporates elements of spatial memory, visual search, and executive control. Cognitive abilities were assessed before, during, and after training; structural MRIs were collected before and after training. This study allows

observation of the effects of video game training, if any, on cognitive abilities and brain structure in both younger and older adults.

(3096)

**Of Mice and Movement: Using a Computer Mouse in the Serial Reaction Time Task.** MARC V. RICHARD, BENJAMIN A. CLEGG, & CAROL A. SEGER, *Colorado State University*—Three serial reaction time (SRT) task experiments investigated representations of sequence information within and across motor response modalities. The traditional SRT responses are keypresses. We introduced mouse responding to examine transfer between response types, as well as mouse response characteristics. Experiment 1 examined transfer between mouse and key responding, and vice versa. Sequence knowledge did not transfer between response modalities. One important difference between keypress and mouse responses is the lateral mouse movement. In Experiment 2, we investigated whether such lateral movements play a role in mouse learning, and found complete transfer between sequences preserving a pattern of right–left movements, despite changing specific sequence elements. Experiment 3 further established the learning of sequenced right–left mouse movements when that sequence was the stimuli’s only regularity. Future work should examine whether sequenced lateral movements are represented abstractly within the movement hierarchy. If so, other effectors may also utilize this information.

(3097)

**A Cognitive Antidote to Inhibition: Data Entry Under Conditions of Prolonged Work.** JAMES A. KOLE, ALICE F. HEALY, & LYLE E. BOURNE, *University of Colorado, Boulder*—In two experiments, we explored the basis for a speed–accuracy trade-off (decrease in both accuracy and response time across trials) found by Healy, Kole, Buck-Gengler, and Bourne (2004) to affect performance in a data entry task. In Experiment 1, a cognitive stressor (articulatory suppression) and a motoric stressor (wrist weights) were independently added during the task of data entry, with the combination of stressors yielding a decline in accuracy across blocks and with the cognitive stressor enhancing the speed–accuracy trade-off. In Experiment 2, mental multiplication and simple data entry tasks were compared, and the presence of feedback was manipulated. Accuracy improved both with mental multiplication and with feedback, suggesting that cognitive complications can serve as an antidote to boredom and that motivation provided by feedback can also overcome the decline in accuracy due to prolonged work.

(3098)

**Fowr + Siks: Pseudonomophones and the Impact of Phonological Codes in Solving Simple Arithmetic Problems.** MARTHA A. ROBERTS, JO-ANNE LEFEVRE, MARCIE PENNER-WILGER, & VELIAN PANDELIEV, *Carleton University* (sponsored by Jo-Anne LeFevre)—According to multiple-code models of simple arithmetic, adults’ solutions are affected by input format (e.g., digits, number words) because each format selectively or differentially activates particular internal codes. In particular, presentation of arithmetic problems as words (e.g., four + six) is assumed to result in the activation of reading-based or phonological codes, but there is disagreement on how such codes influence stages of processing (i.e., encoding, calculation, or answer production). We used pseudonomophones of number words, or *pseudonomophones* (i.e., nonword items that sound like real words, such as *wun*, *fowr*, or *siks*) as an input format that requires the use of phonological codes. Performance with pseudonomophone problems (e.g., *fowr* × *siks*) was compared with performance on digit and word problems (e.g.,  $4 \times 6$  and four × six, respectively). Results are discussed in terms of the interaction between separate visual word recognition and number-processing systems.

(3099)

**Choking and Excelling Under Pressure in Perceptual Classification: Contrasting Novice and Expert Performance.** DARRELL A. WORTHY, W. TODD MADDOX, & ARTHUR B. MARKMAN, *Uni-*

*versity of Texas, Austin* (sponsored by W. Todd Maddox)—We explored ways that pressure causes novice and expert performance in a learning task to get worse (choking) or better (excelling). In Experiment 1, pressure caused novices to choke when learning rule-based categories, but to excel when learning information integration categories (Markman, Maddox, & Worthy, in press). These data support a distraction theory of choking over a monitoring theory of choking, because working memory enhances learning of rule-based categories but interferes with learning of information integration categories. Experiment 2 examined expertise by having participants train in the classification task to asymptote under nonpressure conditions. Then, a strong pressure manipulation was introduced. The performance criterion used to induce pressure affected the magnitude and direction of the pressure effect for rule-based and information integration classification. Implications of this work for theories of performance pressure are discussed.

(3100)

**Individual Differences in Statistical Learning and Language.** JENNIFER B. MISYAK & MORTEN H. CHRISTIANSEN, *Cornell University* (sponsored by Morten H. Christiansen)—There is evidence of systematic individual differences in statistical learning performance, as well as other research that implicates this skill in language acquisition. But the source(s) for such variation and its relationship to language have been heretofore unexplored. In this study, a large group of monolingual native English speakers were administered statistical learning tasks employing two kinds of artificial grammars, and they were assessed on a battery of tasks measuring sentence processing, reading experience, vocabulary, working memory capacity, sequential digit recall, fluid intelligence, and cognitive motivation. Beyond straightforward correlation analyses, the resultant data were used to address various subquestions of interest such as, for example, whether sensitivity to particular kinds of statistical regularities predicts a learner’s ability to process different types of sentence constructions. These and other patterns of findings are discussed with respect to illuminating the nature of human statistical learning and its relation to language and other cognitive factors.

• MOTION PERCEPTION AND MULTISENSORY INTEGRATION •

(3101)

**On the Influence of Movement Planning, Initiation, and Execution on Motion Perception.** JAN ZWICKEL, *Max Planck Institute for Human Cognitive and Brain Sciences*, MARC GROJEAN, *Universität Dortmund*, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—Previous research has demonstrated that perceived motion directions are repulsed by concurrently produced movement directions. In the present experiments, we sought to determine what aspect of movement (planning, initiation, and/or execution) underlies this effect. Participants were asked to plan a hand movement in a particular direction and to execute it as soon as a tone was presented. Independent stimulus motions that varied in direction were presented during the planning, initiation, or execution phase of the movements. A repulsion effect was obtained, but only when movement execution overlapped with motion processing. The results of a subsequent experiment, in which a static line that varied in direction appeared at different times during movement execution, revealed that the size of the repulsion effect remained unchanged with respect to the phase of movement execution. Unlike other action/perception effects (e.g., action effect blindness), movement planning/initiation fails to induce a repulsing effect on motion perception.

(3102)

**Multimodal Enhancement, Motion, and the Dynamic Capture Effect.** TAMARA L. Y. BOND & RANDOLPH D. EASTON, *Boston College*—Stimuli in motion may trigger binding rules, and/or neural pathways, for the perception of a unified multimodal object similar to those triggered by stationary stimuli. This report examines the ability

of individuals to localize a vehicle in motion using auditory, visual, directionally matched, and directionally mismatched bimodal stimuli at spatially coincident points in space. Vehicles were presented using audio, video, and bimodal audiovisual tracks. Participants pressed a button indicating the direction of motion when they perceived each vehicle crossing their midline. Preferential attention to auditory and visual information was manipulated. Enhancements in localization performance were observed for directionally matched bimodal stimuli in comparison with unimodal stimuli. Multimodal enhancement was particularly strong during preferential attention to auditory information if the participant mistook directionally mismatched information as matching and traveling in the direction of visual information but absent when the mismatch was identified.

(3103)

**Can Humans Transfer an Object's Representation Across Modalities?** YOSHIYUKI UEDA & JUN SAIKI, *Kyoto University*—This study investigated the sharing and transference of object representations across visual and haptic modalities. Participants were presented with novel stimuli composed of six identical LEGO bricks, from various views along the vertical axis of the stimuli in one of two modalities (visual or haptic). Then they were asked whether the test stimuli were the same as the studied object, regardless of viewpoint differences. The test stimuli were presented from a certain viewpoint either along the vertical axis (the same as the view in training) or along the horizontal axis (the orthogonal rotation) in one of these two modalities. The accuracy in recognizing the test stimuli was significantly lower when transferring from haptics to vision than when transferring from vision to haptics. Furthermore, vision was much more affected by viewpoint changes than was haptics. The results suggest that it is quite difficult for humans to form modality-independent representations.

(3104)

**Cue Weighting Is Affected by the History of Cue Relations Across Trials.** JENNIFER L. CAMPOS, ASHLEY M. TOWNS, & HONG-JIN SUN, *McMaster University* (sponsored by Lorraine G. Allan)—This study assessed the relative contributions of visual (optic flow) and proprioceptive/efferecent copy information to self-motion perception using virtual reality. Subjects wore a head-mounted display and rode a stationary bike along a straight path in an empty, seemingly infinite hallway with a random surface texture. Subjects traversed a standard distance and a comparison distance and judged which of the two was longer. The relation between visual and proprioceptive cues was made incongruent by changing the optic flow gain (OFG). Results indicate that relative cue weighting was affected by the frequency with which the cue relations were varied. Specifically, an approximately equal weighting of cues was observed for low OFG variability, whereas a visually dominated response was observed for high OFG variability. This suggests that a dynamic reweighting of cues occurs in response to the recent history of cue relations. These findings support and expand upon currently proposed models of optimal cue integration.

(3105)

**Multisensory Activation of the Intraparietal Area When Classifying Grating Orientation: An fMRI Study.** RYO KITADA, *Queen's University*, TOMONORI KITO, *Juntendo University*, DAISUKE N. SAITO, *National Institute for Physiological Sciences, Japan*, TAKA-NORI KOCHIYAMA, *Kagawa University*, NORIHIRO SADATO, *National Institute for Physiological Sciences, Japan*, & SUSAN J. LEDERMAN, *Queen's University* (sponsored by Susan J. Lederman)—Humans can judge grating orientation using either touch or vision. The present study utilizes functional magnetic resonance imaging during the classification of grating orientations to evaluate the neural substrates responsible for the multisensory processing of orientation. We hypothesized that a region within the intraparietal sulcus (IPS) would be engaged in processing orientation, regardless of the sensory modality. Sixteen subjects classified the orientations of passively presented gratings and performed two control tasks, all with both right and left

hands. Tactile orientation classification with either hand activated regions around the right IPS when contrasted with roughness classification of the same stimuli. In contrast, visual orientation classification activated a part of the right IPS that was also activated by the tactile orientation task, when contrasted with color classification of the same stimuli. We suggest that a part of the right IPS is engaged in the multisensory spatial processing of grating orientation.

(3106)

**Modality Effects in Sentence Recall.** PAULA GOOLKASIAN & PAUL W. FOOS, *University of North Carolina, Charlotte*—The present work examined the intrusion of lures into sentence recall when the modalities of distractor word lists and sentences were manipulated separately. Conceptual regeneration of the sentence during recall predicts a higher rate of lure intrusions than spontaneous intrusions in all conditions. If, however, surface information is remembered, then the modality of sentence and list should influence intrusions. The results show that both factors are important, since intrusions were always higher when lures were contained in the distractor word list and when visual rather than auditory sentences were recalled. However, the auditory–visual difference in intrusion rates was influenced by same or different modality of the stimulus materials. Modality effects influenced performance on all measures, suggesting that the obtained effects may be due to differences in the processing of auditory and visual input.

(3107)

**Face/Voice Congruity and Impression Formation.** MARILYN G. BOLTZ, *Haverford College*—Although past research has shown that initial impressions are influenced by both facial and vocal characteristics, much of this work has examined one modality independently of the other. The aim of the present research was to investigate the joint impact of faces and voices when these display congruent versus incongruent relations. In Experiment 1, participants were presented with face/voice pairs that were (in)congruent in their level of attractiveness or maturity, and asked to rate each for degree of fitness (i.e., emotional stability, physical health, intelligence) and social desirability (i.e., trustworthiness, likeability, behavioral consistency). Results showed that incongruent relations led to more negative impressions than did congruent ones, and for the former, vocal variations had a greater impact than did facial variations. Two subsequent experiments converged upon and extended these findings by more closely examining those impressions associated with maturity (in)congruence. Some explanations for the congruity and vocal dominance effects are offered.

• SPATIAL COGNITION •

(3108)

**Do Mental Maps Have to Be Seen? Evidence From the Blind and Sighted.** ALISON F. EARDLEY, PIERRE-EMMANUEL MICHON, & GEOFFREY EDWARDS, *Université Laval*, & JOHN M. KENNEDY, *University of Toronto, Scarborough* (sponsored by John M. Kennedy)—The sighted are able to construct allocentric mental maps of a spatial environment not only through active navigation (e.g., Tolman, 1948), but also when simply listening to a verbal description of that environment (Taylor & Tversky, 1992). It has been argued that, without vision, the blind are restricted to largely egocentric spatial representations (e.g., Millar, 1994; Thinus-Blanc & Gaunet, 1997). In this study, 20 individuals profoundly visually impaired from infancy and 20 sighted individuals carried out an adapted version of the Taylor and Tversky (1992) paradigm. Their capacity for allocentric spatial representation was compared by examining the tactile maps they produced for each of four spatial environments. Results showed that the blind participants were able to produce accurate tactile maps. However, subgroups were identified. Thus, even without vision, the blind are able to generate adaptive allocentric representations of space. This is discussed in context of current theories of spatial cognition.

(3109)

**Perceiving Action Changes Spatial Perspective.** SANDRA C. LOZANO, BRIDGETTE MARTIN HARD, & BARBARA TVERSKY, *Stanford University*—Perceiving another's actions changes the spatial perspective people adopt in thinking about objects in a scene. This could happen because people encode observed actions by mapping them to representations of their own bodies and actions. If so, perspective taking should be modulated by action experience. In the present studies, observers viewed a photograph depicting an actor and two objects and answered a question about the location of one object relative to another. The likelihood of action in the scene, the plausibility of the actions performed, and the degree to which observers had performed the actions themselves were manipulated. Observers tended to use a self-perspective when the action was unlikely or implausible, or when observers lacked experience with the action. However, observers used the actor's perspective when action was likely or plausible, or when they had direct experience performing the actions themselves.

(3110)

**Maintaining Perspectives and Building Spatial Mental Models.** A. REYYAN BILGE, TAD T. BRUNYE, & HOLLY A. TAYLOR, *Tufts University*—Humans experience the world from two primary perspectives—the within-environment route perspective (e.g., navigation, first-person description), and the above-environment survey perspective (e.g., maps, bird's-eye description). Two experiments investigated the extent to which mental representations differ as a function of acquisition perspective. Experiment 1 examined spatial updating in nested environments (i.e., room within a campus) after learning from navigation or maps. Results demonstrated differential promotion of proximal and remote environment details as a function of learning from navigation and maps, respectively. Experiment 2 examined the effect of differential study time on mental models formed from route or survey descriptions. Results demonstrate a main effect of study time, but no interaction with description type, suggesting that forming abstract spatial representations is taxing regardless of acquisition perspective. Taken together, Experiments 1 and 2 demonstrate both perspective influence in environmental mental representations and the complex nature of forming abstract spatial mental models, respectively.

(3111)

**Do People Exhibit Perceptual Adaptation to Environmental Scale?** CHRISTINE ZIEMER, JODIE M. PLUMERT, JAMES F. CREMER, & JOSEPH K. KEARNEY, *University of Iowa*—We examined whether people perceive the same distances differently after exposure to environments that differ in scale. During adaptation, participants made 20 distance estimates in either a large, medium, or small "cave" in an im-

mersive virtual environment. On each trial, participants saw a target 6–18 m away that disappeared after 4 sec. Participants then attempted to move to the location using a joystick with either their eyes closed or open, after which they received visual feedback about their estimate. During test, all participants made estimates about the same five distances in the medium cave with their eyes closed and without feedback. Distance estimates made during adaptation did not differ across the three caves. At test, however, participants who had initially experienced the large environment judged the same distances as longer than did participants who had initially experienced the small environment. Explanations for this perceptual adaptation effect are discussed.

(3112)

**Is the Iron Curtain Still Present? Characteristic Distance Distortions in Germany.** CLAUS-CHRISTIAN CARBON, *Universität Wien*—A study about distance estimations between German cities investigated the organization of mental maps and their specific deviations from reality (Carbon & Leder, 2005). Potential factors for the deviation of mental maps from reality are physical barriers, emotional involvement, and semantic unity. Distance estimations between cities situated in different former parts of Germany (East or West) were systematically overestimated in comparison with distances of cities located within the same part of Germany. This trend was even strengthened when participants had a negative attitude to the reunification of Germany. The impact of these results is far reaching, because overestimated distances between both German parts indicate that there still exists a mental gap between East and West, even in young people, 14 years after the German reunification.

(3113)

**Rapid Prototyping of Visual Scenes: Evidence for View Combination in Scene Recognition.** DAVID WALLER, *Miami University, Ohio*, ALINDA FRIEDMAN, *University of Alberta*, & NATHAN GREENAUER & ERIC HODGSON, *Miami University, Ohio*—Two experiments examined people's ability to recognize views of a computer-generated 3-D environment that depicted a real-world scene. Participants learned to recognize the scene from four training views that surrounded an untrained central viewpoint location. Two of the trained scenes were depicted from viewpoints that were separated from the central view by 15° in azimuth; two were separated by 15° in elevation. At test, participants recognized the untrained central view more quickly and accurately than the trained views. A second experiment replicated this effect and showed that the view combination processes implicated by it were sensitive to the central view very early in testing. This implies that view combination does not occur as the result of prolonged exposure to the central view during test, but rather occurs rapidly, perhaps before the test trials have begun.

## POSTER SESSION IV

Ballroom of the Americas, Saturday Noon, 12:00–1:30

## • JUDGMENT AND DECISION MAKING •

(4001)

**Estimation Biases in Correlation Estimation and Illusory Correlation.** RICHARD B. ANDERSON & MICHAEL E. DOHERTY, *Bowling Green State University*—A number of previous studies demonstrate a tendency for people to underestimate the magnitude of sample correlations. In a procedure that explicitly assesses people's ability to infer population correlations from random samples, and using a methodology that allows direct comparison of subjective to objective correlation, participants were shown varying sequences of  $x,y$  data pairs that were randomly sampled from populations that varied in the degree of  $x,y$  correlation. The results confirmed and extended the underestimation phenomenon described above. Additional research, in progress, examines correlation estimation within an illusory correlation paradigm—i.e., one in which the population correlation is precisely zero—to assess whether illusory correlation is influenced by the presence or absence of random sampling.

(4002)

**The Influence of Cognitive Load on Guilty Verdicts: Operation Span Matters.** HEATHER M. KLEIDER & LESLIE RIDDICK, *Georgia State University*—The extent to which cognitive load influences a juror's ability to objectively review the facts in a criminal case when the suspect's ethnicity is congruent with the crime is investigated. Jones and Kaplan (2003) found that white participants more often convicted a black suspect when the crime was race congruent (e.g., grand-theft auto) than when it was race incongruent (e.g., embezzlement). In this study, operation span was measured, and then participants performed a dual task (load) or not (no load) while making judgments of guilt, sentencing, and confidence in their decision about criminal cases. The results showed that suspects were more often found guilty in the load than in the no-load condition, regardless of ethnicity, with no effect on sentencing. Conversely, low- compared to high-span participants more often found black than white suspects guilty when "loaded" and were more confident of their decision. This suggests that increased cognitive demands and reduced capacity may influence the reliance on stereotypes when making juror-type decisions.

(4003)

**Wording Effects on the Understanding and Use of Uncertainty Information.** SUSAN L. JOSLYN, LIMOR NADAV-GREENBERG, & MENG U. TAING, *University of Washington*—Interpretation of uncertainty has been shown to be dependent on the outcome it describes (Weber, 1994; Windschitl & Weber, 1999). The work reported here extends that finding beyond the outcome to the overall task. In four studies, we demonstrated that the same amount of uncertainty describing similar outcomes can be misinterpreted altogether, interpreted differently, or lead to decision biases depending on the task. Participants were given the upper and lower bounds of the 90% predictive interval and asked to make threshold weather forecasting decisions. The results indicated that the crucial factor was the match between the verbal expression and the relevant threshold. Errors increased when there was a mismatch between the phrase (e.g., winds less than 20 knots) and the task (e.g., post an advisory when winds exceed 20 knots). Surprisingly, framing, emphasizing the positive or the negative outcome, had little effect. Frequency expressions provided some advantage over probability expressions.

(4004)

**A Signal Detection Analysis of the Recognition Heuristic.** TIMOTHY J. PLESKAC, *Universität Basel*—The recognition heuristic uses a recognition decision to make an inference about an unknown variable in the world. Theories of recognition memory typically use a signal detection framework to predict this binary recognition decision. In

this poster, I integrate the recognition heuristic with signal detection theory to formally investigate how judges use their recognition memory to make inferences using this heuristic. The analysis reveals that false alarms and misses systematically influence the performance of the recognition heuristic. Furthermore, to exploit the structure of information in the environment, judges should adjust their recognition response criterion according to their experience with the reference class. Finally, the less-is-more effect is found to depend on the sensitivity between experienced and novel items and on the distribution of cue knowledge. Theoretical implications of this bridge between the recognition heuristic and models of recognition memory are considered.

(4005)

**The Alternative-Outcomes Effect and Bayesian Belief Updating.** KUNINORI NAKAMURA & KIMIHIKO YAMAGISHI, *Tokyo Institute of Technology* (sponsored by Kimihiko Yamagishi)—This study proposes a Bayesian interpretation to the alternative-outcomes effect (Windschitl & Wells, 1998). The alternative-outcomes effect refers to a phenomenon that the probability judgment of a "focal" outcome is often sensitive to variations in the distribution of alternative outcomes, even when such variations have no bearing on the objective probability of the focal. The previous studies have assumed the probability judgment task to be a calculation of ratio of the focal outcome, and positioned the alternative-outcomes effect as a bias in probability judgment. In contrast, this study formalizes the alternative-outcomes effect as a result of Bayesian belief updating. On the basis of this formalizing, we reanalyzed data in previous papers and performed a new experiment. All results of this study consistently supported our Bayesian interpretation.

(4006)

**A Multiprocess Account of Hindsight Bias in Children.** UTE J. BAYEN, *University of North Carolina, Chapel Hill*, RÜDIGER F. POHL, *Universität Mannheim*, CLAUDIA MARTIN, *Universität Würzburg*, & DENNIS BOYWITT, *University of North Carolina, Chapel Hill*—Hindsight bias is the phenomenon whereby, after people are presented with the correct response to a question, their judgment regarding their own past response to this question is biased toward the correct response. In our experiment, 191 participants (9-year-olds, 12-year-olds, 15-year-olds, and adults) gave numerical responses to general-knowledge questions (e.g., "How many teeth does a dog have?") and later attempted to recall their responses. For some questions, the correct response was provided during recall. We observed age-related differences in memory and hindsight bias. For all age groups, multinomial model-based analyses revealed a bias to use the correct response to reconstruct the original response. In addition, the youngest group showed a memory impairment caused by the presentation of the correct response as well as an increased belief that they knew the exact correct response all along. These results support a multiprocess explanation of hindsight bias in children.

(4007)

**Decoy Effects in Preferential Choice Across the Adult Life Span.** MARK E. FAUST, *University of North Carolina, Charlotte*, & KRISTIS. MULTHAUP, PATRICIA A. BROOKS, SARAH FREY, BLAIR HICKS, ROBBIE MAUNEY, & CHARLOTTE WILLIAMS, *Davidson College*—When asked to choose an ice cream from {vanilla, chocolate} or {vanilla, chocolate, strawberry}, people who choose vanilla from one set and chocolate from the other demonstrate an irrational preference reversal due to the addition of a decoy (i.e., strawberry). The literature on young adult preferential choice has discussed three major decoy effects (attraction, similarity, compromise), but data sets including older people are few and focus on attraction effects. Participants ( $N = 178$ , age range, 18–92 years) chose between automobiles that hypothetical experts had rated on performance and economy. Attraction and similarity effects varied by age group; the compromise effect did not. Moreover, the pattern of significant intercorrelations of the decoy effects differed across age groups. The present results

contrast with those of a recent study that used greater within-choice-set similarity, suggesting that item similarity is an important aspect of age-related differences in decoy effects in preferential choice.

(4008)

**An Analysis of the MINERVA-DM Model of Likelihood Judgments.** DAVID G. SMITH & PETER J. KWANTES, *Defence Research and Development Canada*—MINERVA-DM (Doherty, Gettys, & Ogden, 1999) is an extension of the MINERVA model of human memory intended to mimic human likelihood judgments. The model has been successful in modeling the results of many classic experimental paradigms and is able to capture disparate results using a common mechanism. One barrier to the model's broad acceptance is that it is a simulation model and, hence, predictions depend on using Monte Carlo techniques. In analyzing the model, we have been able to find closed-form solutions for the model's expected behavior in several paradigms. We also discuss possible modifications to the model's assumptions, which, though still capturing the data and staying true to the spirit of the model, could simplify its application.

(4009)

**Encoding and Assessment of Probabilities.** DANIEL S. LEVINE, *University of Texas, Arlington*, STEVEN ESTRADA & BRITAIN A. MILLS, *Cornell University*, & IFE TOGUN, *University of Texas, Arlington*—To understand gambling tasks, we asked: How accurately do humans encode frequencies if not explicitly asked to? Is accuracy different if the question is framed in terms of frequency versus probability? Do distracting tasks or affective loadings change accuracy? Do affective judgments reflect expected gains or losses? Participants were shown red or green cards in sequence (proportion varied across participants), then asked either the probability or the frequency of either red or green. Accuracy was lowest with probabilities around .7, greater for frequency than for probability questions, and greater for the less frequent than the more frequent color. Adding distracting tasks or hypothetical monetary gains or losses did not affect accuracy. We are now testing choices between gambles with probabilities learned by feedback. Afterward, participants are asked either (1) which gamble they would choose given one choice with real money or (2) how they would allocate 100 choices, and about their affect toward each gamble.

(4010)

**Intuitive  $t$  Tests: Lay Use of Statistical Information.** NATALIE A. OBRECHT & GRETCHEN B. CHAPMAN, *Rutgers University* (sponsored by Gretchen B. Chapman)—Normatively, the statistical power of a pairwise comparison is determined by the mean scores, the standard deviation of those scores, and the sample size. In our experiment, 279 undergraduates compared product pairs and judged their confidence that one product was better than the other. We experimentally manipulated (within subjects) the average product ratings, the number of raters (sample size), and the standard deviation of the ratings. Each factor had two levels selected so that the same change in statistical power resulted from moving from the low to the high level. We also manipulated (between subjects) presentation of product information as numerical only or numerical + visual. Subjects gave the most weight to mean product ratings, less weight to sample size, and very little weight to standard deviation. Subjects in the numerical + visual condition actually reversed the weighting of standard deviation (i.e., they assigned higher confidence when the standard deviation was high).

(4011)

**Inferior Parietal Lobule Supports Decision Making Under Uncertainty in Humans.** TIMOTHY J. VICKERY & YUHONG V. JIANG, *Harvard University* (sponsored by Yuhong V. Jiang)—Many decisions faced by humans are inherently uncertain, yet we are able to choose well by considering prior choice outcomes. Previous studies suggest that the parietal cortex is involved in this process, yet uncertainty is

often confounded with increased attentional effort. To dissociate decision making from attentional effort, we used fMRI to measure brain activity while participants played a “matching pennies” game. We found that the inferior parietal lobule showed higher activity when the decision was uncertain rather than certain and when humans were informed of prior choice outcomes than when they were not. Crucially, increasing attentional load by adding a secondary task reduced inferior parietal activity, suggesting that general attention does not drive its activity. These results are contrasted with those from medial superior frontal gyrus, which showed increased activity under attentional load. We suggest that decision making under uncertainty is dissociable from general attentional processes in the human brain.

(4012)

**External Indication of an Internal Decision.** GERALD A. EPLING, *MindJava*—It can be very difficult to detect when action will back up an expressed intention to accomplish an act. Fortunately, the distinction between a casual, noncommittal intention to do something and an intention backed by a decision to take action can be seen in the electrophysiological response of an animal preparation. The replication and expansion of an earlier observation of the response of a chicken egg to human intention is presented along with the parameters that lead to the observations.

• CATEGORY LEARNING •

(4013)

**Learning Relational Categories Is Easier Than Learning Featural Categories.** MARC T. TOMLINSON & BRADLEY C. LOVE, *University of Texas, Austin* (sponsored by Bradley C. Love)—We present results from a series of experiments that demonstrate that it is easier to learn relationally defined categories than featurally defined categories. The stimuli consisted of pairs of circles. The categories were defined by a logical exclusive or of the features (overall size and brightness) or the relations (which circle is bigger and which is brighter). Even though the features needed to be processed to appreciate the relations, relationally defined categories were easier to learn. A second set of experiments ruled out a relative processing explanation that attributes the results to difficulties in encoding absolute stimulus values (the relations are defined by relative comparisons). Manipulations used in the second set of experiments included providing a reference circle and pretraining participants in an identification task. The manipulations remove the need for or enable absolute processing. A third set of experiments suggests that the relational advantage arises from flexible recoding of the stimuli.

(4014)

**Explanation as Category Learning.** SETH CHIN-PARKER, OLIVIA HERNANDEZ, & MURRAY MATENS, *Denison University*—In the present study, we examined how individuals used explanations to learn about novel social categories. In each trial of explanation learning, the participant saw a description of an individual consisting of four characteristics along with the category label and was asked to explain why this particular individual belonged to the category indicated. The characteristics varied in how they related to the category essence (each category was constructed to represent a different personality type, either caring or social) and how predictive the specific characteristic was of the category membership. We analyzed the participants' explanations to see how the different types of characteristics were used to construct the explanations. We also compared the learning outcomes of explanation learning with those of classification learning. The same materials were used in both learning conditions, but we found that the participants in the two learning conditions focused on different information about the categories.

(4015)

**Stimulus Generalization in Category Learning: Implications for Selective Attention, Similarity, and Category Representation.** MATT

JONES, W. TODD MADDOX, & BRADLEY C. LOVE, *University of Texas, Austin*—Theories of category learning differ regarding how people generalize from past instances to each new stimulus, yet there has been no direct method for measuring stimulus generalization in this paradigm. We describe such a method, based on sequential analyses of learning data. Comparison of the empirical generalization gradient across different category structures allows tests of attentional learning theories. Analysis of a task with four categories shows that multiple generalization gradients are simultaneously active within a single judgment, posing a strong challenge to similarity-based theories of generalization. Finally, a series of experiments shows that the contribution of generalization from recent stimuli is qualitatively different from that of information from earlier trials. This suggests that categorization is subserved by separate short- and long-term processes, and furthermore that much past evidence for exemplar-based models of categorization reflects short-term processes and not the nature of category representations in long-term memory.

(4016)

**Individual Differences in Concept Learning.** MATT J. ROBBINS & MARK A. MCDANIEL, *Washington University* (sponsored by Mark A. McDaniel)—Concept learning can be based on associations between instances and paired responses or on abstractions that unify these instances and responses. We hypothesize that individuals differ in their approach and that these individual differences reflect a relatively stable preference. We first identified participants' learning tendencies in a function learning task. After extensive training on a specified range, participants were given extrapolation trials. Based on formal function learning models, we assumed that participants who extrapolated along the function had abstracted the functional relation; those who minimally extrapolated relied on associative/exemplar processes. We next tested a categorization task involving categories for which an abstract relation governed membership. Participants' learning tendencies in the function learning task significantly predicted abstraction acquisition versus exemplar behavior during training, whereas working memory (OSPAN) and nonverbal reasoning (Raven's matrices) did not. The results suggest that individual differences in the use of abstraction or associative/exemplar processes exist in higher order conceptual learning.

(4017)

**Using Motor Responses to Form Categories in a Stimulus Estimation Task.** L. ELIZABETH CRAWFORD & ERIN L. JONES, *University of Richmond*, & JACK L. VEVEA, *University of California, Santa Cruz*—How do physical interactions with objects influence inductive category learning? Sailor and Antoine (2005) and Huttenlocher et al. (2006) had participants view and estimate squares that varied in size. The smaller squares were one color and the larger squares another, thus cuing participants to subdivide the stimulus set into two categories. Estimates of square size were biased toward the center of the distribution, showing no evidence that participants used color to categorize the set for the purpose of estimation. Using similar stimuli, the present study had participants estimate square size by using a different action (buttonpress, mouse movement) to adjust squares from each category. The resulting estimates were biased away from the category boundary, indicating that participants divide the stimulus set into two categories when those categories require different motor responses. Implications for the role of embodiment in category induction are discussed.

(4018)

**Category Load, Structural Alignability, and Category Learning.** JOHN P. CLAPPER, *California State University, San Bernardino*—Theories of unsupervised learning often assume that people can create new categories as needed, with no limit on the number of categories that can be learned and maintained. The present experiment investigated people's ability to learn three categories (instead of the usual two) in an incidental (unsupervised) task. The results showed

that category load had a significant effect on learning. After learning two categories, people showed significantly poorer learning of a subsequent third category. Learning of the first two categories also declined following exposure to the third category. Importantly, this only occurred if the third category had the same overall dimensional structure as the first two; if the categories differed in dimensional structure, no interference was observed. These results raise the real-world question of how people manage to learn and maintain large systems of structurally alignable categories without debilitating interference effects.

(4019)

**Linear Separability and Concept Learning: Eyetracking Individual Differences.** AARON B. HOFFMAN & BOB REHDER, *New York University*—A category learning study using eyetracking measured individuals' attention as subjects learned categories with multiple solutions: The categories allowed subjects to form a linearly separable (LS) concept on the basis of one subset of dimensions or a nonlinearly separable (NLS) concept on the basis of another. We conducted a regression analysis on typicality ratings to estimate relative preferences for LS and NLS category information. Consistent with Blair & Homa (2001), we found large individual differences: 5 out of 18 learners formed LS concepts, 5 formed NLS concepts, and 8 formed concepts with both types of information. Moreover, there was a strong linear relationship ( $r = .90$ ) between regression weight and eye gaze. In contrast to our previous findings (Rehder & Hoffman, 2005), however, in which learners shifted attention after errors were eliminated, we found early attention shifts to those dimension subsets that would eventually form the basis of individuals' category representation.

(4020)

**Learning Cross-Cutting Systems of Categories.** PATRICK SHAFTO, CHARLES KEMP, VIKASH K. MANSINGHKA, & JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology*—Natural domains can be represented in multiple ways: Animals can be organized according to their taxonomic categories or their ecological niches, and foods can be organized according to their nutritional content or the situations in which they are typically eaten. We present a computational model that discovers multiple systems of categories given information about a set of objects and their features. Each system of object categories accounts for a distinct and coherent subset of the features. In our first experiment, we show that the model predicts human performance on an artificial category learning task. In our second experiment, we show that the model discovers interpretable systems of categories given biological data, and that these systems account for inductive judgments about novel animals and novel features. For each of our tasks, we explain why traditional models of categorization and inductive reasoning cannot account for our results.

(4021)

**Category Learning Through Inference and Classification: Attentional Allocation Causes Differences in Mental Representation.** NAOMI SWELLER, BRETT K. HAYES, & BENJAMIN R. NEWELL, *University of New South Wales*—Two experiments examined how attention to different aspects of a category structure during learning can lead to different kinds of category representations. Previous work (e.g., Yamauchi & Markman, 1998) has suggested that learning categories through classification results in a category representation that includes both prototypical and atypical features, whereas learning through feature inference results in a representation based primarily on prototypical features. Both studies found that differences between the representations formed during inference and classification depend on the degree to which each task requires attention to atypical category features. Inference learning that required attention to atypical features led participants to incorporate both prototypical and atypical features into their representations. These findings suggest that previous work may have overestimated the degree to which inference learning differs from classification learning.

(4022)

**Stages of Category Learning in Humans and Rhesus Monkeys (*Macaca mulatta*).** JOSHUA S. REDFORD, WILLIAM P. CHAPMAN, & J. DAVID SMITH, *SUNY, Buffalo*, & DAVID A. WASHBURN, *Georgia State University* (sponsored by J. David Smith)—Dot distortion categorization in humans seems to be a two-stage process. During the first stage, knowledge of a category's prototype is abstracted in order to classify items. The second stage involves exemplar memorization of to-be-categorized items. With the present paradigm, we explored this categorization model across species. Both humans and 2 rhesus macaques (*Macaca mulatta*) replicated this pattern using multiple sets of dot-distortion stimuli consisting of typical and atypical category exemplars. These 2 monkeys clearly demonstrated that exemplar memorization was a more difficult cognitive process to employ since it took much longer than prototype abstraction. A 3rd monkey was a testament to the fragility of exemplar memorization by failing to successfully memorize exemplars despite highly accurate abstraction-based categorization. The same individual differences were also observed in humans.

• DISCOURSE COMPREHENSION •

(4023)

**The Influence of Dynamic and Static Spatial Abilities and Learning Complex Scientific Concepts.** CHRISTOPHER A. SANCHEZ & JENNIFER WILEY, *University of Illinois, Chicago*—Given the very physical and spatial nature of much science content, learners' abilities to visualize, manipulate, and animate spatial information in mental models may be an important determinant of their comprehension. The present study examined the influences of dynamic and static spatial ability, in addition to that of working memory capacity, on the comprehension of a complex scientific text on volcanic eruptions. Participants read a text explaining the processes that underlie volcanic eruptions that was nonillustrated, was illustrated with relevant static illustrations, or contained animated versions of the static illustrations. Participants were later evaluated on their understanding of a causal model of volcanic eruptions with several different learning measures. The results indicated that both dynamic and static spatial abilities predicted understanding of a complex scientific topic. In addition, these abilities interacted with the type of illustrations viewed by the participants.

(4024)

**The Influence of Temporal Shifts on Long- and Short-Term Goals.** DAVID E. COPELAND, *University of Nevada, Las Vegas*, & ANGELINA M. COPELAND, *University of Notre Dame*—Research with narratives has demonstrated that readers monitor time changes and keep track of characters' goals as long as they remain relevant. For example, people typically keep characters' goals more accessible when they are unsatisfied. This study examined the extent to which people keep track of goals that vary in their level of immediacy and how time shifts affect them. For example, cooking a healthy dinner is a much more immediate, or short-term, goal than losing twenty pounds, which is much more of a long-term goal. This study examined the accessibility of these types of goals across either short or long time shifts (e.g., a moment later/two months later). The results showed that, interestingly, after long time shifts short-term goals seem to be more accessible than long-term goals. These findings are considered in the context of situation models.

(4025)

**Hemispheric Processing of Words: The Effects of Single Versus Multiple Primes.** LAURA MOTYKA & SANDRA VIRTUE, *DePaul University*—Previous research indicates that the left hemisphere (LH) and right hemisphere (RH) differentially process semantic information. For example, the RH shows greater priming when targets (e.g., *cut*) are preceded by distantly related primes (e.g., *cry, foot, glass*), whereas the LH shows greater priming when targets (e.g., *cut*) are preceded by closely related primes (e.g., *scissors*) (Beeman et al., 1994).

In the present study, we utilized the divided visual field paradigm to examine how the number of primes influences hemispheric facilitation. Specifically, we presented single primes (Experiment 1) and multiple primes (Experiment 2) from Beeman et al. during a lexical decision task. The results suggest that the number of primes influences how the LH and RH process semantic information.

(4026)

**Language Comprehension After Brain Injury.** CONNIE SHEARS, *Chapman University*, & VANESSA MILLER, *University of California, Riverside*—Survivors of acquired brain injury (ABI) have shown reduced ability to draw inferences from planning knowledge relevant to physical knowledge (Shears & Chiarello, 2004). These findings were based on two-sentence texts specified for knowledge domain. Here, we investigated whether survivors maintain these inference abilities for physical text relevant to planning text when reading longer, more natural, text. Two-sentence texts were converted to four-sentence texts and were normed in a noninjured population to rely upon physical or planning-knowledge domains. Inference processes for survivors were measured by probe word reorganization and answers to knowledge-validating questions. The results show that under more natural reading conditions survivors maintain comprehension via inferences from physical knowledge. However, survivors show deficits in inference processes that support comprehension of planning knowledge. These findings indicate that survivors maintain inference abilities for physical knowledge relative to planning knowledge. Cognitive rehabilitation depends upon specifying the deficits in comprehension. We offer survivors and rehabilitators insight into language comprehension deficits and potential retraining.

(4027)

**Alliteration and Resonance in Poetry Comprehension.** R. BROOKE LEA, *Macalester College*, & DAVID N. RAPP & ANDREW ELFENBEIN, *University of Minnesota, Twin Cities*—When we read poems, lines of verse can evoke thoughts, feelings, and memories. But how do particular poetic cues drive such evocations, and can the operation of those cues be explained by existing accounts of human information processing? We propose that general models of memory might provide insight into how these cues drive moment-by-moment experiences of poetry. We investigated the role of one of these types of cues, alliteration, to assess its effects on on-line processing of both poetic and prose texts. Alliteration is an important poetic cue that is often associated with helping readers to relate disparate concepts or ideas across sections of poetic verse, even without readers' strategic awareness of doing so. Two poetry reading experiments and one prose reading experiment support the hypothesis that memory-based theories of language processing such as resonance can help us understand the workings of alliteration, one of the oldest known poetic devices.

(4028)

**What Prior Knowledge Can and Cannot Do During Text Comprehension.** DAVID N. RAPP, *University of Minnesota, Twin Cities*—Readers' prior knowledge can facilitate text comprehension, but does prior knowledge reduce the effects of potentially misleading text? This issue was investigated by examining readers' comprehension of stories in which unfolding contexts suggested outcomes consistent or inconsistent with well-known events. Participants read stories that either aligned closely with actual historic events or ran counter to them (e.g., George Washington was hesitant to accept the Presidency after his long years as military commander). In Experiment 1, participants were slower to read story outcomes inconsistent with actual events; nevertheless, participants' reading times still reflected an influence of story contexts. In Experiment 2, names and places in these stories were changed to create unfamiliar contexts with identical plot. Reading times closely mimicked those of Experiment 1, albeit without the inconsistent outcome slowdown. Prior knowledge facilitates text comprehension, but prior knowledge activation does not necessarily inoculate readers from the biasing influence of story contexts.

(4029)

**Individual and Social Factors Contribute to Conversational Perspective Taking.** MIJA M. VAN DER WEGE, RACHEL VALLENS, & LIAM REILLY, *Carleton College*—Two studies were conducted that investigate the role of working memory, empathy, gender, and hierarchical power in conversational perspective taking. People with larger working memory capacity (as measured by the Daneman & Carpenter [1980] reading span test) are more likely to distinguish between items in common ground and items in privileged ground (using the Keysar, Barr, & Horton [1998] object matching task) than people with smaller working memory capacity. Likewise, participants working with conversational partners who were in a position of power over them were more likely to distinguish between common and privileged ground than those whose partners were equals. Empathy (measured by Mehrabian & Epstein's [1972] QMEE scale) and gender had no effect on perspective taking.

(4030)

**Expected Question Difficulty Effects on Comprehension: Interactions With Reader Ability.** KYLE DEMPSEY, YASUHIRO OZURU, & DANIELLE S. MCNAMARA, *University of Memphis* (sponsored by Danielle S. McNamara)—The goal of the study was to examine the effect of instructions given before reading on participants' postreading comprehension. Comprehension was assessed with multiple choice and open-ended questions; each including text-based, local bridging-inference, and global bridging-inference questions. Prereading instructions were designed to vary both the participants' depth of processing and the participants' expected question type (multiple choice vs. open ended). We examined interactions between prereading instructions, text cohesion, question type, prior knowledge, and reading skill. The study included 166 college students. This study showed a two-way interaction between prereading question type instruction and question type performance, revealing an advantage when question type instruction was matched with performance on that question type. There was also a three-way interaction between question type, question depth, and question depth instruction. Finally, when individual difference measures were included in the analyses, fourth- and fifth-order interactions occurred that will be described in the presentation.

(4031)

**Is Counterfactual Meaning Grounded on Sensorimotor Cognition?** MANUEL DE VEGA, MABEL URRUTIA, & YURENA MORERA, *Universidad de La Laguna*—How do we understand counterfactual sentences such as "If I had won the lottery last year, I would have bought a palace"? In this study we compared factual ("Because I am generous, I've lent the novel to my brother") and counterfactual ("If I had been generous I would have lent the novel to my brother") sentences in a double task paradigm. While hearing a sentence, the transfer verb (e.g., *lent*) was visually animated, apparently moving away or toward the participant, and he/she had to move their finger in the same direction to press a key. Keypressing reaction time was longer for the matching conditions (e.g., transfer away/finger away) than the mismatching conditions (e.g., transfer toward/finger away). But this interference pattern was much clearer when the sentences were factual rather than counterfactual, suggesting a diminishment of perceptual grounding in the latter.

(4032)

**An ERP Study of Anaphoric Reference in Sentences and Discourse.** VEENA A. NAIR & AMIT ALMOR, *University of South Carolina, Columbia*—We report the results from an ERP study of repeated name anaphors in sentences and discourse. Antecedents were either single noun phrases (NPs) or part of conjoined NPs. Replicating the results of Swaab et al. (2004), we found an increased N400 with sentence items in response to repeated name anaphors when the antecedent was a single NP in comparison with when it was part of a conjoined NP. In contrast, with discourse items, we found a larger N400 in the conjoined relative to the single condition. The difference between the N400 re-

sponse to sentence and discourse items is incompatible with Swaab et al.'s interpretation of the increase in N400 as a marker of the repeated name penalty, which should have been elicited in both sentences and discourse. Rather, our results suggest that the increased N400 reflects difficulty in antecedent identification that precedes the integrative discourse processes that underlie the repeated name penalty.

• ATTENTIONAL CONTROL •

(4033)

**Can Participants in a PRP Paradigm Temporarily Interrupt Task 1 Processing in Order to Minimize Total Processing Time?** ROLF ULRICH & TANJA LEONHARD, *University of Tübingen*, & JEFF MILLER, *University of Otago*—In typical PRP experiments, the processing demands for the two tasks are usually quite similar and consequently the single task RTs of the two tasks are about the same. In our experiments, Task 1 (mental rotation) was especially time-consuming, whereas Task 2 (left-ear vs. right-ear tone discrimination) could be performed relatively quickly. According to an optimization account of the PRP effect, we expected that when SOA was short, participants would temporarily interrupt Task 1 processing and switch to Task 2 in order to minimize the total processing time  $RT_1 + RT_2$ . That is, they should complete Task 2 before they finish Task 1 and thus produce R2 before R1. In contrast to this prediction, our results indicate that participants very rarely interrupt Task 1, almost always producing R1 before R2.

(4034)

**Tracking the Time Course of Reactive Control Following Errors.** ROBERT WEST, *Iowa State University*, & STEPHANIE TRAVERS, *Luther College*—The neural correlates of error detection have been extensively investigated in studies examining the characteristics of the error-related negativity. In contrast, relatively little work has explored the time course of neural processes that are active following error detection. In two experiments, we used ERPs to examine the temporal dynamics of processes that are related to updating of cognitive control following errors. Our data reveal a frontal slow wave between 200 and 2,000 msec after the response that differentiated errors from correct responses. The frontal slow wave was correlated with the degree of posterior slowing of response and with levels of calmness and happiness before undertaking the task, and with changes in these variables during task performance. The latter finding demonstrates that the implementation of cognitive control is modulated by aspects of positive affect.

(4035)

**The Effect of Dual-Task Processing Overlap on Sequence Learning.** HILLARY D. SCHWARB & ERIC H. SCHUMACHER, *Georgia Institute of Technology*—Many studies have investigated the nature of sequence learning under dual-task conditions. Some suggest sequence learning is impaired (e.g., Shanks & Channon, 2002), whereas others suggest it is not (e.g., French, Buchner, & Lin, 1994). Typical dual-task studies of sequence learning combine a sequenced visual-manual task with a randomized auditory task that requires participants to count tones throughout each block of trials. This tone-counting task may not be ideal for studying the processes involved in sequence learning because it requires the covert and continuous processing of auditory stimuli across blocks. As such, it provides little behavioral evidence for the organization of processing on individual trials. The present study sought to identify the locus of interference in dual-task sequence learning by using discrete tasks and varying stimulus onset asynchrony. The results suggest that process overlap of the concurrent tasks, and not the presence of multiple tasks per se, leads to sequence learning deficits.

(4036)

**The Effect of External Stimulus Availability on Task Choice in Voluntary Task Switching.** CATHERINE M. ARRINGTON, *Lehigh*

*University*—In voluntary task switching, subjects choose which task to perform on a given trial in a multitask environment. Although task choice is assumed to be under internal control, external factors may affect choice processes. External influence on task choice was examined by varying the availability of the stimulus for each task. Subjects performed even/odd and consonant/vowel judgments on digit/letter pairs with the two stimuli appearing with SOAs of 0, 50, 100, or 150 msec. Across experiments, the probability of choosing the task associated with the first stimulus [ $p(S1)$ ] rose significantly with increasing SOA from approximately 0.5 to approximately 0.6. Manipulations of response to stimulus interval (200–2,000 msec), associated with the time to intentionally select a task for the upcoming trial, also affected  $p(S1)$ . These results suggest a significant influence of both external and internal factors on the choice to perform a specific task in a multitask environment.

(4037)

**Switching Between Task Sets: Factors Determining the Presence or Absence of Inhibition.** DAVID KUHNS & MEI-CHING LIEN, *Oregon State University*, & ERIC D. RUTHRUFF, *University of New Mexico*—Task-set inhibition has been proposed as an important mechanism of task switching. Its existence is supported by the observation of the “ $N-2$  repetition cost” (e.g., ABA slower than CBA). Many studies have reported this cost, but several others have not. We noted that many failures to find the cost have several things in common: predictable task sequences, consistent assignment of tasks to locations, and lack of explicit verbal task cues. Because there have been numerous other differences between previous studies, however, no firm conclusions are possible. To better understand inhibition and its role in task switching, we systematically manipulated these factors in a series of experiments. We consistently found an  $N-2$  repetition cost, even with all of the conditions suspected to eliminate it. The search for the true cause of occasional failures to find  $N-2$  repetition costs continues.

(4038)

**Ex-Gaussian Analyses of Residual Task Switching Costs: Dissociating Failure-to-Engage and Stimulus-Cued Completion Hypotheses.** SCOTT WATTER & JAMES W. KARLE, *McMaster University*—Residual reaction time (RT) task switching costs are widely observed to persist, despite optimal conditions, strategies, and participants’ effort to perform experimental tasks. We tested whether this residual cost could be abolished by internally rehearsing a switch task, including internally imaging a stimulus and its correct response, during a very long intertrial interval, as a test of the stimulus-cued completion hypothesis. Performance was compared using ex-Gaussian parameter estimates from participants’ RT distributions. Imagery reduced residual costs compared to a high-preparation group using between-trial verbal rehearsal and a third no-preparation group. However, only the tails of participants’ RT distributions differed between switch and repeat trials with both verbal rehearsal and imagery preparation, suggesting stimulus-cued completion was not the cause of reduced residual costs. Residual costs appeared to be due to a small number of trials in both preparation conditions, supporting a failure-to-engage account.

(4039)

**Decomposing the Multisource Interference Task.** HEATHER M. GILMORE & ELISE TEMPLE, *Cornell University* (sponsored by Glover C. Gilmore)—The multisource interference task (MSIT) was developed to examine the neural networks associated with attention and cognitive interference. The MSIT combines different types of interference known to delay reaction time for the purpose of maximizing cognitive interference. The MSIT has been shown to produce activation in the anterior cingulate cortex, a region of the brain implicated in processes of executive attention. Previous work has not addressed the separate influences of each source of interference. This study was designed to decompose the sources of interference to de-

termine their independent contributions. Participants were instructed to identify the number that was different in a three-digit array. Font cue, flanker, and spatial interference factors were evaluated. Additionally, blocked versus mixed design was compared. It was found that blocking of interference type yielded more potent effects. Results of the study can be used to design a maximally potent MSIT.

• SPEECH PERCEPTION •

(4040)

**Beyond Fixed-Point Attractors: Modeling Speech Perception With Continuous Recurrent Networks.** GAUTAM K. VALLABHA & JAMES L. MCCLELLAND, *Carnegie Mellon University*—Speech perception is often taken as a prime example of perceptual categorization and is therefore modeled using classifiers or fixed-point attractors. However, such models do not address how the system can “reset” itself to deal with the following input, or how suprasegmental patterns (such as the rhythmic structure of a native language) may be learned. One alternative is that speech is processed by a network whose ongoing dynamics are modulated by the input stream, with speech “categorization” corresponding to particular patterns of dynamic activity. This alternative was explored using recurrent neural networks trained with continuous backpropagation through time. Preliminary results indicate that training in such networks results in “quasi-attractors” wherein the network does not have fixed-point attractors but is still sensitive to central tendencies of inputs. The architecture is used to model how native-language rhythmic structure leads to differential syllable assignment by English and Japanese speakers.

(4041)

**Age Contributions to Language Learning.** JOAN A. SERENO & KAZUMI MANIWA, *University of Kansas*—Research has shown that the adult perceptual system may be more plastic than previously thought. The present experiments extend this research by examining both adults and children who are learning a nonnative language contrast, investigating not only what is learned but also evaluating the shape of the learning curve. Six adults and 6 children (ages 6–11) participated. We focused on a suprasegmental contrast (four Mandarin tones) and determined daily gains in accuracy (a pretest, six training sessions with feedback, and six posttests), with the listener’s task being tone identification. Overall, adult trainees improved (19%) from pretest to final posttest. Children also did very well, showing a similar improvement over the six training sessions, although overall accuracy rates were well below those of the adults. Differences in the daily gains in learning across adults and children were also observed. Implications for mechanisms involved in speech learning will be discussed.

(4042)

**The Temporal Dynamics of the McGurk Effect and Lexical Effects: Evidence From Mouse Tracking.** LAWRENCE BRANCAZIO, *Southern Connecticut State University and Haskins Laboratories*, JULIA R. IRWIN, *Haskins Laboratories*, & CAROL A. FOWLER, *Haskins Laboratories, University of Connecticut, and Yale University* (sponsored by Carol A. Fowler)—We employed a recently developed paradigm, mouse tracking (Spivey et al., 2005), to investigate the time course of audiovisual integration and lexical effects in speech perception. Auditory words and nonwords (e.g., MESH/meck, nesh/NECK) were paired with congruent and incongruent videos (/mE/, /nE/). For incongruent pairings, the McGurk effect (“N” responses for auditory mesh, meck) reversed the perceived lexical status (MESH became nesh; meck became NECK). Using a mouse, participants moved a cursor to “M” and “N” response boxes at the top of a computer monitor. Mouse movement was analyzed as a function of time, separately for McGurk (“N”) and non-McGurk (“M”) responses on incongruent trials and for correct responses on congruent trials, for words and nonwords. Analyses reveal early visual effects and slightly later lexical effects on cursor

position and velocity. The results indicate that mouse tracking holds promise for providing an early window into perceptual ambiguity resolution in speech.

(4043)

**Investigating the Effects of Perceptual Similarity of Talkers' Voices on Recognition Memory.** JENNIFER S. QUEEN, *Rollins College*, LYNNE C. NYGAARD, *Emory University*, MELANIE TUMLIN, *Rollins College*, & AUBREY THOMPSON, *University of Central Florida*—Geiselman and Glenny (1977) found that recognition memory was better when words were presented at test in the same gender voice in which they were imagined during study. Two experiments were conducted to examine the hypothesis that this benefit was due to the perceptual similarity of same-gender voices. The present study investigates the effects of perceptual similarity of talkers' voices on memory for imagined and spoken words. In Experiment 1, participants imagined words during study and then heard either the same, similar, or different speakers at test. The results suggested a small benefit of similarity. Experiment 2 employed a similar procedure with the words presented auditorily in both study and test. The results indicated that words are better remembered if presented in the same voice at study and test and that the gender benefit decreases as a function of similarity.

(4044)

**Perceptual Adjustments: All Pronunciations Are Not Created Equal.** TANYA KRALJIC, *University of California, San Diego*, & SUSAN E. BRENNAN & ARTHUR G. SAMUEL, *SUNY, Stony Brook*—Listeners rapidly adjust to variations in speakers' pronunciations. These adjustments are retained and accessed when listeners encounter those speakers again. Perceptual learning is a possible mechanism for such adjustments: listeners' phonemic categories change to accommodate the pronunciations they hear. However, variation in pronunciation can occur for a number of reasons. Some "odd" pronunciations are due to the surrounding phonetic context: Such contextually driven changes are ubiquitous in dialects (e.g., in many U.S. dialects, /s/ is pronounced as /ʃ/ ("sh") when it immediately precedes [tr]—as in *strawberry*—but not when it precedes other sounds). Other "odd" pronunciations must instead be attributed to some idiosyncrasy of the speaker (e.g., to a speaker's foreign accent or lisp). We show that the source of a particular acoustic-phonetic variation affects how that variation is handled by the perceptual system. In particular, although speaker-specific variations in pronunciation do produce long-term perceptual adjustments, contextually specific variations do not.

(4045)

**Overcoming Native-Language Bias in the Perception of Nonnative Speech.** MEGHAN SUMNER & ARTHUR G. SAMUEL, *SUNY, Stony Brook*—Listeners constantly face an incredibly variable speech signal. Language-specific variation common in nonnative speech adds to the complexity of spoken words. For example, a native Polish speaker of English may produce the English words *beat* and *bead* with final [t]. While these words may be indistinguishable to the ears of native English speakers, subtle acoustic details make the words distinct. If listeners do not use these cues, many words (e.g., *beat* and *bead*) are at best ambiguous. At worst, an incorrect mapping for the word *bead* would occur (e.g., /bit/). In order to process these two words as distinct, a listener must overcome a perceptual bias: A familiar acoustic cue (e.g., vowel length) used to map a final devoiced sound onto an appropriate phoneme must be replaced with a novel cue (e.g., closure duration). We examine the perception and encoding of nonnative variation and the conditions that promote disambiguation.

(4046)

**Compensation for Coarticulation: Comparing Contrast and Gestural Theories.** NAVIN VISWANATHAN, JAMES S. MAGNUSON, & CAROL A. FOWLER, *University of Connecticut and Haskins Laboratories* (sponsored by Carol A. Fowler)—Compensation for coar-

tication is a speech context effect in which listeners hearing a [da-ga] continuum report more [ga]s after [al] and more [da]s after [ar]. Two competing theories have sought to explain this phenomenon. The gestural theory holds that this phenomenon reflects listeners' sensitivity to the vocal tract gestures (e.g., place of articulation [POA]) of the speaker. Auditory contrast explains that this phenomenon is a sensory effect that results from the difference in third formant frequency (F3) offset between the precursor and target syllables. Telling the theories apart is difficult because F3 is confounded with POA in the materials typically used. We used Tamil phonemes, where F3 and POA are disentangled. The results indicate that the compensation patterns side with POA rather than F3 offsets, thereby supporting a gestural account. Furthermore, we present the results of experiments that pose problems for a contrast explanation of the compensation effects.

(4047)

**Featural Similarity and Position of Overlap in Lexical Confusions.** SARAH C. CREEL, DELPHINE DAHAN, & DANIEL SWINGLEY, *University of Pennsylvania*—Spoken word recognition is a process of perceptual choice among candidates that share similarity with the input. We examined competition and similarity in word learning. Participants were taught 32 novel CVC words for 32 novel pictured objects. Then, a non-time-pressured word-picture verification task probed for false alarms to phonological neighbors overlapping at onset (e.g., *joop*–*joob*) or offset (*choob*–*joob*), varying their featural similarity (one vs. three features changed). Both featural similarity and position of overlap influenced errors, with substantially more false alarms to onset-overlapping competitors than offset-overlapping competitors. Featural-similarity effects were as strong word finally as word initially, suggesting that the entire word was processed before responding. The same participants' explicit similarity judgments were influenced primarily by featural similarity, not position of overlap. Positional effects on competition are not restricted to responses made while the signal is still phonetically ambiguous; word similarity models based on similarity judgments alone require a temporal component to model interference in lexical processing.

(4048)

**Beyond Metrical Stress: Effect of Prosodic Context on Speech Segmentation.** LAURA C. DILLEY, *Ohio State University*, & J. DEVIN MCAULEY, *Bowling Green State University*—Research into phonetic factors affecting how listeners isolate words from speech has focused almost exclusively on local properties of to-be-parsed material, such as metrical stress and allophonic variation. The present study investigated whether global prosodic context may also influence how listeners organize syllables into words. Participants listened to target and filler syllable sequences and reported the last word they heard. Sequences consisted of a five-syllable "context" string (e.g., *channel dizzy foot*-) plus a three-syllable string with ambiguous lexical organization (e.g., *notebook worm*, *note bookworm*). Participants were randomly assigned to one of three conditions in which the F0 and/or timing of the context was varied in a manner predicted to affect whether they heard a disyllabic or monosyllabic final word. Both the F0 and timing of the context affected final word reports in the predicted direction. Findings suggest that global prosodic context is important for listeners' organization of syllables into words.

(4049)

**Age Differences in Spoken Word Perception: An Examination of the Influences of Age-Related Slowing and Inhibitory Deficits.** MCKENZIE R. BALLOU & MITCHELL S. SOMMERS, *Washington University* (sponsored by Mitchell S. Sommers)—Previous research suggests that increased phonotactic probability (PP) has facilitative effects on nonword naming but inhibitory effects for naming real words (Vitevitch & Luce, 1998). If inhibitory deficits contribute to age-related difficulties in speech perception, then the effects of PP on real-word naming should be disproportionately greater for older compared with younger adults. In contrast, findings of slower naming re-

sponses for nonwords (Vitevitch & Luce, 1998) would predict greater age differences for nonword naming, under a general slowing account. Consistent with predictions based on age-related inhibitory processing deficits, preliminary results from Experiment 1 indicate that older adults are disproportionately impaired by increases in PP for words but not for nonwords. In Experiment 2, we replicated these findings using a same–different task that eliminated the need for production. Taken together, the present set of results suggests that the age effects observed in both tasks can be attributed to age-related inhibitory decline.

• ATTENTIONAL PROCESSES •

(4050)

**Audiovisual Binding of Affective Information in the Psychological Refractory Period Paradigm.** HARTMUT LEUTHOLD & CATHERINE F. MCGRORY, *University of Glasgow*—Psychological refractory period (PRP) studies typically use a pitch discrimination (high vs. low) task. Given the known semantic association of high and low tone pitch with the affect-related dimension happy–sad, we tested whether cross-modal congruency effects would result when affective judgments are demanded by the other task in the PRP paradigm. Thus, Task 1 required emotion judgments (positive, neutral, negative) to a centrally displayed schematic face embedded within irrelevant faces and Task 2 demanded pitch discrimination. At short SOAs, Task 1 reaction time (RT1) was shorter when facial expression and affective connotation of Task 2 tones were congruent (happy/high and sad/low) than when they were incongruent (happy/low and sad/high). The flankers played no role in pitch-affect congruency effects. When task order was reversed, surprisingly, no reliable backward congruency effect on RT1 was obtained. The present findings suggest that pitch-affect binding depends on the activation of task-relevant information at a higher processing level where affective states are semantically represented.

(4051)

**Verbal Cued Recall and Numerical Judgments: Can They Be Performed Without Interference?** ANA M. FRANCO-WATKINS, *Auburn University*, & HAL PASHLER & TIM C. RICKARD, *University of California, San Diego*—It has been claimed that when a numerical concurrent task is performed at the same time as a verbal memory retrieval task, little or no interference occurs. The goal of the present study was to further examine this hypothesis using a more temporally fine-grained analysis than in previous research, in addition to examining the costs associated with the concurrent task as well as memory retrieval. Subjects performed a cued recall task while simultaneously attempting to perform a numerical judgment task. Substantial interference was observed, primarily involving response omissions and response latencies in the numerical task coupled with some increase in cued recall failures. The temporal relationship of the two response streams was analyzed in an effort to determine whether a single central processing/retrieval bottleneck is responsible for this interference.

(4052)

**Effects of Attention on Perceptual Priming: A Test of the Distractor-Selection Hypothesis.** ANJA SOLDAN, *Taub Institute, Columbia University*, & JENNIFER A. MANGELS & LYNN A. COOPER, *Columbia University*—According to the distractor-selection hypothesis (Mulligan, 2003), dividing attention during encoding reduces perceptual priming when responses to distractor stimuli are selected frequently and simultaneously with target encoding. This interference is thought to occur because response selection and memory encoding rely on the same central bottleneck (CB) (Pashler, 1994). This study tested whether other CB-dependent processes (e.g., difficult perceptual operations) also interfere with perceptual encoding by inversely manipulating the perceptual difficulty of the distractor task and response frequency to distractors. Contrary to the predictions of the distractor-selection hypothesis, selecting frequent responses to distractors did not reduce priming in the possible/impossible object-decision test, in-

dependent of the time available for object encoding. However, priming was reduced when subjects performed a perceptually difficult distractor task and encoding time was reduced. This indicates that frequent response selection to distractors is neither the primary nor a sufficient mechanism by which dividing attention during encoding reduces perceptual priming.

(4053)

**Roles of Working Memory Capacity and Intelligence in the Attentional Blink.** LORENZA S. COLZATO, MICHEL SPAË, MEREL PANNEBAKKER, & BERNHARD HOMMEL, *Universiteit Leiden* (sponsored by Wido La Heij)—Working memory has been assumed to be the limiting mechanism in the attentional blink (AB) and working memory capacity (WMC) has been suggested to predict the individual size of the AB (Bleckley, Hollingsworth, & Maki, 2005). However, WMC often correlates with fluid intelligence, which raises the question of which of the two is the crucial factor. We related WMC (as measured by the operation SPAN task) and fluid intelligence (as measured by Raven's standard progressive matrices) to individual AB performance. AB size correlated negatively with WMC but not with intelligence, whereas intelligence correlated positively with general performance and Target 1 detection in particular. The results are consistent with two-stage models (e.g., Chun & Potter, 1995) and suggest that (1) intelligence affects the first, target-detection stage by modulating the top-down component in biased competition for selection, whereas (2) WMC affects the second, consolidation/maintenance stage.

(4054)

**Electrophysiological Investigations of Emotional Words in the Attention Blink Task.** KAREN M. ARNELL, *Brock University*, & JEFFREY W. MACLEOD, *McMaster University*—Previous work has shown that highly arousing sexual or taboo words can initiate an attentional blink (AB) when presented as a to-be-ignored distractor and increase the magnitude of the AB when presented as the first target. Here, we replicate these effects and show that taboo/sexual words produced larger N400 and P3 event-related potential components during the rapid serial visual presentation (RSVP) task, leading to a smaller P3 for a subsequent target. Overall, when P3s for the emotion word were larger, accuracy was lower for subsequent targets. Furthermore, P3 magnitude and P3 latency for emotion words, recorded during a later word rating task, were positively correlated with arousal ratings (but not valence ratings), negatively predicted accuracy for subsequent targets in the RSVP task, and positively predicted memory for emotion words from the RSVP task. Results suggest that taboo/sexual words receive preferential online processing that increases their encoding into memory at the expense of subsequent RSVP targets.

(4055)

**Visuospatial Attention and Redundancy Gain.** JEFF MILLER, *University of Otago*, & DANIELA BEUTINGER, *Universität Tübingen*—Visuospatial attention has been investigated in many studies comparing processing of items in attended versus unattended locations (e.g., location cuing paradigms) or in single versus redundant item displays (e.g., redundancy gain paradigms). We report two experiments combining these approaches. Participants in a simple reaction time (RT) task were required to respond as quickly as possible to the onset of any visual stimulus. They were given advance cues to expect stimuli in the left or right half of the visual display (Experiment 1) or to expect them in the upper or lower half of the display (Experiment 2). Approximately 1 sec after the cue, one imperative stimulus or two redundant imperative stimuli appeared in either the expected or the unexpected half of the visual display. We report both RT and response force measures, and we discuss the implications of the results for mechanisms of visual attention and redundancy gain.

(4056)

**Assessing Automatic Word Recognition Using Event-Related Potentials.** LOGAN CORNETT, *Oregon State University*, ERIC D. RUTH-

RUFF, *University of New Mexico*, & MEI-CHING LIEN & ZACHARY I. GOODIN, *Oregon State University* (sponsored by Mei-Ching Lien)—Word recognition is often regarded as an automatic process. In dual-task contexts, however, there is evidence that people cannot identify words while devoting central attention to another task. This controversial claim rests on questionable assumptions. To address this issue more directly, we used the N400 component of the event-related potential (ERP). This negative-going ERP component, which peaks about 400 msec after word onset, is sensitive to the degree of mismatch between a word and the current semantic context. Because semantic mismatch can be detected only if a word has been identified, the N400 provides a useful index of word recognition. In a dual-task paradigm, we measured the difference in N400 between Task 2 words that matched or mismatched the current semantic context. The N400 was strongly attenuated for Task 2 words presented simultaneously with Task 1. Thus, word recognition is not fully automatic, but rather requires access to limited central attentional resources.

(4057)

**Preparatory Effects During Gaps in Timing.** CLAUDETTE FORTIN & RÉMI GAUDREAU, *Université Laval*—Previous experiments showed that when duration of gaps in time production varies from trial to trial, produced intervals shorten as gap duration lengthens. This suggests that participants use the gap as a preparatory period to react quickly to the signal ending the gap, in a way similar to foreperiods in reaction time studies. Another classical result in foreperiod studies is that opposite effects are observed when the foreperiod varies between blocks of trials. This was tested in production (Experiments 1 and 2) and discrimination (Experiments 3 and 4) of intervals in which gaps could be of short, medium, or long durations in separate blocks of trials. Results confirm the role of preparation in time production, but not in time discrimination, as was found in previous studies. Finally, with both timing tasks, the effect of varying gap location appeared to be remarkably stable and independent of gap duration.

(4058)

**Using Spatial Information to Facilitate Task Resumption.** RAJ M. RATWANI, *George Mason University*, J. GREGORY TRAFTON, *Naval Research Laboratory*, & MATTHEW S. PETERSON, *George Mason University* (sponsored by Matthew S. Peterson)—Theories accounting for the process of primary task resumption following an interruption have focused on the suspension and retrieval of a specific goal (Altmann & Trafton, 2002). The ability to recall the spatial location of where in the task one was prior to being interrupted may also be important. We show that being able to maintain a spatial representation of the primary task facilitates task resumption. Participants performed a search and response task and were interrupted with either large windows that completely occluded the primary task or small windows that did not occlude the primary task. Participants were faster at resuming the primary task following interruption from the small window, suggesting that a spatial representation of the primary task is better maintained with a small window. Eye movement data examine how the ability to maintain a spatial representation facilitates primary task resumption.

(4059)

**Central Stage Capacity Allocation in the PRP Paradigm: Effects of Task Instruction and Difficulty.** MICHAEL C. PATTERSON, *Claremont Graduate University*, & WILLIAM P. BANKS, *Pomona College*—There is evidence in the psychological refractory period (PRP) literature suggesting that dual-task interference stems from a limited capacity central stage parallel processor that allocates resources between tasks in a graded fashion. This study examined several factors that are predicted to influence the capacity allocation policy for dual-task processing. In two experiments, equal and unequal task emphasis conditions were used to determine the extent to which task instructions influence capacity allocation. In addition, Task 2 difficulty was manipulated to ascertain whether increased allocation of capac-

ity to Task 2 corresponds with greater Task 1 effort as stimulus onset asynchrony decreases. Attention operating characteristics (AOCs) were constructed to assess the extent of capacity shared between tasks. The results from this study contribute to the debate between the central capacity sharing model and the central bottleneck model.

(4060)

**AB or Attenuated AB: That Might Be a Question of Strategy Choice.** LAURA J. FALCON, THOMAS M. SPALEK, & VINCENT DI LOLLO, *Simon Fraser University*—The attentional blink (AB) is the finding that identification of the second of two sequentially presented targets is impaired at short intertarget lags. Targets can be distinguished from distractors in an RSVP stream by adopting either a target-passing or a distractor-exclusion strategy. We asked whether either strategy can be used preferentially and, if so, what factors determine the choice. A series of experiments suggested that ease of implementation determines the choice of strategy. Although target passing appears to be the default strategy, the probability of using the distractor-exclusion strategy is increased when target passing is made more difficult by using heterogeneous targets. Adopting a distractor-exclusion strategy automatically reduces the effect that the distractors exert on accuracy of performance. This leads to less disruption of the input-filter setting, less masking, and hence an attenuated AB. Extant models need to be expanded to incorporate observer strategy as a determinant of the magnitude of the AB.

• AUTOMATIC PROCESSING •

(4061)

**Detecting Subliminality: Are Individuals at Chance in Subliminal Priming?** RICHARD D. MOREY, JEFFREY N. ROUDER, & MICHAEL S. PRATTE, *University of Missouri, Columbia* (sponsored by Jeffrey N. Rouder)—In many paradigms, the persuasiveness of subliminal priming relies on establishing that stimuli are undetectable. The standard significance test approach is flawed because null results may reflect either truly undetectable stimuli or a lack of power to resolve weakly detectable stimuli. Consequently, researchers can claim undetectability simply by collecting fewer data. We present a statistical model, called the mass at chance (MAC) model, as an alternative. The model provides for estimates of the probability that each individual is truly at chance. Researchers may select participants for whom there is a sufficiently high probability of true undetectability. The model provides a means of accumulating evidence for true chance performance by collecting more data rather than fewer. The model is hierarchical and estimation is done within the Bayesian framework.

(4062)

**Automaticity and Two-Digit Numbers.** DANA GANOR-STERN & JOSEPH TZELGOV, *Achva Academic College* (sponsored by Joseph Tzelgov)—Most past research on automatic processing of numerical magnitude has been limited to single-digit numbers. In the present work, evidence for automatic processing of two-digit numbers was examined using the size congruency effect (SiCE). Although SiCE was found for two-digit numbers, it was affected by the compatibility between units and decades digits, and by the transitions across decades. It was not affected, however, by a number's global magnitude. Together, these results suggest that the magnitudes of the components of the two-digit number, but not that of the whole number, were processed automatically. Finally, SiCE was affected more by the magnitude of the decades digit than that of the units digit, indicating that the digits' syntactic roles were represented. The implications of the present results for the nature of numerical representations are discussed.

(4063)

**Effect of Covert Attention on Estimation of Line Length.** LINDA M. RUECKERT, *Northeastern Illinois University*—Traditional models of

line bisection posit that patients with left hemineglect transect a line to the right because they underestimate the length of the line in their neglected (left) visual field. This assumes that lack of attention causes an underestimation of length. However, this model cannot explain the “crossover effect,” in which neglect patients appear to overestimate the left side of short lines. The present study utilized the Posner paradigm to assess the effect of attention on the perception of line length in normal subjects. Lines varying from 1 to 20 cm were presented in the left and right fields. On 60% of trials, an arrow correctly told the subject where the line would be presented. On 20% of trials, the arrow incorrectly cued the subject. For 20%, there was no arrow. Incorrect cuing led to an overestimation of the length of short lines in the right visual field. This suggests that lack of attention leads to an overestimation of the length of short lines.

(4064)

**The Effects of Attentional Set on Saccades.** NASEEM AL-AIDROOS & JAY PRATT, *University of Toronto*—The oculomotor system is responsible for programming the spatial and temporal aspects of saccadic eye movements. Some evidence that the programming of these two aspects is interdependent has been taken from findings that visual distractors affect both the latency and trajectory of saccades. Current models of saccadic programming differ, however, on the extent of this interdependence. To investigate this issue, participants were required to make saccadic eye movements in the presence of distractors, and the salience of the distractors was manipulated using an attentional set. It was found that the attentional set prevented distractors from affecting temporal programming (measured by saccadic reaction time) but not spatial programming (measured by deviations in the saccadic trajectories). This finding demonstrates that the spatial aspect of a saccadic program can be altered without affecting the temporal aspect, supporting those models in which the signal to initiate a saccade is generated separately from spatial programming.

(4065)

**Masked Priming of Parity Judgments Is Experience Dependent.** GLEN E. BODNER & ANDREAS BREUER, *University of Calgary*—We examined whether masked response priming of parity judgments is learned or automatic. Parity judgments were faster after congruent primes than after incongruent primes for number word targets (e.g., one–THREE vs. two–THREE), but not for the target words ODD and EVEN (e.g., one–ODD vs. two–ODD). One interpretation of this pattern is that masked primes are only effective if they are consciously experienced as targets on some trials. Consistent with this possibility, priming emerged for the target words ODD and EVEN when they were mixed with number word targets. We also compared priming for primes that were either in the target set or not. Consistent with a stimulus–response learning account, only primes that were in the target set produced priming. In sum, we found that masked priming of parity judgments was learned rather than automatic; it depended on the experiences subjects received while performing the task.

(4066)

**Pure and Mixed Stimulus–Response Mappings in Flight and Non-flight Tasks.** MOTONORI YAMAGUCHI & ROBERT W. PROCTOR, *Purdue University* (sponsored by E. J. Capaldi)—Four experiments compared stimulus–response compatibility (SRC) effects with pure blocks of compatible or incompatible trials and blocks in which the two trial types were intermixed. Experiments 1 and 2 used a flight simulator with inside-out and outside-in displays for which the task was to bank the aircraft to the left or right in response to left or right location stimuli. Performance was similar for both display formats, with the SRC effect reduced but still evident in mixed conditions. Experiments 3 and 4 examined the influence of mixing when the display was simplified and responses were yoke turns or buttonpresses. The SRC effect was reduced with mixed mappings for the yoke turns, but completely eliminated for buttonpresses. If elimination of SRC effects by mixing is due to suppression of a direct response–selection route,

then the present findings suggest that the amount of suppression is not equal for all manual response types.

## • EXECUTIVE CONTROL •

(4067)

**Facilitating Executive Function.** MARC G. BERMAN & JOHN JONIDES, *University of Michigan* (sponsored by Richard Gonzalez)—Existing hypotheses propose that increases in positive affect preferentially activate the dopamine reward system, therefore, by hypothesis, improving performance on tasks that require the prefrontal cortex. In this study, we test this hypothesis by exploring the effect of positive affect on interference-resolution capabilities. We tested interference-resolution performance with a verb-generation task, which is known to activate the left inferior frontal gyrus (LiFG) of the prefrontal cortex. We found that changes in affect over the course of the experiment were a significant predictor of changes in interference-resolution performance in this task. Subjects who displayed an increase in positive affect improved their performance, whereas subjects who displayed a decrease in positive affect worsened their performance. These data are consistent with the hypothesis that increases in positive affect facilitate performance on tasks that utilize the prefrontal cortex.

(4068)

**Controlled Versus Automatic Processes in Retrieval-Induced Forgetting.** KOICHI KATO & HAJIME OTANI, *Central Michigan University*—The present experiment examined whether retrieval-induced forgetting (RIF) requires executive control—that is, whether RIF is the result of controlled or automatic processes. It was assumed that controlled processes are resource dependent whereas automatic processes are resource free. If RIF is produced by controlled processes, asking participants to perform a resource-demanding secondary task during the retrieval-practice phase should reduce RIF. In contrast, if RIF is produced by automatic processes, performing a secondary task should have little or no effect. These predictions were tested using Anderson and Spellman’s independent probe technique with or without a secondary task during the retrieval-practice phase. The results showed that performing a secondary task reduced RIF. Relative to the full attention condition, both within- and cross-category RIF was reduced approximately by half in the divided attention condition. The results therefore provided the first direct evidence that RIF represents a form of controlled inhibition.

(4069)

**Dose-Dependent Cognitive Impairments Under Alcohol: Prospective Memory, Digit Span, and Dual-Task Interference.** MARK G. VAN SELST, *San Jose State University*, DANIEL CAMARILLO, *University of Kentucky*, & MARILYN AMPUERO & JAYSON GAWTHORPE, *San Jose State University*—The efficacy of prospective memory judgments is impaired in a dose-dependent manner for recall and recognition. Digit span is similarly affected. The dose-dependent impairment of dual-task PRP interference is more pronounced when using a manual–manual response set rather than a manual–vocal response set.

(4070)

**Effects of Working Memory Capacity in a Directed Suppression Task.** WHITNEY A. HANSEN & STEPHEN D. GOLDINGER, *Arizona State University*—Much recent research on working memory (WM) has focused on individual variations in core capacities, especially in tasks involving controlled attention. We have been collecting data using a directed suppression task, which requires both controlled attention and mental agility. In versions tested thus far, people see words printed in blue, green, or red on a computer screen. When blue or green words appear, the participants must pronounce them as quickly as possible. As conditions change, however, the appropriate response to the red words also changes. When words appear in red, participants must suppress the prepotent naming response and must instead generate some novel response (push a button, say an unrelated word, say

a related word). We have observed certain conditions that disrupt mental agility, including generating unrelated words and holding memory loads. Individual differences in WM capacity predicted performance on several indices, including response time, errors, and memory for experienced words.

(4071)

**Updating Working Memory or Inhibiting Predominant Response Tendencies Temporarily Reduces the Capacity for Executive Control.** BRANDON J. SCHMEICHEL, *Texas A&M University* (sponsored by Heather Bortfeld)—In this research, the hypothesis that exerting executive control temporarily undermines subsequent attempts at executive control was tested. Two experiments revealed that inhibiting predominant writing tendencies (Experiment 1) and taking a working memory test (Experiment 2) reduced later executive capacity as measured by tests of complex working memory span and emotion suppression, respectively. The results supported the view that executive capacity is temporarily depleted by prior attempts at executive control.

(4072)

**Modeling Executive Function in the Wisconsin Card Sort Task.** ANTHONY J. BISHARA, JOHN K. KRUSCHKE, & JULIE C. STOUT, *Indiana University, Bloomington*, DAVID P. McCABE, *Washington University*, & JEROME R. BUSEMEYER, *Indiana University, Bloomington* (sponsored by John K. Kruschke)—The Wisconsin Card Sort Task is a popular measure of executive function. Previous models of this task have only simulated general group-level patterns of behavior, largely because of the complexity of those models. We developed and compared 24 simple models designed to fit trial-by-trial data from individual participants and thereby estimate parameters that can be used as individual difference variables. The model that fit best had three free parameters representing (1) attention shifting rate in response to rewards, (2) attention shifting rate in response to punishments, and (3) attentional gating in response to ambiguous feedback. When applied to data from healthy adults aged 18–90 years, age was associated with somewhat slower attention shifting to reward and much slower attention shifting to punishment. Working memory capacity was also most strongly correlated with attention shifting to punishment. Qualitative patterns in existing data suggest that attentional gating may be an important parameter for other populations.

(4073)

**Executive Control and Emotion in Reward-Based Decision Making: Effects of Decision Time.** ERIC G. FREEDMAN, COREY R. GOUGHERTY, & REGINA M. DEW, *University of Michigan, Flint*—Assuming emotional associations are automatic and executive control engages effortful processes, the present study investigated the effects of decision time (1 sec, 2 sec, or unlimited) on learning outcomes associated with particular choices in the Iowa gambling task. This task required deciding between advantageous (low immediate gains/better long-term gains) and disadvantageous (higher immediate gains/larger long-term losses) choices. During the early blocks, decision times were longer in the unlimited condition than in the 1- and 2-sec conditions, but decision times in the unlimited condition decreased over subsequent blocks. In the unlimited condition, there was a relatively greater increase in the number of advantageous choices selected with succeeding blocks of trials. Thus, executive control is initially important in the formation of associations between choices and outcomes necessary to make future advantageous decisions. Like orbitofrontal patients, undergraduates under modest time pressure are less likely to learn to avoid disadvantageous choices.

(4074)

**Who Shalt Not Kill? Cognitive Control and Moral Reasoning.** ADAM B. MOORE, BRIAN CLARK, SHANNON HOLMES, & MICHAEL J. KANE, *University of North Carolina, Greensboro* (sponsored by Andrew R. Conway)—Behavioral and neuroimaging findings from Greene and colleagues (2001, 2004) show that exerting cogni-

tive control influences responses to moral dilemmas. Here, 24 dilemmas involved sacrificing one person to save others; subjects judged the moral acceptability of each killing. Two resolutions for each dilemma balanced the physical directness of killing (personal vs. impersonal), personal risk to the subject, and inevitability of the death caused by the subject. We assessed individual differences in cognitive control with working memory (WM) span tasks. All dilemma variables produced main effects. Moreover, only when the subject's life was at risk was impersonal (but not personal) killing of others more acceptable when the deaths were inevitable than when they were avoidable. Finally, people with higher working memory (WM) capacity found personal killing when deaths were inevitable to be more acceptable than did people with lower WM capacity. Thus, individual differences in cognitive control are reflected in the ability to process information in morally/emotionally provocative contexts.

• METACOGNITION •

(4075)

**Recent Experience Changes Strategies Regarding Linguistic Frequency in Recognition Memory.** JEREMY K. MILLER, *Willamette University*—The current experiments examine whether participants are able to adjust recognition response strategies in order to account for the effects of linguistic frequency. Experiment 1 uses a counterfeit list technique to expand upon previous findings indicating that participants exhibit a bias toward choosing high-frequency items in a recognition task. Experiment 2 demonstrates that when participants are exposed to a training phase that includes a recognition task involving the discrimination of high- and low-frequency targets and lures prior to exposure to the counterfeit list task, participants learn to adjust for this bias. Experiments 3 and 4 examine the conditions under which participants learn to adjust for linguistic frequency by manipulating the information available to participants during training. The results reported here are consistent with recent findings (Benjamin, 2003) indicating that under appropriate conditions participants can learn to correctly anticipate the effects of linguistic frequency on their recognition decisions.

(4076)

**A Role of Semantic Activation in Familiarity-Based Recognition.** ANNE M. CLEARY, *Colorado State University*, & VERONICA J. DARK, *Iowa State University*—In Experiment 1, it is shown that participants could detect a target's relatedness to an earlier presented prime when the target itself could not be identified in a perceptual identification task. Experiment 2 showed this ability to be short-lived and correlated with the standard semantic priming effect (the tendency to identify more targets preceded by related than by unrelated primes). Experiment 3 showed that the ability to recognize a repeated target in the absence of its identification was long-lived enough to persist in a list-learning paradigm. In Experiment 4, when rapidly-flashed recognition test items in a list-learning paradigm were preceded by either a related or an unrelated prime, participants showed both a recognition-without-identification effect for repeated targets (Cleary & Greene, 2004, 2005) and a bias to judge unidentified targets preceded by related primes as old. Results are discussed in terms of the source of activation confusion model (Reder et al., 2000).

(4077)

**Episodic Memory Guides the Eyes in Scene Recognition.** LINUS HOLM & TIMO MÄNTYLÄ, *Umeå Universitet*—Previous research has been inconclusive as to the relation between eye movements and episodic scene recognition. We investigated this relation by focusing on perceptual reinstatement. In three scene recognition experiments, eye movements were registered. In Experiments 1 and 2, participants indicated their recollective experience at test as based on recollection and familiarity, respectively. In Experiment 1, participants moved their eyes freely during study and test, whereas number of fixations was controlled through a gaze contingent paradigm. In Experiment 2,

idiosyncratic scene preference was controlled by a moving dot paradigm. Both experiments indicated that eye movement consistency between study and test differentiated recollective experience, with a higher consistency related to recollection- compared to familiarity-based recognition. In Experiment 3, participants repeatedly studied scenes paired with village names. At test, participants judged whether shown village names corresponded with subsequently shown scenes. When the subsequent scene corresponded with the village name, participants were more consistent in their eye movements compared to when the subsequent scene did not correspond with the village name. It seems that memory traces activated by the village name guided the eyes during subsequent scene perception. These findings suggest that explicit recollection is a function of perceptual reconstruction and that episodic memory influences gaze control in this reconstruction process.

(4078)

**Beneficial Effects of Positive Affect on Monitoring Processes Reduces False Memory.** HWAJIN YANG, ALICE M. ISEN, & STEPHEN J. CECI, *Cornell University*—Using the Deese/Roediger–McDermott paradigm (1995), we examined whether the well documented role of positive affect in facilitating cognitive flexibility increases false recognition compared with neutral affect. In Experiment 1, positive affect did not increase false recognition of critical lures. Furthermore, compared with controls, it induced significantly more correct “remember” judgments of studied items and fewer incorrect “remember” judgments of critical lures. This suggests that positive affect improves metamemory, the awareness of one’s own memories. In Experiment 2, when subjects were engaged in an active monitoring process through information about intrusion effects, positive affect significantly reduced false recognition compared with controls. Given that a motivational account was unlikely because there was no difference in true recognition in the two mood groups, this indicates that positive affect enhances monitoring ability. Together, our findings imply that positive affect does not increase false memory, improves metamemory, and actually reduces false memory via enhanced monitoring processes.

(4079)

**Repeated Testing Increases Confidence but Not Accuracy in the Misinformation Paradigm.** AYANNA K. THOMAS, *Colby College*, JASON C. CHAN, *Washington University*, & MEREDITH STAUFFER & REBECCA REISMAN, *Colby College* (sponsored by D. Stephen Lindsay)—Research suggests that the presentation of misleading postevent information increases errors in the recollection of an originally witnessed event (see Ayers & Reder, 1998, for a review). Utilizing the multiple testing procedure (Erdelyi & Becker, 1974), the present study examined whether participants would be less susceptible to misleading postevent information if given a memory test prior to misinformation. Secondly, we investigated how confidence in responses would be affected by repeated testing and exposure to both correct and misleading postevent information. The findings demonstrate that repeated testing did not reduce the misinformation effect but instead increased susceptibility to misinformation. In addition, the relationship between confidence and accuracy was significantly better on Test 1, prior to misleading postevent information, than on Test 2. Finally, participants’ confidence in incorrect answers significantly increased following the presentation of misleading postevent information, which led them to alter correct responses and incorporate the misleading postevent information.

(4080)

**“Refreshing Recollection” of Eyewitnesses: Memory Retrieval or Memory Creation?** J. TRENT TERRELL & CHARLES A. WEAVER III, *Baylor University*—Eyewitnesses in civil litigation often have their memories “refreshed” with photographs, particularly in product liability cases, in which witnesses are expected to recall specific brands of products from 30 or more years ago. In two experiments, witnesses

viewed a video containing various brands of products, and their memory for these brands was tested 5 min or 1 week later. In Experiment 1, witnesses were “refreshed” with photographs either of all correct or all incorrect brands. In Experiment 2, witnesses viewed pairs of photographs: the correct alternative paired with a familiar (but incorrect) distractor, the correct alternative with an unfamiliar distractor, or both distractors. Viewing correct photographs increased the likelihood of correct identifications, but viewing incorrect photographs dramatically increased the likelihood of false alarms. Viewing two incorrect pictures caused the highest false alarm rate, reducing accuracy to one fourth of that noted in the absence of photos. Implications for refreshing recollection of eyewitnesses are discussed.

(4081)

**Déjà Vu and Jamais Vu in Normal and Epilepsy Patients.** TAKASHI KUSUMI, KENJIRO FUKAO, TOSHIYA MURAI, & MAKIKO YAMADA, *Kyoto University*, & AKIRA SENGOKU, *Sengoku Clinic*—Using a questionnaire, we examined differences between déjà vu and jamais vu as experiences of normal undergraduates and as ictal symptoms. Undergraduates ( $N = 114$ ) and epileptic patients ( $N = 16$ ) filled out a questionnaire assessing their incidence of experiencing déjà vu and jamais vu of person and place, associated perceptions of similarity and familiarity of present and past experiences, and emotions related to the phenomenon. Results indicate that the incidence of déjà vu (74%) was higher than that of jamais vu (27%) in undergraduates, whereas half of the epileptic patients had both déjà vu and jamais vu and the remaining half had ictal déjà vu only. The most commonly evoked emotions in both groups were nostalgia in déjà vu and fear in jamais vu. While déjà vu (jamais vu) was evoked by general (dis)similarity and (un)familiarity between present and past experiences in normal subjects, such evocations were not reported by patients.

(4082)

**On Old Olympus’s Towering Tops . . . : Changing Effectiveness of Cranial Nerve Mnemonics Among Physical Therapy Students.** SHARLENE D. WALBAUM & MEGHAN NOWAKOWSKI, *Quinnipiac University*—Formal mnemonics are used in the sciences to learn facts that, for the novice, are not obviously related or meaningful. Many mnemonics have been developed to help novices learn the names and the order of the cranial nerves. In the fall of their sophomore year, physical therapy (PT) majors at a small university are taught a specific cranial nerve mnemonic. In the spring, PT sophomores and juniors recalled the mnemonic and the names and order of the cranial nerves. Junior PT students recalled significantly more ( $M = 9.27$ ) than sophomores [ $t(43) = -4.78, M = 4.16, p = .01$ ]. The results indicated that mnemonic effectiveness increases over time as perceived need increases.

(4083)

**I’ve Heard It All Before: Context and Age Effects on the Subjective Experience of Audition.** CHAD S. ROGERS, LARRY L. JACOBY, & MITCHELL S. SOMMERS, *Washington University* (sponsored by Larry L. Jacoby)—Aging is accompanied by declines in hearing acuity, but little is known about how these changes in acuity impact the subjective experience of hearing. Two experiments explored age-related changes in the subjective experience of hearing in a listening-in-noise task by utilizing methods from metamemory research. Older and younger participants identified words in noise preceded by a semantically related prime in the clear. Sometimes the prime was appropriate (facilitative), and other times the prime was inappropriate (interfering). Relative to younger adults, older adults had more hits in the facilitative context but exhibited more false alarms in the interfering context. These context-consistent responses were made at very high levels of confidence. Thus, older adults had excellent calibration and resolution in facilitative listening contexts but very poor calibration and resolution in interfering listening contexts. These data suggest that older adults’ subjective experience of hearing is more dependent on resolving the listening context than on discriminability.

## • RECOGNITION MEMORY •

(4084)

**The Influence of Encoding Condition, Bizarreness, and Prior Recall on Frequency Judgments.** JAMES B. WORTHEN & MICHELLE ZOLL, *Southeastern Louisiana University*—Memory for frequency of common and bizarre action phrases that were either performed or imagined was investigated. Participants were presented with action phrases that varied in frequency under either a self-performance or an imagined-performance encoding condition. After a 48-h retention interval, memory for frequency of occurrence of the phrases was tested with half the participants completing a free recall task prior to making frequency judgments. The results indicated that imaginal encoding and increased frequency were related to inaccuracy of frequency judgments, but that attempted recall of phrases prior to frequency judgment increased accuracy. Further analyses indicated that frequency judgments for bizarre phrases were less accurate than frequency judgments for common phrases only for phrases that had not been correctly recalled. The implications of the results for explanations of frequency judgments based on the availability heuristic are discussed.

(4085)

**Source Memory for Unrecognized Items: Support for a Continuum of Evidence.** JEFFREY J. STARNES, JASON L. HICKS, NOELLE L. BROWN, & BENJAMIN A. MARTIN, *Louisiana State University, Baton Rouge*—This study reports four experiments investigating source memory for words that were previously called “new” on a recognition test. In each experiment, we found evidence that participants could accurately specify the source of words that they failed to recognize. Experiments 1 and 2 also demonstrated that source memory for unrecognized items varies with the bias to respond “old” in recognition decisions: Participants displayed unrecognized source memory when they were told that 25% of the recognition test words were old (promoting conservative responding) but not when they were told that 75% of the test words were old (promoting liberal responding). Our results are consistent with a multidimensional signal detection approach to recognition/source memory.

(4086)

**A Shift in Recognition Response Bias Consequent to a Prior Recognition Decision.** STEPHEN C. DOPKINS & JESSE Q. SARGENT, *George Washington University*—A series of experiments explored a situation in which the response bias for an episodic recognition judgment apparently shifts consequent to the decision in a prior episodic recognition judgment. On each trial of the experimental procedure, the participant reads a short list of words and makes successive recognition judgments to two test words. The results observed with this procedure suggest that, when episodic recognition judgments occur in succession, the degree of positive bias for the second judgment is smaller following a positive than following a negative decision in the first judgment. A similar shift in bias does not occur with successive semantic recognition (lexical decision) judgments. In several experiments, we sought to understand the basis of this phenomenon and its implications regarding the process of episodic recognition.

(4087)

**Dual-Process Signal Detection Theory in Item Recognition: Evidence for Some-or-None Recollection.** SERGE V. ONYPER, YAOFEI ZHANG, & MARC W. HOWARD, *Syracuse University* (sponsored by William J. Hoyer)—The unequal-variance signal-detection (UVSD) model postulates that item recognition depends solely on a unimodal distribution of item strength. The Yonelinas high-threshold (YHT) model claims that item recognition also depends on recollection, a threshold process. These two positions are reconciled by a two-process signal detection model (DeCarlo, 2002; Sherman et al., 2003). This variable recollection (VR) model assumes that recollection contributes to recognition performance but is not a threshold process. We compared UVSD, YHT, and VR models to item (Experi-

ments 1 and 2) and source (Experiment 2) recognition of words and pictures. Comparing the UVSD and the YHT models, we find an interaction between model type and material. The VR model can approximate both the UVSD and the YHT as special cases. As a consequence, it provides a fit superior to either model across materials. We discuss the possibility that the VR model may also simultaneously describe item and source memory.

(4088)

**Retrieval Constraints Create Differences in Recollection.** RICHARD L. MARSH & J. THADEUS MEEKS, *University of Georgia*, GABRIEL I. COOK, *Claremont McKenna College*, ARLO CLARK-FOOS, *University of Georgia*, & JASON L. HICKS, *Louisiana State University, Baton Rouge*—These experiments were conducted to investigate how the cognitive control of memory retrieval selects particular qualitative characteristics when instantiating a retrieval mode for recognition memory. Adapting the paradigm that Jacoby, Shimizu, Daniels, and Rhodes (2005) used, the authors demonstrated that inspecting distractors leaves more than recollective details in memory when participants operate under different retrieval modes. Participants also reported using different rejection strategies under different retrieval modes. That retrieval modes are based on diagnostic characteristics of the study phase was demonstrated by showing that participants cannot establish unique retrieval modes based solely on trace strength. The authors assert that whether early selection versus late correction criteria will be applied during a memory test depends on the particular retrieval mode established by the characteristics of the recognition memory test.

(4089)

**Memory for Intention-Related Material Presented in a To-Be-Ignored Channel.** GABRIEL I. COOK, *Claremont McKenna College*, & RICHARD L. MARSH, *University of Georgia*—These experiments were conducted to investigate the fate of intention-related material processed in a to-be-ignored channel. Participants were given an intention to respond to cues in a visual processing stream while simultaneously trying to ignore information being presented in an auditory stream. Subsequent to the ongoing activity, a surprise recognition test for information presented in the to-be-ignored auditory modality was administered. In comparison with comparable neutral information, corrected recognition memory for intention-related material was significantly better depending on the type of event-based prospective memory task. These results suggest that holding certain kinds of intentions can bias attentional processes in a manner consistent with a perceptual readiness for uptake of intention-related material.

## • WORKING MEMORY •

(4090)

**Interference From Filled Delays on Visual Change Detection.** TAL MAKOVSKI, WON MOK SHIM, & YUHONG V. JIANG, *Harvard University*—How is our ability to detect visual changes affected by intervening sensory input and by additional cognitive tasks? To address this question, we tested change detection of color arrays, spatial configurations, and natural scenes when the interval between changes was (1) blank, (2) filled by a visual scene, or (3) filled by an auditory sound. Participants were informed to either ignore the filled visual or auditory event, or attend to it by categorizing the stimulus as animate or inanimate. Results showed that the ability to detect a visual change was dramatically impaired by attending to a secondary task during the delay. This interference was significant for auditory as well as for visual events and was invariant to the complexity of the change detection displays. Passive viewing, unlike passive listening, produced small but significant interference. These results suggest that visual change detection relies significantly on central attentional processes.

(4091)

**Gestalt Effects in Visuospatial Working Memory.** LAURA PIERONI, *Università di Roma, La Sapienza and University of York*, CLELIA

ROSSI-ARNAUD & MIRIAM DI NARDO, *Università di Roma, La Sapienza*, & ALAN D. BADDELEY, *University of York* (sponsored by Alan D. Baddeley)—Gestalt factors may have a strong positive influence on visuospatial working memory (Woodman et al., 2003). The present study used dual task methods to elucidate this effect. We investigated the effect of symmetry (vertical, horizontal, and diagonal) on the recall of spatial locations presented either serially or simultaneously. Dual task methods were used to investigate the effect on recall of the phonological loop, the visuospatial sketchpad, and the central executive components of working memory. We found a positive effect of symmetry on recall and impairment from the concurrent tasks, but no interaction between these variables. Our results suggest that symmetry is processed automatically and that its influence does not depend on working memory.

(4092)

**Interference in Spatial Working Memory: Effects of Configural Distractors.** AYSECAN BODUROĞLU, *Boğaziçi University*, LEON GMEINDL, *Johns Hopkins University*, & LAURA ZAHODNE & PATRICIA A. REUTER-LORENZ, *University of Michigan*—We investigated interference in the maintenance of spatial locations in working memory. Given the involvement of selective shifts of spatial attention in rehearsal (Awh, Jonides, & Reuter-Lorenz, 1998), we hypothesized that attention-capturing distractor locations might interfere with the maintenance of targets. To test this hypothesis, we presented participants with three simultaneous targets followed by a delay in which sequential distractors were either present or not. The distractors were either three single dots (Experiment 1) or three three-dot configurations (Experiments 2 and 3). Experiments 1 and 2 tested memory for targets and distractors; Experiment 3 tested memory for targets only. The presence of distractors caused no interference despite distractor maintenance demands (Experiment 1), whereas with configural and must-be-encoded distractors interference was observed (Experiment 2). Experiment 3 established that onset of three-dot configurations is not sufficient to cause interference, suggesting that maintenance of distractor configurations interferes with the maintenance of multiple targets.

(4093)

**Underlying Information Processing Mechanisms of the Conjunction Effect.** JESSICA R. CHAMBERLAND, RICHARD A. CHECHILE, LARA N. SLOBODA, & EMILY W. BUSHNELL, *Tufts University*—In two studies, the conjunction effect (e.g., falsely recognizing the foil OVERSEE after learning the parent words SIGHTSEE and OVERCOAT; Jones & Atchley, 2006) was examined by means of multinomial processing tree models to examine the underlying parameters associated with this effect. The first of these studies employed a yes/no procedure, the second used a two alternative forced-choice procedure, and each was followed by a three-point confidence rating. Both studies revealed increased false recognition of conjunctive foils compared to true foils. These errors were also associated with high levels of confidence. Examining multiple retention intervals revealed that targets tested against conjunctive foils at short lags had lower levels of storage than those tested against conjunctive foils at longer lags. The pattern suggests that conjunctive foils act as pseudotargets in both yes/no and forced-choice recognition. Furthermore, as lag increases, conjunctive foils degrade, becoming more like true foils, in both estimates of underlying parameters and overall error rates.

(4094)

**Bias Reversal in Short-Term Priming: Prime Discounting or Event Segregation?** MICHIEL SPAPÉ & BERNHARD HOMMEL, *Universiteit Leiden* (sponsored by Fenna Poletiek)—Huber et al. (2002) observed that short-term repetitions of stimuli turn from repetition benefits (at short SOAs) into repetition costs (at long SOAs). We compared two models that may account for this cost–benefit pattern: (1) the Bayesian ROUSE (responding optimally to unknown sources of evidence) model, which attributes benefits and costs to source confusion and discounting, respectively; and (2) an episodic account de-

rived from TEC (theory of event coding), which attributes benefits and costs to integration and segregation of prime and target. We disentangled previously confounded effects of prime duration and ISI and manipulated prime predictability. The results are not favorable for ROUSE (e.g., making the prime more predictive did not reduce prime “discounting”) but conformed to expectations from the episodic account (e.g., ISI was more important for the sign of the priming effect than was prime duration), which establishes an episodic account as a viable theoretical alternative.

(4095)

**People Use Attention in Working Memory Tasks, But Many Fail to Allocate It.** CANDICE C. MOREY & NELSON COWAN, *University of Missouri, Columbia*—We observed striking individual differences in the ability to allocate attention to one of two cross-domain working memory tasks. In four experiments, participants carried out temporally overlapping working memory tasks: a visual array comparison task and a tone sequence comparison task. To examine the allocation of attention, the relative payoffs for accuracy varied. We found that whereas higher capacity participants were flexible in their allocation of attention, producing orderly attention operating characteristics (AOCs) with varying payoffs, lower capacity participants had only quite small effects of the payoff variable. Nevertheless, attention was required even in low-capacity participants, as is evident from the distracting effects of responding to stimuli in one modality while holding those of another modality in working memory. Individual differences seem critical for the application of standard cognitive methods such as the manipulation of payoffs and should be taken into account when interpreting AOC and performance operating characteristic functions.

(4096)

**Music as Friend and Foe: The Differential Effects of Music on High- and Low-Math-Anxious Individuals.** L. C. BLACK, J. RUDINE, JAMES QUICK, & DOUGLAS A. WARING, *Appalachian State University*—Although the cognitive consequences of math anxiety have been well documented, little if any research has focused on possible factors that may alleviate the performance deficits associated with this problem. The purpose of this study was to examine the role of music in reducing the performance decrements among math-anxious individuals. To test this, high- and low-math-anxious individuals solved a novel arithmetic task in the presence of instrumental, vocal, or no music. Analysis of accuracy rates revealed that the performance of high-math-anxious individuals improved significantly in the presence of music with vocals, whereas the opposite effect occurred for low-math-anxious individuals. These counterintuitive findings are discussed within the context of the research literature on both music and working memory capacity and systems. Future research that could explicate these results is also discussed.

(4097)

**Individual Differences in Adult Reading Skill: A Role for Verbal Working Memory?** GAL BEN-YEHUDAH, MICHELLE MOORE, & JULIE A. FIEZ, *University of Pittsburgh* (sponsored by Christian Schunn)—The contribution of verbal working memory (VWM) to the acquisition and processing of language has been extensively studied. Developmental studies in normal and reading-disabled populations point to a reciprocal relationship between VWM and reading development, which may stem from shared phonological representations. Here, we explored this relationship in adult skilled readers by administering an extensive battery of reading, phonological awareness, and working memory tests to college students. Our findings show that a large proportion of the variance in skilled readers’ comprehension and basic reading skills (word and nonword reading) is still explained by phonological memory (i.e., nonword repetition), even after explicit phonological abilities are controlled. In contrast, classic VWM tests (i.e., serial recall) only accounted for variance in the word identification task. These findings suggest that phonological memory and VWM tasks tap different phonological processes, a dissociation that is also reflected in their relationship with adult reading skills.

(4098)

**Verbal Short-Term Memory of Homophonic Chinese and English**

**Materials.** DENISE H. WU & PRISCILLA L. P. TU, *National Central University, Taiwan*, & OVID J.-L. TZENG, *Academia Sinica, Taiwan* (sponsored by Ovid J.-L. Tzeng)—The close relationship between short-term and long-term language representations has been supported by empirical data. For example, bilinguals' verbal short-term memory (VSTM) performance corresponds to the processing fluency of the materials in different languages. It is not clear, however, whether this linguistic specificity of VSTM performance reflects phonological or lexical-semantic contribution from long-term linguistic representation. In the present study, we examined Chinese–English bilinguals' VSTM of homophonic Chinese characters (L1) and English words (L2) in a serial probed recall paradigm. In Experiment 1, the participants achieved equal accuracy regardless of whether the list was composed of materials in their L1 or of those in their L2. In Experiment 2, when materials in both L1 and L2 were mixed in a list, switching languages between the probe and the target did not cause worse VSTM performance. These findings suggest that for fluent bilinguals materials in L1 and L2 are retained in their phonological but not their lexical-semantic representations.

(4099)

**Working Memory Capacity and Categorization: Sometimes Less Is**

**More.** MARCI S. DeCARO & ROBIN D. THOMAS, *Miami University*, & SIAN L. BEILOCK, *University of Chicago* (sponsored by Robin D. Thomas)—Theories of categorization posit two dissociable learning systems: an explicit hypothesis testing system and a procedural learning system (Ashby & Maddox, 2005). Whereas the former system underlies the learning of working-memory (WM)-dependent rule-based tasks, the latter system supports learning in information integration tasks, requiring information from multiple stimulus dimensions to be integrated at a predecisional stage largely outside of WM. Given the differential demands of these two types of categorization tasks on WM, we tested whether individual differences in WM capacity differentially moderate their acquisition. Higher WM individuals took fewer trials to learn rule-based categories than lower WM individuals. The opposite was true for the information integration categories; there was a working memory  $\times$  categorization task interaction. Consistent with the finding that allocating explicit attention to proceduralized sensorimotor skills disrupts execution (Beilock & Carr, 2001), in situations where explicit hypothesis testing is futile, less WM capacity is actually better than more.

## • IMPROVING MEMORY •

(4100)

**Is Retrieval-Induced Forgetting Context Specific?**

GINO CAMP, DIANE PECHER, & HENK G. SCHMIDT, *Erasmus Universiteit Rotterdam*—Retrieval of information from memory can result in forgetting of related information that is associated to the same cue. Some researchers have found evidence that this retrieval-induced forgetting effect occurs for semantic knowledge (Johnson & Anderson, 2004). However, other researchers suggest that retrieval-induced forgetting is context specific and only found for episodic material when tested with episodic cues (Perfect et al., 2004). We tried to resolve this empirical ambiguity by using a design in which both episodic and semantic effects of retrieval practice could be assessed with item-specific extralist cues. We found no forgetting of semantic memory items. Forgetting of episodic memory items did occur, but only when memory was tested with episodic cues, not with item-specific extralist cues. The results are consistent with a context-specific view of retrieval-induced forgetting.

(4101)

**Rote Rehearsal Learning and Spacing Effects in the Memory of Un-**

**mixed Lists: Evidence From Free Recall and Recognition.** PETER P. J. L. VERKOEIJEN & REMY M. J. P. RIKERS, *Erasmus Universiteit*

*Rotterdam* (sponsored by Remy M. J. P. Rikers)—The spacing effect refers to the finding that memory for spaced repetitions is better than memory for massed repetitions. However, in a recent study, Delaney and Knowles (2005) failed to demonstrate a spacing effect in unmixed lists when participants employed a rote rehearsal strategy. To further investigate this finding, the present series of experiments was conducted. In Experiment 1, participants used a rote rehearsal strategy to study one all-massed list and one all-spaced list. The results revealed a large spacing effect in free recall. Further experimentation showed that the spacing effect in free recall (Experiment 2) and in yes/no recognition (Experiment 3) of unmixed lists interacts with the length of the interrepetition interval. That is, a spacing effect was revealed when the interrepetition intervals were relatively long, but not when they were relatively short. These results were interpreted in terms of a displaced rehearsal framework.

(4102)

**Initial Retrieval Strategies Can Enhance Later Retrieval of Initially**

**Nontested But Related Information.** JASON C. CHAN, KATHLEEN

B. McDERMOTT, & HENRY L. ROEDIGER III, *Washington University*—Recently, we have demonstrated that taking an initial recall test of prose materials can facilitate later retrieval of related information. In this experiment, we attempted to uncover the underlying mechanisms of this retrieval-induced facilitation (RIFa) effect. We hypothesized that RIFa occurs because subjects actively and spontaneously retrieve related information during the initial recall test. To test this hypothesis, we manipulated the way in which subjects performed retrieval during the initial test. Specifically, some subjects were instructed to try to retrieve related information during an initial test (broad instructions) whereas others were asked to minimize such strategies (narrow instructions). If RIFa can be attributed to conscious retrieval of related facts during the initial test, RIFa should only occur in the broad retrieval condition. Indeed, our results confirmed this prediction. Results from reaction time analyses further support the idea that RIFa requires controlled retrieval of related facts during the initial test.

(4103)

**Does Guessing on a Multiple-Choice Test Affect Later Cued Recall?**

BARBIE J. HUELSENER & ELIZABETH J. MARSH, *Duke University*

(sponsored by Patricia Jean Bauer)—Of interest were subjects' reasons for picking answers on a multiple-choice general knowledge test and the consequences of the different strategies for later cued-recall performance. In Experiment 1, subjects in the explanation condition wrote their reason for selecting each multiple-choice answer. Performance in this condition paralleled a control condition in which subjects simply took the multiple-choice test. Both conditions showed positive and negative testing effects on a later cued-recall test. Thus, testing effects were examined as a function of the different reasons given in the explanation condition. Interestingly, guesses on the multiple-choice test were not likely to persist on the final cued recall test. Rather, negative consequences of testing were greatest when subjects claimed to "know" their answer. A second study replicated these results. The negative consequences of multiple-choice testing do not seem to stem from passive guessing, but rather result from active reasoning flaws.

(4104)

**Consequences of Multiple-Choice Testing Persist Over One Week.**

LISA K. FAZIO & ELIZABETH J. MARSH, *Duke University*, &

HENRY L. ROEDIGER III, *Washington University* (sponsored by

Elizabeth J. Marsh)—We had subjects read passages and then take both a multiple-choice and a cued-recall test on the material with different delays. Both positive and negative consequences of prior testing were found. Subjects who had been previously tested on the material answered more questions correctly on the cued-recall test, but they were also more likely to produce incorrect lures from the multiple-choice test. These results persisted after a 1-week delay, especially when the subjects had not read the relevant passages.

(4105)

**The Effect of Type and Timing of Feedback on Learning From Multiple-Choice Tests.** ANDREW C. BUTLER, JEFFREY D. KARPICKE, & HENRY L. ROEDIGER III, *Washington University* (sponsored by David G. Elmes)—Providing feedback after testing facilitates the retention of correct responses as well as the correction of errors. In the present research, we asked how the type and timing of feedback influence learning from a multiple-choice test, variables that have often been confounded in prior research. Students read prose passages and then took an initial six-alternative multiple-choice test. Feedback was given immediately for some of the multiple-choice items and after a 1-day delay for other items. Subjects were either shown the correct answer as feedback (correct answer feedback) or allowed to keep answering until the correct answer was discovered (answer-until-correct feedback). Learning from the test was assessed on a cued recall test 7 days later. The results indicated that delayed feedback led to superior final test performance relative to immediate feedback (perhaps a type of spacing effect). However, type of feedback did not have a differential effect on performance.

(4106)

**Long-Term Retention Is Greater Following Closed-Book Tests Than Open-Book Tests.** POOJA K. AGARWAL, JEFFREY D. KARPICKE, SEAN H. KANG, HENRY L. ROEDIGER III, & KATHLEEN B. McDERMOTT, *Washington University* (sponsored by Leonard Green)—Most tests in education are “closed-book.” However, “open-book” tests, in which students can view their textbook or notes during the test, are currently gaining interest among educators. We investigated the effects of open- and closed-book testing on long-term retention. Subjects studied a prose passage and then restudied the passage, took a short-answer test (closed-book) and then restudied the passage for feedback, or took the test while simultaneously viewing the passage (open-book). Subjects took a final short-answer test 1 week later. Taking the initial test enhanced retention on the final delayed test relative to restudying the passage. Although open-book testing produced better performance on the initial test, it did not improve long-term retention relative to closed-book testing. Increasing the effort involved in learning by using closed-book tests with delayed feedback leads to better retention than using open-book tests and simultaneous feedback.

• MEMORY PROCESSES •

(4107)

**Is Memory Inherently Predictive?** JASON J. JONES & HAL PASHLER, *University of California, San Diego* (sponsored by Hal Pashler)—It has been suggested that prediction may be an organizing principle of the mind and/or the neocortex, with cognitive machinery specifically engineered to detect forward-looking temporal relationships rather than merely associating temporally contiguous events. There is a remarkable absence of behavioral tests of this idea, however. To address this gap, subjects were shown sequences of shapes governed by stochastic Markov processes and then asked to choose which shape reliably came after a probe shape (prediction test) or before it (retrodiction test). In a variety of experiments, it was found that prediction performance was never superior to retrodiction performance.

(4108)

**Active Inhibition or Behavioral Competition in the Think/No-Think Paradigm.** TRACY D. TOMLINSON, *University of Maryland, College Park*, & DAVID E. HUBER, CORY RIETH, & EDDY J. DAVELAAR, *University of California, San Diego* (sponsored by David E. Huber)—The memory suppression theory of Anderson and Green (2001) supposes that unwanted memories are inhibited during retrieval. This makes it difficult to retrieve target memories when memory is probed either with learned cues or with semantic associates (cue-independent memory). In the think/no-think paradigm, participants are trained on cue-target memories and then trained to suppress these memories

through no-think instructions. We propose an alternative account that appeals to behavioral competition rather than memory suppression. Participants learn an alternative behavioral response (e.g., “do nothing”) during no-think training, and this competes with target production. Behavioral competition also predicts cue-independent deficits because the competition concerns the learned response to the retrieved target. We differentiated between these theories by including a “press-enter” condition in which participants quickly pressed enter rather than spending time suppressing the target memory. As predicted by our behavioral competition account, both the press-enter and no-think conditions produced memory deficits.

(4109)

**A New Paradigm for Measuring the Independent Contributions of Familiarity and Recollection to Recognition.** NORBOU E. BUCHLER & LYNN M. REDER, *Carnegie Mellon University*, & LEAH L. LIGHT, *Pitzer College* (sponsored by Lynne M. Reder)—Recognition memory can be based on either the familiarity of the test probe or the recollection of details associated with the memory’s origin. Subjects studied word pairs and later discriminated original word pairs from various types of foils. Instead of old–new judgments, they chose one of five responses: (1) old–old (original), (2) old–old (rearranged), (3) old–new, (4) new–old, and (5) new–new. We manipulated how many times words were studied and how many other words they were associated with as pairs in order to tease apart the contributions of item strength and associative interference. Subjects were good at discriminating among the types of foils, indicating that they were able to retrieve the association and assess the familiarity of each word in a test pair. Item familiarity increased with repetition, whereas recollection of the association decreased with the number of competing associates. These results have implications for dual-process and global models of memory.

(4110)

**Within-List Interference and Inhibition in Retroactive Interference.** DENNIS J. DELPRATO, JUSTIN M. OLDS, & CHRISTINA SILL, *Eastern Michigan University*—Experimental participants in retroactive interference (RI) experiments studied a two-category word list, then a second list of different words from only one of the two first-list categories. First-list retention was estimated from a stem-cued recall test to minimize noninhibitory sources of forgetting. The design of the experiments yielded data on between-condition RI (indicated by lower recall under experimental conditions relative to control activity) and within-list RI (impaired recall of words from the category more susceptible to interference, presumably the category repeated in the second list). The former class of RI was obtained in all experiments. However, within-list RI occurred only in experiments that yielded a substantial level of clustering on a free recall test at the end of first-list study and when second-list study was accompanied by free recall in each cycle, as opposed to supplemental study only. These findings may indicate inhibitory processes in RI.

(4111)

**Retrieval-Induced Forgetting and Levels of Processing During Initial Study Phase.** DAVID P. YELLS, *Utah Valley State College*, & KENNETH A. DEFFENBACHER, *University of Nebraska*—In retrieval-induced forgetting (RIF), practicing some items of a study list reduces subsequent memory for nonpracticed items. We modified our approach to studying RIF by having participants note certain characteristics of items (color, initial letter, or part of speech) during the initial study phase. These characteristics then provided the basis for the practice phase. A final recognition task evaluated the occurrence of RIF. In Experiment 1, RIF was observed for verbs when the practice task was based on item color. We have not previously observed RIF for verbs when item color was the critical characteristic. In Experiments 2 and 3, RIF was not observed for concrete nouns when the critical characteristic was the initial letter (Experiment 2) or part of speech (Experiment 3) of items. The latter results are consistent with our previous reports wherein we did not observe RIF for concrete nouns.

(4112)

**Watching Gestures: Effects on True and False Memories.** KAREN G. NICHOLSON, JENNIFER L. TOMES, & KATHRYN I. POWLES, *Mount Allison University*—We previously found that producing gestures while learning DRM lists increases veridical memory for list words but decreases false memory for lure words. Next, we examined whether simply observing gestures produces similar effects. In Study 1, participants watched a video of an actor performing a gesture related to each list word (e.g., a drinking gesture accompanied by the word *TEA*). Watching ges-

tures increased recognition of studied words and decreased false recognition of both lure and novel unrelated words compared to listening to the lists. Study 2 evaluated whether the gesture needed to be meaningfully related to the list items. We added a group of participants who viewed gestures that were not related to the words (e.g., handwaving accompanied *TEA*). We replicated the results of Study 1 and found that viewing nonrelated gestures had effects similar to those of simply listening to the lists. These data indicate that simply observing meaningfully related gestures improves veridical memory and decreases false memory.

## POSTER SESSION V

Ballroom of the Americas, Saturday Evening, 6:00–7:30

## • JUDGMENT AND DECISION MAKING •

(5001)

**Malevolent Agent Detection: A Cognitive Theory of Conspiracy Theories.** IZZAT JARUDI & FRANK C. KEIL, *Yale University* (sponsored by Frank C. Keil)—The existence of a malevolent agent detector (MAD) may explain the popularity of many conspiracy theories. A MAD is a cognitive bias toward detecting harmful agents that has evolved due to asymmetric fitness costs for false alarms and misses. A conspiracy is simply a group of malevolent agents that colludes to cause large negative outcomes. In two supporting experiments, (1) making an agent more representative of malevolence or (2) increasing the magnitude of a negative outcome led participants to attribute negative outcomes to malevolent agents rather than to other plausible causes. As representative examples of malevolent agents in popular perception, large corporations were judged to be more likely to have engaged in willful wrongdoing than were small businesses with comparable abilities and interests. An unexplained threat to a president was also more likely to be attributed to a conspiracy if he died from it than if he survived (large vs. small negative outcome).

(5002)

**Are Morally Motivated Decision Makers Insensitive to the Consequences of Their Choices?** DANIEL M. BARTELS & DOUGLAS L. MEDIN, *Northwestern University* (sponsored by Douglas L. Medin)—Is morally motivated decision making different from other kinds of decision making? There is evidence that when people have sacred or protected values (PVs), they reject trade-offs for secular values (e.g., “You can’t put a price on a human life”) and tend to employ deontological rather than consequentialist decision principles. People motivated by PVs appear to show *quantity insensitivity*. In trade-off situations, they are less sensitive to the consequences of their choices than are people without PVs. The present study shows that the relationship between PVs and quantity insensitivity varies across contexts: in one design, previous results are replicated; in a second, PVs are related to increased quantity sensitivity. We argue that PVs involve attentional processes and other processing principles that yield different patterns of performance in different contexts (directing attention to whether or not one should make a trade-off vs. a focus on balancing risks and consequences).

(5003)

**Personal Identity and Concern for the Future.** DANIEL M. BARTELS & LANCE J. RIPS, *Northwestern University*—Economists studying intertemporal choice offer many normative bases for discounting future utility—that is, for impatience about the time of receiving a benefit. One compelling argument for impatience rests on an account of personal identity by Derek Parfit (1984). According to Parfit, “psychological connectedness” between one’s current and future selves decreases over time. Because one’s current and distant future selves are sufficiently different in terms of personality, beliefs, and desires, one is not rationally required to care as much about distant future utility. A previous study (Frederick, 2002) failed to find a relationship between self-perceived stability of identity and impatience. Some economists have interpreted this null finding as evidence that identity-based differences do not underlie people’s intertemporal preferences. We ran two studies demonstrating a link between people’s intuitions regarding their personal identity and impatience, finding strong evidence for this relationship in monetary domains and suggestive evidence in nonmonetary domains.

(5004)

**Men and Women: Same World, Different Geographic Representations?** CATHERINE MELLO & MICHÈLE ROBERT, *Université de Montréal*—Estimates of the geographic locations of North Amer-

ican cities reveal biases resulting from category-based, plausible reasoning processes. Gender differences are likely to influence such estimates, since geographic knowledge, which may orient the required judgments, is usually greater in men than in women. Recruited from Quebec university students, the present participants did not exhibit systematic biases in situating Canadian cities, but placed American and Mexican cities south of their actual locations. Unlike men, women did not assign American cities to either a northern or a southern region, and tended to locate Mexican cities in the southern hemisphere. Measures of geographic knowledge, travel experience, and exposure to geographic information provide complementary evidence for understanding the gender differences observed in the subjective geography of North America.

(5005)

**Cognitive Concomitants of Protected Values and Moral Stands.** RUMEN I. ILIEV & DOUGLAS L. MEDIN, *Northwestern University*—Morally motivated decision making appears to have a number of distinctive properties. For example, there is evidence that sacred or protected values are associated with reluctance to consider trade-offs and with deontological decision rules. We report two studies examining the cognitive correlates of protected values. The results demonstrate that people with protected values or strong moral attitudes show a larger Stroop effect for value-related words, a larger conjunction fallacy for value-related scenarios, but a reliably smaller effect of an irrelevant anchor on judgments. These data support the idea that protected values and strong moral attitudes affect attention and the representation of task-related information.

(5006)

**Wealth Disparity and Undermatching in Human Group Foraging.** MICHAEL E. ROBERTS & ROBERT L. GOLDSTONE, *Indiana University, Bloomington* (sponsored by James C. Craig)—Our agent-based foraging model, EPICURE, accurately modeled the empirical resource matching results for a human group foraging task in a virtual world, and it made several testable predictions (Roberts and Goldstone, in press). Here we compared the model’s predictions with new human group foraging results. We examined the effects of high and low levels of Gaussian resource variance for two patchily distributed resource pools, high and low travel distances between pools, and the interaction of three resource pools with two visibility conditions for resources and other foragers. As was predicted, participants switched pools significantly less frequently in the low than in the high variance condition, and in the low travel than in the high travel condition. The low variance condition also led to significantly less wealth disparity, as measured by Gini coefficients. Finally, the three resource pool conditions showed significant resource undermatching in both visibility conditions, thereby extending our previous undermatching results achieved with two pools.

(5007)

**Changes in Risk Taking After Viewing Pictures of the Opposite Gender.** PATRICK McALVANAH, JOEL MYERSON, & LEONARD GREEN, *Washington University*—Prior research has suggested that males who view attractive females show increased levels of delay discounting. We investigated whether viewing photographs of the opposite gender induced greater risk taking in both males and females, using a probability discounting procedure with hypothetical monetary rewards. Experimental subjects viewed pictures of opposite-gender faces; control subjects viewed pictures of cars. Only the experimental group showed increases in risk taking after viewing the pictures (i.e., rates of probability discounting decreased). For subjects who viewed pictures of attractive people, their ratings of the photographs predicted the magnitude of the increase in their risk taking. Males who rated the women as highly attractive displayed a larger increase in risk taking than did men who rated the women as less attractive. In contrast, women who rated the men as less attractive displayed a larger increase in risk taking than did women who rated them as more attractive.

## • COMPARISON AND USE OF CATEGORIES •

(5008)

**Interaction Between Perception and Conceptual Processing.** SASKIA VAN DANTZIG, DIANE PECHER, & RENÉ ZEELENBERG, *Erasmus Universiteit Rotterdam*, & LAWRENCE W. BARSALOU, *Emory University*—According to the embodied view of cognition (see, e.g., Barsalou, 1999), sensorimotor simulations underlie the representation of concepts. This view is supported by findings of similar phenomena in perception and cognition. For example, in perception, switching attention from one modality to another involves a processing cost (Spence, Nicholls, & Driver, 2000). Responses to stimuli are typically slower and less accurate when they are preceded by a stimulus in the same modality than when they are preceded by a stimulus in a different modality. This so-called modality switch effect has also been found using a (conceptual) property verification task (Pecher, Zeelenberg, & Barsalou, 2003). In the present experiment, we investigated whether a modality switch effect occurs across perception and conceptual processing. Subjects performed a perceptual detection task and a property verification task in alternation. A modality switch effect was found, supporting the hypothesis that the same system underlies perception and conceptual representations.

(5009)

**Conceptual Combination With Prototypes Requires Pragmatic Knowledge.** ANDREW C. CONNOLLY, LILA R. GLEITMAN, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Reductionist accounts that identify concepts with matrices of sublexical properties, such as prototypes, have difficulty accounting for the compositionality of concepts, as a result of an apparent commitment to the inheritance of sets of stereotypical properties under conceptual combination. We report an experiment that shows that conceptual combination with prototypes requires mechanisms which serve to discount inherited properties, and that this discounting would have to be highly variable and complex. In particular, conceptual combinations that violate assumptions generally specified by a concept's stereotype (e.g., *purple carrots*) reduce the certainty with which participants ascribe other stereotypical properties (e.g., *crunchiness*) to the combination, and this effect is lessened if the combination does not violate the concept's stereotype (e.g., *Dutch carrots*). Thus, adjustment of weights on inherited properties involves interactions of properties and concepts that seem to require access to general pragmatic knowledge.

(5010)

**Comparing Structural and Discourse Priming in Conceptual Combination.** RANDY E. SAPPINGTON, HEATHER BORTFELD, & STEVEN M. SMITH, *Texas A&M University*—What does *freedom fighter* mean? Conceptual combinations are lexical expressions that people use to communicate efficiently about concepts. Much of the research on these phrases has focused on internal (i.e., structural) features of the combinations and how these dictate understanding. However, discourse also influences how these phrases are understood. In the present study, we demonstrate that using discourse to prime meaning has a greater influence on how people interpret conceptual combinations than does a commonly used structural-level manipulation. We then examine the strength of the discourse-based influence over a series of time delays. Our findings indicate that, while structural features do influence how a combination is interpreted, the discourse context surrounding the combination plays an influential role in guiding interpretation as well. Furthermore, this influence persists over time. We argue that a complete account of how conceptual combinations are understood must include both structural- and discourse-level influences.

(5011)

**Effect of Boundary Placement on Similarity Judgments for Natural Stimuli.** KATJA WIEMER-HASTINGS, *Northern Illinois University*—Similarity judgment is largely determined by the extent to which items

share perceptual and functional features. The spatial arrangement of items, including spatial distance and boundaries, can affect perceived similarity as well. This project tested the influence of two spatial factors, spatial proximity and boundary placement, on similarity judgments of natural stimuli presented in photographs. Both factors were combined factorially with perceptual and functional similarity. Spatial distance had no effect on the ratings, nor did it interact with other factors. However, there was an interactive effect for boundary with perceptual and functional similarity. Two items with perceptual, but not functional, similarity were rated as more similar when presented within the same bounded region. However, boundary placement had no effect on the similarity of functionally and perceptually similar items. This may suggest that placement within the same boundaries is interpreted as indicating a common function.

(5012)

**Relating Similarity and Difference.** SABRINA SIMMONS & ZACHARY ESTES, *University of Warwick* (sponsored by Zachary Estes)—Current models of similarity assume that all people construe similarity in the same way. In two studies, we investigated individual variability in similarity and difference judgments, as well as the relationship between similarity and difference. Both studies used a triad task in which participants judged whether a target (*bees*) was more similar to (or more different from) a taxonomically related alternative (*flies*) or to a thematically related alternative (*honey*). Study 1 revealed that similarity and difference are bimodal: Approximately half of the participants in both the similarity group and the difference group tended to choose the thematic alternative. In addition to this bimodality, Study 2 also demonstrated noninversion: Participants who chose the thematic alternative as more similar often chose that same item as more different from the target. These results suggest that some participants' preference for thematic relations causes a noninversion of similarity and difference.

(5013)

**Dissociating Typicality and Goodness Judgments: Category-Based Differences.** ANIKET KITTUR & KEITH J. HOLYOAK, *UCLA*, & JOHN E. HUMMEL, *University of Illinois, Urbana-Champaign*—Items that are rated as good examples of a category have generally been assumed to be highly typical as well. However, in a prior study using artificial stimuli, we showed that for categories defined by relations between features, goodness-of-exemplar judgments were based on relational ideals, whereas typicality judgments were based on a mix of ideals and central tendencies. In the present experiment, we reexamined a range of categories to determine whether these results held for everyday categories as well. The categories were sampled from a variety of landmark categorization studies, and included natural kinds, artifacts, classically defined categories, and ad hoc categories. Participants were asked to rate exemplars based on either category goodness or typicality. The results indicate that exemplar goodness and typicality can lead to two distinct forms of graded category structure, and should not be treated as equivalent.

(5014)

**An Eye Tracking Analysis of the Effect of Prior Comparison on Analogical Mapping.** CATHERINE A. CLEMENT, *Eastern Kentucky University*, & RUBY C. HARRIS, TARA N. WEATHERHOLT, & BARBARA M. BURNS, *University of Louisville*—We explored the use of eyetracking to study the effect of prior comparison on analogical mapping. Analogical mapping can be difficult because the relational structure shared between analogues is embedded in contexts that have either dissimilar surface features or irrelevant surface similarities. Past research has indicated that experience with mapping a structure facilitates future mapping (e.g., Markman & Gentner, 1993). The present subjects compared scenes that shared a relational structure. Scenes differed in primary surface context but included some irrelevant surface matches. Prior experience with matching scenes did not affect eye fixations on components of the shared structure, and

had only a small tendency to reduce fixations on irrelevant surface matches, which were relatively few overall. Analyses of eye movements showed that proportionally few movements occurred directly between similar objects or between corresponding objects. We discuss the implications for the value of eyetracking for understanding analogical mapping.

(5015)

**The Influence of Conceptual Coherence on the Plausibility of Property Explanations.** DANIEL HEUSSEN & JAMES A. HAMPTON, *City University London* (sponsored by James A. Hampton)—Research on explanation has primarily focused on explanations of events (*why did the tree fall?*) rather than of properties (*why do trees have leaves?*). An exploratory study revealed that people often use one property to explain another (i.e., axes' being dangerous was explained by axes' being sharp). Our study examined the factors affecting the relative plausibility of such explanations. A total of 146 explanations of the form *x has p because it has q* were judged for plausibility. Measures of counterfactual relations and co-occurrence between the two properties, mutability of each property, and a measure of conceptual coherence based on network diagrams (Sloman, Love, & Ahn, 1998) were used in a regression analysis to predict plausibility. Conceptual coherence was the strongest predictor of plausibility, followed by counterfactuals, in a model explaining almost 75% of the variance.

(5016)

**The Generation of Category Labels Affects Property Inferences.** BEN D. JEE & JENNIFER WILEY, *University of Illinois, Chicago*—In property inference tasks, people seem to rely on category labels more than on other features. In the real world, however, category labels are often generated, not provided. Categorization may lead to less reliance on category labels because it requires attention to features and is often uncertain. However, if people rely on the labels they generate, their inferences should be highly category consistent. In this research, groups of participants were asked to make property inferences after either generating or receiving a category label. A third group simply made inferences. When categories were learned through classification, the generation group was most category consistent in their inferences. We discuss how different category learning conditions and preference categorization affect performance in property inference tasks.

(5017)

**Circuit Optimization and Rule-Based Categorization.** DANIEL LAFOND, YVES LACOUTURE, & GUY MINEAU, *Université Laval* (sponsored by A. A. Marley)—An early view of human categorization—the classical approach—suggested that learned categories are stored as feature lists of necessary and (jointly) sufficient attributes that define category membership. This theory was incapable of representing ill-defined categories. The minimal algebraic descriptions listed in the catalog of Boolean concepts (Feldman, 2003) are Boolean propositions that describe classification rules. We argue that Boolean complexity minimization provides a complete version of the classical approach: It can represent any category structure defined over a set of binary variables. SIS is a digital circuit optimization program producing minimized categorization rules. We developed a new script and revised the minimal formulae of 158 out of 253 category structures listed in the catalog of Boolean concepts. There are basic similarities between rule-based categorization, multilevel combinatorial circuits, and McCulloch–Pitts artificial neural networks. Additionally, the verification process of a Boolean rule can be represented by a decision tree.

(5018)

**Essentialist Beliefs About Basic and Superordinate Level Categories.** CLAIRE L. SIMMONS & JAMES A. HAMPTON, *City University London*—Our study investigated essentialist beliefs about basic and superordinate concepts in artifact and natural kind domains. In four

tests of essentialist beliefs, 128 participants judged borderline members of a range of conceptual categories (about 190 items). While natural kind categories consistently showed greater essentialist responding than did artifact categories across all four measures, the pattern of results for the basic/superordinate level distinction was more complex. Basic level concepts elicited more graded (rather than all-or-none) membership judgments than did superordinate concepts for artifacts but not for natural kinds. In contrast, basic level concepts in both domains were more essentialist in terms of willingness to defer to experts and in the belief in the existence of objective criteria for membership. A dissociation between gradedness and deference/objectivity of membership criteria is implied. Results are discussed in terms of structural differences between basic and superordinate level categories.

• PSYCHOLINGUISTICS •

(5019)

**Influence of Dynamic Masking on Horizontal Saccades in Divided Visual Field Studies.** KEITH YOUNG, RUTH ANN ATCHLEY, & PAUL ATCHLEY, *University of Kansas*—A typical issue in divided visual field research is that of the horizontal saccades made by participants. The attention literature suggests that there should be fewer saccades with the use of a mask that both proceeds and follows the target, reducing the impact of luminance changes. Recent research demonstrates the ineffectiveness of a simple offset mask, so a complex, dynamic mask was created. The new mask occludes the targets with other words and is paired with a nonword placeholder in the opposite visual field. Results show the elimination of both the visual field main effect and a visual field  $\times$  relatedness interaction. This could be due to either the new mask or a property of the placeholder. Current research compares (recording both behavioral and saccade data) a dynamic onset mask with the dynamic offset mask and investigates the effect of the placeholder in a factorial design.

(5020)

**Modulation of Semantic Competition Through Novel Word Learning.** ANNA MARIA DI BETTA & GARETH GASKELL, *York University*—How do novel words influence the activation of both form and meaning of existing phonological lexical representations? Two experiments targeted this issue. Experiment 1 compared the effects of learning novel words when the training conditions involved either a phoneme monitoring task or a repetition task. In both cases, effects on corresponding base words (lexical competition) were not observed immediately, but they emerged on Day 2. Experiment 2 added a training condition in which the novel words were presented in a semantically rich context. Preliminary results showed changes in the level of activation of the base words in a cross-modal semantic priming task. In addition, there was no evidence of lexical competition in Day 1. Therefore, the type of training does not affect the time course of lexicalization of the novel words. Theoretical implications of these results are discussed.

(5021)

**Do Semantic and Associative Priming Effects Show Age-Related Change?** PHYLLIS P. TAM, MEREDITH A. SHAFIQ, BILLI RANDALL, & LORRAINE K. TYLER, *University of Cambridge*—Semantic priming studies comparing younger and older adults have yielded variable results, including age-related priming increases, decreases, or invariance. Reported age differences are interpreted as reflecting age-related impairment, linguistic expertise, or an artifact of general slowing. Inconsistent findings may be due in part to a failure to account for different prime–target relationships (e.g., semantic vs. associative), item characteristics (e.g., word frequency), and subject characteristics (e.g., word knowledge) which may differentially affect young and older adults' priming. The present experiment contrasted priming for semantically and/or associatively related word pairs and found that older and younger adults demonstrated both priming types. Differ-

ences in priming between age groups were examined by correlating degree of priming in younger and older adults with measures of item characteristics (e.g., frequency and imageability) and subject characteristics (e.g., vocabulary scores, digit span, or NART scores). Implications are discussed for the interpretation of age differences in semantic priming.

(5022)

**Variability in Response Criteria Affects Estimates of Conscious Identification and Semantic Exclusion Failure.** JESSE J. BENGSON & KEITH A. HUTCHISON, *Montana State University*—The role of response criteria in masked semantic priming was examined using an exclusion task. Experiment 1 used online prime report (“report the prime if you saw it”) and exclusion instructions. Participants were told to avoid completing a word stem (e.g., *mo—*) with a word related to a briefly flashed prime (e.g., *cash*). Semantic priming (i.e., exclusion failure) was moderated by people’s ability to report the prime. In Experiment 2, prime report thresholds were made more liberal by instructing participants to guess on every trial. Prime report increased from Experiment 1 as exclusion failures dissolved. Experiment 3 clarified the relationship between awareness and prime identification using an online measure of confidence and different liberal prime report instructions. The present findings suggest that the ability to act upon (via exclusion performance) and report information in a masked prime is determined by response criteria, which can be manipulated as independent variables.

(5023)

**Implicit Effects of Grammatical Gender on Categorization in German Speakers.** ELEANOR C. PRESSON, *Carnegie Mellon University*, & MARIA D. SERA, *University of Minnesota, Twin Cities*—How does the language you speak change the way you categorize the world? The present study had two goals: to determine whether a grammatical gender system conveyed information similar to that of biological sex, and to further examine whether such effects are implicit or explicit, linguistic or nonlinguistic. A reaction time measure from the implicit association test, originally used to measure prejudice, was administered using nonlinguistic stimuli to native German speakers. Data showed an implicit association between grammatical gender and biological sex, even though stimuli were pictures and therefore should not have activated linguistic representations, and the task was administered in English. This result should help clarify the nature of often-controversial effects of language on thought.

(5024)

**Homophone Meaning Dominance in the Visual World Paradigm.** LILLIAN CHEN & JULIE E. BOLAND, *University of Michigan*—Two head-mounted eyetracking experiments found meaning dominance effects in both the latency and the probability of looks to a picture representing one meaning of a homophone (e.g., *flower/floor*) in a “Look at the flower/floor” paradigm. In each experiment, a central fixation was followed by four pictures, only one of which represented a homophone meaning. In Experiment 1, the pictures appeared at sentence onset; in Experiment 2, they appeared at homophone onset. Experiment 1 demonstrated that meaning dominance predicts gaze latency better than does orthographic string frequency. In Experiment 2, a shape-similar item was displayed for the nonpictured meaning of the homophone (e.g., a pillow, a flower, and two distractors). We replicated the meaning dominance effect on looks to the actual picture (*flower* or *floor*), and also found meaning dominance effects on looks to the shape-similar pictures. Thus, the paradigm can reveal the time course of activation between different meanings of a homophone.

(5025)

**Prior Visual Experience Modulates Sentence Comprehension: The Visual Memory Paradigm.** MARK AVEYARD, ROLF A. ZWAAN, RALPH R. RADACH, & CHRISTIAN VORSTIUS, *Florida State University*—In Phase 1 of a two-part experiment, participants viewed

word–picture pairs while making verification judgments on each pair. In Phase 2 (ostensibly unrelated to Phase 1), participants read short texts in which the final sentence of critical texts implicitly constrained the shape of a focal object (e.g., “In the sky, an eagle was soaring over the prairie”). Eye-fixation data showed that participants spent more time reading sentences that constrained the shape of a focal object in a way incongruent with the visual experience of the object in Phase 1 (a picture of a perching eagle). This match advantage first emerged on the critical word “eagle” in first fixation reading times and was particularly pronounced on regressions to the word that implicitly disambiguated the shape or condition of the focal object (“sky”). The results point to a highly specified and immediate influence of recent perceptual experience on naturalistic reading.

(5026)

**Finding the Right Word: Hemispheric Asymmetries in the Use of Sentence Context Information.** EDWARD W. WLOTKO & KARA D. FEDERMEIER, *University of Illinois, Urbana-Champaign*—Recent behavioral and electrophysiological evidence suggests that the two cerebral hemispheres are sensitive to sentence-level information in different ways. It has been suggested that only the left hemisphere (LH) makes predictions about upcoming items, while the right hemisphere (RH) processes words in a more integrative fashion. The present study used event-related potentials to examine the effect of sentential constraint on the processing of expected and unexpected sentence completions. Plausible but unexpected words matched for contextual fit were inserted into strongly and weakly constraining sentence frames. For right visual field (RVF)/LH presentation, the response to unexpected items was affected by the level of expectancy for the best completions, consistent with the hypothesis that the LH uses context predictively. For left visual field (LVF)/RH presentation, only strongly constrained endings elicited a clearly reduced N400 in comparison with the other conditions, supporting the view that the LH and RH have different language comprehension architectures.

• PHONOLOGICAL PROCESSING •

(5027)

**The Impact of Phonological Neighborhood Spread on Visual Word Recognition.** MARK YATES, JOHN FRIEND, & DANIELLE M. PLOETZ, *University of South Alabama*—Recent studies have shown that phonological neighborhood influences visual word processing. In most cases, the results of these studies indicate that words with many neighbors are processed more rapidly than are those with few neighbors. What has not been considered in this research is the influence of neighborhood spread. *Spread* is defined as the number of phoneme positions that can be changed to yield a phonological neighbor. The two studies reported here compared responses to words that had the same number of neighbors but differed on neighborhood spread. The results indicate that words having three phoneme positions that form a neighbor are responded to more rapidly than words having only two positions that form a neighbor. This effect was evident in both the progressive demasking and lexical decision tasks. The results are interpreted in terms of current models of visual word recognition.

(5028)

**The Role of Intervocalic Consonants in Disyllabic Word Naming.** MICHELLE WAESE & DEBRA JARED, *University of Western Ontario*—This study investigated skilled readers’ knowledge of spelling–sound relationships in disyllabic words. Previous research has indicated that vowels are the major source of inconsistency in English spelling–sound correspondences. We examined whether readers use knowledge about the number of intervocalic consonants to determine the pronunciation of the initial vowel in disyllabic words. The number of intervocalic consonants may provide a clue to readers as to whether the first syllable is open (CV) or closed (CVC). The vowel in open syllables often is given a long pronunciation, whereas the vowel in closed syllables typically is given a short pronunciation. One study

had participants name disyllabic words with either one or two intervocalic consonants and either a long or short first vowel. In a second study, participants named disyllabic nonwords with either one or two intervocalic consonants. The results provided evidence that vowel pronunciations are influenced by the number of intervocalic consonants.

(5029)

**Do People Pronounce Words in the Same Way? The Applicability of Phonological Rules in Reading Hangul Words.** YOO-KYOUNG LIM & HYE-WON LEE, *Ewha Womans University*—Hangul (the Korean writing system) is characterized by alphabetic letters but also by the syllabic structure into which the letters are combined. Because letter-to-sound mapping is rather regular, phonological changes occur across a syllabic boundary rather than within a syllable. Phonological changes are strictly regulated by the rules, but Korean readers do not seem to pronounce the words in the same way as predicted by the rules. We examined the applicability of the eight phonological rules that are used most frequently. In Study 1, participants transcribed the 320 words after they had pronounced them. The results showed that there were differences in the applicability of the rules. Further, there was a slight hint of the correlation between rule applicability and word frequency. In Study 2, participants named the same 320 words. The results showed that the naming latency tended to increase when the words involved the less applicable rules.

(5030)

**Do Early Phonological Representations in Visual Word Recognition Include Prosodic Information?** JANE ASHBY, *University of Massachusetts, Amherst* (sponsored by Arnold D. Well)—Three studies examined the representation of prosodic syllable information in word recognition during silent reading. In Experiment 1, we measured fixation durations for high and low frequency words that were silently read in sentence contexts. Parafoveal previews that contained the exact initial syllable of the target (i.e., the congruent preview condition) or the initial syllable plus the next letter (i.e., the incongruent preview condition) preceded each target. In Experiment 2, we used a modified lexical decision paradigm to measure reaction times to targets preceded by congruent and incongruent previews. In Experiment 3, we recorded EEG during single word reading in a masked priming paradigm and compared waveforms elicited in the incongruent and congruent conditions. The data from these three studies indicate that participants processed initial-syllable information. This suggests that skilled readers activated prosodic phonological representations early in visual word recognition.

(5031)

**Naming Pseudohomophones: Does Similarity to the Baseword Matter?** KAREN A. HUSSEY & STEPHEN J. LUPKER, *University of Western Ontario*—Pseudohomophones, nonwords that sound like words when pronounced, have been used in a number of naming experiments in order to examine various theoretical proposals concerning lexical processing (see, e.g., Reynolds & Besner, 2005). In the present research, we examined the variable of whether the pseudohomophone is an orthographic neighbor (i.e., different by only one letter) of its baseword (e.g., DURT for DIRT vs. GLEW for GLUE). This variable was crossed with baseword frequency. Counterintuitively, pseudohomophones having low-frequency basewords were consistently named more slowly if they were orthographic neighbors of their baseword than if they were not. This *baseword interference effect* was less consistent with pseudohomophones having high-frequency basewords. Versions of Coltheart, Rastle, Perry, Langdon, and Ziegler's (2001) dual route cascaded (DRC) model which can and cannot simulate these phenomena are considered.

(5032)

**Scale-Free Network Structure in Orthographic and Phonological Word Forms.** BRANDON C. BELTZ & CHRISTOPHER T. KELLO, *George Mason University* (sponsored by Christopher T. Kello)—

Steyvers and Tenenbaum (2005) reported that semantic networks of English words exhibit a scale-free structure. The present study investigated whether words also exhibit a scale-free structure when their orthographic and phonological forms are linked as networks. Network analyses were conducted on English, Dutch, and Japanese corpora of over 45,000 words each. For each corpus, a network was created by linking any two words for which one was a substring of the other. For all three networks, the number of words inside  $k$  other words was proportional to  $k$  raised to a power. The exponents of these lawful scaling relations were comparable to other scale-free networks that have been found in computer networks, social networks, and many other kinds of networks found throughout nature. The scaling relations were simulated by a simple “rich get richer” growth process applied to word concatenations. The implications of these findings for lexical processing are discussed.

• WORD RECOGNITION •

(5033)

**The Syllabic Neighborhood Effect in Polysyllabic English Word Recognition.** HSIN-CHIN CHEN & JYOTSNA VAID, *Texas A&M University* (sponsored by Jyotsna Vaid)—How polysyllabic words are accessed poses an interesting problem for visual word recognition: Are such words segmented on the basis of syllabification principles reflecting the words' sounds (e.g., the maximum onset principle), or are they segmented according to their orthographic structure (e.g., the coda-maximizing strategy proposed by Taft [1979], termed the basic orthographic syllable structure [BOSS])? The evidence to date suggests that readers of different languages may differ in their segmentation biases. Spanish and French readers, for example, show a phonological preference, while English readers do not (Chen & Vaid, in press). The present lexical decision study with English readers examined whether a syllable neighborhood effect previously observed for Spanish (Perea & Carreiras, 1998) and French (Mathey, Zagar, Doignon, & Seigneuric, 2006) is observable in English and whether it reflects orthographic versus phonologically based syllable segmentation. The results provided support for an orthographically based syllable neighborhood effect for English.

(5034)

**Functional Forms of Frequency and Contextual Diversity Effects in Lexical Decision.** JAMES S. ADELMAN & GORDON D. BROWN, *University of Warwick*—Several recent papers have examined the functional form of frequency effects on lexical decision latencies in the context of specific mechanisms for the task. We (Adelman, Brown, & Quesada, in press) have recently provided evidence that contextual diversity (i.e., the number of contexts in which a word occurs), not word frequency, determines such latencies, and it is therefore of theoretical interest to examine the functional form of the relationship between these measures and lexical decision latencies. Here we outline the functional forms predicted by various lexical decision mechanisms and report statistics describing the fit of several functional forms—namely, rank, logarithmic, exponential, logistic, power, race, and APEX.

(5035)

**Constituent Frequency in Recognizing Compound and Pseudocompound Words.** GREG B. SIMPSON, APRIL FUGETT-FULLER, UN-SO PARK-DIENER, & SPENCER LAZOROW, *University of Kansas*—Recent research has proposed that compound words are decomposed into their morphological constituents prior to recognition. Recognition should therefore be sensitive to the frequency of these constituents. In two lexical decision experiments, we examined frequency effects of first and second constituents of compound words. In Experiment 1, compounds in which both constituents were high frequency were recognized more quickly than words with any low-frequency constituents. Compound nonword foils (e.g., ARTBALL) showed faster responses when the first constituent was low frequency.

In Experiment 2, compounds were compared with pseudocompounds (e.g., BRANDISH). Compound words again showed an advantage when both constituents were high frequency, but pseudocompounds did not show the first-constituent frequency effect. This result suggests that compound decomposition may not be obligatory.

(5036)

**The Role of Orthographic Neighbors in Masked Semantic Priming Effects.** YASUSHI HINO & YUU KUSUNOSE, *Waseda University*, & STEPHEN J. LUPKER, *University of Western Ontario*—Finkbeiner, Forster, Nicol, and Nakamura (2004) suggested that the size of a masked semantic priming effect in lexical decision is determined by the number of target senses activated by the masked prime. We evaluated this hypothesis by manipulating the number of senses for the prime and the target (using few–many sense pairs and many–few sense pairs) using Japanese words. In contrast to the predictions from Finkbeiner et al.'s model, the masked semantic priming effect was larger for the few–many sense pairs than for the many–few sense pairs. Additional data analyses revealed that the effect size was modulated by the relatedness between the orthographic neighbors of the masked prime and the target—that is, the larger effect for the few–many sense pairs emerged because many-sense targets were related to more orthographic neighbors of their primes. The underlying mechanism of the masked semantic priming effect is discussed.

(5037)

**Orthographic Uniqueness Point (OUP) and Word Recognition Processes.** SUSAN J. RICKARD LIOW & WENYA ZHUANG, *National University of Singapore*, & DAVID W. GREEN, *University College London*—The orthographic uniqueness point (OUP) is the position of the first letter, reading from left to right, that allows a word to be distinguished from all others. If sequential processing operates, this kind of orthographic neighbor variable should be salient for the early stages of word recognition. In Experiment 1, we failed to replicate the reported latency advantage for early OUP words in lexical decision (Kwantes & Mewhort, 1999; Lindell, Nicholls, & Castles, 2003) with a new set ( $N = 64$ ) of matched monomorphemic eight-letter words (see also Lambert, 2005). In Experiment 2, we employed a within-string letter search task for the same set of early versus late words and found the predicted main effect of OUP, but also a reliable OUP  $\times$  target position interaction with final position target letters in early OUP words showing a significant latency disadvantage. This counterintuitive result is discussed with reference to extant models of skilled reading.

(5038)

**Stroop Effect in Chinese Characters and Pinyin: Orthography and Language Experience.** LIANG TAO, *Ohio University*, & ALICE F. HEALY, *University of Colorado, Boulder*—In a Stroop task, subjects named ink colors in Chinese with four stimulus types (color patches and incongruent color words in Chinese characters or in pinyin [a Romanized alphabet] with or without tone markings) and seven subject groups (native Chinese speakers of three dialects [Mandarin, Cantonese, Xiang], native Japanese speakers, and native English speakers in Chinese language courses at three levels). A Stroop effect (slower responses to color words than to color patches) was obtained. The effect was larger with Chinese characters than with pinyin for the native Chinese and Japanese speakers, but the opposite held for the native English speakers. The Stroop effect was found with the pinyin stimuli only for subjects who knew English. The findings suggest that logographic and alphabetic writing systems evoke different cognitive processes, and that the cognitive processes develop with language proficiency. Familiarity with the alphabetic system promotes automatic phonological processing during unintentional lexical access.

(5039)

**Morphology and Meaning in the Recognition of English Compounds.** ERIC G. MATHIAS, GREG B. SIMPSON, & GEORGE KELLAS,

*University of Kansas*—Currently, there is great interest in the role of morphology in word recognition. Most research has focused on inflectional or derivational representations. In the present research, in two lexical decision experiments we examined the decomposition of English compounds. In Experiment 1, compound words primed either their first or second constituents (e.g., ARMBAND–arm or ARMBAND–band) at SOAs of 100 or 300 msec. Both constituents showed priming from the compound, though second constituents were faster overall than first. In Experiment 2, compounds primed associates of the constituents (e.g., ARMBAND–leg or ARMBAND–music). At the 100-msec SOA, only associates of the first constituent were primed by the compound. At 300 msec, however, only those of the second constituent were primed. These results suggest rapid decomposition of compound words and changing semantic activation of individual constituents. The first (leftmost) constituent activates associated information initially, but the second constituent (semantic anchor) becomes more dominant as processing continues.

(5040)

**Semantic Transparency and Masked Morphological Priming: An ERP Investigation.** JOANNA A. MORRIS, *Hampshire College*, TIFFANY FRANK, *Tufts University*, JONATHAN GRAINGER, *Université de Provence*, & PHILLIP J. HOLCOMB, *Tufts University*—This experiment examined the role of semantic information in the segmentation of morphologically complex words, by examining event-related responses (ERPs) to targets primed by semantically transparent (e.g., *hunter–hunt*), opaque (e.g., *corner–corn*) and orthographically, but not morphologically, related primes (e.g., *scan–scandal*), using a lexical decision task and the masked priming technique. The behavioral data showed that both transparent and opaque items gave rise to significant priming effects, whereas orthographic items did not. The physiological data showed similar effects; for both the N250 and the N400, we found that items in the transparent and opaque conditions generated greater priming effects than did items in the orthographic condition. Both the behavioral and the physiological data indicated that these effects were greater for transparent items than for opaque. In addition, the N250 differed in its topographic distribution, with an anterior effect for the transparent items and a more posterior effect for the opaque.

• ATTENTIONAL CAPTURE •

(5041)

**Electrophysiological Evidence for Contingent Attentional Capture.** ZACHARY I. GOODIN & MEI-CHING LIEN, *Oregon State University*, ERIC D. RUTHRUFF, *University of New Mexico*, & ROGER W. REMINGTON, *Johns Hopkins University*—Some studies have suggested that attentional capture is contingent on attentional control settings induced by task demands, whereas others have suggested that attentional capture depends primarily on stimulus salience. We addressed this issue using the N2pc, a negative voltage spike in the brain potentials in the parietal cortex, thought to reflect attentional allocation. The N2pc is lateralized, making it possible to assess whether attention is allocated to the left or the right visual field. We used a cuing paradigm, with a color cue (25% valid, 75% invalid) followed by a target display. Participants identified the letter in a specific color (red or green). The behavioral data showed a typical cuing validity effect (~50 msec). The event-related potential data showed a robust N2pc to the color cue, similar in magnitude to the N2pc to the target itself. Furthermore, the color cue elicited a similar N2pc even when competing with a salient, simultaneous abrupt onset.

(5042)

**No Attentional Capture by Incongruent Cues: Tests of Rapid Disengagement.** PEGGY CHEN & J. TOBY MORDKOFF, *Pennsylvania State University* (sponsored by Cathleen M. Moore)—Previous research has shown that salient cues that do not contain the target's defining attribute do not cause a spatial cuing effect in response time.

This can be explained by contingent capture (under which incongruent cues do not capture attention at all) and also by rapid disengagement (under which salient incongruent cues cause only brief capture). We tested these models using very short SOAs between the cues and the targets. We found no evidence of a spatial cuing effect for salient incongruent cues, even at an SOA of 35 msec. Thus, the evidence to date favors contingent capture.

(5043)

**The Parting Shot: More on the Effects of Cue Offsets on Attentional Capture.** SHU-CHIEH WU, *NASA Ames Research Center*, & ROGER W. REMINGTON, *Johns Hopkins University*—In spatial cuing studies, abrupt onsets typically produce a biphasic reaction time pattern: facilitation at short cue–target stimulus onset asynchronies (SOAs), inhibition at long SOAs. It has been observed that the facilitation at short SOAs is affected by whether or not the abruptly onset cue offsets prior to the target. Offsetting the cue prior to the target results in relatively slower responses at cued than at uncued locations at early intervals, as opposed to relatively faster responses predicted by current theories of attentional capture (referred to as the offset effect). Here we report experiments showing that, rather than inhibition of cued target locations, the offset effect involves instead facilitated responses to targets at uncued locations. The finding that unattended locations are responded to much faster than attended locations challenges common mechanisms of spatial attention. We discuss potential nonattention-related mechanisms contributing to the offset effect.

(5044)

**Synergistic Attentional Effects of Abrupt Onsets and Color Singletons.** FENG DU & RICHARD A. ABRAMS, *Washington University*—Subjects identified the sole colored letter in a rapid serial stream of letters presented at fixation. Previous research has shown that an irrelevant, peripheral distractor can capture attention under such conditions if it matches the target color, causing an attentional blink. In the present study, we found that such an effect depends on presentation of the distractor via an abrupt onset. Without an abrupt onset, the distractor did not impair target identification. Additional results indicate that abrupt onsets in this paradigm might help to establish a preparatory state necessary for contingent attentional capture. The results reveal a synergism between the attentional effects of abrupt onsets and color singletons.

(5045)

**New Objects and New Motion.** SHAWN E. CHRIST & RICHARD A. ABRAMS, *Washington University*—Past studies have identified a handful of stimulus events that appear to capture attention in a stimulus-driven, bottom-up fashion. Two such events are the appearance of a new object and the introduction of motion to a display. To date, previous research has focused on these events in isolation. In the present study, however, we utilized a visual search paradigm to study the attentional influence of new objects and new motion under conditions in which each stimulus event occurred in isolation (e.g., a preexisting object began moving, or a new static object appeared) as compared with when the events co-occurred (e.g., a new moving object appeared). Results are discussed within the context of our current understanding of visual attention and the underlying neurocognitive substrates.

(5046)

**Effects of the Range of Distractor Positions on Auditory Target Detection.** MICHAEL D. HALL & JEFFREY ANDRE, *James Madison University*—Detection of visual targets is adversely affected when they occur outside a constrained range or window of locations for preceding objects (e.g., tunnel vision). The present investigation determined what effects the range of distractor positions might have on the detection of auditory events. Listeners heard extended sequences of distractors distributed across five spatial positions; isolated targets were assigned positions (e.g.,  $\pm 60^\circ$ ) either inside ( $-90^\circ$  to  $+90^\circ$ ) or outside ( $-30^\circ$  to  $+30^\circ$ ) the range of distractors. In one experiment, tar-

gets and distractors were clicks that differed in intensity. Detection was faster and more frequent when targets were outside the range of distractors, and not because of spatial cuing by immediately preceding distractors. The experiment was replicated using sine tones of different frequencies to establish whether the observed effects are restricted to dimensions that are required to assess event location. Implications for cuing and models of attention are discussed.

(5047)

**Irrelevant Auditory Singletons Capture Attention During Sequential Visual Search.** POLLY DALTON & CHARLES JASON SPENCE, *University of Oxford* (sponsored by Charles Jason Spence)—Attentional capture has typically been studied in spatial search tasks. However, Dalton and Lavie (2004, in press) have shown recently that visual and auditory attention can be captured by a singleton item presented during sequential search tasks. In the experiments reported here, we investigated whether these findings extend to tasks of audiovisual sequential search. Participants searched a stream of centrally presented audiovisual stimuli for visual targets defined on a particular dimension (e.g., size). Task performance was compared in the presence versus the absence of an auditory singleton distractor that was unique on an irrelevant dimension (e.g., duration). Irrelevant auditory singletons captured attention during the visual search task, leading to interference when they coincided with distractors but to facilitation when they coincided with targets. These results provide the first demonstration of audiovisual attentional capture in a sequential search task.

(5048)

**Auditory Distraction: A Unitary or Dual Phenomenon?** ROBERT W. HUGHES, *Cardiff University*, FRANÇOIS VACHON, *Université Laval*, & GARETH LINSMITH & DYLAN M. JONES, *Cardiff University* (sponsored by Charles Hulme)—In three experiments, we examined whether task-irrelevant changing-state sound disrupts visually based focal processing via the same mechanism as infrequent, deviant, auditory events or whether auditory distraction comes in at least two varieties. In line with the dual-phenomenon hypothesis, the disruption of visual–verbal serial recall produced by changing-state speech was additive to that of a single deviant voice embedded within the speech; a deviant voice repetition within the context of an alternating-voice irrelevant speech sequence disrupted serial recall; and a voice deviation effect, but not a changing-state effect, was found in the context of a missing-item task. We suggest that whereas the changing-state effect results from the sound competing for the control of action, deviation effects result from the actual capture of attention. However, the two phenomena may nevertheless be unified conceptually as different outputs of the same auditory-change detection mechanism involved in the process of organizing auditory stimuli into streams.

(5049)

**Distraction Within and Between Modalities: Semantic and Perceptual Determinants.** JOHN E. MARSH, HELEN M. HODGETTS, & DYLAN M. JONES, *Cardiff University* (sponsored by Fabrice B. Parmentier)—When learning lists of items, is it more difficult to ignore semantically related information when irrelevant information is presented in the same or in a different modality? While encoding lists—whose membership was drawn from single semantic categories—for free recall, participants were presented with irrelevant items drawn from either the same or a different semantic category as those in the to-be-remembered list. Also manipulated was the modality (auditory or visual) in which the relevant and irrelevant items were presented: They could occur in the same or a different modality. The extent to which interference was evident from same-category irrelevant items was equivalent regardless of the modality of relevant items, suggesting that distraction takes place at an abstract level of representation. However, intrusion from irrelevant items categorically related to list members was greater when they shared modalities, suggesting an additional role for perceptual factors. These findings are discussed in terms of semantic activation and inhibition theories.

## • ATTENTION •

(5050)

**Attentional and Motor Consequences of a Pointing Movement Observation.** ARTEM V. BELOPOLSKY, CHRISTIAN N. L. OLIVERS, & JAN THEEUWES, *Vrije Universiteit Amsterdam* (sponsored by Jan Theeuwes)—Pointing movement is a universal nonverbal cue for directing attention in social situations. In the present study, using a Posner cuing task, we demonstrated that observation of a pointing action (1) results in automatic attentional allocation to the pointed location and (2) activates a neural representation of that action in anatomical space so that, on validly cued trials, responses are speeded when the observer's response hand corresponds to the pointing hand. The effect of action representation persists when the object responded to is not the object initially attended to (as in the invalid cue condition). We conclude that observation of action triggers an anatomical representation of that action, regardless of whether or not attention is initially directed to the object of that action.

(5051)

**Effects of Attention on Perception and Action.** TONY RO, *Rice University*—An abundance of evidence has demonstrated a tight link between covert visual attention and saccadic eye movements, suggesting that spatial attention may simply be a by-product of unexecuted motor programs. In four experiments, the effects of attention on spatial perception, saccadic eye movements, and reaching hand movements were examined to assess the relationship between attention and motor control. The results demonstrate that allocating visual attention in space has more direct consequences on the spatial parameters of subsequently generated actions than on visual perception. These findings suggest that the orienting of attention involves processes similar to those involved with motor programming, and that the enhancement effects of attention on visual perception may be a secondary consequence to this readiness to respond.

(5052)

**Grab It! Action Plus Attention Cues Covert Orienting.** JOHN P. GARZA, CATHERINE L. REED, & RALPH J. ROBERTS, JR., *University of Denver*—Prior studies investigating spatial attention and action have considered action only as a response. The present study considers how actions themselves might direct attention. We used a modified nonpredictive cuing paradigm in which participants grasped with one of their visually hidden hands to cue attention to one of two target locations. Attention shifted in response to actual, but not imagined, grasps, indicating that actual action is needed to cue attention. Attentional shifts were also found when attention was allocated to one hand, and participants grasped with either that hand or both hands, suggesting combined effects of action and spatial attention. However, in all experiments, action cues interacted with motor responses. Thus, functional actions can direct spatial attention, but lateralized motor response compatibilities must be considered, especially at short stimulus onset asynchronies.

(5053)

**Direct Selection by Color: Uncertainty Reduction or Signal Enhancement?** ESTHER VIERCK & JEFF MILLER, *University of Otago* (sponsored by Jeff Miller)—Two possible mechanisms can explain precuing effects: signal enhancement and uncertainty reduction. With signal enhancement, valid cues improve performance because the signal at the known input channel is enhanced. With uncertainty reduction, they improve performance by allowing observers to ignore confusing distractor items. Both mechanisms seem to be involved in location precuing effects, but it is still unclear which is responsible for color cuing effects. To find out, we used single-item displays with briefly presented and masked targets. If color cues produce signal enhancement, performance should be better for stimuli in expected than in unexpected colors, even with single-item displays. If color cues only allow uncertainty reduction, however, there should be no color

cuing effect because there are no distractors in such displays. The results of two experiments favor uncertainty reduction as the mechanism behind color cuing: No color cuing effects were observed with single-item displays.

(5054)

**Distinctness, Not Memorability, Affects Background Contextual Cuing.** KAZUHIKO YOKOSAWA, *University of Tokyo*—The contextual cuing effect (Chun & Jiang, 1998) is a phenomenon in which repeated visual properties are implicitly learned, which facilitates search performance. This study examines whether background distinctness affects the contextual cuing effect. The results demonstrate that the contextual cuing effect of layout always appears regardless of the background distinctness, confirming that the search items are segmented from the background before the individual analysis for target identification begins. On the other hand, the contextual cuing effect of background appears only when the backgrounds are of medium distinctness. Furthermore, we found that background memorability does not influence the contextual cuing. We conclude that background repetition facilitates search performance when the backgrounds could be recognized as contextual cues during the segmentation process.

(5055)

**Can a Narrow Field of View Explain Limited Tactile Memory During Search for Change?** TAKAKO YOSHIDA, *Harvard University*, YUKI MIYAZAKI, *Chukyo University*, KENJI YOKOI, *University of Tokyo*, HIROMI WAKE, *Kanagawa University*, & TENJI WAKE, *Chukyo University*—In previous studies, we have assessed the amount of information that can be maintained in working memory with a “search for change” task (Rensink, 2000) in both the visual and the somatosensory modality. We have reported a series of experiments that showed extremely limited amounts of tactile memory (roughly one item). Here, we tested the hypothesis that an extremely narrow field of view may explain our results. Using an eye movement contingency moving window system, an apparatus that actively narrows the visual field of view based on eye movements, we found that a narrow field of view also dramatically reduced visual memory during active visual scanning. These results indicate that the limited amounts of tactile memory observed previously can be attributed to a narrow field of view.

(5056)

**Do We Attend Where We're Looking or Do We Look Where We're Attending?** GUSTAV KUHN, *University of Durham*, BENJAMIN W. TATLER, *University of Dundee*, & GEOFF G. COLE, *University of Durham* (sponsored by Geoff G. Cole)—Magicians use misdirection to manipulate people's attention in order to prevent their audiences from uncovering the magicians' secrets. Here we used a prerecorded version of a magic trick developed to investigate some of the factors that accompany successful misdirection. Prior information about the nature of the trick significantly improved participants' detection. The informed participants fixated closer to the event in question, suggesting that they were monitoring it more closely once they knew about the trick. Participants' detection was independent of how far the participant was looking from the “secret” event as it happened, but participants who detected the event moved their eyes toward where it took place much earlier than participants who missed it. This result suggests that attention is allocated ahead of the current locus of fixation, and we present evidence that attention may be allocated at least two saccade targets ahead of where the participant is fixating.

(5057)

**Color Word Availability Modulates the Stroop Effect.** HYO SUN KIM & YANG SEOK CHO, *Korea University*, & ROBERT W. PROCTOR, *Purdue University*—Three experiments were conducted in which we examined whether the color word in a Stroop task had an effect because it captured attention or because it was processed automatically. When the duration of the stimulus display and the location of the color

carrier were manipulated in Experiments 1 and 2, the Stroop effect was larger for the longer presentation than for the shorter one. This outcome occurred when the color carrier was a neutral word or bar (Experiment 1) and when it was a color word (Experiment 2), regardless of the color-carrier location. When the SOA of the color and the color word was manipulated in Experiment 3, the Stroop effect systematically decreased, but the Stroop dilution effect was more evident, as SOA increased. Results show that the attentional shift plays a key role in producing the Stroop effect, but do not exclude the account of automatic processing of the color word.

**(5058)**

**Strategic Control Over Object-Based Attention.** MENAHEM YEARI & MORRIS GOLDSMITH, *University of Haifa* (sponsored by Morris Goldsmith)—Is object-based attention “mandatory” or under strategic control? In two experiments, participants fixated attention on a central cue, which was a part of a perceptual group (Experiment 1) or a uniformly connected object (Experiment 2). The cue always pointed to an opposite, different-object location. By varying cue validity, the strategic disadvantage of allocating attention to the entire cue object was manipulated: When the cue was undiagnostic of target location, so that same-object (as the cue) and different-object targets were equally likely (no strategic disadvantage of object-based attention), a same-object response time (RT) advantage was observed. However, when the cue was highly valid, so that cued different-object targets were much more likely than uncued same-object targets (strong strategic disadvantage of object-based attention), the same-object RT advantage disappeared. This was true at all cue–target SOAs (100–400 msec). These results suggest that object-based attention is a default allocation mode that can be overridden by strategic control.

**(5059)**

**Differential Effects of Event Rate on Sustained Auditory and Visual Attention.** LORI M. CURTINDALE & J. DEVIN MCAULEY, *Bowling Green State University*—An important factor in assessments of sustained attention performance is event rate. A number of previous studies have found an inverse relationship between performance and event rate—as event rate increases, performance tends to decline. This slow event rate advantage occurs primarily for sustained attention tasks involving visual stimuli. Less is known about effects of event rate on sustained attention in the auditory domain. The present study compared sustained auditory and visual attention using continuous performance tasks that were  $d'$  matched at a medium event rate and then contrasted at faster and slower event rates. Results revealed a differential effect of event rate on sustained attention performance in the visual and auditory domains. Visual sustained attention showed the expected slow event rate advantage, whereas auditory sustained attention showed a fast event rate advantage.

**(5060)**

**Directing Attention to Auditory Local-Global Levels.** ALEXANDRA LIST & LYNN C. ROBERTSON, *University of California, Berkeley and Medical Research Service, Veterans Affairs* (sponsored by Lynn C. Robertson)—Hierarchically organized auditory stimuli were used to investigate to what extent information from unattended dimensions influences the identification of attended dimensions. Here, as in Justus and List (2005), local and global levels were defined by frequency or time ranges. Patterns presented at high frequencies or fast rates are considered local, whereas those presented at low frequencies or slow rates are considered global. Within a block, participants were required to direct attention to either the local or the global level, and to report the identity of a pattern at that level in a two-alternative forced choice task. The identity of the pattern at the opposite (unattended) level was manipulated to be consistent or inconsistent with the identity of the pattern at the attended level. Reaction times and error rates from consistent and inconsistent conditions indicated the degree to which selection of one level was influenced by the identity of the opposite level.

## • METAMEMORY AND METACOMPREHENSION •

**(5061)**

**Testing Enhances Recollection: Process Dissociation Estimates and Metamemory Judgments.** JEFFREY D. KARPICKE, *Washington University*, DAVID P. MCCABE, *Colorado State University*, & HENRY L. ROEDIGER III, *Washington University* (sponsored by David B. Pisoni)—We investigated whether the testing effect is due to enhanced recollection or to familiarity by using the process-dissociation procedure. Subjects either repeatedly studied a categorized word list or studied it once and then took free recall tests over the list. Process estimates on a final test were obtained by comparing forced recall for an inclusion test and forced production of new category members for an exclusion test (McCabe, Roediger, & Karpicke, 2005). After a 5-min delay, repeated studying produced better recall than did repeated testing but also increased errors on the exclusion test, indicating a short-term boost due to enhanced familiarity. However, after a week, repeated testing led to better retention and enhanced recollection. When we asked subjects to predict their future recall on the final test, subjects predicted that they would recall more from repeated studying than from repeated testing, which was the opposite of actual performance.

**(5062)**

**Sensitivity of Metamemory Predictions Is Influenced by Explicit but Not Implicit Familiarity.** DEBORAH K. EAKIN & TEENA GARRISON, *Mississippi State University*—Metamemory sensitivity has been shown to be dissociated from recall under conditions of retroactive interference (Eakin, 2005). However, predictions of knowing (POKs) were not higher for intralist versus extralist cuing, as might be suggested by the cue familiarity hypothesis (see, e.g., Metcalfe, Schwartz, & Joaquim, 1993), even though the cue was repeated twice prior to prediction in the intralist condition. Differences in POK magnitude may not have been obtained because, as a semantic associate of the target, the cue potentially was implicitly present in the intralist condition. We explored whether POKs demonstrate implicit familiarity with the cue. Participants studied targets with no or a strong backward association to a cue in intralist and extralist conditions. POKs for no association were higher when the cue was explicitly familiar (intralist). However, POKs were not equal in the extralist and intralist conditions for strong associations. As such, POKs did not reflect implicit familiarity with the cue.

**(5063)**

**Cue Set Size Effects Occur Only for Retrieval-Influenced Metamemory Judgments, Not for Immediate Judgments of Learning.** DEBORAH K. EAKIN, *Mississippi State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—Cued recall performance is better under extralist cuing when cues have a small number of semantic associates. Cue set size effects are eliminated when cues and targets are studied together (intralist cuing) for young adults, but not for older adults (Eakin & Hertzog, in press). Metamemory predictions collected before recall (predictions of knowing, POKs) and after attempted recall (feeling of knowing judgments, FOKs) are sensitive to cue set size and show equivalent resolution for both age groups. POKs and FOKs are retrieval-influenced metamemory predictions. The present study contrasted cue set size effects on metamemory for POKs and FOKs against immediate judgments of learning (JOLs) made during encoding. As before, cue set size effects were found for POKs and FOKs. However, JOLs were equal for small and large set size cues for both cuing conditions. Implications for the theoretical bases for metamemory judgments are discussed.

**(5064)**

**Age Differences in Latency and Memory Monitoring.** DAYNA R. TOURON, *Appalachian State University*, & JARROD C. HINES & CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (sponsored by Christopher Hertzog)—Previous research has suggested age-

related deficits in latency monitoring which might impede the acquisition of cognitive skills. The present study examined the effects of age and feedback on latency monitoring and on memory monitoring for a paired-associates learning task. Younger and older adults completed three study–test trials for 60 semantically unrelated noun pairs. In Trial 1, each stimulus was studied for a set duration. In Trial 2, participants self-paced study for each stimulus. Trial 3 introduced a new stimulus set. A judgment of learning was collected after each stimulus study. Recognition testing followed each study phase. All participants provided latency estimates after odd-numbered tests, and participants in a feedback condition were provided latency information after even-numbered tests. A confidence judgment was collected after each stimulus test. Results will elucidate the relationship between memory monitoring and latency monitoring accuracy as well as the role of latency monitoring in the allocation of study time.

(5065)

**Moderation of Age-Related Differences in Response Criteria Through Latency Deadlines.** MATT E. MEIER & DAYNA R. TOURON, *Appalachian State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—We examined age-related differences in the effects of response latency deadlines (RDs) on a strategy-based associative learning task. Young and older adults performed the noun-pair (NP) lookup task, which involves a practice-related performance shift from a scanning strategy to a retrieval strategy. Two conditions per age group were tested in three phases. Phase 1 introduced NP testing, and was consistent across conditions. Phase 2 continued NP testing, with a condition which enforced RDs compared with a self-paced condition. Deadlines were individually determined from Phase 1 performance indices. In Phase 3, all participants performed self-paced feeling-of-knowing ratings (FOKs) and recognition memory probes. Results focus on the effects of RDs on age differences in Phase 2 strategy performance as well as on age differences in Phase 3 FOKs and recognition memory accuracy. The extent to which RDs promote NP learning rather than simply inducing retrieval strategy performance is discussed.

(5066)

**The Revelation Effect in Metamemory.** KYMBERLY D. YOUNG & ZEHRA F. PEYNIRCIOĞLU, *American University* (sponsored by Zehra F. Peynircioğlu)—We showed revelation effects in two metamemory tasks that were not based on recognition. In Experiment 1, participants studied word pairs and received recall tests in which the first word of each pair served as a cue for the second word. When recall failed, they gave feeling-of-knowing (FOK) ratings. Half of the cue words were in anagram form and needed to be revealed first. Participants gave higher FOK ratings after revealed cues even though the target items that these FOKs referred to remained unrecalled. In Experiment 2, participants studied single words, half of which were anagrams and needed to be revealed first, and gave judgments-of-learning (JOL) ratings. Participants gave higher JOL ratings to words that were initially in anagram form. Thus, revelation increased the magnitude of the metamemory decisions although their accuracy, as gauged by subsequent criterion tests, was unaffected. Implications for current theories are discussed.

(5067)

**The Accessibility Hypothesis in Psychopharmacology: Effects of the Amnesic Drug Lorazepam on Complete and Partial Information Retrieval and Monitoring Accuracy.** ELISABETH BACON, *INSERM*, & MARIE IZAUTE, *Université Blaise Pascal*—In Koriat's accessibility model (1993, 1995, 1997), when a person fails to recall a required target, he/she can nevertheless provide some partial information about the target. Moreover, individuals are able to provide feeling-of-knowing (FOK) judgments about the availability of the target in memory. The cues for the FOK evaluations reside in the products of the retrieval process itself. The effects of the amnesic benzodiazepine lorazepam on the total and partial recall of recently learned material, and on the

effects of the retrieved partial information on FOK ratings, were investigated in healthy volunteers. Twenty-eight healthy volunteers participated in the study: Fourteen received a capsule containing lorazepam (0.038 mg/kg) and 14 a placebo capsule. The material to be learned consisted of four-letter nonsense tetragrams, with each letter providing partial information with regard to the four-letter target (Koriat, 1993). The results show that the number of incorrect letters reported was higher for the lorazepam than for the placebo condition. The FOK magnitude was higher for the placebo participants than for the lorazepam participants. The predictive value of FOK for recognition was preserved by the drug. When studying four-letter nonsense letters string under the influence of lorazepam, participants presented an impairment of episodic short-term memory performance, and the drug had an effect on FOK estimates but not on the predictive accuracy of the FOK. In conclusion, the accessibility hypothesis as a basis for the construction of FOK was confirmed in this study and seems to be relatively preserved under the effect of an amnesic drug.

(5068)

**When Metacognition Meets Emotion: Predicting Memory for Emotional Materials.** CARISSA A. ZIMMERMAN & COLLEEN M. KELLEY, *Florida State University* (sponsored by Colleen M. Kelley)—People's memory for emotionally charged material is often better than their memory for neutral material. However, we know little about the effect of emotional valence on the subjective monitoring and control of memory. The present experiments examined the effects of emotional valence of words on the monitoring of learning, as measured by judgments of learning (JOLs), and on the control of learning, as measured by self-paced study time. Experiment 1 measured JOLs and cued recall of neutral versus emotional paired associates over two study–test presentations. Experiment 2 examined the amount of study time allocated to neutral versus emotional pairs across two presentations. In both experimenter- and self-paced conditions, emotion appeared to act as a misleading intrinsic cue for JOLs in the first study trial. Experiment 3 tested the effect of emotional valence on monitoring in the context of free recall. Results are discussed in terms of theory-based versus experience-based monitoring.

(5069)

**Generating Concept Maps Improves Metacomprehension Accuracy.** KEITH W. THIEDE, *University of Illinois, Chicago*, MARY ANDERSON, *College of DuPage*, & THOMAS D. GRIFFIN & JENNIFER WILEY, *University of Illinois, Chicago*—Metacomprehension accuracy improves when people generate summaries or a list of keywords prior to judging comprehension, but only when generation occurs after a delay, not immediately after reading (Thiede & Anderson, 2003; Thiede, Dunlosky, Griffin, & Wiley, 2005). We have argued that the delay improves accuracy by focusing readers on their situation model when making metacomprehension judgments, and that the situation model largely determines performance on tests of comprehension. To evaluate this situation model hypothesis, we trained participants to construct concept maps and had participants construct them while reading texts (before making immediate judgments of learning). Metacomprehension was significantly better when participants constructed concept maps than in the standard control condition. Results are discussed in terms of recent theories of comprehension monitoring.

(5070)

**Interactive Effects of Rereading, Working Memory, and Reading Ability on Metacomprehension.** THOMAS D. GRIFFIN, JENNIFER WILEY, & KEITH W. THIEDE, *University of Illinois, Chicago*—Metacomprehension monitoring is typically quite poor. Rereading has been shown to improve accuracy, but this effect is not always observed. In two experiments, we evaluated a limited-resources explanation for both poor monitoring accuracy and the unreliable rereading effect. Results revealed that individual differences in reading ability and working memory capacity (WMC) moderate the effects of rereading on metacomprehension accuracy, so that rereading primarily helped

low ability readers, who tended to have poor accuracy after a single reading. Although reading ability and WMC interacted similarly with rereading, these effects were independent, which was expected since these two factors should theoretically relate to resource availability in different ways. Results support a limited-resources explanation, suggesting that some readers fail to monitor accurately because they lack the resources needed to carry out the dual tasks of comprehension and monitoring, and that rereading improves accuracy when it relieves an existing resource load.

(5071)

**Accuracy of Younger and Older Adults' Term-Specific Judgments of Text Learning.** JULIE M. BAKER & JOHN DUNLOSKEY, *Kent State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (sponsored by John Dunlosky)—Research has consistently demonstrated that adults of all ages are quite poor at evaluating their learning of text materials. One technique that shows promise for boosting the accuracy of text predictions involves having people read texts and make term-specific judgments. These term-specific judgments involve judging one's memory for specific information (definitions) embedded in each text. For younger adults, accuracy has been greater for term-specific judgments than for the standard metacomprehension judgments. Our current questions are (1) Will older adults achieve high levels of accuracy using term-specific judgments, especially when they can view the correct definitions when making these judgments? and (2) Will older and younger adults regulate their restudy of key terms in a text in a similar manner? We present two experiments that provide answers to these questions, and we discuss the implications of the results for a current theory of metacomprehension accuracy.

• IMPLICIT MEMORY •

(5072)

**Sequence Structure and Explicit Learning in the Serial Reaction Task.** FRANCISCO J. GUZMAN-MUÑOZ & ADDIE JOHNSON, *Rijksuniversiteit Groningen*—Dual tasks have been hypothesized to interfere with sequence learning by disrupting hierarchical learning (Cohen, Ivry, & Keele, 1990), preventing intrusion of explicit knowledge (Cleeremans & Jiménez, 1998), or suppressing the expression of learning (Frensch, Lin, & Buchner, 1998). We show that learning of a sequence consisting of both first- and second-order conditionals (FOCs and SOC) under single- and dual-task conditions results in a similar learning rate for FOCs but not SOC. Under dual-task conditions, the learning rate was steeper and reaction times faster for FOCs than for SOC; in the single-task condition they did not differ. The single-task group also acquired more explicit knowledge, supporting the hypothesis that explicit intrusions occur less often in dual-task conditions. That FOCs and SOC were differentially learned under dual- but not single-task conditions shows that some aspects of sequence learning require attention whereas others do not, and that the two modes of learning can coexist.

(5073)

**Decomposing Action–Effect Transformations.** MIRIAM LEPPER, CRISTINA MASSEN, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—In tool use, a tool transforms the bodily movement into the associated effect, depending on the transformation rule of the tool. Therefore, switching between tools with different transformation rules requires flexible mappings between movements and their effects. In a sequence learning paradigm, we investigated the independent roles of (1) the final effect a person wants to achieve by his or her action, and (2) the instructed transformation rule according to which the bodily movement is transformed into the intended effect. Subjects had to realize different action–effect transformations. Either the transformation rules or the action effects followed a fixed sequence. The results showed that—depending on the relative salience of both components—transformation rule sequences and effect sequences could be learned independently and that this

learning facilitated switching between action–effect transformations. From these results, some of the principles that stand behind the cognitive representation of action–effect transformations can be derived.

(5074)

**Spatial Context Learning and Switching Strategy.** NOBUTAKA ENDO, *National Institute of Advanced Industrial Science and Technology*, WALTER R. BOOT & ARTHUR F. KRAMER, *Beckman Institute, University of Illinois, Urbana-Champaign*, ALEJANDRO LLERAS, *University of Illinois, Urbana-Champaign*, & TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology*—Spatial context, such as the layout of stimuli, is implicitly encoded through repeated experiences, and can control human behavior. Chun and Jiang (1998) demonstrated that visual context could efficiently guide spatial attention to a target location in the visual search task (contextual cuing). Recently, Lleras and von Mühlhausen (2004) showed that contextual cuing did not occur when participants conducted visual search actively, whereas it was observed when participants conducted visual search more passively. They concluded that contextual cuing is dependent on the participants' top-down strategy. In the present study, we replicated Lleras and von Mühlhausen's study and controlled participants' search strategy in the different sessions of the experiment. We examined the interaction between the occurrence of contextual cuing and the search strategy, and clarified whether the search strategy would affect learning of the context itself or the expression of the learned context.

(5075)

**Faking of the Implicit Association Test Is (A) Difficult and (B) Detectable.** DARIO CVENCEK & ANTHONY G. GREENWALD, *University of Washington* (sponsored by Anthony G. Greenwald)—Implicit association test (IAT) measures of social-cognitive association strengths (Greenwald, McGhee, & Schwartz, 1998) have been shown to resist faking (Egloff & Schmukle, 2002), but are not totally impervious. Three new experiments developed methods of distinguishing faked from genuine performances for an IAT measure of association of self with male or female gender. When instructed to fake by slowing performance in the easier of two tasks (one that required the same response to words representing self and names representing own gender), subjects' limited success in faking was correlated with two measures of their extent of deliberate slowing ( $R = .51$ ). When applied to three published faking-IAT experiments using pleasant and unpleasant words with German or Turkish stimuli (Fiedler & Bluemke, 2005), these two measures successfully predicted performances intended to fake stronger association of Turkish than of German with pleasant words ( $R$ s of .71, .56, and .56, respectively).

(5076)

**Effects of Spelling Rime Consistency on Phonological False Recollection.** KEVIN J. MULQUEENY, *Washington University*, SARAH SNOOK, *University of Sussex*, ROBYN E. HOLLIDAY, *University of Kent*, & BRENDAN S. WEEKES, *University of Sussex*—Holliday and Weekes (2006) reported that phonological false recollection in children depends on sublexical properties of the critical lure. Our question was whether sublexical effects depend on the consistency of the word. Here we compared phonological false recollection using visual and auditory presentation. In Experiment 1, 50 children 9 to 10 years of age were tested using written and spoken words that varied in phonological overlap at initial phoneme, head, and rime. Results showed equivalent phonological false memory effects in visual and auditory modalities weakest in the rime condition. In Experiment 2, we used the same paradigm and varied the rime spelling consistency of items. The results showed greater phonological false memory for words with consistent rimes and no interaction with modality. In Experiment 3, EEG data collected with adults confirmed differences between consistent and inconsistent items. We argue that sublexical phonological activation is automatic during false recollection in both children and adults.

(5077)

**Involuntary Aware Memory Affects Production Tests More Than It Does Identification Tests.** BRIAN T. CRABB, *U.S. Army Research Institute*, SARA A. HUNT & KRISTI G. DILLMAN, *Western Washington University*—We replicated Hunt's (2004) finding that participants' test awareness increased the size of a levels of processing (LOP) effect in perceptual identification (33-msec presentation), but not in word fragment completion. In addition, we found that perceptual identification with slow presentation rates (40 msec) showed a smaller LOP effect when participants were test aware. Further, speeded reading showed no LOP effect when participants were test aware. Together, these findings suggest that repetition priming tests that are productive in nature are more likely to be affected by test awareness than are repetition priming tests that are better categorized as identification tests. These results suggest that a revision to Kinoshita's (2001) preferential processing view of involuntary aware memory is needed.

(5078)

**The Nature of Text Repetition: Evidence for a Contextual Dependence Continuum.** MATTHEW COLLINS & BETTY ANN LEVY, *McMaster University*—The experiment explored the rereading benefit for seven sentences embedded in two different passages. In one condition, the two passages had little semantic overlap at the level of the situation model. In the other condition, there was partial overlap of the situation models for the two passages. When there was a short interval between readings of the two passages, words in repeated sentences were read significantly faster upon rereading, regardless of whether they had previously appeared in passages with little or with partial overlap at the level of the situation model. However, when there was a longer interval between readings of the two passages in a pair, words in repeated sentences were only read faster for the condition with a partial overlap of situation models. The results are discussed in terms of Raney's (2003) notion of a context dependent continuum of text representation.

• FALSE MEMORY •

(5079)

**Why Do Children Show Fewer False Memories Than Do Adults?** SHANNON M. LEWIS, *Arizona State University*, JEFFREY S. ANASTASI, *Sam Houston State University*, MATTHEW G. RHODES, *Colorado State University*, & KRISTEN A. DILIBERTO-MACALUSO, *Berry College*—Several previous studies have demonstrated that children exhibit both lower levels of veridical memory and fewer intrusions when given semantically associated lists. There are two primary explanations for this finding. Most studies have postulated that children have a less developed semantic network and are thus less able to extract the general meaning or gist from a list of related items than are adults. However, a second possibility is that children have a qualitatively different semantic network than do adults. Most studies have utilized semantically associated word lists that were normed with adults and that may not lead to the same semantic activations with children. The present study normed similar word lists with children and then evaluated the memory of children and adults using these newly normed lists as well as the adult-normed lists. Results indicated that children show lower true and false memories with both the child-normed and adult-normed lists.

(5080)

**Memory Illusions for Conjunctions in Children and Adults: The Effect of Thematic Context.** ROBYN E. HOLLIDAY, *University of Kent*, TIMOTHY N. ODEGARD, *University of Texas, Arlington*, CHARLES J. BRAINERD & VALERIE F. REYNA, *Cornell University*, & KEITH M. FRANKLIN, *University of Kent*—The Deese/Roediger-McDermott (DRM) paradigm was used to investigate whether the effects of guiding participants to encode a gist for list items that are more compatible with the gist (e.g., *break-glass*) of a list's corresponding critical lure (*window*) would produce greater levels of false memories

for a critical lure than would guiding participants to encode a gist for list items that are less compatible (e.g., *drinking-glass*) with the gist of the corresponding critical lure. Participants studied a block of six DRM lists, three gist "toward" and three gist "away," followed by a recognition test. False recognition of critical lures in the "toward" lists was higher than in the "away" lists. The context manipulation had a greater impact on the extent to which children falsely recognized critical lures, suggesting that gist extraction is more context dependent in childhood.

(5081)

**Dissociative Experiences and Retrieval Monitoring.** DAVID A. GALLO, *University of Chicago*—Prior studies have indicated that subjects who are more likely to report dissociative experiences in daily life (via the dissociative experiences scale, or DES) are more susceptible to laboratory-based false recognition. The present study investigated this relationship using the criterial recollection task. Subjects studied red words and pictures, and then had to recollect these formats using black words as test cues. Importantly, some items were studied as both red words and pictures, so subjects had to selectively search their memory for red word recollections (on the red word test) or for picture recollections (on the picture test). As predicted, DES scores were positively correlated with false recognition on the red word test. However, this relationship was weakened when subjects used a distinctiveness heuristic to reduce false recognition (the picture test). Whether DES scores will correlate with false memories might depend, in part, on the monitoring processes involved in the memory task.

(5082)

**Expanding the Distinctiveness Heuristic: Exploring the Impact of Pictures on False Recognition.** HEATHER R. COLLINS & RICHARD E. MAYER, *University of California, Santa Barbara* (sponsored by Richard E. Mayer)—In four experiments, participants encoded 48 home burglary scenes, consisting of pictures and narration or narration alone (Experiments 1 and 2), or of pictures or narration (Experiments 3 and 4). Participants were later given false information via pictures or narration during a manipulation phase. Finally, participants took either a written recognition test or a pictorial recognition test. Studying pictures resulted in reduced false alarm rates as compared with studying narration, showing the beneficial impact of pictures on memory. However, receiving false information via pictures during manipulation led to increased false alarm rates as compared with receiving false information via narration, but only when a pictorial recognition test was administered. When participants were given a picture recognition test rather than a written recognition test, the material presented during the manipulation phase was more likely to create false memories. False recognition was influenced not only by the modality of study information, but also by the testing modality.

(5083)

**Comparing Decay Rates for Accurate and False Memories in the Deese/Roediger-McDermott Paradigm.** JORIE M. COLBERT, *University of Utah*, & DAWN M. MCBRIDE, *Illinois State University*—Although previous studies have consistently reported different forgetting rates for true and false memory when tested with recall, studies comparing the rates of decay for true and false recognition have reported inconsistent results. The present study attempted to clarify this inconsistency by comparing forgetting rates for true and false recognition in a Deese/Roediger-McDermott study that addressed methodological differences among previous studies. Recognition of list items and unstudied critical lures was assessed at six delays. Significant differences were found between the slopes of the forgetting functions fit to the recognition data for list and lure items, indicating that true and false memories decay at different rates when tested with a recognition task.

(5084)

**Source-Constrained Recall Reduces Errors But Does Not Reduce Feature Importation.** SEAN LANE, *Louisiana State University, Baton*

Rouge, LINDA A. HENKEL, *Fairfield University*, & CRISTINE C. ROUSSEL & STEPHANIE GROFT, *Louisiana State University, Baton Rouge*—In two experiments, participants saw and imagined pictures, and made repeated recall attempts before taking a source memory test. Prior research has found that the rate of false memories on the source test is substantially reduced when participants are required to specify the source of an item during recall than when they are not (Henkel, 2004). Our experiments demonstrated the same beneficial effect when participants engaged in source-constrained recall (only pictures or imagined items) relative to a free recall control condition. In Experiment 2, we varied the location of the picture during study and queried participants about this feature when they identified an item as a picture on the source test. False memories of pictures were frequently identified as having been seen in the same location as related studied pictures. Such “feature importation” was similar regardless of type of recall. Implications for the role of reactivation in false memories are discussed.

(5085)

**Remembering Words Not Presented in Sentences: How Study Context Alters Different Types of False Memory.** LAURA E. MATZEN & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—People falsely endorse semantic associates (Roediger & McDermott, 1995) and morphemic rearrangements (Jones & Jacoby, 2001) of studied words at high rates. Here we investigate the effects of sentence study contexts on these different types of false memories. Participants studied compound words such as *tailspin* and *floodgate* either presented in a list of single words or embedded in a list of sentences such as “The fighter plane went into a tailspin after being hit by enemy fire.” It was expected that sentence contexts would lead to greater extraction of meaning and more rapid discarding of surface information. Consistent with this interpretation, subjects were more able to reject rearrangement lures (*tailgate*) following sentence-context than following individual-word study, but were better at rejecting semantic lures (*nosedive*) following individual-word than following sentence-context study. The context of study changed what the participants remembered about the items and made them susceptible to different types of memory errors.

(5086)

**False Recollection of the Role Played by an Actor in an Event.** JULIE L. EARLES, ALAN W. KERSTEN, & CHRISTIN UPSHAW, *Florida Atlantic University*—Thirty-two young adults (mean age = 19.39 years) and 32 older adults (mean age = 71.44 years) viewed a series of brief, videotaped events, each involving an interaction between two people. A later test of recognition memory revealed that participants were more likely to falsely recognize same event conjunction items, in which an actor performed an action that had previously been performed by a different actor within the same event, than to falsely recognize different event conjunction items, in which an actor performed an action that had previously been performed by an actor appearing in a different event. This pattern was evident in both age groups, although the overall rate of conjunction errors was higher in older adults. The greater rate of false recognition of the same event conjunction items was associated exclusively with “absolutely sure” confidence ratings, suggesting that participants falsely recollected having seen the presented actor perform the presented action.

(5087)

**Phantom Recollection Processes in Older Adults’ False Recognition.** DONNA J. LAVOIE, JENNIFER N. SMITH, ELLEN HINKEL, & EVAN CHUDNOW, *St. Louis University*—Previous research (e.g., Brainerd et al., 2001) has demonstrated that false recognition responses are largely supported by phantom recollection processes, rather than by familiarity processes. The series of studies reported here investigated potential age differences in the contribution of these processes to false recognition. We hypothesized that older adults’ increased susceptibility to false recognition would be a consequence of a greater contribution of phantom recollection processes to recognition judg-

ments than is seen in young adults. Results supported this hypothesis, with phantom recollection being a larger contributor to older adults’ false recognition than to young adults’ false recognition. We also examined the relationship between these processes and frontal/executive function to determine the correlation between phantom recollection and frontal ability. While we had predicted negative correlations here, results were mixed, but nonetheless were suggestive of a relationship between frontal ability and phantom recollection and the need for further research investigating this relationship.

(5088)

**Temporal Characteristics of True and Illusory Memories.** VINCENT PROHASKA, *Lehman College, CUNY*, DEBBIE DELVALLE, *John Jay College, CUNY*, & MICHAEL P. TOGLIA, *SUNY, Cortland*—The Deese/Roediger–McDermott (DRM) word-list paradigm represents one of the easiest ways to induce illusory memories in the laboratory. Researchers have employed this paradigm not only to study people’s memories of stimuli that were not actually presented, but also to study the phenomenological qualities of these illusions. In four experiments, we explored temporality, a phenomenological quality of illusory memories that has received little attention. We developed a serial position task that was incorporated into the DRM paradigm to examine temporal characteristics of participants’ true and illusory memories. Effects of list strength, presentation order, and types of warnings were examined. Results showed consistent serial position responses for true and illusory memories. However, only responses for illusory memories were affected by manipulations at study. Overall, the pattern of findings in the present experiments lends support to encoding-based explanations of false memory.

(5089)

**Reducing False Familiarity in Recognition With Feedback.** JUSTIN KANTNER & D. STEPHEN LINDSAY, *University of Victoria* (sponsored by D. Stephen Lindsay)—The effects of trial-by-trial corrective feedback on recognition memory sensitivity provide a potential means of parsing theoretical accounts of recognition: Some describe it as an automatic, strictly familiarity-based process that would not be expected to benefit from feedback, whereas others invoke additional inferential, recollective mechanisms, such as source attribution, that might make use of such information. We present data from a recent series of experiments demonstrating that feedback may or may not enhance recognition accuracy, depending critically on the nature of the to-be-recognized stimuli. Feedback failed to increase sensitivity in recognition of simple, highly familiar items (e.g., words) and unfamiliar but static items (e.g., Chinese characters), but produced an advantage when the stimuli were highly complex, temporally dynamic, and aesthetically evocative (e.g., spoken poetry). The advantage has consistently manifested in decreased false alarm rates relative to controls. Theoretical context for this pattern of results and unanswered questions are discussed.

• ASSOCIATIVE LEARNING •

(5090)

**Perceptual Constraints on Visual Statistical Learning of Multielement Scenes.** CHRISTOPHER M. CONWAY & ROBERT L. GOLDSTONE, *Indiana University, Bloomington*, & MORTEN H. CHRISTIANSEN, *Cornell University*—Visual statistical learning allows observers to extract high-level structure from visual scenes (Fiser & Aslin, 2001). Previous work has explored the types of statistical computations afforded but has not addressed to what extent learning results in unbound versus spatially bound representations of element co-occurrences. We explored these two possibilities using an unsupervised learning task with adult participants who observed complex multielement scenes embedded with consistently paired elements. If learning is mediated by unconstrained associative learning mechanisms, learning the element pairings may depend only on the co-occurrence of the elements in the scenes, without regard to their spe-

cific spatial arrangements. If learning is perceptually constrained, co-occurring elements ought to form perceptual units specific to their observed spatial arrangements. Results showed that participants learned the statistical structure of element co-occurrences in a spatial-specific manner, showing that visual statistical learning is perceptually constrained by spatial grouping principles.

(5091)

**Incidental Sequence Learning: How the Indirect Assessment of Learning Affects the Acquisition of Reportable Knowledge.** DENNIS RÜNGER & PETER A. FRENSCH, *Humboldt-Universität zu Berlin*—Incidental sequence learning with the serial reaction time (SRT) task creates conscious, reportable knowledge in some participants and unconscious knowledge in others. Buchner et al. (1997) presented evidence that the common practice of measuring sequence learning by interpolating random blocks in the training phase with the task increased the availability of reportable sequence knowledge. With a modified SRT task, we found that the interpolation of an alternate systematic sequence, but not of random sequences, facilitated the generation of reportable knowledge. The facilitative effect could be offset by a concurrent secondary task that selectively prevented learning of the alternate sequence. The findings are consistent with the notion that transfer sequences bring about unexpected performance decrements that trigger a search for their proper cause (Frensch et al., 2003). For the search to result in reportable sequence knowledge, the presence of a regularity is required. The secondary task presumably precluded the initiation of the search process.

(5092)

**Human Latent Inhibition and Learned Irrelevance: Addressing Existing Limitations.** MIA SCHMIDT-HANSEN, NICOLA S. GRAY, LISA H. EVANS, & ROBERT J. SNOWDEN, *Cardiff University* (sponsored by Andrew Delamater)—The study of latent inhibition (LI, retardation in learning or performance induced by conditioned stimulus preexposure) in humans is hampered by limitations in the existing tasks (e.g., they are between-subjects, use a masking task, and/or produce small effects with equivocal dependent variables), and research on learned irrelevance (LIRR, retardation in learning or performance induced by uncorrelated conditioned stimulus and unconditioned stimulus preexposure) in humans is limited. Novel, within-subjects, continuous LI and LIRR tasks that yield large effects on both correct response and reaction time measures and involve no masking task will be described. Both tasks were found to be sensitive to the number of preexposures given and context change between the preexposure and test stages, but no effects were found of imposing a 15-min delay between the task stages. Preliminary analyses suggest that both tasks are sensitive to the positive dimensions of schizotypy.

(5093)

**The Role of Attention in the Item-Order Hypothesis: Application to the Word-Frequency Effect.** PAUL MERRITT & KATHY DRIGGERS, *Texas A&M University, Corpus Christi*—The item-order hypothesis has been proposed to describe the typical word frequency effect in free recall, in which recall is superior for high frequency items in pure lists, whereas there is a recall advantage for low frequency items in mixed lists. According to the item-order hypothesis, low frequency items automatically attract additional attentional resources and thus have superior item processing at the cost of order information. We tested this account by presenting pure and mixed lists under full versus divided attention conditions. For high frequency items, recall performance was similarly reduced in pure versus mixed lists under divided attention conditions. However, for low frequency items, divided attention reduced recall substantially more for pure lists than for mixed lists. These results are evaluated in relation to the item-order hypothesis.

(5094)

**Amnesic H.M.: New Data Indicate Parallel Selective Deficits in**

**Language and Memory.** DON G. MACKEY, *UCLA*, & LORIE E. JAMES, *University of Colorado, Colorado Springs*—Contrary to recent claims that H.M.'s sentence-level language is deficit-free, this study presents 11 new sources of experimental evidence indicating deficits in H.M.'s comprehension and production of noncliché sentences. H.M. performed 2–6 standard deviations worse than controls (matched for age, IQ, and education) in the following experimental tasks: detecting grammatical errors; repairing sentences that contained an error; answering questions about who did what to whom in sentences; multiple-choice recognition of possible versus impossible interpretations of sentences containing ambiguities and figurative speech; discrimination between grammatical versus ungrammatical sentences; and describing the meanings of ambiguous sentences, phrases, and words. However, H.M.'s deficits were selective (e.g., sparing comprehension of familiar but not unfamiliar phrases). We discuss parallels between H.M.'s selective deficits in language, memory, and other cognitive processes (e.g., reading and visual cognition). These parallels lack a parsimonious explanation in systems theories (where nonoverlapping mechanisms process language vs. memory) but were predicted under binding theory.

(5095)

**Memory for Time Is Preserved Following Extinction but Is Lost After a Long Retention Interval as Assessed in Fear-Potentiated Startle.** ROBERT C. BARNET, *College of William & Mary*—In three experiments, I examined the durability and loss of temporal specificity of fear-potentiated startle (FPS) in rats. The research addresses the question of how time is represented within associative memory. Following fear training with a 30-sec light CS (light and shock), the magnitude of FPS was found to be greater in late as opposed to in early portions of the CS, indicative of timing (cf. Davis, Schlesinger, & Sorenson, 1989). Experiment 1 revealed that timing specificity of startle that was lost as a result of extinction could be reinstated with a US reminder treatment. Experiment 2 demonstrated that FPS could spontaneously recover after extinction but that timing specificity was not retained. Experiment 3 revealed a similar loss of timing specificity of FPS following a long retention interval. Outcomes are consistent with the hypothesis that temporal information is a functionally independent attribute and not integral to an associatively activated CS-US representation.

(5096)

**Reward Prediction in New Situation Based on the Integration of Acquired Associative Knowledge: Implication From Neural Activities in the Prefrontal Cortex.** KOSUKE SAWA, *Senshu University*, & XIAOCHUAN PAN & MASAMICHI SAKAGAMI, *Tamagawa University*—Two male Japanese monkeys (*Macaca fuscata*) were trained to perform two-stage matching-to-sample tasks by using visual stimuli (A1→B1→C1 and A2→B2→C2). After monkeys acquired two sequences, new pairs of stimuli (i.e., D1 and D2, E1 and E2, etc.) were introduced to be associated with B1 or B2 (i.e., D1→B1, D2→B2, etc.). In a given block of trials, reward instruction trials were first inserted to instruct which sequence would be rewarded in the following sequence task by pairing C (C1 or C2) with the reward. Monkeys showed differential reaction time and accuracy in first cue presentation after instruction trials based on the reward prediction, and we found neural activities related to the reward prediction and the stimulus-reward relationship from the prefrontal cortex (PFC). These results suggested that monkeys could predict reward by combining associations among trained sequences, C-reward association, and new stimuli; the PFC may be involved in integration of such associations.

(5097)

**Modeling Marine Mammal Vocalizations in High-Dimensional Semantic Space Using HAL and an SRN.** ALLISON B. KAUFMAN, CURT BURGESS, & ARUNAVA CHAKRAVARTTY, *University of California, Riverside*, BRENDA McCOWAN, *University of California, Davis*, & CATHERINE H. DECKER, *Chaffey College*—The hyperspace

analog to language (HAL) model has been used to analyze language in humans by encoding the complex sequential information in the language stream. Grammatical and semantic regularities emerge using a global lexical co-occurrence learning algorithm (Lund & Burgess, 1996). HAL and a simple recurrent network (SRN; Elman, 1990) were used to quantify contextual relationships in marine mammal vocalizations, primarily that of the bottlenose dolphin (*Tursiops truncatus*). In Experiment 1, the whistle sequences showed internal structure. In Experiment 2, several contextually dependent and meaningful behavioral dimensions are seen in the analysis.

• IMAGERY •

(5098)

**Viewpoint Changes in Naturalistic Scenes Produce Automatic Interpolation.** MONICA S. CASTELHANO, ALEXANDER POLLATSEK, & KEITH RAYNER, *University of Massachusetts, Amherst*—How do we represent viewpoint changes of a scene? When two viewpoints of a scene are viewed, a linked representation can be formed, so that new viewpoints falling in between the known viewpoints (interpolated) are part of the representation and should be less distinguishable than viewpoints outside the known viewpoints (extrapolated). Alternatively, each viewpoint could be represented independently, so that new viewpoints are easily distinguished whether interpolated or extrapolated from known viewpoints. To test this, two study images were shown from either the same or different viewpoints of a scene. Immediately following, participants indicated whether a test image was identical to a study image. In Experiment 1, there were many more errors for interpolated than for extrapolated views. In Experiment 2, this effect was still present when only the first image was tested. These results suggest a linked representation in memory that may be formed automatically even when detrimental to performance.

(5099)

**Altering Test Instructions to Improve Women's Spatial Cognition Performance.** MARYJANE WRAGA, MOLLY HELT, & LAUREN E. DUNCAN, *Smith College*, & EMILY C. JACOBS, *University of California, Berkeley*—Women exposed to positive stereotypes make fewer errors on a mental rotation task than do women who receive neutral information (Wraga et al., in press). The present study examined whether altering the context of the stereotype message could enhance performance further. Female participants performed the mental rotation task in one of four conditions. Prior to testing, participants in the general enhancement condition were exposed to a message stating that women's perspective-taking abilities are superior to men's. In the personalized enhancement condition, superior performance was narrowed to "women at all-female institutions." In the female-competitor enhancement condition, inferior performance was targeted to "women at coed colleges." Performance in all enhancement conditions was compared with that of controls, who received neutral information. Although all enhancement conditions showed significantly fewer errors than did controls, the magnitude of the improvement (5%) was constant across all groups. These findings suggest an upper limit to improving spatial cognitive performance via test instructions only.

(5100)

**Perceptual and Psychophysiological Correlates of False Memory With Age.** SAMANTHA C. OTERO, SAM B. HUTTON, & BRENDAN S. WEEKES, *University of Sussex* (sponsored by Brendan S. Weekes)—We compared false recollection of Deese/Roediger–McDermott lists varying input modality of pictures (color, grayscale, and line drawing) and written words, administered to healthy young and older adults. Semantic categories and list words were derived from the Snodgrass and Vanderwart (1980) set. Ratings were obtained for within list conceptual similarity of critical distractors and visual similarity between list items, using an online validation study. We predicted that structurally similar categories would generate more false memories than would structurally dissimilar categories in the picture condition, but we did

not expect an effect of structural similarity in the written word condition. Experiment 1 found effects of structural similarity between study and test items on false recollection for young adults in both modalities, but effects of structural similarity for older adults on false recollection of pictures only. Experiment 2 investigated these effects using an index of pupil dilation. Results suggest encoding difficulties for older adults.

(5101)

**Neural Underpinnings of Individual Differences in Mental Imagery.** MICHAEL A. MOTES & MARIA KOZHEVNIKOV, *George Mason University* (sponsored by Maria Kozhevnikov)—Research has revealed distinctions between object and spatial imagery (pictorial, high-resolution images vs. relatively abstract images of spatial relations among objects and object parts, often involving transformations) and has shown that such distinctions characterize individual differences in imagery. We investigated the neural underpinnings of such individual differences in imagery by examining BOLD signal data collected from seven object imagers and seven spatial imagers while they completed a visual memory task. Task trials consisted of encoding a line drawing, imagining the drawing, judging the presence of a global (e.g., vertical symmetry) or local (e.g., T-junction) property, and then resting. When imagining, object imagers showed greater activity than did spatial imagers in parietal regions, and spatial imagers showed greater activity than did object imagers in occipital and temporal regions. The findings are consistent with an efficiency model in which ease at solving a task is related to less neural resource consumption.

(5102)

**Phenomenology of Autobiographical Memory in Blind Individuals.** ENGIN YILMAZ & ALI İ. TEKCAN, *Boğaziçi University*—Visual imagery is argued to be the most important component of autobiographical remembering (Brewer, 1996). Research (e.g., Brewer, 1986; Rubin & Kozin, 1984) has shown that visual imagery is almost always present when one remembers autobiographical memories. We investigated blind and sighted individuals' recollective experience regarding word-cued autobiographical memories within the context of a basic systems approach to autobiographical memory (Rubin, 2005). Congenitally total blind and sighted participants recalled autobiographical memories in response to cue words. For each autobiographical memory, they filled out measures of recollective experience, belief, and component processes (imagery, narrative, and emotion). Results showed that the blind participants retrieved fewer memories than did the sighted participants. Moreover, autobiographical memories of blind participants were associated with higher auditory imagery and lower visual imagery ratings. Blind individuals' visual imagery was partially accounted for by spatial imagery. Moreover, blind participants reported stronger belief in the accuracy of their memories than did sighted participants.

(5103)

**The Dynamics of Fictive Motion.** TEENIE MATLOCK, *University of California, Merced*, & DANIEL C. RICHARDSON, *University of California, Santa Cruz*—Fictive motion sentences such as "The road runs along the coast" are interesting because they include a motion verb but describe no motion. In one view, their conceptual structure is static and similar to that of nonfictive motion sentences such as "The road is next to the coast" (Jackendoff, 2002). In another, it is dynamic, involving mentally simulated motion (Talmy, 1996). In two eyetracking experiments, participants viewed spatial scenes and heard descriptions about them while their eye movements were recorded. In Experiment 1, fictive motion descriptions produced longer gaze durations along the relevant trajectory (e.g., *road*) than did nonfictive motion descriptions. In Experiment 2, a priming study, the effect was shown not to be the result of subtle differences in sentences. The work provides further support for the idea that fictive motion sentences include mentally simulated motion (see, e.g., Matlock, 2004), and offers novel insights into how nonliteral language influences visual processing.

## • VISUAL PERCEPTION •

(5104)

**The Role of Eye Fixations in Amplification and Concentration Effects During MOT.** MATTHEW M. DORAN & JAMES E. HOFFMAN, *University of Delaware*, & BRIAN J. SCHOLL, *Yale University*—Alvarez and Scholl (2005) recently reported that during multiple object tracking (MOT), attention is preferentially allocated to the centers rather than to the ends of objects, and that this *attentional concentration* becomes more pronounced with increased object length (*amplification*). However, it is unclear whether these effects depend on attentional allocation or on coincidental differences in eye fixations. The present research addressed this question by measuring eye movements while participants performed an MOT task while simultaneously detecting probes that appeared at the centers or endpoints of the objects. Consistent with Alvarez and Scholl, probes presented at objects' centers were detected at higher rates than those presented at objects' endpoints, and this discrepancy became larger with increased object length (i.e., concentration and amplification effects). Critically, concentration and amplification were still observed when probes were equated for distance from eye fixation, indicating that these effects cannot be attributed to coincidental differences in eye fixation.

(5105)

**Feature Binding: Exactly How Do Features Move?** ERIN M. BUCHANAN & M. KATHRYN BLECKLEY, *Texas Tech University*—Errors in feature binding have been attributed to poor location information (Ashby et al., 1999; Baylis & Driver, 1993). Paradigms that study how features migrate use only vertical or horizontal displays (Butler et al., 1991; Prinzmetal, 2005). However, real life displays are horizontal, vertical, and diagonal. This study examines how features migrate in a more dynamic display. As seen before, features do move in horizontal and vertical directions, but features also move diagonally. Diagonal errors show many movements, and farther movements than both horizontal and vertical errors. Horizontal and vertical errors move small amounts (1–2 places), whereas diagonal errors show an excess of larger movement errors (2–4 places over). Implications of location coding of feature binding are discussed.

(5106)

**The Influence of Irrelevant Distractors on Eye Movement Trajectories in Hemianopic Vision.** STEFAN VAN DER STIGCHEL, *Vrije Universiteit Amsterdam*, WIESKE VAN ZOEST & JASON J. BARTON, *University of British Columbia*, & JAN THEEUWES, *Vrije Universiteit Amsterdam* (sponsored by Jan Theeuwes)—Patients with hemianopic defects often have blindness in part or all of one hemifield. There is evidence, however, that some visual information in the blind region may still be processed (“blindsight”). Previous research with healthy participants has shown that irrelevant distractors cause saccades to deviate away from their location. We presented distractors in the blind and intact portions of the visual field and recorded eye movements to targets in the intact field, to determine whether blind-field distractors also caused saccadic trajectories to deviate. We found no influence on saccade trajectory from “blind” distractors in four patients with hemianopia from lesions of the optic chiasm, radiations, or striate cortex. However, in one patient, we observed saccadic trajectory deviations away from the “blind” distractor and a greater “global effect” when target and distractor were closely aligned. Thus, in some patients, there is the potential for blind-field stimuli to influence saccadic metrics.

(5107)

**Object Substitution Masking by Illusory-Contour Figure.** NOBUYUKI HIROSE & NAUYUKI OSAKA, *Kyoto University* (sponsored by Naoyuki Osaka)—The visibility of a briefly presented target is reduced by a lingering sparse mask that does not even touch it (object substitution masking, or OSM). OSM is thought to reflect mainly

higher object-level interference because the spatially distant mask, which is too inconsequential to produce lower image-level interference, impairs perception of the target. In the present study, to derive truly object-level interference, we introduced an illusory-contour figure resulting from changes in orientation of previewed pacman inducers (rotating to face inward) as a mask. The illusory-contour figure, when appearing near and remaining after the target, reduced the visibility of it. This masking effect was not due simply to the local changes in inducers but relied on the presence of perceptual object formed by illusory contours. These results suggest that OSM could occur at the purely object level.

(5108)

**Involuntary Attention Does Affect Accuracy.** ELISABETH G. HEIN & CATHLEEN M. MOORE, *Pennsylvania State University*—Prinzmetal, McCool, and Park (2005) suggested that involuntary attention does not influence the perceptual representation of attended objects. We examined this hypothesis in the context of Hein, Rolke, and Ulrich (2006). Observers in that study performed less accurately in a task probing temporal properties of a display on valid trials than on invalid trials. This negative attention effect suggests that involuntary attention affects perceptual processing by impairing the temporal resolution of the visual system. We asked whether these findings would extend to conditions that meet Prinzmetal et al.'s criteria for a pure-accuracy experiment. We used a temporal-order discrimination task and manipulated attention with noninformative peripheral cues. To avoid location uncertainty, we used only two target locations with no masks. 100% correct identification was nearly impossible, and observers were urged to take their time when responding. Performance was worse in valid than in invalid conditions, suggesting that involuntary attention can affect perceptual processing.

(5109)

**A Bayesian Framework for Modeling Intuitive Dynamics.** ADAM N. SANBORN, *Indiana University, Bloomington*, VIKASH K. MANSINGHKA, *Massachusetts Institute of Technology*, & THOMAS L. GRIFFITHS, *University of California, Berkeley* (sponsored by Steven Sloman)—People have strong intuitions about the masses of objects and the forces that they exert upon one another. These intuitions have been explored through many tasks, such as judging the relative masses of objects involved in collisions and evaluating whether one object caused another to move. We present a unifying framework for explaining the judgments that people make about the dynamics of objects, on the basis of Bayesian inference. In this framework, we define a particular “forward model” of dynamics—essentially Newtonian physics plus Gaussian noise—which predicts the trajectories of objects following collisions on the basis of their masses and initial velocities. By applying Bayesian inference, it is possible to reason from trajectories back to masses, and to infer whether one object caused another to move. We tested the predictions of this framework through a series of experiments in which people made judgments about masses and causal forces involved in collisions.

(5110)

**Perceptual and Decisional Noise in Signal Detection.** CHRISTOPH T. WEIDEMANN & SHANE T. MUELLER, *Indiana University, Bloomington* (sponsored by W. K. Estes)—Signal detection theory (SDT) is often used as a means to separate perceptual and decisional components of detection. SDT accounts for decisional aspects of detection performance by assuming a flexible decision threshold, which allows performance to adapt to the environment. Recently, this assumption has been challenged with measures suggesting that the decision threshold is fixed, whereas the stimulus distributions change (e.g., Balakrishnan, 1999). We offer an account for the apparent discrepancies on the basis of the assumption that noise in confidence judgments may distort measures of response bias and confidence ROC functions. We present data that supports this hypothesis and provides converging evidence that nonnegligible decision noise exists in confidence judgments.

(5111)

**Fuzzy Signal Detection Theory: ROC Analysis of Stimulus and Response Range Effects.** JAMES L. SZALMA & PETER A. HANCOCK, *University of Central Florida*—Prior ROC experiments have found that the fuzzy signal detection theory (FSDT) meets the normality assumption of traditional signal detection theory (SDT). However, support for the equal variance assumption depended on discrimination difficulty. To further explore fuzzy ROC space, we manipulated the number of stimulus categories (range), the difference in magnitude between categories (interval size), and the response set permitted (binary vs. seven categories). Response bias was manipulated via a payoff matrix. Three participants engaged in four temporal discrimination tasks. Results confirmed that the FSDT model meets the normality assumption of SDT and that fuzzy ROC functions are of the same general form as those of traditional SDT. The equal variance assumption was met depending on the condition and the participant, possibly because of difficulty in setting stable “fuzzy criteria.” Forcing binary responses resulted in poorer performance relative to con-

ditions in which a range of responses was permitted.

(5112)

**Functional Frameworks of Illumination Revealed by Probe Disk Technique.** ALAN L. GILCHRIST & ANA RADONJIC, *Rutgers University*—We pasted 13 identical gray disks into a photo of a real scene depicting separate regions of sunlight and shadow, and asked observers to match them for lightness. Disks within a region of illumination appeared roughly equal in lightness while a three Munsell unit step-function occurred at the illumination boundary, suggesting that regions of illumination function as frames of reference. This difference became larger when the disks were made to belong more strongly to their fields of illumination by altering disk shape and/or size to conform to slant and/or distance of depicted walls, by adding some blur to disk edges to match the graininess of the photo, and by viewing the scene through a pinhole. The difference was reduced when paper disks were pasted onto the front of the monitor screen. A control condition showed that this effect cannot be reduced to a local contrast effect.