POSTER SESSION I
Fairmont Hotel–Conference Level, Thursday Evening, 6:00–7:30

• PERCEPTION •

(1001)

From Encoding to Retention to Recognition. MICHAEL J. WENGER & ANGELINA M. COPELAND, *University of Notre Dame*—The perception of meaningful, organized visual forms, such as human faces, has been hypothesized to result in an encoded representation that possesses a high degree of dependence among the constituent elements. In contrast, the perception of such forms as common objects is thought to produce encoded representations that possess much less dependence. Previous tests of these ideas (Wenger & Copeland, 2002; Wenger & Ingvalson, 2002, 2003) suggest that shifts in decisional criteria, rather than dependence on the underlying sensory or mnemonic information, may be critical. Here, we present results of a series of experiments designed to explore how such shifts in performance evolve, from the time of first encoding, through retention, to eventual use in recognition. Using both latency and response frequency information, we develop and constrain a dynamic model for perception, retention, and use of this visual information.

(1002)

The Perception of Harmony in Combinations of Blinking Visual Stimuli. KATHARINE TEPE, *University of Colorado,* & DONALD POLZELLA & GREG ELVERS, *University of Dayton*—Research on the perception of musical harmony indicates that combinations of tones tend to be judged consonant when their respective frequencies are reducible to simple ratios. This phenomenon was studied in the visual mode by using combinations of two blinking lights as stimuli. Eight two-light combinations were created whose frequency ratios corresponded to those of eight common musical intervals—for example, octave, fifth. In a pair comparison task, participants judged which one of two, two-light combinations appeared more harmonious or blended. The judgments were compared with those obtained from studies of musical harmony by regressing the scaled auditory preferences onto the raw preference counts obtained from the visual study. There was a high degree of correspondence between the two sets of data. The results suggest that the perception of harmony reflects similar mathematical properties in the visual and the auditory domains.

(1003)

Auditory and Visual Apparent Motion in the Presence of Moving and Nonmoving Cross-Modal Distractors. ARGIRO VATAKIS & THOMAS Z. STRYBEL, *California State University, Long Beach*—Research on multisensory audiovisual apparent motion (AM) typically uses temporally synchronous stimuli, yet auditory and visual AM in isolation are perceived at different SOAs and spatial separations. We examined audiovisual integration in the perception of motion and its direction with asynchronous stimuli. Participants were tested on auditory and visual AM in isolation, followed by auditory and visual AM in the presence of cross-modal moving distractors. SOAs for distractor stimuli were selected for each participant so as to produced motion and nonmotion. The direction of distractor motion was either congruent or conflicting. Participants categorized their perceptions of the stimuli according to whether motion was detected and its direction. The presence of distractors did not affect whether motion per se was perceived in either modality. The perceived direction of auditory AM was negatively affected by a conflicting visual distractor. However, interference occurred when the distractor SOA was both moving and nonmoving.

(1004)

Learning to Combine Arbitrary Signals from Vision and Touch. MARC O. ERNST & FRANK JÄKEL, *Max Planck Institute for Biological Cybernetics*—Humans integrate visual and haptic size information in a statistically optimal fashion (Ernst & Banks, 2002). Combining such size estimates is reasonable, because, naturally, both these size cues are correlated. The purpose of this study is to investigate whether cue combination is learned on the basis of a correlation between cues. Therefore, we took naturally uncorrelated cues—the object's luminance (visual cue) and stiffness (haptic cue)—and trained 12 subjects for 1 h in an environment in which these cues were correlated. To test whether training had an effect, we compared subjects' discrimination performance before and after training for two intermixed conditions: In one condition, the cues were consistent with the correlation during training (congruent); in the other, the cues were anticorrelated relative to training (incongruent). We predict that discrimination performance becomes slightly better for stimuli with congruent cues and worse for stimuli with incongruent cues. In agreement with our prediction, we found a significant interaction between pre- and posttest for the two congruent and incongruent conditions ($p < .001$). This indicates that subjects picked up the correlation during training and learned to combine two arbitrary cues. We conclude that combination of cues can be learned on the basis of the statistics of their co-occurrence.

(1005)

Reference Frame Adjustment in Object Recognition. MARKUS GRAF, *Max Planck Institute for Biological Cybernetics,* DANIEL KAPING, *University of Nevada, Reno, & Max Planck Institute for Biological Cybernetics,* & HEINRICH H. BÜLTHOFF, *Max Planck Institute for Biological Cybernetics*—If the recognition of disoriented common objects relies on an adjustment of a reference frame, recognition should be facilitated if the object is preceded by a different object in the same orientation. Two objects from different basic categories were presented in close temporal contiguity in brief masked displays, either in the same or in different picture plane orientations. Subjects had to name both objects. Before the test phase, presentation times for the second object were individually adjusted such that accuracy was at 80%. Line drawings of common objects were employed. In Experiment 1, objects were selected such that 12 were from biological and 12 from artifact categories. In Experiment 2, 12 objects with a vertical and 12 with a horizontal main axis were used. In both experiments, naming accuracy was higher when the two objects had congruent orientations. This effect was independent of object category and of the objects' main axis.

(1006)

The Perils of Using Panels and Projectors in Cognitive Research. RICHARD R. PLANT, NICK V. HAMMOND, & GARY TURNER, *University of York* (sponsored by Gareth Gaskell)—TFT panels are rapidly replacing standard CRTs in all areas of computing. On the surface, they offer much the same functionality, take up less space, and consume half the energy. However they are based on fundamentally different technologies, which have an inherent side effect of introducing timing delays. So, rather than having to worry about refresh rates, researchers should now be contending with slow display onset times in timing critical studies. Typically these can be upward of 40–50 msec, which can mean, for example, that a visual stimulus will no longer be synchronized with an auditory one, as before. Since data projectors are based on fundamentally the same technology, the issue of response time applies here too. In this poster, we hope to make researchers more aware of differences inherent in the technologies involved, how this might affect their own research, and more important, possible solutions that might allow the use of TFT panels.

(1007)

Visual Search for Faces (Revisited): Orientation, Identity and "Faceness." DARREN C. BURKE, *Macquarie University,* SIMONE K. KEANE, *University of Wollongong,* & WILLIAM G. HAYWARD, *Chinese University of Hong Kong*—We examined visual search for a face that differed from a set of identical distractors in orientation, identity, or configuration. Orientation searches involved targets and distractors that differed by either 180º (aligned vertically or horizon-

tally) or 30º (targets or distractors upright, inverted, or 15º either side of vertical). Identity searches involved targets that differed from distractors in terms of internal face features but that had identical outlines (one individual's eyes, nose, and mouth were replaced by another's). Configuration (or "faceness") searches involved targets and distractors that were either normal faces or vertically reordered face parts within the same outline. In general, orientation searches were much more efficient than configuration searches, which were more efficient than identity searches, but there were some exceptions to this pattern and some surprising search asymmetries that hold implications for theories of both visual search and face perception.

(1008)

Own-Face Imaging Effect: Demonstrating That One's Own Face Is Processed Differently Than Faces of Others. SETH N. GREENBERG, *Union College,* & YONATAN GOSHEN-GOTTSTEIN, *Tel-Aviv University*—A series of experiments demonstrated that imaging one's own face takes longer than imaging the faces of relatives, celebrities, or objects and also indicated one factor contributing to this distinctive "own-face generation effect." Ratings of image clarity suggested that there was no tradeoff between clarity of image and the time to generate a face. The initial experiments established the slow own-face generation effect across two different cultures. Subsequently, we found that when subjects image parts of a face, imaging one's own face was faster than imaging the face of another. Consequently, we assessed the effect on face imaging of an unrelated training task that oriented processing toward global or local features. The results indicated that with the global-feature orientation, the imaging of one's own face was slower than that of another's face; however, with the local-feature orientation, the imaging of one's own face was faster. Together, these studies identified an interesting phenomenon—that is, a distinctive own-face generation effect—and explained that whereas other-face imaging is predominantly configural, own-face imaging is primarily feature based.

(1009)

The Fate of the Ground in Figure–Ground Assignment. SHAUN P. VECERA, NORA S. BRODSON, & ANASTASIA V. FLEVARIS, *University of Iowa*—What is the effect of figure–ground assignment (FGA) on the ground? Rubin (1915/1958) suggested that grounds were shapeless, and some data support this (Baylis & Cale, 2001). Other studies, however, have found that the ground has an inhibited shape (Treisman & DeSchepper, 1996). A biased competition account of FGA resolves these discrepant results by suggesting (1) that ground shape is determined by the presence of multiple regions that compete for figural assignment and (2) that ground shape may result from attentional processes, not FG processes. We tested these hypotheses, using a shape-priming paradigm. We found that figures inhibit grounds (negative priming, NP) when the grounds are possible figures (i.e., could have been perceived as figure), suggesting that competition between regions produces NP of the ground. Active selection of the figure is necessary for this ground shape, however. Figures that are not selected for report do not produce NP of the ground.

(1010)

Causes of Linear Vection's Body-Centered Frame of Reference. DOUGLAS L. MORSE & JOHN J. RIESER, *Vanderbilt University*—Helmholz noted that people sitting in a stationary train perceive themselves moving backward when the train beside them begins to move. Lepecq et al. showed that people report such linear vection more rapidly in the lab when large peripheral fields of moving stripes specify up/down self-motion (as if viewed through an elevator's window) rather than forward/backward self-motion (as if through a train's window). We replicated this asymmetry (up/down vection was judged more rapidly and reliably than forward/backward vection) and asked about the asymmetry's frame of reference. If it is organized relative to the body (not the environment), supine people would judge environmentally forward/backward stimuli more effectively than environmentally up/down stimuli. The results show a body-centered organization. To find out whether this, in turn, depends on purely visual factors or on vestibular–visual interactions (note that otolith activity differs in upright vs. supine postures), bilaterally labyrinthectomized people judged linear vection while viewing visual stimuli from upright versus supine postures.

(1011)

Tones, Noise, and the Perceptual Bias for Auditory Looming. JOHN G. NEUHOFF, *College of Wooster*—When a sound source approaches a listener, most listeners exhibit a perceptual bias to hear the source as closer than it actually is. This bias for "auditory looming" may provide a selective advantage by giving advanced warning of the approaching source and, thus, more time to prepare for arrival. In the present work, three-dimensional binaural recordings were made of approaching and receding sound sources that emitted either tones or noise. In two experiments, listeners estimated the time to arrival of the approaching sources and made a speeded decision as to whether the sound source was approaching or receding. The results show that tones create greater advanced warning than does noise and that approaching sources are detected more quickly than receding sources. The results demonstrate the advanced warning provided by the looming bias and underscore the reliability with which tones indicate the presence of a single source in an auditory scene.

(1012)

Prisms and Environment Differentiate Verbal and Blind-Walking Distance Estimates. SHEENA ROGERS, JEFFREY ANDRE, REBECCA BROWN, & THOMAS QUIST, *James Madison University*—Blind-walking estimates of distance are more accurate than verbal reports (Andre & Rogers, 2002). Differences could be the result of either two separate underlying representations (in separate visual pathways) or a single representation with additive error's causing inaccuracy in verbal reports. In the present study, we found that walking environment (Experiment 1) and prism wearing (Experiment 2) influence the two tasks differently. Experiment 1: While blind walking was equally accurate indoors and outdoors, verbal reports were less accurate outdoors. The difference between the two responses was also more pronounced outdoors. Experiment 2: While observers blind-walked further when wearing 10-diopter base-down prisms (as compared with base-up or no prisms), their verbal reports were not affected by prismatic displacement of the visual field. From these results, we conclude that the two tasks utilize separate visual pathways: one supporting the action-based task, and the other supporting the verbal reports.

(1013)

Calibration, Information, and Control Strategies in Braking to Avoid a Collision. BRETT R. FAJEN, *Rensselaer Polytechnic Institute*—Among the most routine maneuvers performed by automobile drivers is braking to avoid a collision. We tested several models of braking by manipulating information about speed in an actively controlled braking task. Participants viewed displays simulating approaches to a stop sign and used a joystick as a brake to stop as closely as possible to the sign. Information about speed was manipulated by varying the simulated eye height above a textured ground plane, which alters the rate of global optic flow. Eye height influenced final stopping distance and the magnitude of individual brake adjustments. Observers were also more likely to increase brake pressure as the required deceleration approached the brake's maximum deceleration. We conclude that people calibrate visual information about the required deceleration, on the basis of speed and time to contact, to the brake's maximum deceleration. Brake pressure can then be adjusted to keep the required deceleration within a safe boundary.

(1014)

Gender From Gait Revisited. FRANK E. POLLICK, JIM KAY, KATRIN HEIM, & REBECCA STRINGER, *University of Glasgow*—Although an explanation for our ability to perceive human movement from sparse point-light displays remains elusive, there has been con-

siderable recent interest in its computational and neurophysiological basis, as well as in its examination in special populations. The two principal findings about point-light displays are that they are robustly organized into human movement and that subtle distinctions among movement categories are possible. In this presentation, I will examine the second of these findings, that point-light displays support the recognition of movement style. In particular, I will review the past 25 years of research into the recognition of gender from point-light walkers. This review indicates that we are moderately above chance in recognizing gender from gait. This somewhat surprising result will be discussed in the context of why gender recognition is a difficult problem and what it reveals about our general abilities to represent human movement.

• Imagery & Scene Processing •

(1015)

Priming of Lexical Decision by Scenes and Objects. ROBERT D. GORDON, *North Dakota State University*—Within a single fixation, observers are able to rapidly determine the gist (i.e., category) of a scene and the identities of several objects within it. The present experiment investigated the processes involved in this rapid acquisition of information. On each trial, participants made a lexical decision response to a letter string that immediately followed a briefly presented line-drawn scene (e.g., a dining room). Positive priming was observed when the word named an object that was semantically consistent with the scene but was not present in the scene (e.g., candle) and also when it named a semantically inconsistent object that was present in the scene (e.g., tricycle). However, when the word named a semantically consistent object that was present in the scene (e.g., flowers), negative priming was observed. These results may reflect differential allocation of attention to consistent and inconsistent objects during the initial fixation on a scene.

(1016)

Aesthetic Preferences for Symmetry Resist Influence of Color Illusions. SUSAN T. DAVIS, *University of Dayton,* & JOHN C. JAHNKE, *Miami University*—Research in aesthetic preferences, heralding back to Fechner, has been, figuratively, evaluating a rose without color, focusing almost exclusively on black and white images. In the present research, preferences for symmetry in colored divided rectangles were reliable despite attempts to perturb them with a high saturation color contrast illusion (e.g., a red area adjacent to gray). Furthermore, location of the division between the two areas was highly accurate to 0.01 mm, indicating that relative proportions are a critical determinant of aesthetic preference. These results are congruent with findings that Mach bands consisting of shadings of light produce a stronger illusion than do those consisting of shadings of saturated colors. In addition, the visual processing of proportion versus color information in aesthetic preference judgments may be manipulated by how the observer is instructed.

(1017)

Individual Differences in Drawing and Writing: The Role of Imagery, Verbal, and Performance Skills. PAUL C. AMRHEIN, *Montclair State University,* & AIMEE KNUPSKY, *University of New Mexico*—Individual differences in imagery, verbal, and performance skills, and picture–word translation were investigated. Participants were assessed for imagery ability, including generation, maintenance, manipulation, and quality (Rey-Osterrieth; Image IDQ; Mental Rotation;VVIQ), and verbal and performance skills (Verbal IDQ;VIQ, PIQ:WAIS III). Participants then completed a picture–word interference task requiring drawing or writing from a picture or picture-name flanked by picture or picture-name distractors. Response onset latencies replicated evidence for stimulus and production modality independence in translation and interference (Hamilton & Amrhein, 1997). Imagery generation proficiency predicted drawing onset overall. However, imagery proficiency did not correlate with word–picture translation when isolated. Imagery generation proficiency predicted interference from picture distractors when drawing from words. Thus, imagery relates to output representation retrieval, not prior conceptual retrieval. When imagery proficiency affords faster retrieval, greater interference from picture distractors accrues prior to drawing onset—further enforcing the view that picture–word interference arises from response, rather than from concept-competition. Such imagery relationships also support modality-independent accounts of picture–word translation.

(1018)

Representational Momentum for Objects Coming Into and Out of View. MARGARET P. MUNGER, MATTHEW DELLINGER, KATHERINE JOHNSON-REID, EMILY KUHN, TRAVIS LLOYD, JASON SCOTT, NICOLE TONELLI, & KATHARINE WOLF, *Davidson College*—Representational momentum (RM) is a forward distortion of a moving object's position. We examined RM when a central camera rotated such that various objects moved either into or out of view. Significant RM was observed for both directions, and larger RM was observed when objects were moving into view. In addition, after the RM task was finished, a surprise map test was administered. Participants were at chance to correctly identify the map. A second experiment explicitly taught participants a map of the scene, and while they successfully learned the map, this had no impact on subsequent RM performance. Again, significant RM was observed, and larger RM was observed when objects were moving into view. Knowing which object would be next in the sequence did not affect RM, but an object's coming into view led to larger RM. Implications for RM and attention and for scene perception are discussed.

• Spatial Cognition •

(1019)

Seeking Representation, Commonalities of Distance Estimation, and Map Drawing. MARK VAN SELST, RANDALL RUBIDA, & KHANG PHAM, *San Jose State University*—Familiarity with an area predicts accuracy in distance estimation. Regional familiarity (San Francisco Bay Area) is more predictive than that for larger scale areas (California-wide and USA-wide, respectively). Accuracy is predicted by the quality of the relevant output produced for a "draw-a-map" task but is only weakly (or not at all) predicted by the quality of the nonrelevant scale maps (e.g., regional distance accuracy is predicted by the quality of the regional map but is only weakly predicted by a state map and not at all by a USA map). These findings replicate (across samples) and generalize (across exemplars).

(1020)

Orienting and Reorienting Using Geometric and Featural Cues. DEBBIE M. KELLY, *University of Nebraska,* & WALTER F. BISCHOF, *University of Alberta*—One important step for successful navigation is determining the appropriate direction in which to travel. We investigated how humans orient using 3-D environmental information. Observers were presented with different views of a room on a computer monitor and were asked to locate a single reinforced corner. For half the subjects, the room initially did not contain any distinct featural information (i.e., only the metric information provided by the shape of the environment). Upon completion of training, participants were presented with the same images, but now with distinct features in each corner. A second group received the conditions in the opposite order. All participants received tests in which either the featural or the geometric cues were manipulated. All participants showed strong reliance on featural cues. However, when all distinct featural cues were removed, the participants were able to use the geometric shape of the environment to search for the goal location.

(1021)

The Role of Landmarks in Route Learning. DAVID A. WALLER & YVONNE LIPPA, *Miami University*—In three experiments, people learned a route consisting of 20 left and right turns through a desktop

computer-generated environment. Choice points along the route were marked with no landmarks, landmarks that required associating an action (e.g., go left at the table), or landmarks that served as beacons (e.g., go toward the table). Contrary to previous results (Tlauka & Wilson, 1994), we show that the presence of landmarks is clearly beneficial for learning such routes. In addition, when landmarks serve as beacons, their presence is more beneficial for route learning than when they serve as associative cues for action. Additional experiments show that landmarks as beacons give rise to a qualitatively different knowledge representation than do landmarks that serve as associative cues for action.

(1022)

Spatial Representations From Language and Visual Perception. MARIOS N. AVRAAMIDES & JACK M. LOOMIS, *University of California, Santa Barbara,* ROBERTA L. KLATZKY, *Carnegie Mellon University,* & REGINALD G. GOLLEDGE, *University of California, Santa Barbara*—Past research (e.g., Loomis, Lippa, Klatzky, & Golledge, 2002) has provided some evidence that spatial representations derived from spatial language are functionally equivalent to those derived from perception. To examine whether this holds for spatial relations that are not explicitly stated during learning, we conducted a series of experiments in which people first learn a spatial layout egocentrically, through either visual perception or spatial language, and then make exocentric direction and distance judgments. In the first two experiments, although performance was generally very accurate for both visual perception and spatial language, a latency advantage for visual perception was present. In a third experiment in which participants were forced to create a spatial image prior to being tested (by being required to do spatial updating during a backward translation), performance with spatial language was at par with visual perception. Implications of these results are discussed.

(1023)

Influence of Geometric and Nongeometric Cues in Foraging by Tamarins. JULIE J. NEIWORTH & ROBIN BALLARD, *Carleton College*—A new method presented integrated geometric and nongeometric cues in a foraging situation to cotton top tamarins first and then, after acquisition, tested the types of cues separately. Tamarins ($n = 6$) had learned that both geometric and nongeometric cues predicted food distribution and showed this by choosing the cup with the most food by geometry alone or by nongeometric cues alone. When the two types of cues were pitted against each other in conflict conditions, tamarins showed a tendency to prefer color over location but switched to geometric cues when color cues predicted low food availability.

(1024)

The Hebb Effect in Visuospatial Serial Memory. MATHIEU COUTURE, CAROLINE CELLARD, & SÉBASTIEN TREMBLAY, *Université Laval*—Two experiments were conducted to explore the functional characteristics of visuospatial serial memory with regards to the well-known Hebb effect. Within a serial recall procedure, the repetition of a sequence of verbal items at every four trials leads to a marked improvement in recall performance, in comparison with nonrepeated random sequences. This learning effect is considered to be incidental, since most individuals do not notice the repetition and participants aware of the repetition show no extra gain in performance over time. Using the dot task (see Jones, Farrand, Stuart, & Morris, 1995), regarded as a good visuospatial analogue of the classical verbal serial recall task, we reproduced the Hebb effect in the spatial domain (Experiment 1), and varying the frequency of repetitions affected the learning curve (Experiment 2). Our results provide further evidence that processing of order in short-term memory is the same regardless of the content.

(1025)

Spatial Skills Differentially Mediate Route and Survey Learning. AMY L. SHELTON & DANA M. CLARK, *Johns Hopkins University*—Differences between route (ground level) and survey (aerial) perspectives have been used to infer differences in the cognitive processes that support spatial learning from wayfinding and maps. Overall performance for route and survey encoding has generally been equated through overlearning. This study investigated differences in route and survey learning when encoding was self-regulated. Participants learned two environments, one from the route perspective and one from the survey perspective, in desktop virtual reality. Participants terminated the encoding phase on the basis of their perceived knowledge of the layout. For each environment, participants built a large model. Participants spent equivalent amounts of time encoding route and survey environments but showed an advantage for survey encoding in model-building speed and accuracy. In addition, variability in spatial skills predicted the size of the survey-learning advantage. These finding converge with neuroimaging data supporting distinguishable spatial learning mechanisms and their relationship to individual differences in spatial skill.

(1026)

Using the Skeleton in the Cognitive Map to Predict Human Wayfinding Behavior. BRIAN J. STANKIEWICZ, DAN G. TECUCI, & BENJAMIN KUIPERS, *University of Texas, Austin*—Humans are able to navigate through large-scale spaces (e.g., buildings and cities) with remarkable ease and accuracy. Previous research by Chase (1982) shows that taxi drivers tend to generate a "skeleton" of strongly preferred streets in their environment. Recently, Kuipers (2000, 2001) developed a hypothesis to explain the skeletal representation. Kuipers proposed that a cognitive map includes places, paths, and boundary relations (e.g., Right-Of[Place,Path,Dir]) that are learned during exploration. If people are biased toward selecting paths with larger numbers of boundary relations, a positive feedback cycle among path use, boundary relation learning, and path selection leads to the creation of the skeleton. We have implemented a computational model of this hypothesis (Kuipers, Tecuci, & Stankiewicz, 2003) and have used it to predict human route selection in a wayfinding task. On the basis of each subject's navigation experiences within a virtual reality environment, the model can predict 60%–90% of that subject's action choices.

• Associative Learning •

(1027)

Protein Synthesis Inhibition After Retrieval: Impairment of Memory Reconsolidation or Facilitation of Extinction? MATTHEW LATTAL & TED ABEL, *University of Pennsylvania*—In several contextual fear-conditioning experiments, we examined the impact of protein synthesis inhibition after initial acquisition and after retrieval. Inhibition of protein synthesis following acquisition resulted in decreased fear during a subsequent test. Inhibition of protein synthesis following normal retrieval of contextual fear conditioning also resulted in decreased fear during a subsequent test, similar to the pattern predicted by a reconsolidation account. However, when tested in the conditioning context 21 days later, mice injected with the protein synthesis inhibitor anisomycin showed similar levels of fear, as compared with mice injected with saline. This occurred following short or long durations of exposure during the retrieval period, and the recovery of fear was specific to the conditioning context. These results suggest that protein synthesis inhibition following retrieval does not retroactively affect the memory from conditioning but, instead, results in a facilitation of extinction.

(1028)

Integrating Mechanisms of Memory Acquisition and Mechanisms of Fear-Potentiated Startle Expression. ROBERT C. BARNET & PAMELA S. HUNT, *College of William & Mary*—Associative learning is not equally well expressed across all response measures. This is particularly true in rat development, where the expression of fear-potentiated startle (FPS) emerges later than freezing. In three experiments, we treated the developmental delay of FPS as a performance failure and employed manipulations designed to enable FPS expres-

sion of target light–shock learning, which, in each experiment, occurred early in development, when FPS is not normally seen. Experiments 1 and 2 demonstrated that FPS was delayed relative to freezing and that a US reminder treatment administered prior to the FPS test was not sufficient to enable expression of FPS. Experiment 3 administered nontarget CS–US training just prior to FPS testing with the target light. FPS to the light was observed even though original learning had occurred at an earlier period of development, when FPS is not normally shown. Conditions important for integrating mechanisms of acquisition and performance are discussed.

(1029)

CS Preexposure Illuminates the Different Associative Structures of Forward and Backward Pavlovian Conditioning. AARON P. BLAISDELL, *UCLA*—Backward pairings between a conditioned stimulus (CS) and an unconditioned stimulus (US) result in excitatory responding if relatively few trials are given. Chang, Blaisdell, and Miller (2003) provide evidence that excitatory backward conditioning is mediated by a CS–context and context–US associative chain (i.e., second-order conditioning), rather than by a direct first-order CS–US association. In a conditioned leverpress suppression procedure, rats received pretraining exposure to an auditory CS, followed by either forward or backward pairings with a footshock US. While CS preexposure typically causes a decrement in forward conditioning (i.e., latent inhibition) through a strengthened CS–context association, we expected no decrement in backward conditioning. As was expected, CS preexposure produced latent inhibition of forward conditioning but had no demonstrable effect on backward conditioning (as compared with appropriate controls). These results provide further evidence that excitatory backward conditioning is due to a CS–context–US associative chain, rather than to a direct CS–US association.

(1030)

Testing the Associative Responses Account of False Recognition Memory. STEPHEN A. DEWHURST & SELINA J. HOLMES, *Lancaster University*—Two experiments tested the hypothesis that false *remember* responses occur because participants generate associates to items presented at study. Both experiments used the category repetition procedure (Dewhurst & Anderson, 1999) to create false remember and know responses. Experiment 1 manipulated the presentation duration of study items and the instructions given to participants. Numbers of false remember responses were not influenced by presentation duration but increased when participants were explicitly instructed to make associations to study items. Participants in Experiment 2 studied the categorized lists either under full attention conditions or while performing one of two secondary tasks (articulatory suppression or random letter generation). Both secondary tasks led to a reduction in the number of false remember responses, with random letter generation producing the greater disruption. These findings support the view that false remember responses are the result of semantic associations made at encoding.

(1031)

Time and Extinction After Continuous or Partial Reinforcement. MICHAEL R. DREW, *Columbia University,* & CAROLYN OLSON & PETER D. BALSAM, *Barnard College, Columbia University*—In autoshaping, the number of omitted reinforcers to extinction is equivalent across partial and continuous reinforcement schedules. Time-based models of conditioning explain this finding by positing that extinction is driven by a ratio comparison between the currently elapsing waiting time to a reinforcer and the expected waiting time to a reinforcer. A plausible alternative is that animals develop expectations about the number of trials to reinforcement and that these are the basis of the ratio comparison. To test these competing hypotheses, rats were trained on partial or continuous reinforcement in a Pavlovian approach paradigm and then were extinguished via CS presentations that were longer than, shorter than, or the same as the training CS duration. Results provide information about whether the loss of responding in extinction occurs because of violated trial- or time-based expectations of reinforcement. Moreover, the experiments test the generality of partial reinforcement effects outside the pigeon autoshaping paradigm.

(1032)

Relational Learning Without Awareness: Awareness Dissociation in Transitive Inference Across Three Levels of Difficulty. ANTHONY J. GREENE, ANNA F. BERG, & KELLI M. PELLMANN, *University of Wisconsin, Milwaukee*—In the transitive inference task, participants learn premise pairs (A > B, B > C, C > D, D > E, etc.), which they may organize hierarchically (A > B > C > D > E). This supports inference (B > D) on untrained pairs. Although not necessarily aware of the hierarchy, participants may perform on the transitive pairs in the five-item task. Increasing task difficulty may necessitate the use of conscious strategies. The present experiments compared transitive performance in three conditions, utilizing 5, 6, and 7 items. For each condition, an "informed" group was given explicit directions about the task, and an "uninformed" group was not. Uninformed participants may become serendipitously aware of the task; however, serendipitous awareness did not facilitate performance across conditions, and awareness did not occur more frequently in easier conditions. Dissociation of awareness and performance prevailed across difficulty levels. An interaction between level of difficulty and informedness was also significant, indicating that performance is facilitated by informedness, depending on the condition of difficulty.

(1033)

Maximizing Long-Term Retention: How Much Spacing is Useful? NICHOLAS J. CEPEDA & HAROLD E. PASHLER, *University of California, San Diego*—Since the late 1800s, researchers have known that spaced learning increases later recall. However, only a handful of studies have examined retention intervals over a week, a precondition for serious application of research findings. We report our initial findings in a research program designed to characterize spacing effects quantitatively and determine whether absolute time or the interstudy interval (ISI)/retention interval (RI) ratio better predicts recall of verbal material at long RIs. Using Swahili–English word pairs and a 1-day ISI gave maximal recall at a 10-day RI, as compared with a range of ISIs from 15 min to 14 days. There was a large gain from increasing ISI from 15 min to 1 day and a relatively small cost from increasing ISI further. The implications for theories of the spacing effect will be discussed.

• False Memories •

(1034)

Context Effects in False Memories. GILLIAN MACDONALD, ERIN WARRINER, IMOGEN HALL, & LORI BUCHANAN, *University of Windsor*—We evaluated context effects in the false memory paradigm (Roediger & McDermott, 1995) by manipulating the similarity of study and test rooms. Thirty-five undergraduate students participated in two context conditions of a recognition memory test using Roediger and McDermott lists. In one condition, the study and the test rooms were identical, and in another condition, they were very different (e.g., very bright office-like room for study; very dim, home-like room for test). Overall, memory performance on a recognition task produced similar d' values across the two conditions. In contrast, the false memory rates, or endorsement of critical lures as *old*, increased substantially in the same context, relative to the different-context condition. Participants were asked to indicate whether they *remembered* or *knew* that the word was on the study list. Critical lures were more frequently *remembered* than were control items, but this judgment did not show an effect of context.

(1035)

Measuring True and Phantom Recollection With Fuzzy Trace Theory's Dual-Retrieval Model. TAMMY A. MARCHE, *University of Saskatchewan,* & CHARLES J. BRAINERD, *University of Arizona*—Fuzzy trace theory's dual-retrieval model was implemented in two

paradigms, repeated recall and conjoint recall, using the same Deese/Roediger–McDermott lists. Convergent results were expected in terms of the parameter values for true recollection and phantom recollection and of their dissociation by a manipulation that involved strength of the false memory illusion. In each of two experiments, participants studied 12 ten-word lists in blocks of 4, which elicited low, intermediate, or high false recall. Participants in Experiment 1 completed three recall tests, and those in Experiment 2 recalled presented words, unpresented words that shared meaning with the presented words, or both. True recollection did not vary with list strength, whereas phantom recollection increased with lists of higher illusion strength, indicating that the two phenomenologies are by-products of different retrieval processes. The parameter estimates of true and phantom recollection were similar across paradigms, and parameters that measure false memory varied with illusion strength. Independent estimates of true and false memory can be derived from the dual-retrieval model.

(1036)

Semantic Convergence Drives Age Differences in False Memories. AYANNA K. THOMAS & MITCHELL S. SOMMERS, *Washington University*—Central to false memory research comparing older and younger adults is the finding that veridical recall decreases as a function of age, whereas false recall and recognition increase. A possible explanation for these findings is that older adults are less able than younger adults to use item-specific information derived at encoding to counteract increased activation on critical items (CIs) resulting from semantic convergence. Two experiments manipulated the strength of these competing sources to determine the nature of false memory creation in older adults. Presenting DRM lists of words (Roediger & McDermott, 1995) in the context of sentences increased item-specific information. Semantic convergence was manipulated by developing stimuli that converged on the dominant or subordinate meaning of the nonpresented critical item. Results showed that when list items converged on the subordinate, rather than the dominant, meaning of a CI, older and younger adults exhibited similar levels of false memories.

(1037)

The Allure of the Alignable: False Memories of Choice Features. MICHAEL McCAFFREY & MARA MATHER, *University of California, Santa Cruz*—When making a choice, people engage in a structural alignment process in which they attempt to make correspondences between elements of one option and elements from the other, yielding commonalities, alignable differences, and nonalignable differences (e.g., Medin, Goldstone, & Markman, 1995). Alignable features are weighted more heavily and are more memorable than nonalignable features (Markman & Medin, 1995; Zhang & Markman, 1998). In this study, we examined whether structural alignment processes might also lead to false memories. We found that in both free recall and recognition memory, people were more likely to falsely remember features alignable with previously seen features than nonalignable features. As the interval between making the choice and remembering it increased, people had fewer accurate and more false memories of alignable features. Thus, although the framework that structural alignment processes provide can increase memory accuracy for alignable features, it also fosters alignable false memories.

(1038)

Made in Brazil: The Effect of Emotion on Memory Illusion. LILIAN M. STEIN & GUSTAVO ROHENKOHL, *Pontifical Catholic University of Rio Grande do Sul*—We developed new lists of word associates to critical nonpresented Portuguese words with emotional content.We also generated 36 lists based on the translation of the Deese/Roediger–McDermott (DRM) original lures. Approximately 600 participants studied 15 associate lists including three emotional lists. The results of recognition and recall tests were compared for the effect of emotion on memory illusion. False recall and false recognition appeared to be affected by the emotional content of the lists.

(1039)

Correct and False Recall in Spanish–English Bilinguals. GLORIA MARMOLEJO, *Winona State University,* KRISTEN A. DILIBERTO-MACALUSO, *Berry College,* & JEANETTE ALTARRIBA, *SUNY, Albany*—People around the world often receive information in one language and recount it in another. However, we ignore how language congruence between encoding and retrieval impacts correct and false recall. In this study, we adapted and translated Stadler et al.'s (1999) false memory norms. Participants were 119 Spanish–English bilingual U.S. college students born in North, Central, or South America or the Caribbean. They listened to 10 lists of 12 words associated to a critical nonpresented lure, either in English or in Spanish, and recalled five lists in English and five in Spanish. Results showed lower correct recall in Spanish than in English and lower recall across languages than within languages. Moreover, false recall was higher across languages than within languages. Apparently, retrieval in another language encouraged gist processing, increasing the probability of falsely recalling critical intrusions. Results are discussed within the frameworks of bilingual language processing and false memory effects.

(1040)

Expecting Distinctive Recollections Reduces the Prime Misattribution Illusion. DAVID A. GALLO, DAVID PERLMUTTER, & DANIEL L. SCHACTER, *Harvard University*—Prior work demonstrates that studying pictures, relative to words, reduces false recognition of related lures. One explanation is that subjects expect more distinctive recollections with pictures and lures do not evoke such recollections. We investigated whether this effect generalizes to the prime misattribution illusion originally demonstrated by Jacoby and Whitehouse (1989). All subjects studied visually presented words. In the low-distinctiveness condition, each visual word was followed with an auditory presentation at study. In the high-distinctiveness condition, each visual word was followed with a pictorial representation. In both conditions, words were visually presented on the recognition test, and half were preceded by brief repetition primes. These primes boosted hits and false alarms in the low-distinctiveness condition, demonstrating the typical prime misattribution illusion. This illusion was reduced in the high-distinctiveness condition, and overall, false alarms were lower in this condition. Both of these findings are consistent with the use of a distinctiveness heuristic.

(1041)

Developmental Changes in False Memory Following Gist Cuing and Verbatim Repetition. ROBYN E. HOLLIDAY, *University of Kent, Canterbury,* & VALERIE F. REYNA & CHARLES J. BRAINERD, *University of Arizona*—The Deese/Roediger–McDermott (DRM) paradigm was used to investigate effects of gist cuing and verbatim repetition on 7-, 9-, 11-, 13-, and 15-year-olds' recall and recognition of studied (i.e., targets) and unpresented (i.e., critical distractors) words. Children heard six lists of words that are associates of a critical unpresented word, recalled each list after it was presented, and were then given a recognition test. False-alarm rates for critical distractors increased with age in free recall and recognition tests. Gist cuing increased recall of critical distractors in the 9-, 11-, and 13-year-olds and increased recognition of critical distractors in all but the youngest children. Although verbatim repetition increased recall and recognition of studied words (i.e., targets) in all age groups, it decreased recognition of critical distractors and other semantically related distractors for the oldest age group (as with adults). Data support a dual opposing processes (fuzzy trace theory) account of false memory development.

(1042)

False Memories About Food Can Lead to Food Aversion. DANIEL M. BERNSTEIN, *University of Washington,* & CARA LANEY, ERIN K. MORRIS, & ELIZABETH F. LOFTUS, *University of California, Irvine*—In two experiments, we suggested to subjects that, as children, they had become ill after eating either hard boiled eggs or dill

pickles (Experiment 1) or after eating chocolate cake or potato chips (Experiment 2). We then asked them to complete a food history inventory and two food preference questionnaires. In both studies, participants increased their confidence that they had become ill after eating the suggested food item. More important, we showed that this enhanced confidence was accompanied by avoidance of the target food. These results indicate that adults can be led to believe falsely that they have become sick after eating certain foods as children and that such false beliefs can have consequences for the individual.

• Recognition Memory •

(1043)

False Recognition: Auditory Confusion for Printed Words and Visual Confusion for Spoken Words? JOHN P. TAYLOR, MARTHA D. AMBERG, SARA HABER, JESS REIS, NICK THOMAS, & WILLIAM P. WALLACE, *University of Nevada, Reno*—A previous false recognition experiment reported that phonetic processing of printed words was obligatory. Two new experiments examined this under conditions designed to maximize or minimize phonetic/orthographic processing during study. Materials were selected to dissociate auditory and visual similarities between studied and new test words (e.g., *chauffeur–show* for auditory similarity; *archaic–arch* for visual similarity). Critical study words (*chauffeur*, *archaic*) were presented visually or auditorily. Articulatory suppression (repetitions of "the") accompanied one visual condition. Pleasantness ratings based on visual appearance, meaning, or sound were obtained during study of visually presented words. Evidence for auditory similarity effects (*chauffeur* increasing false recognition of *show*) was restricted to auditory presentation and visual presentation accompanied with sound pleasantness ratings. Evidence for visual similarity effects (*archaic* increasing false recognition of *arch*) was evident most of the time but was marginal with auditory presentation or articulatory suppression. There was little evidence of phonetic processing unless procedures emphasized word sounds.

(1044)

List Length Effects in Recognition Memory as a Function of Serial Position. YONATAN GOSHEN-GOTTSTEIN & AMIT STEINBERG, *Tel-Aviv University*—The list length effect describes the worse memory that is found for items when they are learned as part of a longer list, as compared with a smaller list. This effect has been observed primarily in the free recall and has helped constrain possible models of episodic memory. Models of recognition have also attempted to account for this effect, although its empirical basis in tests of recognition is quite tenuous (e.g., Strong, 1912). We presented 6, 9, and 12 word lists in a single probe recognition test and examined the effects of recognition on accuracy and latency at different serial positions. Our data allow us to explore whether the list length effect in recognition is similar to recall and whether there is a special status for items in recency positions.

(1045)

Intentional Suppression of Novel Stimuli: Suppressing Nonverbalizable Shapes. RHIANNON ELLIS & JONATHAN W. SCHOOLER, *University of Pittsburgh*—Recently, Anderson and Green (2001) demonstrated suppression-induced forgetting, using a novel think/no-think paradigm. In this procedure, participants studied pairs of words and then were repeatedly shown cue words, for which they had to either suppress or rehearse the corresponding associate. During subsequent cued recall, associates that were suppressed were recalled less than either rehearsed words or words that were omitted from the think/no-think phase. The present experiment explored the generalizability of this phenomenon by replicating the think/no-think paradigm with nonverbalizable shapes and a recognition test. Results showed that even a single suppression was sufficient to bring participants to chance levels in their ability to recognize shapes. These findings demonstrate that the effects of suppression are not dependent on the existence of preexisting semantic associations and that suppression-induced inhibition is maintained in the face of the extensive contextual cues associated with recognition.

(1046)

Extracting Concepts About People in the Absence of Explicit Recollection for Specific Encounters. KATHERINE BIEGER & JENNIFER A. MANGELS, *Columbia University*—We investigated whether conceptual information can be extracted from multiple learning trials in the absence of memory for specific study episodes. Subjects were asked to encode names shown with three massed or distributed descriptive sentences and to extract an impression of the individuals' personalities. At test, subjects categorized name recognition according to level of context recollection: RI (recollection of name with sentence context), RO (recollection of name with unrelated context), K (recollection of name, no context), F (name vaguely familiar, no context), and N (new). Then subjects judged which of four adjectives best described the named individual (concept judgment). Performance was best in the RI condition but was also above chance even when no memory for the sentence context was reported (RO and K). Confidence in the concept judgment was related to level of context recollection. The ability to extract conceptual information may not depend on recollection of encoding context.

(1047)

Recognition Without Picture Identification. ANNE M. CLEARY, KEVIN R. SEILER, & MOSES M. LANGLEY, *Iowa State University*—After viewing a study list of black-and-white line drawings, participants were given a picture fragment identification task for which half of the fragments corresponded to studied pictures and half corresponded to nonstudied pictures. Regardless of whether a picture fragment could be identified, participants rated the likelihood that the fragment came from a studied picture, using a scale of 0 (*definitely not studied*) to 10 (*definitely studied*). Among those fragments that could not be identified, higher ratings were given to those that came from studied pictures than to those that came from nonstudied pictures. However, this recognition-without-identification effect was shown to occur only when the picture fragments contained information about the geometric components (geons) present in the original pictures. There was no recognition without identification found when the picture fragments contained only line segment information.

(1048)

Recollection and the Mirror Effect: When the Probe Is Willing but the Mind Is Weak. MARTY NIEWIADOMSKI & STEVE JOORDENS, *University of Toronto, Scarborough,* & WILLIAM E. HOCKLEY, *Wilfrid Laurier University*—In the frequency version of the mirror effect, hits are higher and false alarms lower for low- relative to high-frequency words. Joordens and Hockley (2000) argued that this effect reflects oppositional influences of familiarity and recollection. Thus, in contexts in which familiarity is not manipulated, the mirror effect can provide information about the degree to which recollection affects recognition performance. By combining a novel partial-probe method with the mirror effect, we show that partial probes result in a reduction in the use of recollection. Critically, we then show that recollection does not occur for complete probes when they are mixed at test with partial probes. Thus, although both encoding and environmental support during test are sufficient to sustain recollection, it does not occur in contexts in which recollection is generally poor. These findings support the notion that conscious recollection occurs only when it succeeds at some acceptable level.

• Working Memory •

(1049)

Why Working Memory Measures "Work": Proactive Interference in Tests of Immediate Memory. MICHAEL F. BUNTING, *University of Missouri, Columbia,* & ANDREW R CONWAY, *University of Illinois, Chicago*—It has long been understood that proactive interference (PI) causes forgetting in short-term and working memory (WM) tests

(Keppel & Underwood, 1962; Wickens, Born, & Allen, 1963). Surprisingly, susceptibility to PI may be a critical component to co-variation between individual differences in WM capacity and higher order cognitive abilities. Participants (n = 70) completed Ravens Advanced Progressive Matrices Test (Ravens) and multiple versions of operation span (Turner & Engle, 1989) and probed recall (Cohen & Sandberg, 1977), modified for the category of the to-be-remembered stimuli, either digits or words. Switching within task from digits to words and back provided release from PI, whereas continued exposure to digits or words over multiple trials provided an opportunity for PI to build. Scores derived from PI-build trials, but not PI-release trials, correlated with Ravens and accounted for as much variance in Ravens as unmodified WM tasks. This suggests that individual differences in WM capacity depend on susceptibility to PI.

(1050)

The Relationship Between Age, Working Memory, and On-Line Syntactic Processing, Sentence Comprehension, and Text Comprehension. GAYLE L. DEDE & GLORIA S. WATERS, *Boston University,* & DAVID CAPLAN, *Massachusetts General Hospital*—Structural equation modeling was used to examine the relationships among age, verbal working memory (vWM), and three types of language measures: on-line syntactic processing, sentence comprehension, and text comprehension. Participants were older (>60 years) and younger (18–30 years) adults. The best-fit model for on-line processing revealed neither a direct effect of age on on-line sentence processing nor an effect mediated through vWM. The best-fit model for sentence comprehension included both a direct effect of age and an effect of age mediated through vWM. For text comprehension, the best-fit model did not include a direct effect of age but did include an effect mediated through vWM. These results indicate that the relationship between age, vWM, and comprehension differs for different aspects of comprehension and support the view that age and individual differences in vWM do not affect individuals' on-line syntactic processing.

(1051)

Individual Differences in Processing Speed, Working Memory, and Reasoning in the Verbal and Visuospatial Domains. JING CHEN, *Grand Valley State University,* & SANDRA HALE & JOEL MYERSON, *Washington University*—Two different models of working memory were tested by administering participants a large battery of tasks and tests drawn from two cognitive domains. For the verbal domain, we used two speeded judgment tasks (category decision and lexical decision), two simple working memory tasks (letter span and word span), two complex working memory tasks (letter forward-two span and word span with verbal secondary task), and two reasoning subtests from the Kaufman Adult Intelligence Test. For the visuospatial domain, we used a parallel set of tasks (speeded abstract matching and shape classification, two different simple and complex spatial span tasks, the Matrix subtest from the WAIS III–R, and the Spatial Relations subtest from the Woodcock–Johnson battery). Results were generally consistent with Baddeley's model of working memory, which distinguishes between the verbal and the visuospatial domains, but were not consistent with a working memory model that distinguishes between simple and complex memory span.

(1052)

The TraceBinding Architecture: Competition and Binding in Visual and Episodic Working Memory Systems. ANTONINO RAFFONE, *University of Sunderland,* JAAP M. MURRE, *University of Amsterdam,* & GEZINUS WOLTERS, *Leiden University*—Psychophysical and neurophysiological studies suggest that visual objects are represented in terms of discrete features integrated by attention or neural synchronization. Feature binding also plausibly occurs in visual storage (Luck & Vogel, 1997) and episodic retrieval (Baddeley, 2000) in working memory. In order to provide a unitary account of binding and competition in working memory systems, we developed and studied the TraceBinding neurocomputational architecture. In TraceBinding, object or episodic memory features (traces) are activated by external stimuli and associative activation spreading. This activation process is dynamically biased by current goals, task context, and prior knowledge. Within-unit integration is achieved by neural synchronization, and between-units segregation by desynchronization. Competition between representations occurs both at the level of active features and at the level of integrated representational units. Our simulation results account for short-term memory limited capacity, visual and episodic chunking, and attention-based competition for feature activation and binding.

(1053)

Visuospatial Working Memory: Serial Recall and Configural Strategies. AYSECAN BODUROĞLU & PRITI SHAH, *University of Michigan*—Short-term memories of locations for sequentially presented objects were investigated using a serial retrieval task. Earlier studies investigating this phenomenon have relied on recognition paradigms, and verbal encoding of locations confounded the results. Our study employed a recall task in which objects appeared in one of 441 locations on an invisible matrix, reducing potential contributions of verbal encoding to performance accuracy. Results indicate a list length effect such that recall was increasingly inaccurate as list length increased. In addition, there was equally accurate retrieval of items in all positions in shorter list lengths (three and four items), confirming evidence indicating that the capacity of visual short-term memory is around three or four object files. For longer list lengths (five or seven items), there were marked primacy and recency effects. Further analyses suggest that subjects formed configurations from sequentially presented individual items and were able to maintain these configurations accurately during the retrieval phase.

(1054)

Is Visual Working Memory Consolidation Slower When It Is Already Partially Filled? GEOFFREY F. WOODMAN, *Vanderbilt University,* & EDWARD K. VOGEL, *University of Oregon*—Although many studies have examined the transformation of perceptual representations into memory representations, little is known about the consolidation of information into visual working memory when it already contains information. Thus, we required subjects to remember simple objects that were masked in order to interrupt the consolidation process and to estimate the amount of information consolidated prior to the mask presentation. We contrasted a consolidation-alone condition with a consolidation-plus-maintenance condition in which subjects needed to remember a set of unmasked items and then were shown an array of masked items to remember. We hypothesized that if the control processes of consolidation and maintenance draw upon common resources, consolidation should be less efficient when performed concurrently with maintenance. In contrast, we found that an identical amount of information was encoded per unit time in both conditions. These results indicate that visual working memory consolidation is equally efficient regardless of what is being maintained.

(1055)

Male/Female Differences in Basic Working Memory Support for a Dual Subsidiary System Task. MIRIAM E. DUNBAR, ALICE J. CORKILL, & MARK A. GUADAGNOLI, *University of Nevada, Las Vegas*—The research reports on a stimulus presentation technique designed to allow subjects to use verbal, spatial, or both verbal and spatial working memory systems to recall information. This dual subsidiary system task was analogous to both word span and the Corsi block tapping task (a measure of spatial span). Working memory span for the dual subsidiary system task exceeded working memory span for the two individual tasks (or working memory subsidiary systems) alone. Males and females displayed equivalent span lengths on the dual subsidiary system task. Regression analyses, however, demonstrated that subsidiary system support for the dual subsidiary system task differed for males and females: Males appeared to rely on spatial working memory, whereas females appeared to rely on verbal working memory.

(1056)

Bimodal Format Effects in Working Memory. PAULA GOOLKASIAN & PAUL W. FOOS, *University of North Carolina, Charlotte*—Three or six concrete nouns were presented as spoken words, printed words, or pictures while participants verified the accuracy of math sentences. In our first experiment, comparisons were made between single- and dual-format conditions, and the results showed an advantage for items presented as spoken words and pictures simultaneously and individually. In our second experiment, different items were presented together, and interference effects depended upon the similarity between the target and the distractor formats. Our results suggest that the bimodal and split-attention effects observed when dual-format items are presented in a working memory task may depend upon feature similarities in processing information between two presentation formats, rather than upon just the fact that one or two modalities are used to present item information.

(1057)

An fMRI Investigation of Short-Term Source Memory in Young and Older Adults. KAREN J. MITCHELL, MARCIA K. JOHNSON, CAROL L. RAYE, ERICH J. GREENE, & JULIE A. HIGGINS, *Yale University*—Little is known about age-related changes in the brain areas subserving short-term source memory processes. Using functional magnetic resonance imaging, we compared working memory for two types of source information (modality, location) to old/new recognition. On each trial, young (M = 23 years) and older (M = 72 years) adults saw four items, presented sequentially: two words, two line drawings, one of each on the right, one on the left. They were tested immediately for old/new recognition or modality or location of a single item. Consistent with neuroimaging findings from long-term memory paradigms, we found greater frontal activation on source memory trials than on old/new recognition trials that was left-lateralized for both young and older adults. The data suggest overlap in at least some of the processes subserving short-term and long-term source memory.

(1058)

Object- or Space-Based Allocation of Attention? Working Memory Capacity Makes a Difference. M. KATHRYN BLECKLEY, *Texas Tech University*—In previous studies, Bleckley, Durso, Crutchfield, Engle, and Khanna (in press) and Bleckley and Engle (under review) have shown that participants with high working memory capacity (WMC) allocate their visual attention differently than participants with low WMC. This remarkable finding was predicted by the view that WMC is essentially attentional in nature. This study addresses the question of whether these differences in visual attention allocation could be attributed to either space-based or object-based allocation. Using Egly, Driver, and Rafal's (1994) methodology, high-WMC participants were found to use object-based allocation, whereas low-WMC participants showed space-based allocation.

(1059)

Rats' Working Memory for Place, Object Place, and Object. JEROME COHEN, VARAKINI PARAMESWARAN, & ROBERT ZUNIGA, *University of Windsor*—Rats' working memory for food site locations in a square foraging arena is investigated. In some sessions, these locations were only spatially differentiated; in other sessions, they were redundantly distinguished by different objects; and in other sessions, by objects independent of their initially experienced locations. The amount of information rats can store in their working memory was assessed under each condition. This preparation for studying a rat's working memory storage capacity is compared with less accurate methods used in the radial maze task.

• Implicit Memory •

(1060)

An Investigation of False Memory in Perceptual Implicit Tasks. JENNIFER H. COANE & DAWN M. McBRIDE, *Illinois State University*—With the DRM paradigm, true and false memories were measured in two perceptual tasks. Memory for list and lure items was compared in word stem completion and graphemic cued response tasks with implicit and explicit instructions. To reduce explicit contamination on the implicit tasks, the retrieval intentionality criterion (Schacter, Bowers, & Booker, 1989) was implemented with a levels-of-processing manipulation. Participants were given speeded response instructions to further reduce explicit retrieval attempts. Consistent with results obtained by Zeelenberg and Pecher (2002), but inconsistent with results obtained by McDermott (1997) and McKone and Murphy (2000), lure items did not result in significant priming on the implicit tasks. These findings fail to provide evidence for implicit false memory in perceptual tasks.

(1061)

Explicit Memory for Encoding Context Without Context Dependency in Perceptual Implicit Memory. BRIAN T. CRABB, *Western Washington University,* VERONICA J. DARK, *Iowa State University,* & SARA A. HUNT & RYAN A. DICKSON, *Western Washington University*—Some current theories state that the memory representations underlying perceptual implicit memory (PIM) tests are episodic in nature. For example, the REMI model states that the encoding processes underlying PIM for words involve the adding of both internal and external context to a lexical representation (Schooler, Shiffrin, & Raaijmakers, 2001), suggesting that the reinstatement of such a context should increase PIM (i.e., there should be a context dependency effect). Across four experiments we failed to find context dependency effects either for external or for internal context on a number of different measures of PIM. Follow-up experiments using the same encoding conditions showed explicit memory for the context in which the words were encoded, suggesting that although encoding context is stored with the lexical representation, the context is not used in a PIM task. This appears to pose a problem for episodic models in general and for the REMI model in particular.

(1062)

Automatic and Conscious Retrieval in Directed Forgetting. JENNIFER VONK, *University of Louisiana, Lafayette,* & KEITH D. HORTON, *Wilfrid Laurier University*—Directed forgetting effects were studied with the stem completion task. With both the item and the list methods, a standard PDP group yielded lower automatic estimates than did either a standard implicit group or a group receiving our speeded response procedure (Horton et al., 2001). The data for the speeded response group (and the standard implicit group) show directed forgetting effects in automatic retrieval only for the item method, whereas the PDP group failed to show directed forgetting effects in automatic retrieval for either method. The data are discussed in terms of the role of conscious retrieval processes in the directed forgetting effect and the comparison of methodologies for investigating automatic and conscious processes.

(1063)

The Role of Sequence Integration in Hierarchical Coding. JACQUELINE C. SHIN, *University of Virginia*—Previous research suggests that people can integrate two sequences into a common sequence representation in the serial reaction time task. Does sequence integration facilitate hierarchical coding of individual sequences? In Experiment 1, sequences were presented in a spatial dimension (location of the stimulus) and a temporal dimension (response-to-stimulus interval, RSI), where keypressing responses were based on the spatial dimension. The effect of sequence integration on spatial learning was compared when the spatial sequence required hierarchical coding (ambiguous sequence) or did not (hybrid sequence). In Experiments 2 and 3, an ambiguous spatial sequence was presented along with a correlated secondary sequence in a dimension truly incidental to keypressing—the color of the stimulus in Experiment 2 and the duration of change in background screen color embedded within random RSIs in Experiment 3. The three experiments lacked evidence that se-

quence integration facilitated hierarchical coding of the response-relevant spatial sequence.

(1064)

A Comparison of Involuntary and Voluntary Autobiographical Memory Retrieval. CHRISTOPHER T. BALL, *College of William & Mary*—Many instances of involuntary memory retrieval exist, such as a slip-of-the-tongue (involuntary retrieval of a semantic memory), an action slip (involuntary retrieval of an action plan), a prospective memory (involuntary retrieval of a planned event), and a flashback (involuntary retrieval of an autobiographical memory). The present paper examines differences between voluntary and involuntary retrieval of autobiographical memories. Results from diary and word-cuing studies will be reported that highlight differences in the memories and retrieval processes associated with these two different types of memory retrieval.

(1065)

The Prototype Illusion and Repetition Blindness: Activation and Inhibition or Construction and Attribution? BRUCE W. WHITTLESEA, *Simon Fraser University,* MICHAEL E. J. MASSON, *University of Victoria,* & ANDREA D. HUGHES, *Simon Fraser University*—When words are presented in rapid lists, two opposite effects can be observed. One is false recognition of prototype words (e.g., SLEEP) following a list of its associates (e.g., NIGHT, DREAM, etc.; the prototype illusion); the other is failure to remember one of the occurrences of a word presented twice in the list (repetition blindness). The former has been explained through spreading semantic activation, the latter through inhibitory processes that prevent immediate reactivation of a word's representation. We provide evidence against both of those explanations. Instead, we propose that these phenomena can be better understood through the principles of construction and attribution.

(1066)

DRM Lists as Prime and Target: Violent Blackman Stereotype Induction. BEM P. ALLEN, *Western Illinois University*—One hundred forty-six web participants read and attempted to recall 10 Deese/Roediger–McDermott lists, including a prime list followed by a target list of ethnic/racial names. When the prime list contained violent-man labels (e.g., *murderer*, *gang member*, etc.), participants were much more likely (23%) to falsely recall "African American" (not on the target list), as compared with those reading a nonviolent-blackman stereotype prime list or an irrelevant prime list [2% false reports in each case; $\chi^2(2) = 12.40$; $p < .002$; Cramer's $V = .291$]. A preliminary failure to replicate in the lab is explained in terms of lowered social desirability influences in Web studies.

(1067)

Antipriming of Familiar Objects: Does Priming Have a Purpose? REBECCA G. DEASON, *University of Minnesota, Twin Cities,* CARMEN E. WESTERBERG, *Northwestern University,* & JOHN C. CAPPS & CHAD J. MARSOLEK, *University of Minnesota, Twin Cities*—Familiar objects appear to be stored as superimposed representations in the visual cortex, which may highlight a purpose for repetition priming. Recognizing an object provides an opportunity for its shape representation to be "relearned" among learning and relearning of other objects that share its representational media. Such relearning may cause repetition priming but should also cause "antipriming" (impaired recognition of familiar objects not viewed recently). Previously, we observed antipriming with peripheral visual presentations, and we now examine antipriming with central presentations. First, we obtained a baseline measure of familiar object recognition (uninfluenced by positive priming or antipriming). One week later, the same participants viewed a new set of objects, and then they named that set of objects (measuring positive priming) intermixed with still new objects (measuring antipriming). Significant positive priming and antipriming were observed when compared against the baseline performance, and antipriming occurred even with low visual similarity between relevant objects.

(1068)

Real/Nonreal Object Decision Priming in Young Participants Using a Continuous Priming Paradigm. LYNN A. COOPER, H. JOHN HILTON, TOMISLAV PAVLICIC, & YAAKOV STERN, *Columbia University*—Prior results with the real/nonreal object decision task with a study/test block design showed preserved priming for real objects with delays up to 1 week. In the present study, priming was measured over repeated test presentations, using a continuous paradigm. Seventy-eight novel line-drawn stimuli (39 real, 39 nonreal) were individually presented for four 1,000-msec exposures distributed over 16 trials. Priming was measured in terms of response time decrement for correct trials. Immediately following the continuous priming task, an "old/new" explicit recognition task was administered. Preliminary results indicate priming for both real and nonreal objects in the continuous priming task. Furthermore, stochastic independence was suggested in comparing performance on the implicit and the explicit tests. These results indicate that coherent representations of real and nonreal visual stimuli are formed at the time of encoding but that representations of nonreal items deteriorate more quickly. Supported by NIA AG-16714

(1069)

Testing Multinomial Models of the Recall–Recognition Procedure. FRANCIS S. BELLEZZA, *Ohio University*—In the recall–recognition paradigm, participants complete word stems that may result in words that had been previously presented. Later, participants are asked if they recognize any of the words formed as members of the previously presented list. A variety of multinomial models, which include both conscious and unconscious memory processes, can fit data from the recall–recognition paradigm. A number of these models are discussed and are fit to data collected by varying type of encoding, retrieval instructions, and retention interval. An important characteristic of any pair of models is whether they are equivalent with regard to goodness-of-fit tests. If they are not, experiments must be designed that try to falsify the less general model. This is done by expressing the parameters of one model in terms of the other and determining under what experimental conditions parameter values less than zero or greater than one may occur.

• Selective Attention •

(1070)

When Is It Good to Share the Spotlight? MATTHEW M. DORAN, JASON E. REISS, & JAMES E. HOFFMAN, *University of Delaware*—When subjects attend to a precued spatial location, they are faster and more accurate at detecting and identifying objects appearing in that location. In addition, there appears to be a spatial gradient of enhancement surrounding the attended location, suggesting that spatial attention is allocated in the form of a "spotlight" whose intensity gradually decreases from the center. Bahcall and Kowler (*Vision Research*, 1999) recently attempted to determine the size of the attentional spotlight in a series of experiments that asked subjects to identify two target letters that appeared either close together or separated in space. Surprisingly, they found better joint identification for separated letters than for adjacent ones, which argues against the claim that subjects allocate attention to spatial locations in the form of a unitary spotlight. The present research attempts to determine which factors are important in producing an advantage or disadvantage for nearby items.

(1071)

Is Treisman's "Glue" Related to Posner's "Beam"? ERIC L. SOETENS, NATACHA DEROOST, & WIM NOTEBAERT, *University of Brussels*—Exogenous cues direct subjects' attention to a limited location in the visual field, resulting in faster RTs after valid than after invalid cues. We investigated whether this effect is related to the serial conjunction search process reported by Treisman and Gelade (1989). Subjects had to detect the presence of a target in one of two letter strings of three to five letters presented left and right of fixation.The

target differed either in size only (feature search) or in a combination of size and identity (conjunction). In the feature search task, there was no interaction between cue validity and number of distractors, whereas in the conjunction search task there was. The results are discussed in the context of Briand and Klein's (1987) suggestion that Posner's "beam" is related to Treisman's "glue."

(1072)

Constraining the Spread of Attention Within an Object: Elimination of the SOE. GARY C.-W. SHYI & PEI-LUEN TSAI, *National Chung Cheng University*—Judging two attributes leads to better performance when they belong to the same object than when they belong to two different objects. One hypothesis to explain the same-object effect (SOE) proposes that spread of attention within the same object may be faster and/or more efficient than that across objects. Attentional spread may be constrained, however, when detailed object representations are required for a task, leading to elimination of the SOE. In four experiments, participants were asked to judge whether two small 3-D shapes, shown as part of a same or two different large cylinders, were identical to each other (Experiments 1 and 2), or whether two of the four small 3-D shapes, distributed across two large cylinders, were identical to each other. The typical SOE was replicated in the first two experiments. However, it was eliminated in Experiments 3 and 4, when more detailed object representations were apparently needed.

(1073)

Measuring Components of Volitional and Reflexive Spatial Attention. BETTINA OLK, BRENDAN CAMERON, & ALAN F. KINGSTONE, *University of British Columbia*—Attention can be directed volitionally to objects, as well as triggered reflexively by events in our environment. Recent research suggests that the traditional assessment of volitional attention, with spatially predictive central arrow cues, may overestimate the effects of volitional orienting. This is because nonpredictive central arrows generate reflexively a significant spatial attention effect. The present experiments compared spatial attention effects with directional cues (e.g., arrows), nondirectional cues (e.g., numbers), and peripheral box cues. Each of these cues could be predictive or nonpredictive with respect to a target's location. The results suggest that the volitional component of attention may be best measured by using nondirectional central cues that are predictive and that the reflexive component of attention may be best measured by using directional central cues that are nonpredictive.

(1074)

Spatial Reference Frames for Attention. KRISTA SCHENDEL & LYNN C. ROBERTSON, *VA Northern California Health Care System & University of California, Berkeley*—Whether attention is directed toward a particular location or not depends on the spatial reference frame that is used (e.g., viewer vs. object centered). We examined spatial biases in healthy adults (presented with spatial precues) and in neglect patients. Targets appeared either to the left/right of the participant's body midline or on the left/right side of an object that was visibly rotated ±90º. Spatially biased target detection was then used to determine whether targets were processed within a viewer- or an object-centered frame of reference. Stimulus parameters investigated included stimulus rotation and level of orientation information in the display (global, local, or both). Overall, stimulus rotation had a strong influence on reference frame selection. Findings from the patient data further suggested that viewer- and object-centered reference frames could additively influence the distribution of attention. Results indicate that external features can influence reference frame selection but that this may not be a winner-take-all process.

(1075)

Gaze Following: Orienting of Attention Is Object Based. ANDREW BAYLISS & STEVEN P. TIPPER, *University of Wales, Bangor*—Observing a centrally presented face with averted eyes triggers a reflexive shift of attention to the gazed-at location. Two experiments examined whether these gaze orienting effects were determined by object-based representations. In Experiment 1, the head was oriented 90º from vertical, and the eyes gazed up or down. Detection of targets to the left or the right was influenced by whether gaze was to the left or the right of the head-based frame. In a second experiment, the nature of the target object was manipulated. It was predicted that attentional orienting via gaze would be greater when the target toward which attention was directed was a socially meaningful object, such as a face. This object-based attention effect was also confirmed. Finally, it should be noted that these head-based cuing effects were most salient in subjects reporting high levels of social competence via the Autism-Spectrum Quotient Questionnaire (Baron-Cohen et al., 2001).

(1076)

Incidental Memory in Visual Search: Age Differences in Visual Memory for Targets but Not Distractors. CARRICK C. WILLIAMS, ROSE T. ZACKS, & JOHN M. HENDERSON, *Michigan State University*—The present study examined the effect of executive processes on the long-term incidental memory for both targets and distractors in a visual search task. Younger and older adults counted the number of targets (identified by a color and a category) present in arrays of 12 real-world objects. Age differences in executive processes could lead to differences in processing distracting objects. Search arrays contained targets, color distractors, category distractors, and distractors unrelated to the search target. Participants' memory was tested using a surprise token discrimination task. Memory for targets was reliably better than that for distractors. Color and category distractors were discriminated from foils at similar levels, and both were discriminated better than unrelated distractors. Although older adults demonstrated poorer memory for the target objects, they were able to remember the distractors as well as the younger adults. Eye movement analyses demonstrate that the more an object is viewed, the better the visual memory.

(1077)

Cluster Size and Eccentricity in Visual Search: Adult Age Differences. WILLIAM J. HOYER, JOHN CERELLA, & NORBOU BUCHLER, *Syracuse University*—An 11×11 hexagonal array was populated with 60 ± 2 dots and slashes, configured so as to create an easy target and a hard target. In both conditions, response-terminated search performance was recorded as a function of target eccentricity. Both errors and RTs could be predicted by a cluster search model fitted to each observer, in which cluster size varied with target discriminability and cluster time and cluster accuracy were constant. In our samples of 18 younger adults and 18 older adults, cluster accuracy was reduced with age, and cluster time increased with age. For the hard target, there was no age difference in cluster size; for the easy target, older observers showed larger clusters. These results bear on the distinction between feature search (cluster > 1) and conjunction search (cluster < 1) and on the precise description of age differences in the size of the effective visual field.

(1078)

Search for Multiple Targets: Search Rate Depends on What Is Being Remembered. TODD S. HOROWITZ & JEREMY M. WOLFE, *Harvard Medical School and Brigham & Women's Hospital,* & RANDALL S. BIRNKRANT, *Brigham & Women's Hospital*—During visual search, we deploy attention to sample the environment. Classic search models assumed sampling without replacement, implying memory for rejected distractors. Previously, we measured this memory, using multiple-target search, varying number (n) of targets to find. Assuming constant search rate across n, we found that memory for rejected distractors was small (three items). Recently, Takeda demonstrated that rate increases with n. His data seemed to support a larger memory capacity. However, Takeda's targets were identical circles, whereas ours were varied digits. In multiple target search, observers must remember which targets have already been found. Remembering identical targets requires spatial

memory, whereas verbal memory may be used to remember unique, nameable targets. Search is more vulnerable to spatial than to verbal memory loads (Oh & Kim; Woodman & Luck).We replicated Takeda, using both circles and varied digits. Digits supported much smaller memory than did circles. Spatial memory load may force systematic search.

(1079)

Dimension Weighting for Responses in Visual Feature Search. TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology*—This study examined whether weighting feature dimensions for responses facilitate target detection in visual feature search. Three types of target displays (color singleton, orientation singleton, and no target) were presented in one experimental block. Two response keys were assigned to display types differently for tasks. In the singleton detection task, one key was assigned to color and orientation singletons and the other to no-target displays. In the color detection task, one key was assigned to a color singleton, and the other to orientation singleton and no-target displays. Reaction times to color singletons were faster in the color detection task than in the singleton detection task, showing that target detection was faster when two targets defined by different dimensions were assigned to different responses rather than to the same response. The results were discussed in terms of a perceptual account (Muller et al., 1995) and a response account (Cohen & Magen, 1999) of dimension weighting and of a hybrid account of them (Kumada, 2001).

(1080)

The Nature of Interference With Small Target–Distractor Distances. SHU-CHIEH WU & ROGER W. REMINGTON, *NASA Ames Research Center*—One method of measuring attentional capture by irrelevant distractors is to compare reaction time to targets with a distractor presented simultaneously with that obtained without one. Recent analysis shows significantly more interference from distractors in close proximity to the target. We report a series of experiments exploring whether interference from nearby irrelevant distractors reflects attentional capture. Subjects searched for a color singleton target with an onset distractor located 30 to 150 angular degrees away. Virtually all interference normally regarded as evidence of attentional capture came from distractors 30º from the target. Interference for static targets was pronounced; for targets with transient change, little interference occurred. Despite the elevated interference, target response was unaffected by incompatible foil identities at the nearest distractor location, inconsistent with attentive processing. These results suggest that interference found with the irrelevant distractor may have causes other than attentional capture.

• Cognitive Control •

(1081)

Measuring Cognitive Control: An Integration of Working Memory and the Process Dissociation Procedure. KAREN A. DANIELS & JEFFREY P. TOTH, *Washington University,* & RANDALL W. ENGLE, *Georgia Institute of Technology*—Cognitive control is a central concept in psychology, but little work has been done to integrate the various approaches to its definition and measurement. The present study combined two well-known approaches to cognitive control, working memory (WM) and process dissociation (PD). PD estimates of control and automaticity were obtained for groups with high versus low WM span on a verbal proactive interference (PI) task and the Stroop task. Span differences in the PI task were isolated to the control (recollection) estimates, whereas span differences in the Stroop task were isolated to the "automatic" (word-reading) estimates. Thus, WM-related control processes appear to be indexed by PD, but by different parameters for memory and attention tasks. Correlations among the estimates from the PI and the Stroop tasks, and between the estimates and a measure of fluid intelligence, suggest that similar forms of control are operating in these tasks.

(1082)

Exploring the Nature of Switch Cost: Inferences From P300 and the Lateralized Readiness Potentials. SHULAN HSIEH & YEN-TING YU, *National Chung Cheng University*—We describe a protocol whose aim is to examine various hypothetical models of task switching. This protocol analyzes the two event-related potentials, the lateralized readiness potential (LRP) and P300. P300 peak latency is documented as being related to the stimulus identification process. The LRP intervals, stimulus locked and response locked, are related to the duration of premotor processes and the motor process, respectively. The present results showed that the mean reaction time and the stimulus-locked LRP were longer for switch than for repeated trials. This suggested that task switching affected stage processes before the onset of LRP. A further analysis of P300 confined task switching to the process after the stimulus identification stage. Moreover, the results of additivity (reflected on reaction time and stimulus-locked LRP) between task cuing and task switching suggested that the two factors affected a distinct stage of processing. A further implication would be that there was no switch-specific control process supporting the switch model of the carryover effect.

(1083)

Neural Correlates of Attentional Control in the Counting Stroop Task With Numerical Stimuli. ELIZABETH G. OPAROWSKI & DALE DAGENBACH, *Wake Forest University,* & PAUL J. LAURIENTI, *Wake Forest University School of Medicine*—fMRI was used to study the neural activations associated with attentional control in a counting Stroop task using numerical stimuli in a blocked design. Significant activations were observed in the bilateral middle and inferior frontal cortex, the left lateral and the medial orbitofrontal cortex, the left inferior parietal lobule, and the left precuneus and superior parietal lobule. No significant anterior cingulate activation was found. The behavioral data indicated a significant slowing on incongruent versus congruent trials but approximately equal error rates. Thus, the overall pattern seems consistent with accounts in which control is exerted by prefrontal cortex, whereas the anterior cingulate is responsive to errors.

(1084)

Equivalence of Cognitive Processes in Brain-Imaging and Behavioral Studies: Evidence From Task Switching. IRING KOCH, *Max Planck Institute for Psychological Research,* HANNES RUGE & MARCEL BRASS, *Max Planck Institute for Cognitive Neuroscience,* ORIT RUBIN & NACHSHON MEIRAN, *Ben-Gurion University,* & WOLFGANG PRINZ, *Max Planck Institute for Psychological Research*—For the validity and generality of functional brain-imaging (e.g., fMRI) results, it is important that the relevant cognitive processes are equivalent to those functioning in typical settings used in behavioral research. In the present study, we tested whether the cognitive processes, as reflected in behavioral data in brain-imaging settings, are indeed functionally equivalent to those reflected in "purely" behavioral settings. To this end, we used a task-switching paradigm and compared the data of three groups that differed in testing environments (real operating fMRI vs. simulated fMRI vs. standard behavioral with upright position of participants) but used otherwise strictly identical experimental conditions. We replicated a predicted complex data pattern in all groups, suggesting functional equivalence of the underlying cognitive processes. We also found strongly increased reaction time (RT) levels in the fMRI groups. We attribute this increase of baseline RT to unspecific, distracting factors affecting late motor processes and discuss methodological implications.

(1085)

Inhibitory Control Over Selective Attention During Switching of Selection Criteria. MARK E. FAUST, *University of North Carolina, Charlotte,* & STEVE SANOW, *University of South Alabama*—One potentially important component of effective task switching is the efficiency with which processes associated with the switched-from task are inhibited during the performance of the switched-to task. In two

experiments, participants named one of two words under either an early (color) or a late (category) selection criterion in four successive displays with a switch in criteria halfway. The influence of target attributes (i.e., color or category) associated with the switched-from task (i.e., a prior task interference effect) was assessed. Prior task interference effects were larger when the early selection task was switched from under conditions in which there was not a consistent stimulus–response mapping for the switched-from task. The results suggest that stimulus-driven reactivation of the more automatic or stimulus-driven processes associated with the switched-from task may require inhibitory control during task switching.

(1086)

Backward Inhibition: The Influence of Working Memory and Response Complexity. KATHERINE D. ARBUTHNOTT, *University of Regina*—In task switching, alternating between two tasks impairs performance more than does switching among three tasks. The proposed cause of this pattern is backward inhibition, the suppression of a task set as it is abandoned. This study examined the role of working memory (WM) span and response complexity on backward inhibition. In the context of switches between three two-choice digit judgments, responses were either univalent (six responses) or trivalent (two responses). WM was assessed using a list span task. Participants were faster with trivalent responses, likely due to the reduced memory load for that condition. WM span influenced speed only with trivalent responses: High-span participants were faster. Span and response complexity influenced backward inhibition interactively: High-span participants had greater backward inhibition for univalent responses, whereas low-span participants had greater backward inhibition for trivalent responses. This suggests differential use of backward inhibition as a function of WM capacity.

(1087)

Task-Switching Performance: Univalent Versus Bivalent Target and Response Mapping. RUSSELL E. COSTA & FRANCES J. FRIEDRICH, *University of Utah*—Many studies have shown that switching attention between tasks is accompanied by a performance cost. Several factors affect the size of switch costs, including the use of task cues, preparation intervals, motivational factors, and univalent versus multivalent target and response mappings. One approach to understanding these processes is to examine boundary conditions, or the conditions under which switch costs should not occur. A series of experiments investigated whether switch costs are eliminated with increased cue information and with univalent target and response mapping. Switch costs occurred regardless of response mapping but were eliminated by manipulating the amount of information a subject was given prior to the target. Contrary to some predictions (e.g., Meiran, 2000), switch costs occurred even when both the target and the response sets had univalent mappings. In addition, we attempted to isolate the cost of inhibiting the competing task in bivalent stimulus sets.

(1088)

Costs of a Voluntary Switch Between Tasks. CATHERINE M. ARRINGTON & GORDON D. LOGAN, *Vanderbilt University*—Task-switching paradigms are widely used to study executive control. However, standard paradigms may not require active control to switch tasks (Logan & Bundesen, 2003). We examined voluntary switching by having subjects choose which task to perform on a series of bivalent stimuli. Subjects performed parity or magnitude judgments on single digits. Instructions were to perform each task equally often and in a random order. RSI was manipulated between blocks and was either 100 or 1,000 msec. Task switches were slower than task repetitions. This switch cost was greater at short than at long RSIs (310 and 94 msec, respectively). Additionally, subjects produced more task repetitions than would be expected if the tasks were performed in a random sequence. These results show costs associated with a voluntary task switch, where subjects must actively control the choice of the task to be performed.

(1089)

Speed/Accuracy Tradeoffs and Planning in Sequence Production. PETER Q. PFORDRESHER, *University of Texas, San Antonio,* & CAROLINE PALMER & MELISSA JUNGERS, *Ohio State University*—Speed/accuracy tradeoffs have often been observed in human performance, but examinations of this phenomenon have largely focused on simple tasks. It is likely that tradeoffs in complex tasks, such as music performance, reflect the use of cognitive plans under strict temporal demands (Lashley, 1951). We report an experiment that reveals speed/accuracy tradeoffs in piano performances, in which performers produced complex sequences at different tempi. The relationship between produced tempo and error rate is described by an extension of the range model of planning (Palmer & Pfordresher, in press), originally designed to account for retrieval processes that lead to serial ordering errors in sequence production. The model fits imply that speed/accuracy tradeoffs in music performance result from cognitive, as well as motor, constraints and that the same underlying architecture accounts both for the probability of making an error and for the type of error that occurs.

(1090)

Does Speed Stress Affect Early or Late Processes? Inferences From the LRP. GERHARD RINKENAUER & ROLF ULRICH, *University of Tübingen,* & ALLEN OSMAN, *University of Pennsylvania*—Two reaction time (RT) experiments assessed the locus of speed–accuracy tradeoff (SAT) within the RT interval. Experiment 1 employed a line discrimination task and Experiment 2 a lexical decision task, to emphasize perceptual and cognitive processing, respectively. In both experiments, participants performed under three levels of speed stress, controlled by an adaptive tracking algorithm. RT, response force, and the lateralized readiness potential (LRP) were measured in order to examine effects of the speed–stress manipulation on early and late processes. Both experiments showed that speed stress affects the duration of processes that occur before LRP onset and the duration of processes that intervene between LRP onset and the response. The latter effect of SAT on the duration of late, presumably motor processes cannot be explained by variations of response force. The earlier pre-LRP locus is in line with most models of SAT. The late post-LRP locus, however, is not.

(1091)

Response Grouping in Dual Tasks. STEFANIE SCHUCH & IRING KOCH, *Max Planck Institute for Psychological Research,* & WILFRIED KUNDE, *University of Halle-Wittenberg*—In dual-task studies, it is often observed that participants do not perform the responses independently of each other but group the responses together. Grouping is indicated by short and constant interresponse intervals (IRIs). In four dual-task experiments, we investigated the mechanisms of response grouping. We measured both IRI and initiation time of the grouped response. The data show that initiation time was affected by stimulus onset asynchrony, which is in line with the assumption that the two responses are selected serially. Response order also had a large effect on initiation of the grouped responses, suggesting that grouping responses in a reversed order is more difficult. However, IRI depended only on whether the two responses had the same task-specific meanings. We conclude that the extent of grouping depends solely on the cognitive interpretation of the involved responses but is completely independent of temporal aspects of the paradigm.

(1092)

A New Form of Action-Based Stimulus–Response Compatibility. SHARON MOREIN-ZAMIR, *University of British Columbia,* & PAUL NAGELKERKE, ROMEO CHUA, IAN FRANKS, & ALAN F. KINGSTONE, *University of British Columbia*—By varying finger pressure on a force sensor key, participants could control the movement of a small visual disk. Their task was to keep the disk inside a visual target that could move or stop. In the compatible condition, participants applied force to move the disk and inhibited the force to keep it sta-

tionary. In the incompatible condition, participants applied force to stop the disk and inhibited the force to move the marker. We found that pressing latencies were faster when the target moved. Conversely, response inhibition was faster when the target stopped. These results were found whether compatibility trials were blocked or mixed. The results indicate a new action-based stimulus–response compatibility effect that spans production and inhibition.

(1093)

Relations Between Specific and General Executive Function Abilities, IQ, and Working Memory: A Latent Variable Analysis. NAOMI P. FRIEDMAN, AKIRA MIYAKE, JOHN K. HEWITT, SUSAN E. YOUNG, JOHN C. DEFRIES, & ROBIN P. CORLEY, *University of Colorado*—The present study is a replication and extension of a previous study in which we found that three executive functions—inhibition of prepotent responses, shifting mental set, and memory updating and monitoring—were correlated but separable (Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000; *Cognitive Psychology*, **41**, 49–100). We use new data collected from a more diverse sample to examine two issues: (1) Does the factor structure we reported in 2000 replicate and (2) What is the relationship of the specific and general executive function variances (i.e., the variances associated with only one of the functions vs. the variance common to all three functions, respectively) to general intelligence and working memory (measured with the reading span, operation span, and spatial span tasks)? We use confirmatory factor analysis and structural equation modeling to address these issues.

• Speech Perception •

(1094)

Consonants and Consonant Clusters as Units for Representing Words. LISA J. INCOGNITO & JAMES R. SAWUSCH, *SUNY, Buffalo*—Previous work has shown that perception of a phoneme in a syllable is influenced by the number of similar-sounding words (lexical neighborhood). This previous work determined neighborhoods for target syllables, using a one-phoneme change rule. *Bow*, *bath*, and *mouth* are neighbors of *bowth*. The present work focused on how consonant clusters are represented in the mental lexicon. Nonsense syllables composed of initial consonant clusters followed by a vowel and a final consonant were used as stimuli. Two rules were used to compute the neighborhood for each syllable. One was the one-phoneme change rule used in previous studies. The second treated clusters of consonants as single units in a one-unit change rule. Syllables with differential neighborhoods based on the two rules were the endpoints of the test series. Results will be discussed with respect to the role of different scale units (phonemes, onsets) in word recognition.

(1095)

Speech Perception in a Second Language by Late Bilinguals. ZOHAR EVIATAR & MARK LEIKIN, *Haifa University,* RAFIQ IBRAHIM, *RAMBAM Medical Center,* & SHIMON SAPIR, *Haifa University*—Bilinguals who learned their second language (L2) after puberty tend to speak with an accent, presumably because the phonological system of their native language constrains the production of L2 sounds. We present a gating study that explored the ability of healthy late-fluent bilinguals to recognize words at the end of sentences in L2 when they were spoken in an accent like their own, a native accent, or another foreign accent. The dependent variable was the proportion of the word needed to correctly recognize it. The data revealed an interaction between native language of the participants (Hebrew, Arabic, or Russian) and accent of the sentence (Hebrew, Arabic, American, or Russian). Planned comparisons reveal that for Hebrew speakers, there was no effect of accent, whereas for the two bilingual groups, stimuli with an accent like their own and the native Hebrew accent required significantly less phonological information than did the other foreign accents.

(1096)

Idiolectic Information for Cross-Modal Speaker Recognition. NICOLAS M. SMITH & LAWRENCE D. ROSENBLUM, *University of California, Riverside*—There is evidence that isolated idiolectic information in the acoustic signal can be used to recognize speakers. Analogously, isolated visible idiolectic (lip-read) information can be used for speaker recognition. If speaker-identifying idiolectic information is available in both modalities, observers should be able to make cross-modal speaker matches, using this information. To test this prediction, observers were asked to match voices to faces in an XAB context. Stimuli consisted of natural voices, sinewave resynthesized voices, and point-light articulating (visible) faces. The latter two of these conditions served to isolate idiolectic information. Results showed that observers could match both natural and sinewave voices to point-light speakers at better than chance levels. Follow-up experiments established that matches were based on movement information in the point-light stimuli, and not on any pictorial information available in these stimuli. Implications of these results for theories of speech, face, and multimodal perception are discussed.

(1097)

Dialect Effects in Speech Perception: Standard (Parisian) French and Swiss French. JOANNE L. MILLER & MICHÈLE MONDINI, *Northeastern University,* FRANÇOIS GROSJEAN, *University of Neuchâtel,* & JEAN-YVES DOMMERGUES, *University of Paris VII*—Languages differ in the relative importance of given acoustic–phonetic properties in specifying phonological contrasts. Earlier, we reported a comparable effect for dialects: Native speakers of Swiss French, but not native speakers of standard French, used vowel duration when identifying a vowel contrast (Miller & Grosjean, 1997). In the present study, we found that this effect is not limited to identification but also involves which tokens listeners perceive to be the best exemplars of the two vowel categories. For native speakers of Swiss French, the best exemplars of the vowels differed substantially in duration, whereas for native speakers of standard French, they differed only minimally. This pattern closely reflects differences in how native speakers of the two dialects produce the vowels (Miller et al., 2000). These findings provide further evidence that listeners use acoustic–phonetic information in a dialect-specific manner when mapping the acoustic signal onto the phonological categories of their language.

(1098)

Adaptation to Time-Compressed Speech by Young and Older Listeners. JONATHAN E. PEELLE & ARTHUR WINGFIELD, *Brandeis University*—It has previously been demonstrated that young adults' recall accuracy for time-compressed speech improves over time when they are presented with a series of time-compressed sentences. Given older adults' well-documented difficulty in comprehending and remembering time-compressed speech, it is unclear whether they would show similar adaptation. To examine this issue, we presented young and older adults with a series of sentences compressed to a fast rate of speech. Recall accuracy was assessed by asking participants to repeat as much of each sentence as possible immediately following presentation. We found that when we individually equated young and older participants for starting recall accuracy by varying the speed of presentation, older adults' rate and magnitude of improvement was comparable to that seen in young adults. We conclude that, within broad limits imposed by general age-related cognitive declines, older adults' perceptual systems remain flexible.

(1099)

Why Do the Elderly Have Difficulty Following Conversations? DANA R. MURPHY, *Nipissing University,* & MEREDYTH DANEMAN & BRUCE A. SCHNEIDER, *University of Toronto, Mississauga*—Age-related declines in the understanding of conversations may be a consequence of perceptual, rather than cognitive, declines. Schneider, Daneman, Murphy, and Kwong See (2000) showed that age-related declines in comprehending single-talker discourse could be eliminated when adjustments were made to compensate for the poorer hearing of

older adults. The present studies used Schneider et al.'s methodology to investigate age-related differences in comprehending two-person conversations. Compensating for hearing difficulties did not eliminate age-related differences when the two talkers were spatially separated by 9º or 45º azimuth, but it did eliminate age-related differences when the two talkers' contributions came from one central location. These findings suggest that dialogue poses a problem for the elderly, not as a result of additional cognitive demands introduced by having two talkers rather than one, but as a result of the additional perceptual demands imposed by having to track and integrate messages that are coming from two separate auditory locations.

• Lexical Processing •

(1100)

The Nature of OUP Effects in Reading: What Eye Movements Can Tell Us. BRETT MILLER, BARBARA JUHASZ, & KEITH RAYNER, *University of Massachusetts, Amherst*—Do readers identify letters in words serially or in parallel? Kwantes and Mewhort (1999a, 1999b) introduced the concept of an orthographic uniqueness point (OUP), which refers to the point in a word where the letter pattern uniquely identifies a word. They argued that faster naming times for early versus late OUP words are inconsistent with parallel letter-processing accounts. This finding is insufficient to argue against all parallel letter-processing accounts. OUP effects may result from differences in the frequency with which a letter occurs in a particular letter position, rather than being due to OUP. We conducted two eye movement experiments to extend the OUP effect to sentence reading. The second experiment controlled for the amount of letter overlap with other words, while manipulating OUP. Results will be discussed in the context of serial and parallel letter-processing accounts.

(1101)

Transposed Letter Facilitation Effects During Silent Reading. REBECCA L. JOHNSON, *University of Massachusetts, Amherst,* MANUEL PEREA, *Universitat de Valencia,* & KEITH RAYNER, *University of Massachusetts, Amherst*—The present study explored transposed letter (TL) effects in the context of reading sentences by using an eye-movement-contingent display change paradigm. The parafoveal preview of each five-letter target word prior to fixation was either identical to the target word (e.g., *judge*), a TL-internal nonword (e.g., *jugde*), a TL-final nonword (e.g., *judeg*), or an orthographic nonword control (e.g., *jupte* and *judop*, respectively). Although there was a significant main effect of letter manipulation (transposed vs. control) on target fixation durations, the main effect of letter manipulation position (internal vs. final) was not significant. The TL condition provided a preview benefit when compared with an orthographic control when the manipulation fell either in the middle of the word or at the end of the word. Implications for models of visual word recognition and the integration of information across fixations will be discussed.

(1102)

The Overlap Model of the Encoding of Letter Positions. PABLO GOMEZ, *DePaul University,* MANUEL PEREA, *Universitat de Valencia,* & ROGER RATCLIFF, *Ohio State University*—Most computational models of visual word recognition assume that the position of each letter within a word is perfectly encoded. This implies that the activation of the word JUDGE is predicted to be the same when the visual input is JUDGE or JUCRE. However, a number of experiments have shown that transposed letter nonwords are more *similar* to their base word than replaced letter nonwords (e.g., Perea & Lupker, 2003). Current computational models are unable to explain why transposed-letter similarity effects are so robust. Here, we propose a new model for encoding letter positions that can successfully deal with these effects: the overlap model. The basic assumption is that letters in the visual stimulus have distributions over positions so that the representation of one letter will extend into adjacent letter positions. To test the model, we conducted a series of perceptual identification experiments. The overlap model produced very good fits to the empirical data. The model captures the fact that the position in the string of the transposed or replaced letters (external vs. internal) has a large impact on discriminability. The model also captures the fact that, as compared with letter replacements, transpositions of letters are harder to identify even when the transposed letters are up to three positions apart.

(1103)

Long-Lasting Masked Repetition Priming. GLEN E. BODNER, *University of Calgary,* & MICHAEL E. J. MASSON, *University of Victoria*—Masked repetition priming effects are often attributed to a short-lived activation process (1–2 sec; Forster & Davis, 1984). We challenge this assumption by showing that masked repetition priming can be observed with delays of up to 9 sec when 5 trials of a nonlinguistic task intervene between a masked prime and its later appearance as a lexical decision target. We also show that presentation of a masked prime on multiple trials generates reliable priming in the lexical decision task that can be detected even when up to an average of about 100 lexical decision trials intervene between the last presentation of an item as a prime and its reappearance as a target. The presentation of masked primes results in learning within the cognitive system, providing support for a unified, memory-based account of masked and nonmasked priming.

(1104)

Transposed Letters in Masked Primes Facilitate Naming Within, but Not Across, Morpheme Boundaries. KIEL CHRISTIANSON, JANE ASHBY, & KEITH RAYNER, *University of Massachusetts, Amherst*—Previous studies show that transposing adjacent letters within a masked prime results in significant facilitation of target word recognition. We sought to determine whether similar facilitation would obtain when transpositions occurred across morpheme boundaries. Thirty-six compound words (e.g., SUNSHINE) were presented in a masked prime naming experiment. Masked primes containing transpositions within morphemes (*sunhsine*) and identical controls (*sunshine*) facilitated naming to a similar degree. Both were significantly more facilitative than orthographic controls (*sunxhine*) and primes containing transpositions across morphemes (*susnhine*), whose effects on naming did not differ. These results could be taken two ways. Morphological decomposition occurs in the prelexical stages of word recognition. This interpretation forces a definition of "word" that is more sophisticated than "string of letters between two spaces." Alternatively, the masked prime paradigm taps lexical, rather than prelexical, processes. This interpretation questions the role of the masked prime paradigm in investigations of presumably prelexical processes.

(1105)

Cross-Language Masked Repetition Priming Effects in Japanese–English Bilinguals. MARIKO NAKAYAMA & CHRISTOPHER R. SEARS, *University of Calgary*—Bilingual language representation in proficient Japanese–English bilinguals was investigated by examining cross-language masked repetition priming effects. The primes were presented in Kanji and in Katakana, and the targets were high-frequency and low-frequency English words. The primes were presented for 40 msec, and the participants made lexical decisions to the targets. The prime–target pairs were either cognate or noncognate translation equivalents. Cognate primes were presented in Katakana script (orthographically familiar), and noncognate primes were presented in Kanji (orthographically familiar) and in Katakana (orthographically unfamiliar) scripts. For the low-frequency targets, repetition priming effects were observed for Katakana cognates and for Katakana and Kanji noncognates. For the high-frequency targets, only the Katakana cognates produced a repetition priming effect. The implications of these findings for models of bilingual language representation are discussed.

(1106)

Syllable Effects in English Word Recognition? An ERP Investigation. JANE ASHBY, *University of Massachusetts, Amherst,* & ANDREA E. MARTIN & JOANNA MORRIS, *Hampshire College*—An

event-related potential (ERP) experiment was conducted to investigate the impact of stress pattern (e.g., initial- vs. second-syllable stress) on syllable effects in word recognition. We examined whether targets preceded by primes that violated the target's first-syllable boundaries would elicit the expected mismatch response (N400), relative to the syllabically congruent condition. Brain potentials were recorded while participants read words preceded by masked 40-msec primes. Preliminary data indicate that incongruent primes elicited greater negativity than did congruent primes. When the initial syllable was unstressed, the waveforms diverged around 200 msec. When the first syllable was stressed, these waveforms diverged around 400 msec. If this negativity can be interpreted as reflecting processing difficulty, its appearance is consistent with eye movement data that suggest that syllable information is represented during silent reading.

(1107)

Hemispheric Lateralization of Lexical and Sublexical Strategies During Reading. CHRISTOPHER H. DOMEN, *University of Windsor,* & RUTH A. ATCHLEY, *University of Kansas*—Hemispheric strategies for reading were examined in a divided visual field task that had subjects read high- and low-frequency regular target words embedded in lists of either regular or irregular fillers. We found significant frequency effects for targets in both lists for both left- and right-hemisphere presentation. These results may be due to the mechanism of metacontrol. Whether the right hemisphere is capable of phonological processing is still in doubt; however, it seems likely that the right hemisphere prefers a strategy of utilizing orthographic information for reading. The right hemisphere appears to have imposed its strategy of direct route access on the left hemisphere, leading to frequency effects in both hemispheres. Alternatively, our brief presentation time and bilateral stimulus presentation may have affected the sublexical representation of each word. If the sublexical route was disrupted, each word must then be read via the direct route.

(1108)

The Influence of Phonological Neighborhood Density on the Perception of Written Words. MARK YATES, LAWRENCE LOCKER, JR., GREG B. SIMPSON, & GEORGE KELLAS, *University of Kansas*—Previous research has shown that both orthographic and semantic neighbors affect written word perception. However, the influence of phonological neighbors on visual word perception has been relatively neglected. Phonological neighbors are those words that represent a one-phoneme change from the target word. For example, *bet*, *gate*, and *got* are all phonological neighbors for the target word *get*. The research reported here shows that phonological neighborhood density facilitates responses in the visual lexical decision task. These results have important implications for models of visual word perception.

(1109)

The Influence of Phonological Neighborhood Frequency in Visual Lexical Decision. LAWRENCE LOCKER, JR., MARK YATES, & GREG B. SIMPSON, *University of Kansas*—In previous research, we have demonstrated that phonological neighborhood frequency can influence performance in the visual lexical decision task. In low-density neighborhoods, there was an advantage for words with high-frequency neighbors. However, there was no effect of neighborhood frequency in high-density neighborhoods. One explanation for this finding is that competitive effects can arise in the processing of words with many high-frequency neighbors but that the competitive effects are moderated by semantics. To assess this hypothesis, the present experiment examined the effect of semantic neighborhood and phonological neighborhood frequency. The results revealed that within high-density neighborhoods, phonological neighborhood frequency can be inhibitory in conditions in which the influence of semantics is relatively minimal. These results will be discussed in terms of current models of visual word recognition.

(1110)

Rhyming Orthographic Neighborhood Effects and Nonword Context in Lexical Decision: A Test of the MROM–p Model. BRIAN M. FRIEL, TUAN Q. TRAN, & RICHARD J. HARRIS, *Kansas State University*—The present study tests a variant of the multiple readout model of word recognition (MROM–p; Jacobs, Rey, Ziegler, & Grainger, 1998). One relevant variable is a word's rhyming orthographic neighborhood, which is defined by those words that rhyme with the target and differ by one letter, maintaining letter position (e.g., HEAP has REAP and LEAP as rhyming orthographic neighbors). The MROM–p model states that there are multiple criteria in recognizing words in lexical decision tasks and that their use is influenced by the difficulty of distinguishing nonwords from words. Consistent with the model's predictions, relative frequency of rhyming orthographic neighbors did not influence lexical decision times when nonwords were easy to reject. However, contrary to MROM–p's predictions, when nonwords were difficult to reject, targets with many higher frequency rhyming orthographic neighbors were recognized more quickly than those with few or no higher frequency rhyming orthographic neighbors.

(1111)

Homophone, Homograph, and Regularity Effects in Lexical Decision and Semantic Lexical Decision Tasks. PAUL D. SIAKALUK, *University of Southern Mississippi, Hattiesburg,* & CRYSTAL R. SHARP & CHRISTOPHER R. SEARS, *University of Calgary*—We examined homophone, homograph, and regularity effects in the lexical decision task (LDT) and in the semantic lexical decision task (SLDT). In the SLDT, participants discriminated words from nonwords but refrained from responding to animal names. For both tasks the nonwords were pseudohomophones (BRANE). Because semantic resolution plays a larger role when responding in the SLDT, larger homophone and homograph effects would be expected in this task. This is because the phonology of homophones (FEAT) and of homographs (TEAR) may activate two different semantic representations, resulting in competition at the semantic level and, hence, longer reaction times. This would not be the case for irregular words (PINT), because the phonology of these words would activate only one semantic representation. Our results indicate only the homophone effect was larger in the SLDT. The implications of these findings for current models of visual word recognition are discussed.

(1112)

Temporal Constraints on the Interactivity of Visual Word Recognition Processes. JASON F. REIMER & KIRANJEET K. UPPAL, *California State University, San Bernardino,* & THOMAS C. LORSBACH, *University of Nebraska, Omaha*—Models of visual word recognition that have adopted the general interactive activation framework assume that activation spreads from higher to lower levels during word recognition. Evidence for the presence of semantic feedback has been found in the form of orthographically mediated inhibition effects, using a mediated priming paradigm (Reimer et al., 2001). Subsequent research has demonstrated that the effect of semantic feedback on word recognition depends on perceptual ability. Specifically, only high perceptual ability participants exhibit orthographically mediated inhibition effects. One explanation for this finding is that the effect of semantic feedback is diminished by slowed orthographic processing. The present study tested this explanation by manipulating the visual quality of targets within the mediated priming paradigm. Results showed that mediated inhibition effects were found with intact, but not with degraded, targets. These results suggest that the temporal overlap of backward- and forward-spreading activation plays an important role during word processing.

• Text Processing •

(1113)

Accessibility of Outdated Information. KELLY A. PERACCHI, *University of New Hampshire,* ANNE E. COOK, *University of Utah,* & EDWARD J. O'BRIEN, *University of New Hampshire*—Zwaan and Madden (in press) presented evidence that once information has been

outdated, it should no longer affect subsequent comprehension. Four experiments are presented that demonstrate that this finding was the result of confounds in their materials. In the first two experiments, we used revised versions of the Zwaan and Madden materials. In Experiment 1, outdated information continued to influence later comprehension. However, in Experiment 2, we showed that this effect can be mitigated when elaboration is included that highlights that the outdated information is indeed outdated. In Experiments 3 and 4, we outdated information by including an irreversible change in state (i.e., the protagonist was now dead). Information prior to this outdating information continued to influence comprehension unless the outdating information (i.e., the protagonist is dead) was elaborated. The results are discussed within the context of the resonance model and the memory-based view of text processing.

(1114)

Local Integration of Actions with Goals. GIOVANNA EGIDI & RICHARD J. GERRIG, *SUNY, Stony Brook*—Past research has suggested that readers largely background all but a narrative's most recent goal. To extend this conclusion, we wrote texts in which we manipulated the relative urgency of conflicting goals. Each text began with an explicit goal that was of either moderate or urgent importance to a character (e.g., *John needs to get to Mexico to join friends or to elude police capture*). The texts continued with implicit statements of a conflicting goal (e.g., *When he stopped to buy gas, he realized that he was tired*). In their off-line judgments about what characters would likely do next, participants were sensitive to relative urgency. However, when reading story outcomes, participants found it easier to integrate the action that was consistent with the local goal, irrespective of urgency. The results provide strong support for the relative primacy of the most recent goal in moment-by-moment reading.

(1115)

Evaluating What Story Characters Know: The Curse of Knowledge During Reading. KRISTIN M. WEINGARTNER & CELIA M. KLIN, *SUNY, Binghamton*—Although readers must be reasonably successful at evaluating a character's perspective, there is evidence that they are unable to do so with complete accuracy. Recent findings (Keysar, 1994; Weingartner & Klin, 2003) have shown that readers sometimes fall prey to the "curse of knowledge" (CK), mistakenly using information that is inaccessible to a character when evaluating that character's perspective. The goal of the present research was to understand the mechanisms that give rise to the CK. The results from two experiments indicated that readers continued to exhibit the CK even under conditions in which it was emphasized that some critical information was off-limits to the character. This finding is consistent with the view that the CK results from a general cognitive bias whereby once people interpret an ambiguous stimulus, they fail to appreciate its ambiguity or the possibility of alternative interpretations.

(1116)

Demands of Planning Knowledge-Based Inferences. CONNIE SHEARS, *Chapman University*—Causal reasoning theories suggest a hierarchy in knowledge areas that support knowledge-based inferences (Trabasso et al., 1989). Cognitive demands may also vary for knowledge areas. Our understanding of goals and goal-directed behaviors (planning knowledge) may require more cognitive effort than does physical knowledge. This study employed a dual-task paradigm to interfere with normal comprehension of text requiring an inference relative to control. Probe word recognitions and knowledge-validating questions measured inference processes. A word recall task (three vs. six items) was utilized to overload working memory. The impact of load (low vs. high) was expected to impair processing of inference sentences more so for planning than for physical knowledge. The results demonstrated that inference processes were eliminated, as measured by questions, under both loads. However, under high load, probe measures revealed that more inference processes were maintained for physical knowledge, as was expected. These findings suggest that knowledge hierarchies, supporting inference processes, may be based on cognitive processing demands.

(1117)

Specific Inferences or General State Changes: How Are Predictive Inferences Represented in Memory? MARK A. CASTEEL, *Pennsylvania State University*—Recent research is equivocal about whether highly constrained predictive inferences about the consequences of actions are instantiated into the long-term memory representation for a text. Although some research supports the idea that specific inferences are generated, other research suggests that only general "state change" inferences are activated. The purpose of the present research was to build upon previous research from my lab addressing this question. Participants read stories that implied a specific inference outcome, mentioned a general "state change" outcome (not the inference), or explicitly mentioned the inference outcome. The outcome was then backgrounded by a second paragraph. Finally, a target line explicitly mentioned the inference outcome, and reading times were measured. Results will be compared with previous findings and interpreted in light of current discourse-processing models.

(1118)

Language Specificity of Discourse Models: A Tale of Two Stories. SUSANNA T. REYNOLDS & SAM GLUCKSBERG, *Princeton University*—When people read a text, they build a text or discourse model. Do bilinguals build language-specific discourse models (i.e., in one or another of their languages) or language-independent models? We developed two kinds of narratives: propositional (emphasizing object-driven relationships) and spatial (emphasizing spatial relationships). We propose that the discourse models for the former story type would be language specific, whereas the models for the latter would be language independent. To test this hypothesis, Russian–English bilingual participants read the stories in either Russian (L1) or English (L2) and then answered questions presented in L1 or L2. We predicted that performance on the propositional narratives would be better when story and question languages matched than when they mismatched, whereas performance on the spatial narratives would be independent of story and question languages. The results confirmed our expectations: Propositional narratives were represented language specifically; spatial narratives were represented language independently. Implications for bilingual cognition are discussed.

(1119)

Text Repetition and Text Integration. BETTY A. LEVY & NICOLE J. CONRAD, *McMaster University*—When a passage is read repeatedly, reading speed and comprehension improve with each repetition. This improved reading fluency suggests that a memorial representation is formed that can be recruited on subsequent readings to aid processing. This text repetition benefit has been demonstrated with adults and beginning readers. But what is the nature of this representation that improves reading fluency? Debate has centered on whether the representation is abstract and at the lexical level or episodic and at the text level. Raney (in press) presented a model that contains both types of representations within a Kintsch-like text-processing model with surface, text-based, and situation model levels of representation. I will report two studies that demonstrate the control of the text repetition effect from the level of the situation model. The second experiment also shows how new information is integrated into a well-formed versus poorly structured text framework.

(1120)

The Interaction of Quantifiers and Context in Determining Discourse Focus. WILLIAM H. LEVINE, *University of Arkansas*—This project explores comprehension of quantifiers in discourse context. Prior research has shown that different quantifiers (e.g., *few*, *a few*) lead comprehenders to focus on different subsets of individuals in a larger set. In the present experiments, participants read short passages that described a situation with a relatively positive outcome expected (e.g., *The flu vac-*

cine produced for this year was very effective), a negative outcome (e.g., *The flu vaccine . . . was terribly ineffective*), or no expectation. These were followed by a sentence with a quantifier manipulation (e.g., *In the flu outbreak, few/a few people got sick*). Either participants wrote continuations, or reading times were measured on a subsequent sentence that contained a reference to one of the possible subsets (e.g., *They were sick for a week*). The results suggest that discourse focus is a function of both quantifier cues and pragmatic expectations generated by prior context.

Recognition Memory
Regency CD, Friday Morning, 8:00–9:55

Chaired by John J. Shaughnessy, Hope College

8:00–8:20 (1)
Depth of Retrieval: Modes of Cognitive Control. LARRY L. JACOBY, YUJ SHIMIZU, & KATERINA VELANOVA, *Washington University*—As typically described, cognitive control is accomplished by editing responses that come to mind prior to their output or, in the case of source memory, by interrogating the source of recognized items prior to their acceptance. This late-selection mode of cognitive control operates after an item comes to mind. In contrast, we provide evidence of an early-selection mode of control that operates by constraining what is brought to mind. We examined memory for foils from recognition tests to show qualitative differences in bases for recognition memory that reflect differences in cue specification. Foils from a test in which old, target items were deeply processed were better remembered later than were foils from a test in which old items were shallowly processed. Results are discussed in terms of a contrast between source identification (editing) and source-constrained retrieval (cue specification) as distinct modes of cognitive control.

8:25–8:40 (2)
Extra-List Information Controls Correct Rejections in STM for Words. DOUGLAS J. MEWHORT & ELIZABETH E. JOHNS, *Queen's University*—We have shown show that subjects in a recognition memory task reject a foil not because it lacks familiarity, but because it contains features that contradict the features of the studied items. Our previous experiments used stimuli defined by a limited number of values on a limited number of dimensions; we could manipulate the feature overlap among the stimuli. To generalize our findings to standard stimuli, we now present data from experiments using the Sternberg paradigm and a large pool of short words. Both the position and the information value of a contradictory letter affect correct rejections indicating that subjects use the contradictory information to make a *no* decision. The results raise problems for familiarity-based theories but are consistent with the iterative-resonance model.

8:45–9:00 (3)
Recognizing a Word Impairs Subsequent Recognition of Related Words. STEPHEN C. DOPKINS & CATHERINE T. NGO, *George Washington University*—Past results suggest that, when recognition judgments are made to two words in succession, judgments to the second word are made more effectively if the two words are related along some dimension than if they are unrelated. These past results may have been compromised, however, by virtue of the fact that the word pairs in question belonged to categorized lists and by other strategic factors. In the present series of experiments, recognition judgments to the second of two words were made less effectively when the two words were related along a series of dimensions than when the two words were unrelated. These results may have implications for our conception of the relationship between semantic and episodic memory.

9:05–9:25 (4)
Effects of Repetition on Judgment of Recency. DOUGLAS L. HINTZMAN, *University of Oregon*—How is judgment of recency (JOR) affected by repetition? In three experiments, subjects went through a long running-recognition word list, giving JORs to items if they thought they were old. Test words occurred two or three times, and interpresentation lags were manipulated. Some subjects gave JORs for the last time they saw the test item, whereas others gave JORs for the first time they saw the item. In one experiment, subjects also gave judgments of frequency. Results show that subjects can judge the recencies of the first and second presentations of a word but they cannot do so with complete independence. The data appear inconsistent with a strength hypothesis for JOR, but also inconsistent with an independent-trace hypothesis. Alternative accounts will be considered.

9:30–9:50 (5)
Test Similarity Effects in Two-Alternative Forced-Choice Recognition Memory. ANDREW HEATHCOTE, ANET BABAKHANI, & ELIZEBETH DITTON, *University of Newcastle, Australia*—Tulving (1985) reported a dissociation between confidence and accuracy in recognition memory for pictures of natural scenes; two-alternative forced-choice decisions were more accurate but less confident when test alternatives were two halves of one scene, rather than halves of difference scenes. Clark (1997) explained the dissociation by assuming the familiarity of similar test items is positively correlated and proposed a MINERVA-based signal detection model. We tested Clark's model, using 400 pictures of natural scenes divided into high- and low-similarity sets by a rating study. Confidence and accuracy results replicated Tulving, and a speed–accuracy tradeoff was evident with decisions for similar pairs slower by 140 msec. The model provided a good account of estimates of familiarity variance based on ROC analysis but failed on a prediction about mean familiarity. Results for experiments with similar (morphed) faces and orthographically similar words will also be reported.

Motor Control
Regency AB, Friday Morning, 8:00–10:10

Chaired by Geoffrey P. Bingham, Indiana University

8:00–8:15 (6)
Visual Information, Memory, and the Control of Reaching. PETER DIXON, *University of Alberta,* SCOTT GLOVER, *University of Oxford,* & DARRYL W. SCHNEIDER, *University of Alberta*—Subjects reached and grasped a target disk, but adjacent to the target was a context disk that was either smaller or larger. Similar to the Ebbinghaus and related illusions, the size of the target relative to the context provides a misleading cue to the actual size of the target. Previous research has demonstrated that grip aperture is affected by such cues early in the reaching trajectory, suggesting that the illusion has an impact on action planning. However, an analysis of the design of such experiments indicates that relative size is, in fact, correlated with the actual size of the target. When this predictive information is eliminated, there is little overall effect of the visual illusion. Analysis of sequential effects indicates that grip aperture is largely mediated by memory for the stimulus configuration on previous trials.

8:20–8:40 (7)
A Strategy-Based Approach to the Dominance of Vision in Perceptual Motor Tasks. DANIEL GOPHER & ELDAD YECHIAM, *Technion–Israel Institute of Technology*—Visual dominance is described as the tendency of visual input to dominate over other modalities in perceptual motor tasks and in speeded responses. Moreover, visual dominance is argued to suppress awareness of stimuli presented simultaneously in different modalities. The privileged status of vision has been the cornerstone of most theoretical accounts for the initial propensity and final dominance of visually guided response strategies in the performance of perceptual motor tasks, such as driving or typing. The present claim is that an important determinant of the dominance is strategic, rather than inherent. It depends on the overall priority structure of task components, and the discrepancy between the local and the global performance reward structures, when moving from novice to expert performance levels. The implications of these claims are demonstrated in three studies of driving, touch typing, and number keying.

8:45–9:00 (8)
The Acquisition of Nonlinear Visuomotor Transformations. WILLEM B. VERWEY, *Universiteit Twente*—Participants moved a mouse-like input device to bring a cursor on a computer screen to a target position. During motion, the cursor was not visible. The relation between the mouse and the cursor positions was nonlinear for two groups of participants, and linear for the control group. The results indicate that specification of movement amplitude, as well as trajectory

generation, occurred in hand space, rather than in cursor space. This implies that the acquired, internal visuomotor transformation preceded amplitude specification and trajectory generation. Even with only five movement amplitudes, the acquired transformation was rule based, rather than instance based. Limited awareness of the nonlinear mouse–cursor relationship and the fact that a working memory task had little effect on performance suggest that high-level cognitive processes played a minor role in the acquired visuomotor transformation.

9:05–9:25 (9)

Using a "Kinesthetic Cue" to Facilitate Adaptation to Rearranged Stylus–Cursor Relationships. ROBERT B. WELCH, *NASA Ames Research Center,* ANTHONY C. SAMPANES, *University of California, Santa Cruz,* & STEPHEN R. ELLIS & BERNARD D. ADELSTEIN, *NASA Ames Research Center*—A series of experiments examined the role of "kinesthetic cuing" in adapting to an altered stylus–cursor relationship (e.g., a 45º clockwise rotation). In the cue condition, participants attended their unseen nondominant arm and hand, which had been aligned with the transformation. In the first experiment, this cue was found to facilitate adaptation in terms of the "reduction of effect" during exposure to the rotation, but not the postexposure "negative aftereffect." Further experiments showed that reducing the magnitude of the rotation and the number of spatial dimensions involved led to an increase in the size of the negative aftereffect, while lessening the effect of the kinesthetic cue on the reduction of effect. These results have important implications for adapting to the intersensory conflicts found with many virtual environments and teleoperator devices.

9:30–9:50 (10)

Paradoxical Lateralization During Imagined Foot Movements. ALLEN OSMAN, *University of Pennsylvania,* KAI-MARKUS MÜLLER, *University of Tübingen,* PETER SYRE, *University of Pennsylvania,* & BRIAN RUSS, *Dartmouth College*—Although each foot is controlled primarily by the contralateral hemisphere, the movement-related brain potentials preceding a foot movement are largest over the ipsilateral side of the head. This "paradoxical lateralization" occurs because the feet of the "motor homunculus" are located within the longitudinal fissure; because of its location and orientation, activity of the cortical foot region in each hemisphere produces maximal potential at the scalp above the other hemisphere. Can paradoxical lateralization also occur when foot movements are merely imagined? If so, it would indicate involvement of the primary sensorimotor cortex, since such lateralization could be produced only by activation of this brain area. We report paradoxical lateralization for imagined foot movements in the absence of muscle activity. This finding supports the view that motor imagery can engage not only portions of the motor system involved in action planning or programming, but also those more directly involved in movement execution.

9:55–10:05 (11)

Monozygotic Twin Pairs With Discordant Handedness: Birth Stress Implications. STANLEY COREN, *University of British Columbia*—It has been hypothesized that left-handedness may be associated with birth stress. Consistent with this is the fact that left-handedness is associated with various autoimmune and neurological problems. Others have suggested that handedness is genetically determined and, thus, allergies and other problems are related to left-handedness via sharing of common genes. A sample of 109 monozygotic twins, where one was right-handed and the other left-handed, was tested. It was reasoned that the left-handed twin was more likely to be birth stressed and, hence, should have a higher incidence of the expected problems. As was predicted, left-handed twins were significantly more likely to have allergies and migraine headaches, despite having the identical genetic makeup as their right-handed co-twins. This supports the association between left-handedness, birth stress, and susceptibility to autoimmune and neurological difficulties.

Category Learning
Georgia, Friday Morning, 8:00–10:00

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

8:00–8:20 (12)

Tests of a Multiple Systems Theory of Perceptual Category Learning. W. TODD MADDOX & DAVID ING, *University of Texas, Austin*—Ashby et al. (1998) proposed a neurobiological theory of perceptual category learning that suggests that rule-based and information integration category learning are mediated by distinct neurobiological substrates. The theory makes a priori predictions regarding the effect of specific experimental manipulations on rule-based and information integration category learning. In one set of experiments, manipulations that should affect information integration, but not rule-based, category learning were examined. These included delaying the feedback and using a training procedure in which each category did not have associated with it a unique response location. In a second set of experiments, manipulations that should affect rule-based, but not information integration, category learning were examined. These included the presence of a second (sequentially presented) memory-scanning task and manipulations of category numerosity. The results support predictions from the neurobiological theory and suggest that rule-based and information integration categories are solved by different category-learning systems that are mediated by different neural circuits.

8:25–8:40 (13)

The Development of Color Categories in Two Languages: A Longitudinal Study. DEBI M. ROBERSON, *University of Essex,* JULES DAVIDOFF, *Goldsmiths College,* IAN R. DAVIES, *University of Surrey,* & LAURA SHAPIRO, *Goldsmiths College*—This study unites investigations of the linguistic relativity of color categories with research on children's color category acquisition. Color naming and comprehension, together with children's ability to remember colors, were tracked in two populations over a 3-year period. A group of children from a seminomadic equatorial African culture, whose language contains five color terms, was compared with a group of English children. Despite large differences in visual environment, language, and education, there were notable similarities in the pattern of term acquisition. Children from both cultures appeared to acquire color vocabulary slowly and in random order. Those who knew no color terms made recognition errors based on perceptual distance, and the influence of naming on memory increased with age for both groups. The results suggest that an initial perceptual continuum is progressively organized into categories and that color concepts are acquired in much the same way as other dimensional concepts.

8:45–9:05 (14)

Young Children Distinguish Look-Alike Photos of Real and Fabricated Animals. KIMBERLY BRENNEMAN & ROCHEL GELMAN, *Rutgers University* (read by Rochel Gelman)—There are many studies of infants', children's, and adults' use of different kinds of trajectories to assign animacy or inanimacy. Some paths are compelling—for example, Michotte collisions. Others are ambiguous, we contend, because information about category-relevant causal forces (Gelman et al; Williams, 2000) and/or the different "stuff" that makes up inanimates and inanimates is absent. Here, we focus on the information from the outside surfaces of objects by using like pairs of photographs of real and fake animals. First, adults assessed degree of photograph pair discrimination difficulty: low, medium, and high. Then 3- and 4-year-olds were asked to help put the pictures taken in a zoo or store in different books. A reliable number at each age succeeded. Many used ontologically correct material terms—for example, fur versus glass. We conclude that different causal principles encourage attention to various kinds of yoked relevant information.

9:10–9:30 (15)

Statistical Feature Correlations and Explicit Feature Relations: Both Matter. KEN McRAE & CHRIS McNORGAN, *University of Western Ontario*—Recently, Ahn, Marsh, Luhmann, and Lee (2002, *Memory & Cognition*) used off-line typicality ratings to illustrate the importance of explicit theory-based relations in people's representations of natural concepts. They failed to find an influence of implicit statistically correlated feature pairs and concluded that they are not part of people's concepts. However, McRae, de Sa, and Seidenberg (1997, *JEP: General*) previously had argued that statistically based correlated feature pairs influence on-line conceptual tasks, but not off-line ones. We present further evidence of this in the form of a speeded feature verification task in which statistically based feature correlations had a strong influence. We then present evidence that people's statistical knowledge of how features co-occur can influence an appropriate off-line task. Subjects provided relatedness ratings for 65 feature pairs that span a range of correlational strength. Correlational strength significantly predicted ratings. We conclude that both implicitly and explicitly correlated feature pairs influence conceptual computations.

9:35–9:55 (16)

The Role of Predictability in the Launching Effect. MICHAEL E. YOUNG, *Southern Illinois University*—One of Hume's cues to causality, covariation, helps predict whether an effect will occur, but not its time of occurrence. In the present study, evidence is provided that spatial and temporal contiguity improve an observer's ability to predict when an effect will occur, thus complementing the utility of covariation as a predictor of whether an effect will occur. While observing Michotte's launching effect, participants showed greater accuracy and precision in their predictions of the onset of movement by the launched object when there was spatial and temporal contiguity. Furthermore, when predictably changing auditory cues were included that bridged a delayed launch, causal ratings and predictability were similarly affected; the same was not true for constant auditory cues. These results suggest that everyday causal impressions are strongly influenced by our ability to predict when, not just whether, an effect will occur.

Timing and Learning
Plaza, Friday Morning, 8:00–9:55

Chaired by Chizuko Izawa, Tulane University

8:00–8:15 (17)

A Model of the Dynamics of Temporal Discrimination. PAULO GUILHARDI & RUSSELL M. CHURCH, *Brown University* (read by Russell M. Church)—The acquisition of a temporal discrimination in a fixed interval schedule of reinforcement may be characterized by many standard measures, such as a temporal discrimination ratio, the time to the first response, the time to the median response, the time to change from a low response rate to a high response rate, and the slope of the response rate gradient. The relationship of these summary measures to the amount of training may be fit with exponential learning curves, but the parameters of these curves are different for the different measures. Alternatively, a simple process model with a single set of parameters can generate response times that fit the standard summary measures and others. Data will be based on the response times of 24 rats trained on fixed-interval schedules of reinforcement (30, 60, and 120 sec).

8:20–8:30 (18)

Temporal Recalibration of Audiovisual Time Order by Adaptation to Asynchrony. JEAN VROOMEN & MIRJAM KEETELS, *Tilburg University,* BEATRICE DE GELDER, *Tilburg University & NMR-MGH,* & PAUL BERTELSON, *Tilburg University & Université Libre de Bruxelles*—The perception of simultaneity between auditory and visual events is a challenging problem for our sensory system, since there are differences in physical transmission time and neural processing speed. Here, we show that the perceptual system is able to adaptively recalibrate to an audiovisual temporal lag. Participants were, on each trial, exposed to a train of eight flashes and beeps with a constant time lag that ranged from −200 to 200 msec (negative values indicate that the sound was presented first). Following this exposure phase, the same flash and beep were presented with a stimulus onset asynchrony chosen from 11 values between −240 and 240 msec. Participants judged whether the sound or the flash was presented first (Experiment 1) or whether the sound and flash were presented simultaneously (Experiment 2). Results showed, as was predicted, that the point of subjective simultaneity was shifted in the direction of the lag.

8:35–8:50 (19)

Tests of Number Representation in Pigeons. WILLIAM A. ROBERTS, *University of Western Ontario*—After pecking a center key 1–16 times, pigeons had to peck a red key for reward if the number of pecks was less than nine and a green key for reward if the number of pecks was greater than eight. Predictions about the shape of the curve relating accuracy to number were tested for two theories of number representation, linear and logarithmic. Common predictions from both theories were supported. A further experiment tested differential predictions from the two theories.

8:55–9:10 (20)

Conditioned Inhibition of Drug Self-Administration. STANLEY J. WEISS & DAVID N. KEARNS, *American University,* & CHARLES W. SCHINDLER & LEIGH V. PANLILIO, *National Institute on Drug Abuse*—The present experiment systematically investigated conditioned inhibition of drug self-administration for the first time. Two groups of rats were trained to self-administer cocaine when a tone or a click was present, but not when these discriminative stimuli were absent. Additionally, in the A + /B− group, cocaine was unavailable during a light, whereas in the A + /AB− group, it was unavailable when a light was superimposed on an excitor (click). In the A + /B− group, drug-seeking behavior during tone was reduced by 74% when the light was presented simultaneously with the tone during a stimulus compounding test. In the A + /AB− group, light reduced drug-seeking behavior by 92%—significantly more than it did in the A + /B− group. These results are similar to those obtained in previous experiments when food was the reinforcer and should have implications for the development of behaviorally based treatments for drug abuse.

9:15–9:30 (21)

Scaling Incentive Value. SANTIAGO PELLEGRINI, *Universidad de Buenos Aires,* & MAURICIO R. PAPINI, *Texas Christian University* (read by Mauricio R. Papini)—Incentive contrast phenomena demonstrate that the value of a particular reward depends on the value of the incentive expected on the basis of prior experience. Two experiments tested the hypothesis that such incentive relativity scales according to a proportional rule. In Experiment 1, three groups of rats received four daily trials, 40 min apart, of access to 16%, 24%, or 32% sucrose solution (reference solutions). Occasional trials were scheduled with six concentrations (test solutions) selected according to the following test/reference ratios: 0.0625, 0.125, 0.25, 0.50, 0.75, and 1. Consummatory suppression during test trials was proportional to the test/reference ratios, independently of the absolute difference between reference and test solutions. In Experiment 2, similar scaling was observed with a 24-h ITI that rules out sensory adaptation. Such proportional scaling fits Weber's law and suggests parallels between the estimation of incentive value, sensory intensity, and interval timing.

9:35–9:50 (22)

Control of Instrumental Variation by Reward Probability. AFSHIN GHARIB, CHRISTOPHER GADE, & SETH ROBERTS, *University of California, Berkeley* (read by Seth Roberts)—What generates the

variation in behavior from which reward selects? To measure variation in response form, we used the variability of barpress duration. A peak procedure experiment with rats had led to the idea that the variability of barpress duration increases when the expectation of reward decreases. Two discrete-trial experiments supported this conclusion. In both, two signals were associated with different probabilities of reward. The variability of barpress duration was closely tied to the probability of reward—the lower the probability of reward, the greater the variability.

3-D Perception
Regency E, Friday Morning, 8:00–9:25

Chaired by Mark McCourt, North Dakota State University

8:00–8:15 (23)

The Perception and Recognition of 3-D Shape From Shadows Cast Onto Curved Surfaces. J. FARLEY NORMAN, *Western Kentucky University,* & YOUNG-LIM LEE, *Indiana University*—This study examined the perceptual informativeness of shadows of naturally shaped objects that were cast onto curved background surfaces. Observers were shown static and deforming cast shadows of five randomly chosen bell peppers (*Capsicum annuum*). These shadows were cast onto flat, hemispherical, or saddle-shaped background surfaces. The deforming cast shadows were created by rotating the objects in depth. All observers were able to effectively perceive the objects and discriminate between the various objects on the basis of their deforming cast shadows, even when the projected shadows were highly distorted due to the presence of bidirectionally curved background surfaces. The observers' discrimination performance for shadows projected onto the hemispherical curved background surface was essentially identical to that obtained for shadows cast onto a flat planar surface but was lower for shadows cast onto the saddle-shaped surface. Discrimination performance for static cast shadows was even lower but was still above chance levels.

8:20–8:35 (24)

A Bias for Global Convexity in the Perception of 3-D Shape From Texture. JAMES T. TODD & BIN CHEN, *Ohio State University*—Observers were presented with orthographic projections of complex doubly curved surface patches with randomly distributed polka dot textures, and they were required to mark local maxima and minima in depth along designated scan lines, using a computer-controlled pointer. For surface patches that were primarily convex, observers' judgments of local concavity and convexity were almost perfectly accurate. However, when surface patches were primarily concave, the judged signs of curvature were perceptually inverted, and almost all of the depth extrema were labeled inappropriately. These results indicate that observers can accurately distinguish local concavities and convexities from polka dot textures under orthographic projection but that they cannot accurately identify which is which. Observers' judgments appear to be determined by a perceptual bias that maximizes the relative proportion of convex surface regions, which is consistent with the distribution of surface curvature in the natural environment.

8:40–8:55 (25)

The Ground Surface Dominance Effect. ZHENG BIAN & MYRON L. BRAUNSTEIN, *University of California, Irvine,* & GEORGE J. ANDERSEN, *University of California, Riverside* (read by Myron L. Braunstein)—The importance of the ground surface in determining perceived layout in a 3-D scene was compared with that of other environmental surfaces. Two posts were positioned at the same simulated distance from the observer in a scene consisting of a textured ground surface, a ceiling, and walls. In one condition, the posts were vertical, and there was a gap between one post and the ceiling and between the other post and the ground. Judged relative distance of the posts depended on where the posts contacted the ground in the image and was opposite to that indicated by ceiling contact. In a control condition in which the posts were horizontal, there was no consistent preference for judging the top or the bottom post as closer. These results show clear dominance of the ground surface over other environmental surfaces in determining the layout of objects in a 3-D scene.

9:00–9:20 (26)

Representing the Ground Surface: A Proposed Visual Surface Integration Mechanism. ZIJIANG J. HE, *University of Louisville,* TENG LENG OOI, *Pennsylvania College of Optometry,* & BING WU, *University of Louisville*—Egocentric distance can be derived from the eye height (*h*) and angular declination (*a*) of the target on the ground surface (Ooi et al., 2001). If both *h* and *a* are correctly perceived, the onus is on the visual system to accurately represent the ground surface. Supporting this requirement, we showed that disrupting the ground surface with a gap, a discontinuous texture gradient, or an obstacle on the ground (occlusion) leads to erroneous distance judgments. Furthermore, we found that observers with restricted visual fields (<21°) underestimated distance when scanning the continuous ground surface from the far target to their feet (near) but performed accurately when scanning in the reversed order. Altogether, these observations suggest a directional visual process of representing the ground surface from near to far, using near depth and texture cues. If it is hampered, the ground surface is represented with an intrinsic slant bias, resulting in distance underestimation.

Metacognition
Regency F, Friday Morning, 8:00–9:40

Chaired by Janet Metcalfe, Columbia University

8:00–8:10 (27)

Self-Explanation and Reading Strategy Training: Overcoming Knowledge Deficits. DANIELLE S. McNAMARA & TENAHA O'REILLY, *University of Memphis*—During self-explanation reading training (SERT), students learn to use reading comprehension strategies while self-explaining difficult science text. Four experiments with college students in a science course have found that SERT helps low-knowledge students to overcome their knowledge deficits. That is, low-knowledge students who receive SERT training tend to perform as well as high-knowledge students on both comprehension tests and course exams. These benefits occur for both skilled and less skilled readers. In contrast, low-knowledge students who do not receive training perform poorly without training. The benefits of strategy training for high-knowledge students depend on the difficulty of the text and the course topic. The results of these experiments are discussed in terms of the knowledge-based account of reading comprehension skill. This research supports the assumption that reading comprehension depends on knowledge activation and that this activation can occur automatically or strategically.

8:15–8:35 (28)

Consistency Between Summary Statements and Predictions Within Particular Contexts. LEE R. BROOKS & AIMÉE SKYE, *McMaster University*—Participants were given stories about the behavior of target people. These stories contained several episodes that portrayed behavioral consistencies. For each of these consistencies, there was one episode in which the behavior was blatantly inconsistent with the general tendency. Participants were subsequently asked to generate or rate general characteristics of the targets, including agreeing that a characteristic was "always true." The participants were also asked to make predictions about the behavior of the targets in specific situations, some of which were similar to the original inconsistent episodes. The participants were remarkably resistant to acknowledging the inconsistencies in summary statements, even though they used the inconsistency in predicting specific behaviors. Only direct confrontation with the summary statement and the particular inconsistent episode reliably elicited acknowledgment of the inconsistency. This inconsistency between summary statements and predictions within particular contexts may be a feature of many domains in which people induce hidden causes.

8:40–9:00 (29)

No Special K!: Threshold Versus Signal-Detection Models of Knowledge. PHILIP A. HIGHAM, *University of Southampton*—Multiple-choice tests often incorporate formula correction whereby marks are subtracted for incorrect responses. However, for students to decide how many and which items to skip involves both metacognition and, possibly, the setting of a report criterion. Nevertheless, to date, very little research has estimated these parameters from these tests, because of a commonly held belief that people either know the answer or are blindly guessing (threshold theory). In the present research, the penalty for incorrect answers was manipulated to vary participants' willingness to provide answers. Withheld answers were later obtained, allowing memory, metacognition, and report criterion parameters to be estimated using Type 2 signal detection theory and ROC analysis. The results indicated that performance on such tests is better understood as involving a variable report criterion and imperfect memory monitoring, as seen in Type 2 signal-detection theory, but not in threshold theory, on which formula correction is based.

9:05–9:20 (30)

Objective and Subjective Forgetting Functions: The Effects of Retention Interval on Predicted and Actual Memory Performance. ASHER KORIAT, *University of Haifa,* ROBERT A. BJORK, *UCLA,* & LIMOR SHEFFER, *University of Haifa*—If judgments of learning (JOLs) monitor fluency of processing during study, they should be insensitive to the expected time of testing. Indeed, neither item-by-item JOLs nor aggregate JOLs disclosed a "forgetting" function similar to that exhibited by recall performance. However, when participants were asked to estimate recall rate for different retention intervals, their estimates mimicked closely the forgetting function obtained for actual recall. Although this finding suggests that participants apply their knowledge about forgetting when theory-based predictions are solicited, additional results indicated that even theory-based predictions are indifferent to the potential effects of forgetting unless participants' attention is specifically drawn to these effects. The dissociation between actual and predicted recall is discussed in terms of the dual-basis view of metacognitive judgments and in terms of the notion of "focusing illusion" that has been invoked in explaining the impact of objective life events on predictions of subjective well-being.

9:25–9:35 (31)

The Role of Retrieval in the Wishful Thinking Effect. RUTHANNA GORDON, NANCY FRANKLIN, & JENNIFER L. BECK, *SUNY, Stony Brook* (read by Nancy Franklin)—People are biased to remember messages as originating from sources that serve their desires, as when an optimistic message is misremembered as having been said by a reliable source (the wishful thinking effect). Work in the related field of choice-supportive memory suggests that desire-based distortions of this sort occur after encoding. We will present two experiments to suggest that the wishful thinking effect stems from retrieval processes as well. In both, people read about a set of predicted outcomes made by two psychics. In the first experiment, psychics' relative reliability was presented either before or after all predictions were studied. In the second, subjects' desire for high or low psychic reliability was manipulated (by having each predict a particularly wonderful or particularly heinous outcome after critical predictions with outcomes were presented). Source monitoring in both studies showed wishful thinking biases, demonstrating the role of retrieval processes in producing the effect.

Recall Processes
Regency CD, Friday Morning, 10:05–12:00

Chaired by Andrew Heathcote, University of Newcastle

10:05–10:25 (32)

Neural Systems Underlying the Suppression of Unwanted Memories. MICHAEL C. ANDERSON, *University of Oregon,* KEVIN OCHSNER & JOHN GABRIELI, *Stanford University,* BRICE KUHL, *University of Oregon,* & ELAINE ROBERTSON & GARY GLOVER, *Stanford University*—Previous research has shown that when people confront reminders to an experience and consistently try to avoid awareness of the associated memory, later recall for the rejected memory is impaired. Here we used event-related fMRI to identify the neural systems underlying this capacity. After learning a set of paired associates, subjects participated in the think/no-think procedure (Anderson & Green, 2001) while being scanned. After scanning, a final test confirmed that memory for suppression items was impaired. Importantly, when people tried to prevent recollection of unwanted memories, neural activity in the bilateral hippocampus was attenuated, and the extent of the attenuation predicted memory impairment for suppressed items. Both memory impairment for suppressed items and reduced hippocampal activity were related to increased activity in the dorsolateral prefrontal cortex. These results show that executive control mechanisms may be recruited to override declarative memory retrieval, providing a viable neurobiological model of repression.

10:30–10:50 (33)

Recall of Missing Items. BENNET MURDOCK, *University of Toronto,* & DAVID SMITH, *Defence R&D Canada*—Two experiments studied the recall of a missing item. Short lists of common words were presented once and were followed immediately by a random permutation of all but one of the presented items. The task of the subject was to recall the missing item. Experiment 1 replicated the high accuracy with five-item lists originally reported by Yntema and Trask (1963) and found that the latencies were quite short (about 750 msec). Experiment 2 varied list length unpredictably and showed that accuracy was a function of both list length (four, five, or six items) and serial position. Latency was again quite short but was essentially independent of list length and serial position. The results seemed to be more consistent with a direct-access model (the power set model of TODAM; Murdock, 1995) than with the search or serial-scanning model originally suggested by Yntema and Trask.

10:55–11:05 (34)

Training People to Use Expanding Retrieval to Recall Names With Concurrent Memory Demands. JOHN J. SHAUGHNESSY, *Hope College,* & LINDSEY M. ROOT, *University of Miami*—Expanding retrieval has been shown to be an effective technique for remembering names (Landauer & Bjork, 1978). Shaughnessy and Helder (2003) demonstrated a reliable (but smaller) benefit of expanding retrieval, using a videotaped conversation as a concurrent memory demand. We tested whether training participants to use expanding retrieval would increase its effectiveness. College students ($N = 96$) viewed a videotaped conversation and were tested for recall of the conversation and of the names introduced during the conversation. Prior to watching the video, half of the participants were trained using four trials (with feedback), during which they tried to implement an expanding schedule while learning a name in a divided-attention task. The untrained participants completed a filler task. Eighty percent of the trained participants were able to exactly match an expanding retrieval schedule; trained participants also recalled more names from the videotaped conversation than did those in the untrained condition.

11:10–11:30 (35)

Mnemonic Benefit of Perceptual Interference in Young and Older Adults. GROVER C. GILMORE & BETH A. PATTERSON, *Case Western Reserve University*—Words that are more perceptually challenging for young adults to identify are better remembered on an incidental recall task (Gilmore & Patterson, 2001, Hirshman, Trembath, & Mulligan, 1994). A range of stimulus contrasts were examined with young and older adults in order to determine the threshold contrast needed for words to elicit a memory advantage in each age group. Both the speed of word identification and incidental memory were measured. Contrast sensitivity also was collected. There were several major findings. The age-related deficit in contrast sensitivity accounted for reaction time differences in word reading. Only the young adults ex-

hibited a mnemonic advantage with weak (low contrast) stimuli. The absence of a memory advantage with weak stimuli in the older adults suggests that they do not use higher order perceptual processes to encode weak stimuli, as was suggested by Hirshman et al. (1994) for young adults.

11:35–11:55 (36)

Comparing List Length Effects in Recognition and Recall. MICHAEL S. HUMPHREYS, ANGELA M. MAGUIRE, & SCOTT BOLLAND, *University of Queensland*—Dennis and Humphreys (1991) proposed that recognition was primarily a context noise process, whereas recall was primarily an item noise process. This proposal focused attention on whether list length effects occur in recognition. However, it is more diagnostic to ask whether list length effects are smaller in recognition than in recall. Two experiments are reported in which yes/no and forced-choice recognition are compared with cued recall. The list length effects that are produced are compared by seeing if SAM both with and without the differentiation assumption can simultaneously fit the results.

Implicit Learning and Memory
Regency AB, Friday Morning, 10:20–12:00

Chaired by Eric Ruthruff, NASA-Ames Research Center

10:20–10:35 (37)

Activation of Words in the DRM Paradigm: Evidence With Implicit Tests. ELISHEVA BEN-ARTZI, *Bar-Ilan University*—Usually, people infrequently recall nonpresented words from word lists. However, using lists of semantically associated words (e.g., PILLOW, BLANKET, NIGHT), Deese (1959) and more recent researchers (e.g., Roediger & McDermott, 1995) have demonstrated high rates of false recall and false recognition of nonpresented words ("critical") that are highly associated with the list words (e.g., SLEEP). A still controversial issue regards the stage at which critical words are activated. The present series of experiments have addressed this question, using implicit memory tests, which enable one to examine arousal of mental representations without the interference of demand characteristic factors. Findings suggest an early activation of the critical words, supporting the implicit associative response hypothesis (e.g., Roediger, Watson, McDermott, & Gallo, 2001).

10:40–10:55 (38)

Effects of Deselection on Long-Term Memory. STEPHANIE V. TRAVERS & SUPARNA RAJARAM, *SUNY, Stony Brook* (read by Suparna Rajaram)—In contrast to the long-standing view that dividing attention at encoding consistently decreases explicit memory but does not hurt perceptual implicit memory, current research has shown that stimulus deselection instantiated with the Stroop task hurts both forms of memory. Recent studies, including data we presented at a previous Psychonomic Society meeting, have demonstrated that although significant priming occurs in perceptual priming tasks following Stroop encoding, it is significantly decreased relative to priming obtained under full attention at encoding. The extant data support our hypothesis that priming is reduced because the requirement to name the color results in the deselection of automatically processed words. Using variations of Stroop encoding, we extend our investigation to include explicit memory, with a focus on *know* responses. The findings address the role of both encoding and retrieval factors on deselection processes in long-term memory.

11:00–11:15 (39)

Memory Problems Among Korsakoff Patients: Not at Encoding but at Retrieval. GÉRY D'YDEWALLE, *University of Leuven*—At study, subjects either generated an associate of the target word or counted enclosed spaces in the letters of the target word. At test, three-letter stems were presented, corresponding to target words that either had or had not been presented at study. One group was instructed to use these stems as cues to retrieve previously studied items (direct test). Another group was instructed to complete the stems with the first word that came to mind but to use another word if the first word had been encountered at study (opposition test). In two experiments, Korsakoff patients did not show an encoding deficit; however, despite the opposing instruction, they completed the stems with words from the study list almost at the level of control subjects with the direct (intentional) test. Korsakoff patients have major problems in retrieving according to the given instructions.

11:20–11:40 (40)

Dynamically Guided Learning. REBECCA GÓMEZ, JILL LANY, & KATHERINE CHAPMAN, *University of Arizona*—Research on statistical learning has revealed multiple sensitivities, but with myriad possibilities available, how might learning be guided? Perhaps there is an overarching tendency for learners to reduce uncertainty (Gibson, 1991), leading them to seek out the most statistically reliable source of information (Gómez, 2002). We tested this hypothesis by using artificial grammars with multiple sources of structure and asked whether learning one source or another would be determined by the statistical variability of tokens used. Adults were exposed to strings of the form *aX* and *Yb*. We manipulated the size of the set from which we drew *X*- and *Y*-tokens, such that learners should either focus on the co-occurrence of *aX* and *Yb* elements or on string beginnings (*a*-elements) and endings (*b*s), while keeping the underlying grammar the same. Learning was consistent with our predictions, demonstrating how learning might be dynamically guided by statistical structure.

11:45–11:55 (41)

The Influence of Stimulus Set Size on Performance in Artificial Grammar Learning. FENNA H. POLETIEK, *University of Leiden*—In the artificial grammar learning (AGL) paradigm, participants are exposed to a sample of structured stimuli. Next, they categorize new stimuli as grammatical or ungrammatical. Implicit structure learning is evidenced in many studies, showing that categorization performance is higher than chance, although participants are unaware of any knowledge (Reber, 1993). The present study focuses on a rather unattended aspect of this inductive learning process: the influence of characteristics of the stimulus sample, such as sample size, stimulus ordering, and frequency distribution. Interesting predictions can be made about these influences if the grammar in AGL is interpreted as a statistical generative structure (Poletiek, in press). I will discuss one of these influences: the set size effect. A model of this influence, as well as experimental AGL data, are presented. The results are discussed, among others, in the context of the validity of AGL for the study of natural structure learning situations.

Working Memory
Georgia, Friday Morning, 10:10–12:00

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

10:10–10:30 (42)

Age Differences in Perceptual Speed: Contributions of Sensory Ability and Working Memory. MARILYN HARTMAN & JENNIFER MCCABE, *University of North Carolina, Chapel Hill*—The processing speed hypothesis has been a prominent explanation of cognitive aging. It rests in large part on findings showing that accounting for age differences on perceptual speed tasks sharply reduces or even eliminates age effects in a range of cognitive domains. Two experiments tested the hypothesis that these tasks are themselves not pure measures of perceptual speed. The role of sensory processing on the perceptual speed tasks was demonstrated by the greater sensitivity of older than of younger adults to perceptual degradation of stimuli and by their relationship with visual contrast sensitivity. Working memory also contributed to reduced performance in older adults, with smaller age differences for less complex stimuli and for stimuli that

had the least distance between them on the screen. We conclude that perceptual speed is not a cognitive primitive but, instead, is dependent on multiple abilities, each of which may show independent changes with aging.

10:35–10:55 (43)

Prospective Memory in Aging: The Breakfast Task. FERGUS I. M. CRAIK, *Rotman Research Institute,* & ELLEN BIALYSTOK, *York University*—We describe a complex computer-based task designed to assess prospective memory, planning, and working memory. The task is to "cook" five foods by clicking on icons for eggs, sausage, toast, coffee, and pancakes. The foods take different times to cook, so they must be started at different times in order to finish at the same time. Each food is on a separate screen, so participants must remember to check the various foods in order to start and stop them at appropriate times. The home screen contains icons to open each food screen and also contains a table-setting task that participants perform between other operations. Participants' performance is used to derive measures of working memory and prospective memory by calculating their efficiency in starting and stopping each of the foods at appropriate times. Among the results, increasing complexity of the task disproportionately handicapped older adults on most measures.

11:00–11:15 (44)

Influence of Working Memory Constraints on Risky Decision Making. JOHN M. HINSON, PAUL WHITNEY, & TINA L. JAMESON, *Washington State University*—Decision making that favors short-term over long-term consequences of action is typically defined as impulsive or temporally myopic. In prior research we showed that when more demands are made on the executive functions of working memory, decision making is more impulsive. The present study extends our analysis of working memory limitations in decision making to prospect theory. Participants made hypothetical choices of monetary rewards that differed in probability and magnitude. Resources available for decision making were taxed by manipulating either intrinsic working memory load (the number of options to be judged) or extrinsic working memory load (a secondary task performed along with the primary decision-making task). In agreement with our earlier studies, increased intrinsic or extrinsic working memory loads produced systematic changes in decision making. Participants in higher working memory load conditions were generally more impulsive, as reflected in both evaluation of probabilities and assessment of relative value of options.

11:20–11:35 (45)

Factors Influencing Repeating and Following Navigation Instructions. VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado,* & IMMANUEL BARSHI, *NASA Ames Research Center*—In two experiments, subjects heard messages instructing them to move within a two-dimensional depiction of a three-dimensional space consisting of four stacked grids on a computer screen. They repeated the instructions aloud and then followed them. In Experiment 1, movements were made with either a mouse or a keypad. In both cases, with long messages, accuracy of oral repetition and manual movement responses was higher for subjects making movements within a single grid than for those making movements in more than one grid. In Experiment 2, subjects were informed either before or after receiving the instructions whether one or more than one grid was involved. The disadvantage for multiple grids was found only for manual movement responses and only when subjects knew the number of grids involved before they heard the instructions. The results are discussed in terms of the relation between the verbal and the spatial representations of navigation instructions.

11:40–11:55 (46)

Emotional Distraction and Working Memory. KATHERINE A. CAPPELL & PATRICIA A. REUTER-LORENZ, *University of Michigan* (read by Patricia A. Reuter-Lorenz)—Emotional intrusions are part of everyday life, yet little is known about how affectively charged occurrences interact with ongoing cognitive processes. Do emotions exert disruptive effects by altering overall arousal? Do higher cognitive loads insulate from emotional distraction or increase vulnerability? To test these hypotheses, we compared the impact of neutral versus negatively valenced emotional pictures on verbal working memory performance. Participants (n = 36) performed a letter recognition task (set size, three or five) in which neutral or negative pictures from the International Affective Picture System were presented during the 3.5-sec retention interval. Rather than a main effect on memory accuracy being produced, as a general arousal hypothesis would predict, we found that emotional valence interacted with set size: Negative stimuli produced greater disruption on larger memory loads. These results favor an account of specific affect–cognition interactions whereby emotional and cognitive processes compete for common mechanisms or resources.

Categorization
Plaza, Friday Morning, 10:05–12:00

Chaired by D. Stephen Lindsay, University of Victoria

10:05–10:25 (47)

Identification of Strangers: Theoretical Components and Empirical Evidence. RALPH N. HABER & LYN HABER, *University of California, Santa Cruz*—Five components underlie the accuracy of recognizing unfamiliar faces: (1) systematic description of physical faces, (2) demonstration that every face is unique across these dimensions, (3) description of the transformations of the appearance of a face that preserve or fail to preserve uniqueness, (4) methodological procedures to elicit bias-free recognition of faces, and (5) partition of these four factors into a total error rate. Empirically, (1) the dimensions over which physical faces differ is not known. (2) No evidence exists that every physical face is unique, and none can be obtained until the dimensions on which faces differ are identified. (3) No description of the invariant transformations of the appearance of faces exists. (4) The sources of bias in the methodologies for assessing recognition of unfamiliar faces (such as with lineups) are now well understood. (5) Only the contribution of recognition methods to error can presently be estimated. Current estimates of overall error rates exceeding 50% are consistent with this analysis.

10:30–10:50 (48)

Transformations: A Theoretical Component of Fingerprint Comparisons. LYN HABER & RALPH N. HABER, *University of California, Santa Cruz*—The skin on fingertips stretches; and fingers are three dimensional, but fingerprints are two dimensional. As a result, variations in pressure, direction, orientation, surface, and media cause systematic, predictable differences between any two takes of a single finger, even under highly controlled conditions. The fingerprint examiner's task is to judge when differences between prints arise from two different donors and when they result from predictable changes from a single donor. These predictable variations have never been spelled out. This paper develops a transformational theory of predictable variations in an individual's fingerprint. These transformations are analogous to Gibsonian transformations in space perception, to phonetic variants in speech, and to changes in an individual's facial features due to emotion, weight change, or partial masking.

10:55–11:15 (49)

A Model of Category Learning With Multiple Sources of Prior Knowledge. EVAN HEIT & JANET BRIGGS, *University of Warwick,* & LEWIS BOTT, *New York University*—When people learn about a new category, they are influenced not only by their observations, but also by their prior knowledge. Often, multiple, possibly conflicting sources of prior knowledge must be drawn upon after consideration of what is observed. Indeed, one of the roles of prior knowledge is to facilitate learning about incongruent information. In three experiments, subjects learned about food categories with some highly incongruent information (e.g., breakfast cereals that put you to sleep).

The relative influences of observations and prior knowledge were measured at various points during the time course of learning, and different kinds of incongruent information were compared. The results were consistent with predictions of the Baywatch model of category learning (Heit & Bott, 2000), which is based on Bayesian principles of hypothesis selection and mixture-of-experts connectionist networks.

11:20–11:35 (50)

Schematic Influences on Category Learning and Recognition Memory. BRADLEY C. LOVE & YASUAKI SAKAMOTO, *University of Texas, Austin*—The results from four category learning experiments suggest that items are remembered to the extent that they violate a salient knowledge structure, such as an imperfect rule. The more coherent the knowledge structure, the stronger the memory for deviant items. Learning errors, when decoupled from violating a salient knowledge structure, do not facilitate subsequent recognition and perhaps lead to the discounting of high-error items. These findings are extended to unsupervised category learning, in which, by definition, learning is not accompanied by negative feedback. Exemplar-based and hypothesis-testing models are unable to account for the results from the experiments. We propose a clustering account of category learning in which deviant items are remembered to the extent that they are differentiated from clusters that capture regularities. Our results and analyses expose connections among research in category learning, schemas, stereotypes, basic memory phenomena, and analogy.

11:40–11:55 (51)

Categorization and Recognition: Integrating Computational Modeling and Neuroscience Data. PAUL J. REBER, *Northwestern University*—Categorization and recognition have frequently been investigated with approaches that rely selectively on either modeling or neuroscience data, and these approaches have led to very different conclusions. Knowlton and Squire (1993) reported a dissociation supporting the idea of separate memory systems for categorization and recognition. However, Nosofsky and Zaki (1998) described a single representational system model that captured this dissociation. A resolution to this discrepancy is proposed on the basis of integrating key features of the Nosofsky and Zaki model with the description of memory systems organization in distributed computation recently reported by O'Reilly and Norman (2002). This proposal suggests a shift in theoretical focus to specific questions of knowledge representation and provides a method for using such techniques as fMRI to evaluate cognitive models based on information-processing analysis. Recent neuroimaging data comparing different strategies for performing categorization (Reber et al., 2003) will be discussed in the context of this framework.

Face Processing
Regency E, Friday Morning, 9:35–12:00

Chaired by Scott D. Gronlund, University of Oklahoma

9:35–9:50 (52)

Developmental Changes in Face Processing During the First Half Year of Life. RAMESH BHATT & EVELIN BERTIN, *University of Kentucky*—Both first-order relations (i.e., gross spatial relations—e.g., eyes located above nose) and second-order relations (i.e., fine spatial relations—e.g., metric distance between eyes) are involved in adults' face processing. Research suggests that children as old as 6 years of age do not use second-order relations to the same extent as adults. Thus, younger infants might not even be sensitive to second-order relations. We investigated this issue by examining whether infants experience the Thatcher illusion, which research suggests is caused by the interfering effects of face inversion on second-order information processing. Six-month-olds, but not 3-month-olds, exhibited the Thatcher illusion, thereby indicating that, like adults, 6-month-olds use second-order information when processing faces but 3-month-olds do not. Thus, there are developmental changes in the use of different kinds of facial information during the first half year of life.

9:55–10:10 (53)

Computational Modeling of Face Recognition. CHRISTIAN WALLRAVEN, ADRIAN SCHWANINGER, & HEINRICH H. BÜLTHOFF, *Max Planck Institute for Biological Cybernetics* (read by Heinrich H. Bülthoff)—Recent psychophysical results on face recognition (Schwaninger et al., 2002) support the notion that processing of faces relies on two separate routes. The first route processes high-detail components of the face (such as eyes, mouth, etc.), whereas the second route processes the configural relationship between these components. This model was successfully used to explain several aspects of face recognition, such as the Thatcher Illusion or the stimuli composed by Young et al. (1987). We discuss a computational framework, in which we implemented configural and component processing using image fragments and their spatial layout. Using the stimuli from the original psychophysical study, we were able to model the recognition performance. In addition, large-scale tests with highly realistic computer-rendered faces from the MPI database show better performance and robustness than do other computational approaches using one processing route only.

10:15–10:35 (54)

Pattern-Based Analyses for Brain-Imaging Data: Applications to Face Processing. HERVÉ ABDI, FANG JIANG, & ALICE J. O'TOOLE, *University of Texas, Dallas,* & JAMES HAXBY, *Princeton University*—How reliably do patterns of brain activation specify the stimulus being processed by participants in a functional neuroimaging study? We applied pattern-based classification analyses to data from Haxby et al. (2001) to measure the discriminability of brain activation patterns resulting from viewing different kinds of objects (e.g., faces, houses). Using principal component analysis, we derived a basis set from a subset of the brain scans, with ventral temporal voxels that differed significantly for objects in the inferential analyses. Individual scans were then coded by their projections in the derived space. The utility of individual principal components for separating object classes was evaluated by discriminant analysis and PLS regression. A small number of components discriminated among faces and object categories with high accuracy. These components can be mapped back onto the anatomical structural scans and are useful for characterizing the patterns of activation that contrast brain responses to different object categories.

10:40–10:55 (55)

Better the Devil You Know? Approach and Avoidance of Nonconsciously Recognized Faces. TIM VALENTINE & ANNA STONE, *Goldsmiths College*—Processing of faces was investigated using 17-msec masked stimulus presentation to prevent conscious recognition. Faces were presented in simultaneous pairs of one famous face and one unfamiliar face. Participants attempted to select the famous face. Subsequently, participants rated the famous persons as "good" or "evil" (Experiment 1) or liked or disliked (Experiment 2). In both experiments, responses were more accurate to faces of persons rated as good/liked than to faces of persons rated as evil/disliked, and faces of persons rated evil/disliked were selected significantly below chance. Experiment 2 showed the effect in a within-item analysis, which rules out possible confounding factors based on variations in physical characteristics of the stimulus faces, and confirm that the effects were due to participants' attitudes toward the famous persons. The results suggest that facial identity is recognized preconsciously and that aversive processes are invoked toward evil/disliked persons.

11:00–11:15 (56)

Repetition Blindness and Rapid Serial Visual Presentation (RSVP) of Famous Faces. VERONIKA COLTHEART, *Macquarie Centre for Cognitive Science,* CRISTINA BORNHOFEN, *University of New South Wales,* & STEPHEN MONDY & LISA STEPHENSON, *Macquarie Centre for Cognitive Science*—When a sequence of words or pictures is presented at a rapid rate (8–10 items per second) for subsequent recall, if an item is repeated in the sequence, people have dif-

ficulty in detecting and reporting both occurrences, a phenomenon termed repetition blindness. With pictures of objects, repetition blindness is unaffected by differences in size, orientation, and view. Our experiments investigated repetition blindness when the stimuli were pictures of famous faces. Sequences of two or three photographs of faces, some with a repetition, were shown (each sequence preceded and followed by pattern masks). The second occurrence of a repeated face was identical, differed in orientation, or was a different photograph. In one experiment, the stimulus sequence included both a famous face and the printed name of the famous person. Repetition blindness occurred in some conditions, but not in others; we consider the implications of these results for theories of the mechanisms involved.

11:20–11:35 (57)

A Cross-Cultural Study of the Holistic, Own-Race Effect. JAMES W. TANAKA, *Oberlin College,* MARKUS KIEFTER, *University of Ulm,* & CINDY M. BUKACH, *Vanderbilt University*—A robust finding in the cross-cultural research is that people's memories for faces of their own race are superior to their memories for other-race faces. However, the mechanisms underlying the own-race effect have not been well defined. In this study, a holistic explanation was examined in which Caucasian and Asian participants were asked to recognize features of Caucasian and Asian faces presented in isolation and in the whole face. The main finding was that Caucasian participants recognized own-race faces more holistically than Asian faces, whereas Asian participants demonstrated holistic recognition for both own-race and cross-race faces. The differences in holistic recognition between Caucasian and Asian participants mirrored differences in their relative experience with same-race and cross-race faces. These results suggest that the own-race effect may arise from the holistic recognition of faces from a highly familiar racial group.

11:40–11:55 (58)

Face Recognition and Haptic Prosopagnosia. SUSAN J. LEDERMAN & ANDREA R. KILGOUR, *Queen's University,* & BEATRICE DE GELDER, *Tilburg University*—We examined haptic face recognition in a visual prosopagnosic individual (L.M.). L.M. and a normal control group performed a haptic equivalent of the visual inversion paradigm (Kilgour & Lederman, Psychonomics 2002), in which they made same/different judgments of pairs of 3-D face masks and of pairs of 3-D nonface objects (teapots), each presented in both upright and inverted positions. The controls showed the typical face inversion effect obtained visually and haptically—that is, reduced accuracy for inverted, as compared with upright, faces. In contrast, L.M.'s accuracy for both face conditions was at chance, and he was also slower. L.M.'s accuracy in matching upright nonface objects was 72%, and he did so as quickly as the control group. To our knowledge, L.M. is the first reported case of haptic prosopagnosia. We discuss the issue of multisensory processing and interpret the data as evidence for configural processing of faces by the haptic system.

Vision and Audition
Regency F, Friday Morning, 9:50–12:00

Chaired by James Farley Norman, Western Kentucky University

9:50–10:10 (59)

Computation of Illumination Level in Human Vision. ALAN L. GILCHRIST, *Rutgers University,* & SUNCICA ZDRAVKOVIC, *University of Belgrade*—We report three experiments exploring (1) how separate fields of illumination become functionally grouped together and (2) whether the illumination level within a field of illumination is defined by its highest luminance or its average. We projected a spotlight across the upper half of a display consisting of five adjacent dark gray rectangles. Thus, an illumination boundary with an obvious penumbra divided the display into a spotlit upper half and a roomlit lower half. Spotlight intensity was adjusted to equate the luminance of the lightest (middle gray) rectangle in the spotlight with a white surface in room light. Observers reported seeing a shadow on the lower half of five light gray rectangles, not a spotlight on the upper half of five dark gray rectangles. Thus, the part of the display that shared the same highest luminance with the room was seen as having the same illumination level as the room.

10:15–10:30 (60)

Walking With a Point Light Person. ALISSA JACOBS & MAGGIE SHIFFRAR, *Rutgers University, Newark* (read by Maggie Shiffrar)—Studies of biological motion perception traditionally use stationary observers. However, outside the lab, observers frequently analyze the movements of other people for the purpose of action coordination. Walking down a crowded street, shaking someone's hand, or dancing the tango requires a comparative analysis of your own actions with those of the people around you. To examine the perceptual component of this process, observers walked on a treadmill and judged whether they walked faster or slower than a nearby point-light walker. Speed discrimination accuracy was highest when subjects walked with the most common gait speeds. Moreover, the perception of another person's movement depended upon observer exertion. As effort increased, observers overestimated their speed relative to the point light walker's speed. With effort decreases, observers underestimated their relative speed. Thus, observer movement strongly influences one's interpretation of the movements of other people.

10:35–10:55 (61)

Temporal Ventriloquism: Sounds Attract Visual Flashes on the Time Dimension. PAUL BERTELSON, *Université Libre de Bruxelles,* & GISA ASCHERSLEBEN, *Max Planck Institute for Psychological Research*—In a first experiment, participants judged the order of occurrence of tone bursts and light flashes, with stimulus onset asynchronies (SOAs) controlled by a staircase procedure. Response reversals started occurring at longer SOAs when tones and flashes were presented in the same location, rather than in different locations, showing that auditory and visual inputs seem to occur closer together on the time dimension when they coincide in space. This temporal ventriloquism phenomenon can be seen as a mirror image of classical spatial ventriloquism, in which sounds and lights seem to be closer together in space when they coincide in time. Two other experiments, in which participants synchronized finger tapping with either member of sound–light pairs of stimuli showed that the effect on apparent SOA is due mainly to a strong shift of the apparent onset time of the light toward that of the sound.

11:00–11:10 (62)

Auditory Capture of Visual Motion. MARK E. MCCOURT & BRIAN PASIEKA, *North Dakota State University*—Can auditory stimuli (1) alter the perceived direction of visual motion and (2) influence visual motion detection and discrimination thresholds? The visual stimulus was a spatiotemporally vignetted sine wave grating in which leftward and rightward motion energy could be precisely titrated. This visual stimulus was paired with headphone-delivered noise designed to create sounds whose motion in auditory space could be rightward, leftward, centered, or null. In a suprathreshold task, observers judged the direction of visual motion; in threshold tasks, observers indicated the temporal interval containing the greatest motion energy. At suprathreshold, the perceived direction of visual motion was powerfully "captured" by auditory motion. However, visual motion contrast detection thresholds were not significantly influenced by auditory motion, and motion discrimination thresholds for leftward versus rightward motion were significantly elevated for congruent visual–auditory signals and were decreased for incongruent pairings.

11:15–11:35 (63)

The Evolution of Absolute Pitch: Are Humans Special? RONALD WEISMAN, *Queen's University,* MITCHEL WILLIAMS & JEROME COHEN, *University of Windsor,* & MILAN NJEGOVAN & CHRISTOPHER STURDY, *University of Alberta*—We developed discrimination procedures for studying absolute pitch perception

(AP) in avian and mammalian species. When zebra finches (a songbird species) and humans were trained to sort contiguous pitches (based on correlations of reward and nonreward with tones in three or eight ranges) in go/no-go discriminations, (1) songbirds discriminated three ranges to a much higher standard than did humans, and (2) songbirds discriminated eight ranges with precision, whereas humans acquired only a crude discrimination of the lowest and highest of eight ranges. It is possible that human inferiority and songbird superiority at AP reflect evolutionary trends among mammals and birds. We have used three- and eight-range discriminations to test other mammalian and avian species. Rats did no better than humans in these pitch range tests of AP, whereas other songbirds and nonsongbirds sorted pitches into ranges with about the same high accuracy as zebra finches.

11:40–11:55 (64)

A Psychometric Function for Accuracy and Response Time. ALEXANDER C. HUK, JOHN PALMER, & MICHAEL N. SHADLEN, *University of Washington* (read by John Palmer)—The accuracy and speed of discrimination depend on stimulus strength. When stimulus strength is high, accuracy is high, and response times are fast; when stimulus strength is low, accuracy is low, and response times are slow. Although the psychometric function specifying the relationship between accuracy and stimulus strength is well established, the psychometric function for response time is not. We test a theory of sensory decision making that predicts psychometric functions for both accuracy and response time. In this theory, sensory decisions are based on the additive accumulation of evidence toward a criterion, as has been suggested by Link, Ratcliff, and others. We show that this theory can account for accuracy and response time as a function of stimulus strength for a wide variety of conditions. The theory extends signal detection theory's analysis of sensitivity and bias to the analysis of response time.

POSTER SESSION II
Fairmont Hotel–Conference Level, Friday Noon, 12:00–1:00

• PERCEPTION •

(2001)
Learning the Sounds of Speech: A Hebbian Account. GAUTAM K. VALLABHA & JAMES L. MCCLELLAND, *Carnegie Mellon University* (sponsored by James L. McClelland)—The acquisition of speech sound categories has striking similarities to phenomena in general perceptual learning, particularly acquired equivalence and acquired discriminability. To explore this relation in the context of Hebbian learning, a neural network model of auditory category learning was developed. The model consists of three layers: an input layer, a representation layer that uses similarity based representations, and a categorical output layer. The representation and output layers have reciprocal excitatory connections that are tuned via Hebbian learning. When a node in the category layer becomes active, it biases the activity in the representation layer toward that of typical exemplars. The model is applied to three data sets: acquired equivalence and discriminability in nonspeech auditory category learning, the perceptual magnet effect in vowel perception, and the acquisition of the American English r/l distinction by native speakers of Japanese.

(2002)
Preadaptation Effects in Multistable Binocular Rivalry. SATORU SUZUKI & MARCIA GRABOWECKY, *Northwestern University*—Suzuki and Grabowecky (2002, *Neuron*) reported path dependence and on-line adaptation in multistable binocular rivalry (mBR). Perceptual transitions were elevated within pairs of opponent shapes (trapping). During trapping, on-line adaptation to perceived shapes increased the probability of shifting to an unrelated shape. Here, we report effects of preadaptation in mBR. Displays were quadra-stable, generating two pairs of opponent shapes. Observers preadapted to one shape. Transition probabilities to, and dominance durations of, adapted shapes were reduced relative to control conditions; adaptation also boosted the opponent shape. Similar but reduced effects occurred with small adaptors, suggesting nonretinotopic adaptation. Further, when two related shapes were alternated during adaptation, transitions within the pair were increased, as were transitions within the nonadapted pair; transitions between the pairs were reduced, suggesting isolation of the primed transitions. In mBR, preadaptation weakens adapted shapes, can strengthen opponent shapes, and can prime specific perceptual transitions.

(2003)
Psychophysical Evidence for Stochastic Resonance in Binocular Rivalry. YEE-JOON KIM, MARCIA GRABOWECKY, & SATORU SUZUKI, *Northwestern University*—In binocular rivalry (BR), when a different pattern is presented to each eye, the perceived image spontaneously and stochastically alternates between the two patterns; these alternations are presumably caused by neural adaptation and internal noise. In stochastic resonance (SR), a system with internal noise "resonates" with a weak periodic signal when the time scale of the signal (i.e., the driving frequency) statistically matches the time scale of the spontaneous alternations of the system. We drove BR by periodically modulating the contrasts of the two patterns in opposite phase. We found the following signatures of SR: (1) BR was driven probabilistically by a weak periodic signal, (2) the dominance duration distributions showed peaks at odd multiples of the driving half period, and (3) the noise-to-signal ratio was minimized (i.e., resonance occurred) when the driving frequency matched the mean spontaneous alternation rate.

(2004)
Deviant Behavior With an Object: An Investigation of Perceptual Interpretation. AVA J. SENKFOR, *Massachusetts General Hospital* (sponsored by Moshe Bar)—Interpretation of human behavior influences our everyday perceptions. Objects are grasped in a typical (meaningful) and atypical (nonmeaningful) way. One hypothesis would predict that a meaningless grip would be viewed as incongruent behavior, as compared with typical grips, and that an incongruent grip would be indexed by a larger N400 than would congruent grips. Conversely, if meaningless grips were viewed as "deviant" handlings of objects, as compared with "standard" handlings, then a larger P300 or late positivity difference would be expected between deviant and standard trials. The results reveal no evidence of an N400 effect. Instead, ERPs were similar until around an 800-msec poststimulus onset. A larger late positivity was elicited with meaningless grips than with typical grips. Across subjects, the scalp distribution between meaningful/meaningless trials varied from larger over prefrontal areas to larger over posterior sites. The data suggest that individuals tended to perceptually interpret the meaningless grips as either a novel or a deviant use of an object.

(2005)
A Neurophysiological-Based Methodology for Guided Image Search. FRANK M. MARCHAK & CHRISTINA MARCHESI, *Veridical Research and Design*—Complex analysis of imagery is crucial to the missions of many organizations, yet remains constrained by labor-intensive, time-consuming visual search of large volumes of data. Many algorithms have been developed to automatically identify regions of interest in large, complex sets of imagery, yet the utility of such algorithms is limited by the fact that human analysts detect features in imagery with higher accuracy than do existing methods. We present a model of visual feature detection, the neuronal synchrony model, based on neurophysiological models of temporal neuronal processing in the striate cortex, to improve the accuracy of detection of features of interest in complex natural imagery. The effectiveness of the model was tested with natural images containing visually controlled, synthetic targets, as well as with natural targets using a variety of overhead imagery backgrounds and target types. We discuss the strengths and limitations of this approach and directions for extending the model.

(2006)
The Influence of Face Orientation and Sclera/Iris Coloration on Determining Another Person's Direction of Gaze. LAWRENCE A. SYMONS, BRYAN BLACKBURN, & LAURA MIXON, *Western Washington University* (sponsored by Ira Hyman)—Recent studies have suggested that both the orientation of the face and the coloration of the iris/sclera are important in determining where a person is looking. The present study used a threshold task to assess the impact and potential interaction of face orientation and sclera/iris coloration on the ability to determine direction of gaze. Observers' difference thresholds for direction of gaze were determined for digitized images of a person looking at a series of equally spaced targets. Four conditions were assessed: upright normal, upright reversed polarity eye coloration (sclera black, iris white), inverted (rotated 180º) normal, and inverted reversed polarity. Both inversion of the display and reversing polarity increased the threshold of the observers. However, inverting the faces did not increase the threshold for the displays with reversed polarity coloration. These results suggest that the influences of facial orientation and eye coloration are interactive in determining where another person is looking.

(2007)
The Effect of Object Part Connection and Spatial Distance on Visual Short-Term Memory Capacity. YAODA XU, *Harvard University*—Two features from a single object are known to be remembered better in visual short-term memory (VSTM) than two features from two spatially separated objects. This effect is found for features from the same part, as well as for features from different parts, of an object (Xu, 2002). These results have been used to support the hypothesis that the unit of encoding in VSTM is object based. These findings, however, are also consistent with a spatial distance account: the closer the two features, the better they can be remembered in VSTM. To

compare these two theories, two change detection studies were carried out: Experiment 1 varied the connection of object parts while keeping a fixed distance between the parts, and Experiment 2 varied the distance between object parts. Both the connection and the spatial distance between object parts are shown to affect how object features are remembered in VSTM.

(2008)

How Do We Represent Similar Items in Visual Displays? SANG C. CHONG & ANNE TREISMAN, *Princeton University* (sponsored by Anne Treisman)—Everyday scenes often contain sets of similar objects. Perceptual representations may summarize these with statistical descriptors that are automatically computed when attention is distributed over the display. Previously, we found that exposure duration (50–1,000 msec) had little effect on mean size judgment. We now measured accuracy for judging the mean size of sets, varying set size, number of items, or density, and found little effect on statistical judgments. We also found that judgments of mean size were easier to combine with tasks requiring distributed attention (search for C among Os) than with tasks requiring focused attention (search for O among Cs). Mean size thresholds showed no impairment from concurrent visual search tasks that induce distributed attention. The results are consistent with our hypothesis that the mean size of a set of similar items is extracted automatically.

(2009)

Do Subliminally Presented Objects Potentiate Actions? ZISSIS A. PAPPAS & ARIEN MACK, *New School University* (sponsored by Arien Mack)—The dorsal visual stream has been implicated in visually guided action (Milner & Goodale, 1996). Is this the case with objects not consciously perceived? Using the stimulus–response compatibility paradigm, in which a physical correspondence between stimulus and response yields faster reaction times, pictures of common graspable objects (e.g., hammer) oriented to one side were briefly presented (12 msec), followed by a pattern mask containing a salient dot slightly above or below its center. Participants were asked to respond to the position of a dot with their left or right hand as quickly as possible. When the response hand was congruent with the orientation of the object's handle, reaction times were significantly shorter than when the relationship was incongruent ($p < .005$). This finding suggests that the dorsal stream has processed information about the orientation of stimuli that are not consciously perceived and is consistent with the spared ability of blindsight patients.

(2010)

When Movement of the Limbs Affects Visual Perception. WILLIAM C. SCHMIDT & KATRINA L. JOHNSON, *SUNY, Buffalo*—The motion aftereffect (MAE) has a long and rich history in vision science. The MAE occurs upon viewing a high spatial frequency stationary test stimulus after a prolonged adaptation period consisting of viewing the stimulus moving in a single direction. The MAE is a negative aftereffect experienced as motion in the direction opposite adaptation. A reduced duration MAE can survive a blank period intervening between adaptation and test, a phenomenon known as storage. We investigated the effects of simple body movements (i.e., raising the arms, wrist circles with the arms extended, head movements, eye covering during storage) occurring at various points in the experimental trial. The results directly implicate kinesthetic feedback as acting to reduce the duration of the motion aftereffect whether or not it is stored. We propose, therefore, that the motion aftereffect is a proprioceptive, rather than a strictly visual, illusion.

(2011)

An Invariant in Perception and Action Control During Bisection Tasks. ELTON H. MATSUSHIMA, PAULA CHIARETTI, DANIEL B. KRELING, & MURILO F. LIMA, *Universidade de São Paulo, Ribeirão Preto,* NILTON P. RIBEIRO-FILHO, *Universidade Federal do Rio de Janeiro,* & JOSÉ A. DA SILVA, *Universidade de São Paulo, Ribeirão Preto* (sponsored by José A. Da Silva)—Several studies using visually directed actions as indicators of perceived distance showed that people can accurately walk toward targets as far as up to 22 m. Those results, in addition to those related to perceptual measures of perceived distance, showed that those responses were controlled by a single internal variable—namely, visually perceived location. In the present study, we compared performances in bisection tasks, performed by open-loop walking or by perceptual matching. Observers ($N = 20$) walked toward or adjust a pointer to the mean point of an egocentric distance (5, 10, or 15 m), under binocular viewing. Results indicated accuracy on both responses, with no reliable differences between them, supporting the hypothesis of a single internal variable controlling action and perception. This invariant may be determined by a weighted set of sources of information.

(2012)

Extrapolation of Time and Distance in Uniform Linear Velocity and Acceleration. CHANDRAMALLIKA BASAK & PAUL VERHAEGHEN, *Syracuse University* (sponsored by Paul Verhaeghen)—In a within-subjects experiment ($n = 4$), we examined trajectory extrapolation estimates (time and distance) for uniform velocity (1.34–21.15 deg/sec) and uniform acceleration (6.26–62.59 deg/sec^2). The results suggest that both types of motion are perceived indirectly. Although there were no substantial between-subjects differences in the estimation of distance for uniform velocity trials, subjects differed considerably in the accuracy of their estimations of uniform acceleration. In contrast, temporal prediction was invariant within individuals but differed between individuals. In the distance estimation condition, we included trials of uniform velocity and uniform acceleration with identical average exposed velocity. We found that acceleration is predicted not by the actual acceleration shown, but rather by a weighted average of velocities of the exposed motion. The value of this weighted average was generally found to be higher than (1) the average objective velocity and (2) the subjective estimate of the velocity of the corresponding uniform velocity trial.

(2013)

The Dynamics of Infant Bouncing: Learning to Bounce at Resonance. PATRICK S. FOO, *Brown University,* EUGENE C. GOLDFIELD, *Harvard Medical School,* BRUCE KAY, *University of Connecticut,* & WILLIAM H. WARREN, JR., *Brown University*—Goldfield et al. (1993) proposed that infants learn to bounce in a "jolly jumper" at the system's natural frequency by modifying kicking frequency and matching their leg stiffness to the spring stiffness. Baby bouncing was modeled as a forced mass-spring system at resonance, with parameter tuning. We directly tested this hypothesis and investigated how infants explored parameter space in a longitudinal study. Preambulatory infants learned to bounce in weekly sessions as their kinematics, kicking force, and leg stiffness were measured. They were then transferred to new mass and spring stiffness conditions. As infants spontaneously learned to bounce, their leg stiffness approached the spring stiffness. After learning, they rapidly adjusted to transfer conditions. An analysis of covariation in motor variables (Muller & Sternad, 2003) suggests that instead of learning particular parameter settings, infants appear to have learned the dynamics of the task, allowing them to quickly adapt to new conditions.

• Spatial Cognition •

(2014)

Development and Breakdown in a Multiple-Object Tracking Task. KIRSTEN O'HEARN DONNY & BARBARA LANDAU, *Johns Hopkins University,* & JAMES E. HOFFMAN, *University of Delaware* (sponsored by Barbara Landau)—Visuospatial tracking of multiple objects is computationally complex and may be guided by a specialized system (Pylyshyn & Storm, 1989). We examined this ability in normally developing children and children with Williams syndrome (WS), who have severe visuospatial deficits, using a version of the

multiple-object tracking task. One to four objects in a set of eight identical objects were designated as targets, which then remained stationary (static condition) or moved randomly and independently (moving condition) for 6 sec. At the end of this period, observers pointed to each target. In the static condition, children with WS were impaired, as compared with 5- to 8-year-old normally developing children; in the moving condition, they performed worse than both 5- to 8-year-olds and 3- to 4-year-olds. Tracking moving objects appears to be more impaired then remembering static locations for children with WS, lending support to the proposal that object tracking utilizes a specialized system that can be selectively damaged.

(2015)

Modeling Spatial Memory Access Via Egocentric Search Processes. BJÖRN RUMP, *Vanderbilt University,* & STEFFEN WERNER, *University of Idaho*—Numerous studies have shown that access to spatial memories depends on the direction of the remembered target object relative to one's actual or imagined body orientation: Latency and error increase with increasing deviation from front, sometimes accompanied by a sudden decrease of RT and error for locations directly behind. It has been postulated that this effect reflects differences in accessibility that are directly tied to different egocentric directions (e.g., front vs. back). An alternative approach posits that the observed performance differences reflect the course of egocentric search processes, depending partly on the angular distance between the origin and the target of the memory search. Two experiments are presented that contrast both models, using a task that required participants to retrieve the direction of two objects in rapid succession relative to an imagined facing direction. A variable-origin search model best accounts for the RT patterns of egocentric access to spatial memories.

(2016)

Now You See It, Now You Don't: Can People Mentally Impose Spatial Category Boundaries? VANESSA R. SIMMERING, JOHN P. SPENCER, & PHILLIPPE A. TABORGA, *University of Iowa* (sponsored by John P. Spencer)—Several accounts of spatial memory biases propose that people "mentally impose" spatial category boundaries. However, in most tasks that have reported categorical biases, adults have used boundaries aligned with either visible lines or axes of symmetry. This raises a fundamental question: Can people mentally impose a category boundary in the absence of perceptual structure supporting such a division? In our previous research, we have demonstrated that category boundaries can be created and destroyed in a spatial memory task by changing the perceptual cues available in the task space. Thus, in the present study, we added or deleted perceptual structure to see whether people could maintain a categorical division in the absence of relevant perceptual information. Performance differed systematically depending on the available perceptual structure, indicating that people need perceptual support to impose a category boundary.

(2017)

Geometric Information Does Not Dominate Spatial Reorientation in Young Children. ALMUT HUPBACH & LYNN NADEL, *University of Arizona* (sponsored by Lynn Nadel)—Studies carried out in small rectangular environments suggest that young children (2- to 4-year-olds) reorient themselves in accord with the geometric shape of the environment but fail to incorporate nongeometric features. In contrast, older children were found to combine geometric and nongeometric information flexibly while reorienting (Hermer-Vazquez, Moffet, & Munkholm, 2001). The present study sought to replicate this finding in an environment shaped like a parallelogram by studying the reorientation behavior of 4- to 6-year-olds, using a tabletop model and a real space. Surprisingly, geometric information did not control the reorientation behavior of 4-year-olds when nongeometric cues were available. In real space, 4-year-olds used nongeometric and geometric information together. In model space, 4-year-olds used a nongeometric cue but ignored geometry. These results offer little support for the notion of an encapsulated geometric module incapable of interacting with nongeometric information.

(2018)

Don't (Want to) Know Much About History: Memory for Form and Function of Spatial Locations. DAVID N. RAPP, *University of Minnesota, Twin Cities,* & HOLLY A. TAYLOR, *Tufts University*—When we learn about the history of a location, we are usually provided with images and details from the past. Oftentimes, this information is inconsistent with the current form and/or function of those locations. We investigated whether current knowledge about well-learned locations makes it difficult to integrate new historical information into memory. Participants completed a multimedia tour presenting historical details about the Tufts University campus. The tour provided text descriptions of buildings with functions consistent or inconsistent with current use and pictures taken recently or in the past. On surprise recognition tasks, participants tended to reject test items that were inconsistent with the current form and function of campus sites. This rejection of the past was accurate when historical information had not been presented but was problematic if it had actually appeared. These results suggest that experience with environments can interfere with the learning of historical details about spatial locations.

(2019)

Stimulus-Set Position and Orthogonal Stimulus–Response Compatibility. YANG SEOK CHO & ROBERT W. PROCTOR, *Purdue University* (sponsored by E. J. Capaldi)—Three experiments examined effects of stimulus-set position for tasks with orthogonal stimulus and response orientations. In Experiment 1, up–down stimuli were mapped to left–right responses, and stimulus-set position varied along the horizontal dimension. In Experiment 2, left–right stimuli were mapped to up–down responses, and stimulus-set position varied along the vertical dimension. In both experiments, an advantage for mapping up with right and down with left was evident for several response modes, but stimulus-set position had no influence on this mapping effect. When hand posture, response-set location, and stimulus-set position were manipulated in Experiment 3, a Simon-type effect occurred between stimulus-set positions and responses, similar to the mapping effect between stimuli and responses, and this effect interacted with hand posture and response-set location. These results suggest that stimulus-set position and location of the stimulus within the set were coded separately, with these spatial codes affecting performance in a qualitatively similar manner.

(2020)

Imagined Transformations of Bodies and Rooms. JEFFREY M. ZACKS, *Washington University,* & AMY L. SHELTON, *Johns Hopkins University*—Two kinds of imagined spatial transformation can be distinguished. Object-based transformations are imagined movements of external objects. Perspective transformations are imagined movements of one's egocentric perspective. Previous research suggests that (1) these are implemented by dissociable neural systems and (2) they can be selectively elicited by different spatial judgment tasks. In the present study, we tested the hypothesis that the choice of transformation would depend not only on the judgment required, but also on the particular stimulus presented. In two experiments, participants made spatial judgments about pictures of human bodies or interior scenes (rooms). The data suggest that for pictures of bodies, participants flexibly imagined that either the picture or their perspective was moving, depending on the task. However, for the rooms, they were more likely to imagine that their perspective was changing. These results are consistent with the view that multiple mental transformation systems evolved to solve different ecologically important spatial reasoning problems.

(2021)

Training Mental Rotation to Asymptotic Levels. MELISSA S. TERLECKI & NORA S. NEWCOMBE, *Temple University* (sponsored by Nora S. Newcombe)—Males perform substantially better than fe-

males on tests of mental rotation. Recently, studies have shown that computer and videogame experience elevates mental rotation scores. It is not yet clear, however, whether sex differences are maintained or closed when mental rotation improves to asymptotic levels. In Experiment 1, undergraduate males and females practiced a mental rotation test weekly over a semester. In Experiment 2, they played either computerized Solitaire or three-dimensional Tetris. In both experiments, students in all groups reached asymptotic performance at about the 10th week. However, males still outperformed females, and people with high spatial experience also continued to outperform people with low spatial experience. Future studies and implications are discussed.

• Imagery & Visual Processing •

(2022)

Foreshortening and Forelengthening: Underestimated Much More Than Perspective Predicts. IGOR JURICEVIC & JOHN M. KENNEDY, *University of Toronto, Scarborough* (sponsored by John M. Kennedy)—Polar projection, vision's major geometry, produces "forelengthening" and foreshortening. Inspect a wide-angle picture from farther than the correct viewing distance and some quadrilaterals that depict squares at the correct viewing distance still look square, others appear elongated, others compressed. A "perspective band" theory, based on the visual angle ratios of the quadrilaterals, explains which quadrilaterals appear compressed, square, or elongated. The theory should also apply to pictures inspected from closer than the correct viewing distance. Result? All quadrilaterals appeared compressed, and more than perspective predicts, but in line with perspective band theory. We point out implications for theories of constancy.

(2023)

Does the Same Neural Subsystem Mediate Animal Recognition and Face Identification? BRIAN E. BROOKS & ERIC E. COOPER, *Iowa State University*—Two experiments tested whether the same neural subsystem subserves basic-level animal recognition and face identification. Previous research has shown that the neural subsystem that subserves face identification operates more efficiently in the right cerebral hemisphere and that inverting faces eliminates the right hemisphere advantage for face identification. Experiment 1 showed a right-hemisphere advantage for basic-level, but not for superordinate-level, animal recognition. Experiment 2 showed that inverting animals eliminates the right-hemisphere advantage for basic-level animal recognition. This pattern of results suggests that basic-level animal recognition and face identification are mediated using the same neural subsystem.

(2024)

Apparent Gaze Direction in Pictured Faces. LARS STROTHER, *University of Virginia,* MELANIE A. LUNSFORD & SHEENA ROGERS, *James Madison University,* & MICHAEL KUBOVY, *University of Virginia* (sponsored by Michael Kubovy)—Eyes depicted in a picture often appear to follow the viewer as one passes. This phenomenon is predicted by the geometry of pictorial space. Sedgwick (1991) showed that both the objective orientation of depicted objects and the angle of the picture plane (AP) relative to the viewer influence the virtual orientation of these objects. We conducted two experiments to assess (1) the ability to judge the direction of another's gaze (GD), using a live model and photographs of the same model, and (2) the influence of AP on apparent gaze. We found comparable errors in judgments of GD for both live and photo conditions. Our results also suggest two distinct regions of the sampled gaze space. In the first region, viewers consistently judged eyes to be directed at them. We found no effect of AP within this region. In the other region, we observed an additive effect of AP on GD.

(2025)

Visual Skills in Airport Security Screening. JASON S. McCARLEY, *Mississippi State University,* & ARTHUR F. KRAMER, CHRISTOPHER D. WICKENS, ERIC D. VIDONI, & WALTER T. BOOT, *University of Illinois, Urbana-Champaign*—An experiment examined the role of visual scanning and object recognition in luggage x-ray screening. Observers participated in five sessions of a task requiring them to search for knives hidden in x-ray images of cluttered bags. In Sessions 1–4, targets were drawn from a set of four items. In Session 5, targets were drawn from an alternative set. Order of target sets was counterbalanced across observers. Sensitivity and response times improved reliably as a result of practice. Eye movement data revealed, however, that sensitivity increases were produced entirely by changes in observers' ability to recognize target objects, and not by changes in the effectiveness of visual scanning. Data also demonstrated that recognition skills were in part stimulus specific, such that performance was degraded by the introduction of unfamiliar target objects.

(2026)

An Emotional Face Does Not Pop Out From Other, Nonemotional Faces. SHIH-TSENG T. HUANG, *National Chung Cheng University* (sponsored by Gary Chon-Wen Shyi)—In three experiments, we investigated whether, in a search, an emotional face would pop out from among a group of nonemotional faces. In Experiment 1, we constructed a database of faces expressing basic emotions. In Experiment 2, participants were asked to search for an expressive face among a group of neutral faces, while their eye movements were recorded. Both response latency and eye movement measures demonstrated a monotonic increase of search time as the display size increased. In addition, an expressive face among other neutral faces did not automatically capture the initial saccades. In Experiment 3, participants were induced into a specific mood prior to the search task. A short-term pop-out effect was found in the early portion of the search trials, but not in the later trials. Together, these results suggest that processing of facial expressions may require attention, because facial expressions may be an integrative product of elementary facial features.

(2027)

The Role of Attention in Recognizing Prechange Actors in Change Blindness Tasks. PATRICK O. DOLAN & ELIZABETH J. PLORAN, *Drew University*—It has been found that the substitution of one actor for another across a movie scene often goes unnoticed. This change blindness may be due to a failure to maintain a representation of the prechange actor or a failure to compare representations of the pre- and postchange scenes. Two experiments assessed the role of attention in subjects' ability to recognize the prechange actor after failing to spontaneously notice the change. A video depicting three students engaged in conversation contained several peripheral changes and one actor change. Instructions focused subjects' attention on the visual, the auditory (dialogue), the visual and the auditory, or neither aspect of the video. Above-chance recognition of the actor was found only when subjects' attention was focused on visual details. Under these conditions, change blindness is likely due to a failure to compare the representation of the prechange actor with the postchange actor.

(2028)

Differential Modulation of Corticospinal Excitability During Observation, Mental Imagery, and Imitation of Hand Actions. SHANNON E. CLARK, FRANÇOIS TREMBLAY, & DIANE M. STE-MARIE, *University of Ottawa* (sponsored by Diane M. Ste-Marie)—This study attempted to better delineate the changes in corticospinal excitability that accompany perceptual-to-motor transformations when people are asked to observe, image, or imitate actions. Motor evoked potentials (MEP) from transcranial magnetic stimulation were recorded in the first dorsal interosseous muscle of the dominant hand in five different conditions: (1) passive observation, (2) observation to imitate, (3) imagery, (4) imitation, and (5) counting backward mentally. For the observation conditions, participants (n = 19, 18–38 years) watched video sequences (5 sec) of hand actions performed by a model. Active imitation produced the greatest MEP facilitation, as compared with baseline, followed by the two observation conditions and the imagery conditions,

which all produced similar levels of facilitation. The similarity found between observation and imagery of hand actions in terms of corticospinal facilitation is interpreted using Jeannerod's (2001) motor simulation theory, which explains the parallel between actions observed and actions imaged at the representational level.

• Timing and Learning •

(2029)

Do Rats Time UCSs? CHRISTINA M. THORPE & DONALD M. WILKIE, *University of British Columbia* (sponsored by Donald M. Wilkie)—Holder and Roberts (1985) showed that rats time conditioned stimuli (CSs). The present study examined whether rats also time unconditioned stimuli (UCSs). Rats were trained on a fixed interval (FI) 30-sec schedule. Once scalloping was observed, peak trials were started in which the CS (light) remained on for 90 sec and no food was given. As was expected, their response distribution (RD) was approximately normal and peaked at 30 sec. Interspersed within these peak trials were test trials in which 10 sec of the UCS (food) was provided immediately before the CS. If rats timed the UCS, the RD should be shifted to the left by 10 sec. If they did not time the UCS, the RD should not be shifted. Interestingly, RD was shifted to the right by approximately 60 sec. This finding suggests that the UCS may have an inhibitory effect on timing.

(2030)

Memory and Time Production Dual Task: Varying Task Location and Type of Response. JULIE CHAMPAGNE, CLAUDETTE FORTIN, & LOBNA CHÉRIF, *Université Laval* (sponsored by James S. Nairne)—Previous studies showed that varying location of a nontemporal task during time estimation affected judged durations. The present study examines this effect with memory tasks interpolated in time production and verifies whether demands related to responding in a memory task influence the location effect. In Experiment 1, temporal position of a memory probe was identified, and participants responded as quickly as possible to probe presentation. In Experiment 2, a recognition task was similarly interpolated in time production, and participants responded to the memory probe either as quickly as possible or before the end of the target interval. The location effect was observed in both experiments: Productions lengthened as the probe was presented later during the interval. This may be attributed to attentional time sharing due to expecting the interruption caused by the memory task. The type of response required in the memory task did not interact with the location effect.

(2031)

Effects of Encoding Strategies on Spacing Effects in Free Recall. PETER F. DELANEY & MARTIN E. KNOWLES, *University of Florida*—One explanation for the spacing effect relies on displaced rehearsal (e.g., Hall, 1992). According to this account, participants use time during immediately repeated (massed) presentations of items to rehearse spaced items. This should not be possible using "unmixed" lists that contain only one type of item (spaced or massed). We constrained participants to use particular encoding strategies while talking aloud during the study of mixed and unmixed lists. Our results suggest that displaced rehearsal may provide a good account of the spacing effect for participants who use a shallow rehearsal strategy but that further mechanisms are needed to account for the performance of participants who use a deeper associative strategy. Some of these mechanisms are explored more carefully via the rehearse-aloud protocols.

(2032)

Retrieval-Induced Forgetting From Episodic Memory: Free Recall Versus Recognition. DAVID P. YELLS, *Utah Valley State College,* & KENNETH A. DEFFENBACHER, *University of Nebraska, Omaha* (sponsored by Kenneth A. Deffenbacher)—Four experiments examined retrieval-induced forgetting (RIF) in a recall and in a recognition paradigm. Participants studied a list of unrelated words for 90 sec. In Experiments 1 and 2, the list consisted of 10 concrete nouns and five verbs. In Experiments 3 and 4, the list consisted of 10 abstract nouns and five verbs. Following a study phase, participants in the experimental condition recalled verbs from the study list. Participants in the control condition recalled state capitals. Finally, there was either a free recall (Experiments 1 and 3) or a recognition (Experiments 2 and 4) test for the 10 nouns on each list. Consistent with previous work, RIF was observed in recall for abstract nouns, but not for concrete nouns. Regarding new findings, RIF was also observed for recognition for abstract nouns, but not for concrete nouns.

(2033)

Blocking and Retrieval Effects in Human Subjects. JACQUELINE H. RICK, *Columbia University,* & PETER D. BALSAM, *Barnard College* (sponsored by Peter D. Balsam)—The present experiments tested a blocking paradigm in which human subjects clicked a computer mouse on abstract shapes to try to earn points. During Phase 1 of the game, there was a single target shape that was rewarded. During Phase 2, the same target shape was rewarded but now were consistently presented in a specific color. During test, there were the same colored backgrounds but with new shapes, and blocked subjects were expected to have learned less about the target color from Phase 2. In four experiments, some, but not complete, blocking was observed. The ease of the color discrimination relative to the shape discrimination may have attenuated learning effects. However, reaction times at test were consistently longer in blocking groups, as compared with controls. Even when subjects had learned about the redundant dimension, it took them longer to retrieve this information if they had been exposed to the blocking procedure. This provides support for the hypothesis that blocking effects involve retrieval processes.

(2034)

Associative Learning, Memory Confidence, and Retrieval Strategy Selection in Older Adults. DAYNA R. TOURON & CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (sponsored by Christopher Hertzog)—In skill acquisition tasks that involve a transition from rule-based processing to retrieval-based processing, older adults shift more slowly than young adults. We examined how age differences in strategy selection and performance are related to associative learning deficits, as well as to metacognitive factors, such as memory ability confidence. Prior to training in the noun-pair lookup task, young and older adults memorized to criterion either a subset of the noun pairs or the complete set of noun pairs. Results reveal that age differences in associative learning do not provide a sufficient account for age differences in strategy choice. Despite having substantial knowledge of the noun pairings before task onset, older adults showed a substantial delay before shifting toward a retrieval-based strategy. Older adults were less confident in their memory ability than were young adults, and avoidance of the retrieval strategy was associated with memory ability confidence.

(2035)

Stimulus Competition During Perceptual Learning: Training and Aptitude Considerations in the X-Ray Security Screening Process. STEPHEN M. FIORE, FLORIAN JENTSCH, & SANDRO SCIELZO, *University of Central Florida* (sponsored by Rachel S. Herz)—We describe an effort in use-inspired basic research designed to understand some of the fundamental perceptual learning processes associated with x-ray security screening. We manipulated the learning environment by varying amount of "clutter" and explored differential benefits of training threat-item detection based on spatial aptitudes and using test items varying in "occlusion" (x-ray images with/without overlapping items) and "difficulty" (x-ray images varying in amount of distracting clutter). Spatial aptitude differentially influenced learning, dependent on clutter in the training environment. In detecting difficult threat items (many items, but little overlap), low spatial aptitude participants benefited from learning via minimum-stimulus training (no clutter during learning). High spatial aptitude participants bene-

fited from learning via competitive-stimulus training (clutter during learning). In detecting nonoverlapping threat items, low-spatial participants benefited from minimum-stimulus training. In detection of overlapping threat items, low-spatial participants were hindered from competitive-stimulus training. Results are discussed in the context of aptitude–treatment interactions in perceptual learning.

(2036)

A New and Reliable Measure of Verbal Imagery Cognitive Style: VICS. ELIZABETH R. PETERSON, IAN J. DEARY, & ELIZABETH J. AUSTIN, *University of Edinburgh* (sponsored by Martin John Pickering)—The reliability of a newly developed measure of verbal imagery cognitive style (the VICS test) was compared with the reliability of Riding's (1991) verbal imagery dimension of the Cognitive Styles Analysis (CSA–VI) test. Fifty participants completed the verbal imagery dimension of the CSA and the VICS test twice, about a week apart. The verbal imagery style ratios, which are used in both tests to assess a person's verbal imagery cognitive style, showed high internal consistency ($r > .72$) and reasonable stability at retest ($r = .56$) on the new VICS test but poor internal consistency ($r < .03$) and low test–retest reliability ($r < .31$) on the CSA and an extended version of the CSA. These results were confirmed in an independent sample of 100 participants. These findings suggest that unlike the CSA–VI, the VICS test is a reliable measure of verbal imagery cognitive style. The VICS' design and its potential application to other psychological fields are considered.

(2037)

Partitioning Polynomials: A Study of Context-Dependent Learning. SÉBASTIEN HÉLIE, GYSLAIN GIGUÈRE, & ROBERT PROULX, *Université du Québec à Montréal,* & DENIS COUSINEAU, *Université de Montréal* (sponsored by Michele Robert)—Researchers studying the learning of continuous mathematical functions generally agree that negatively sloped and nonmonotonic functions are difficult to learn for humans (Delosh, Busemeyer, & McDaniel, 1997; Koh & Meyer, 1991). However, Lewandowsky, Kalish, & Ngang (2002) have shown that whenever participants are tested using a function defined by those characteristics (such as second-degree polynomials), they succeed by relying on a strategy known as "knowledge partitioning." This heuristic facilitates learning by dividing knowledge into separate context-dependent parcels. We tested the use of this strategy on a third-degree polynomial. Results show that learning this complex function is not harder than learning second-degree polynomials. However, participants did not show any evidence of knowledge partitioning. Moreover, one of the contexts yielded perfect results for the whole function. These results suggest that knowledge partitioning is a consequence of using bounded exemplars during training and may not be as general as was originally thought.

(2038)

Performance in Artificial Grammar Learning: A Signal Detection Analysis. YAEL POZNANSKI & JOSEPH TZELGOV, *Ben-Gurion University of the Negev* (sponsored by Joseph Tzelgov)—In this work, we compared performance following implicit learning of artificial grammar. The stimuli for the test phase included old and new stimuli, half of them legal and half of them illegal. After-learning performance was measured under intentional (legality decisions), incidental (pleasantness decisions), and automatic (recognition test) conditions. The participants' responses on a 6-point confidence rating scale served to estimate the d's in each condition. The results showed that the participants learned the rule used to generate the stimuli in all three groups. In the recognition group, this was indicated by a significant d' obtained when responses to new legal stimuli were defined as hits.

(2039)

Mechanisms of Inferential Order Judgments in Rhesus Macaques. DUSTIN J. MERRITT & HERBERT S. TERRACE, *Columbia University* (sponsored by Herbert S. Terrace)—The present set of experiments was designed to examine how monkeys organize and represent lists during inferred-order judgment tasks. Two monkeys were trained on a transitive inference task (A > B, C > D, etc.) and were later tested with nonadjacent pairs selected from both within and between lists (B > D, C > E, etc.). Performance was above chance during testing, and furthermore, accuracy and reaction time patterns were consistent with both ends-inward scanning processes (positional and associative) and positional comparison processes. To discriminate between these mechanisms, associative interference was created by training adjacent positions with one of two possible items per position, each appearing randomly per trial (e.g., B1 > C1, B2 > C1, B1 > C2, etc.). The findings suggested that the monkeys used positional information when making order judgments. Current experiments are examining whether the positional information is relative (e.g., beginning, middle, end) or absolute (e.g., first, second, third).

• Memory •

(2040)

Assessing Participant and Item Homogeneity in Memory Modeling. JARED B. SMITH & WILLIAM H. BATCHELDER, *University of California, Irvine* (sponsored by William H. Batchelder)—A frequent data structure in memory modeling is a two-way, participants-by-items array, with entries corresponding to responses scored into categories—for example, recall and not recall or confidence ratings. From a statistical standpoint, model analysis is facilitated if the participant–item observations are considered to arise from independent and identically distributed (i.i.d.) random variables. Despite efforts to ensure that participants and items are homogeneous, the i.i.d. assumption about the data may be violated, rendering model fit and parameter estimation difficult to interpret. This poster provides inferential statistics for assessing participant inhomogeneity, using the Dirichlet-multinomial distribution on array-row statistics. In the case of both participants and items, we adapt methods from psychometric item-response theory to make inferences about homogeneity in either or both sources. What results is a set of statistical procedures that can be applied to assess participant and item homogeneity for any two-way, participant-by-item categorical data array.

(2041)

Familiarization of Novel Faces: Effects on Judgments of Recency and Frequency. KERRY A. CHALMERS, *University of Newcastle, Australia* (sponsored by Jennifer S. Burt)—Evidence for generalized and episode specific strength in judgments of recency and frequency of novel faces was investigated in a three-phase design. Novel faces (created using an identikit program) were presented either once or three times in either of two study sets, separated by a 24-h delay. One week prior to the first study session, faces were familiarized either with or without an occupational label (one third of the faces were not familiarized). Judgments of frequency and recency were consistent with reliance on generalized strength (an amalgamation of recency and frequency of presentation), rather than on episode-specific information. Familiarization had opposite effects on judgments of recency and frequency, with familiarized faces being judged as having been studied more frequently (three times) but less recently (yesterday) than unfamiliarized faces. The latter result is consistent with participants, discounting generalized strength when episode-specific information is inadequate.

(2042)

Distinctiveness: An Operational Definition With Empirical Support. HEEKYEONG PARK, *Carnegie Mellon University,* JASON D. ARNDT, *Middlebury College,* & LYNNE M. REDER, *Carnegie Mellon University*—The notion that distinctive stimuli are better remembered is well established; however, the definition of what constitutes a distinctive stimulus has often been poorly defined in the memory literature. We begin with the operational definition that stimuli that have been seen in fewer previous contexts are more distinctive. We test this

notion by manipulating the association between perceptual formats (font) and words, such that each font was associated with a single word or multiple other words. Participants' ratings of distinctiveness and recognition memory combine to indicate that words seen in fewer presented perceptual formats are more distinctive and that more distinctive perceptual formats produce better recognition memory. Furthermore, the results of our studies are consistent with a mechanistic explanation of recognition that highlights the role of retrieval processes over that of encoding processes.

(2043)

Looking at Nonwords Through the Mirror: Specifying the Role of Properties and Context in Recognition Memory. LINDA M. SCOTT & SALLY M. ANDREWS, *University of Sydney* (sponsored by Sally M. Andrews)—Glanzer and Adams (1985) reported evidence of a "mirror effect" in recognition memory, whereby recognition memory performance, indexed by hit and false alarm rates, is better for a more memorable condition than for a less memorable condition for both old and new items. This purported general and systematic mirror pattern of results placed important and universal constraints on models of recognition memory. The experiments to be reported focus on nonword stimuli, a class of item that has yielded inconsistent evidence regarding the mirror effect. Manipulating the properties of different classes of nonword stimuli and examining their interaction with differential encoding and retrieval contexts lead to results that have significant implications for theories of recognition memory. Furthermore, these results allow for analysis of the influence of item and associative processes, to broaden and clarify understanding of the role of familiarity and recollection in recognition memory.

(2044)

Effects of Emotion on Familiarity and Retrieval Processes in Recognition Memory. SONYA DOUGAL, *New York University,* & JONATHAN W. SCHOOLER, *University of Pittsburgh* (sponsored by Jonathan W. Schooler)—Research indicates that emotion influences recognition memory in several possible ways (e.g., Maratos & Rugg, 2001; Ochsner, 2000; Windmann & Kutas, 2001). However, on the basis of the existing literature, it is unclear which memory process underlies these effects. The goal of this research was to determine the recognition processes by which emotion influences recognition of words. Three response–signal associative recognition experiments were conducted that demonstrated familiarity-based effects of emotion on recognition. First, emotional words were associated with a familiarity-based increase in the hit rate. Second, this effect of emotion was driven by the arousal of the words, not by their valence. And third, a familiarity-based effect of emotion was observed for neutral words encoded in an emotional context. Taken together, these results suggest that emotion has a fast-acting, low-level effect on recognition memory independent of the unique perceptual features of emotional items.

(2045)

Cognitive Control of Emotional and Nonemotional Content in Memory. BRENDAN E. DEPUE, MARIE T. BANICH, & TIM CURRAN, *University of Colorado* (sponsored by Tim Curran)—We used a think/no-think paradigm to investigate cognitive control of memory for emotional and nonemotional stimuli. Emotional information, shown to be more salient, may differ from other stimuli in the amount of top-down control required for memory suppression. Participants were trained on picture–face pairs, with pictures taken from the International Affective Picture Series. Prior to recall testing, items were repeated 0, 5, or 10 times in think or no-think conditions. The think condition required participants to explicitly rehearse the picture, whereas in the no-think condition participants were instructed to actively avoid thinking about the picture. We observed a nonmonotonic relationship between later recall and the number of repetitions in the negative no-think condition: Recall increased after 5 repetitions and then decreased after 10 repetitions. These findings suggest that initial attempts to suppress negative, invasive information have the unintended consequence of strengthening memory, whereas true suppression occurs only after numerous attempts.

(2046)

The Persistence of Facts Learned From Fiction. ELIZABETH J. MARSH, *Duke University*—Previously, we found that students use both correct and false information from fictional stories to answer questions later on world knowledge tests. Having read misinformation led to its production on the final test and also reduced correct answers below baseline. The present experiments examined the persistence of the effects following warnings and on a recognition test. In Experiment 1, subjects in two experimental conditions received warnings about the errors of fiction (either before or after story reading), whereas control subjects received no warnings. Warnings did not reduce the effect of having read misinformation in the stories. In Experiment 2, a four-alternative forced-choice test pitted the correct answer against the misinformation. Responding was either free or forced. Misinformation selection was robust in both test conditions. However, free responding reduced costs to correct answers after misinformation was read. In summary, students were quite persistent in their use of false facts from stories.

(2047)

The Subjective Experience of False Memory as a Function of Item Typicality. ROBERT J. NEMETH & ROBERT F. BELLI, *University of Nebraska* (sponsored by Robert F. Belli)—Using the misinformation effect paradigm, we investigated the subjective experience of false recall for items that varied in terms of typicality for common household scenes (e.g., a newspaper vs. a hockey stick in a living room). Participants viewed a series of photographs of common scenes and were subsequently asked to read and rate, in terms of their ability to visualize, short narratives of the scenes. In some conditions, the narratives contained misinformation regarding the critical to-be-remembered item. We administered a cued recall test to the participants after either a short (20 min) or long (1 week) retention interval. In addition, we asked participants to judge the subjective experience of their recall, using Tulving's (1985) remember–know procedure. We predicted that participants would be more likely to report as "known" misinformation for typical items. The data will be discussed in light of other research on the phenomenological experience associated with false memory.

(2048)

False Memory for Emotion-Laden Words. AN T. OSKARSSON & WILLIAM J. BONK, *University of Colorado,* & REID HASTIE, *University of Chicago* (sponsored by Reid Hastie)—Using the Deese/Roediger–McDermott (1995) list-learning task, we tested whether the false memory effect could be produced using emotionally charged lures. Forty participants studied word lists containing semantically related associates (e.g., *struggle*, *sex*, *scary*, *abuse*, *victim*) of nonpresented lures (e.g., *rape*). Memory recognition tests were administered 15 min, 1 h, 1 week, and 2 weeks after the study phase. A significant false memory effect was found for all of our lures, and the size of the effect increased with each testing. We also found that nonemotional lures (*sentence, contract*) were "misremembered" more than positive lures (*paradise*, *graduation*), which in turn were more "misremembered" than negative lures (*rape*, *bomb*). Remember–know judgments (Tulving, 1985) and the role of emotional arousal in the DRM paradigm are discussed.

(2049)

Manipulation–Test Congruency Affects True and False Memories for Events. HEATHER R. COLLINS & RICHARD E. MAYER, *University of California, Santa Barbara* (sponsored by Richard E. Mayer)—Participants viewed a video of a crime event and engaged in imagination, confabulation, or control activities. A recognition memory test was administered, and participants made remember/know judgments for each test item. Test items were either the same as dur-

ing manipulation (congruent) or contrary to manipulation (incongruent). This procedure of event encoding, manipulation, and memory test took place over either a 1-h or a 3-day period. Over four experiments, the experimental groups had greater false memories than did the controls, and manipulation–test congruency influenced memory. When presented with congruent items only, all memories are more likely to be judged as remembered over 3 days, as compared with 1 h, and this pattern diminishes when confronted with both congruent and incongruent items. Experimental groups have more conservative criteria for incongruent items, as compared with control groups. Incongruent items have lower memory strength (d') with more conservative criteria (β), as compared with congruent items.

(2050)

Phonological False Memory Effects and Dyslexia. BRENDAN S. WEEKES, *University of Sussex,* & ROBYN E. HOLLIDAY & AMANDA A. ALBON, *University of Kent* (sponsored by Brendan S. Weekes)—Two experiments were conducted to test whether children display phonological false memory effects. We modified the paradigm developed by Westbury, Buchanan, and Brown (2002) and presented spoken words in English that varied in phonological overlap at the level of the initial phoneme, head, and rime. In Experiment 1, 36 children (8–9 years of age) were tested, and the results showed a reliable phonological false memory effect that was largest in the head condition, consistent with adult data. In Experiment 2, we tested dyslexic children who were known to have phonological processing problems on tasks that required the explicit manipulation of phonological components (e.g., onset-rime awareness). The results showed a pattern of phonological false memory effects that was no different from that for younger children matched for reading age. We interpret these data in terms of fuzzy trace theory (Brainerd & Reyna, 2001) and argue that sublexical phonological activation can be automatic among dyslexic children.

(2051)

Phonological False Memories for Words and Nonwords. McKENZIE R. BALLOU & MITCHELL S. SOMMERS, *Washington University* (sponsored by Mitchell S. Sommers)—Classically, accounts of false memories in the Deese/Roediger–McDermott paradigm suggest that partial activation of nonpresented words by list items is critical for generating false recall and recognition. In the present set of experiments, we examined this proposal by investigating the effects of nonword list items on phonological false memories for both nonword and real-word critical items. Three experiments were conducted in which subjects were tested for their memory on lists of all nonwords, all words, or mixed words and nonwords. Because nonwords do not have lexical representations, we predicted few, if any, false memories for lists containing only nonwords and little influence of nonwords on false memory for lists containing both words and nonwords. In contrast to these predictions, significant levels of false recall and recognition were observed both for lists of all nonwords and for mixed lists. These findings are discussed within the activation-monitoring framework of false memories.

(2052)

Assessing the Recollective Nature of Source Misattributions. LUCIANE M. PEREIRA, *SUNY, Stony Brook,* & MARYELLEN HAMILTON, *Saint Peter's College*—The present experiment attempted to assess whether reality-monitoring misattributions are directed to the source with the least qualitative characteristics (Bink, Marsh, & Hicks, 1999) or to the source with the weakest memory trace strength (Hoffman, 1997). Specifically, we combined the designs of Hoffman's Experiment 3 and Bink et al.'s into one experiment in which we manipulated the presentation of items as perceived or imaged, the strength of the items through repetition, and whether the items were presented on Day 1 or Day 3. We replicated the it-had-to-be-me effect in the image–picture group and the it-had-to-be-you effect in the picture–image group for source misattribution at both repetitions. However, a three-way interaction suggests that the it-had-to-be-you effect was significantly decreased at three repetitions. In addition, remember/know judgments showed differences in the recollective nature of source misattributions across repetitions.

(2053)

Suppressing Episodic Memories. JOHN B. BULEVICH, HENRY L. ROEDIGER III, & DAVID A. BALOTA, *Washington University* (sponsored by Janet Duchek)—Anderson and Green (2001) reported that when people were instructed to not think about certain items, they were less likely to recall those items on a later test. They explained their data as a result of cognitive suppression, which may represent a laboratory analogue of repression. To explore suppression further, we designed two experiments to replicate Anderson and Green's (2001) results and to extend this suppression pattern to response latency measures. Participants were asked to learn a series of A–B word pairs. They were then asked to suppress some items 1, 8, or 16 times. Finally, they received a cued recall test. Our results did not show suppression in recall, but some evidence for suppression was obtained in the response latency data.

(2054)

Starting Small in Visual and Auditory Domains: Differential Effects of Staged Input. CHRISTOPHER M. CONWAY, *Cornell University,* MICHELLE R. ELLEFSON, *University of Warwick,* & MORTEN H. CHRISTIANSEN, *Cornell University* (sponsored by Morten H. Christiansen)—The concepts of "starting small" and "less is more" (Elman, 1993; Newport, 1990) suggest that external and/or internal limitations paradoxically aid the learning of complex, componential input. However, previous evidence related to this hypothesis has been inconclusive and sometimes contradictory. In the present experiments, we explore what conditions might lead to a starting-small effect. Using an artificial grammar learning paradigm with human participants, we test whether incrementally staged input benefits the learning of complex recursive material in the visual and auditory domains. Experiments 1 and 2 reveal a visual starting-small effect with both center-embedded and right-branching recursive structure. However, Experiments 3 and 4 fail to show an effect of starting small for auditory recursive material. These results suggest that only under certain conditions does starting small confer a learning advantage. Our data offer new insights into interpreting the starting-small hypothesis and helps elucidate when less may be more.

(2055)

Explicit but Not Implicit Learning Without Responding. W. GEOFFREY O'SHEA & BENJAMIN A. CLEGG, *Colorado State University*—The Hebb digits task, a short-term memorization paradigm involving incidental learning, indexes implicit learning through improved memory for repeating, as compared with random-digit patterns. In a variant of this task, participants were cued to recall only some of the random series and the repeated series only once. Improvement in recall on the repeating sequence in the absence of responding was seen but was contingent on subsequent explicit knowledge. A second experiment, that again required withholding of responses, employed a chunked presentation format. Chunking influenced the degree of awareness of the repeated sequence that occurred, but not the nature of learning. Combined, these experiments match previous results suggesting the importance of responses in implicit serial learning and imply that the emergence of spontaneous awareness interacts with information-processing capacity.

(2056)

I'd Know That Face Anywhere! VINCENZA GRUPPUSO & D. STEPHEN LINDSAY, *University of Victoria* (sponsored by D. Stephen Lindsay)—In Experiment 1, faces were paired with distinctive contexts at study. At test, recognition and remember(R)/know(K) judgments were made to faces presented with their studied context or with a new context. Experiment 2 was similar, except that at test some

studied faces were presented in a context seen in study with a different face (i.e., switched context). The results for both experiments were similar: Changing context at test reduced R responses and increased K responses. Familiarity derived with Jacoby's independence R/K equation or as a d' value was not affected by any change in context. The results provide the first evidence of the effects of context on the recollection of faces. In addition, they provide support for the independence model of the R/K distinction, as opposed to the claim of Gardiner and colleagues that K responses can be taken as a direct index of familiarity.

• Working Memory •

(2057)

Dissociative Effects of Word Length on Item and Order Retention. GEORGINA A. TOLAN, *Australian Catholic University,* & GERRY TEHAN, *University of Southern Queensland* (sponsored by Gerald Tehan)—The item-order hypothesis argues that under certain conditions, increases in item processing can lead to deficits in order processing. The present experiments explore word length effects within this framework. The crucial prediction of the approach is that the additional item processing of long words should produce a long-word advantage on tasks that require item information. These experiments demonstrate that short words are better remembered than long words across a range of short-term memory and long-term memory tasks that require participants to use serial order information. Conversely, reverse word length effects emerge when item memory is tested across a range of short-term and long-term item tasks. The results are consistent with the item-order approach and provide a novel explanation of the word length effect.

(2058)

Individual Differences in Working Memory Capacity and Visual Attention. RICHARD P. HEITZ & RANDALL W. ENGLE, *Georgia Institute of Technology* (sponsored by Randall W. Engle)—The present study evaluated span differences in the ability to control the spotlight of attention, using the Eriksen flanker paradigm. RT was experimentally controlled using deadlines to prevent differences in speed–accuracy tradeoff and to assess the nature of any possible span differences. Subjects completed trials in blocks beginning with a deadline of 700 msec down to 200 msec, at 100 msec increments. We found that high- and low-span subjects do not differ in flanker performance when collapsing on RT, as would be done in a traditional analysis. However, highs and lows do differ in performance when analyzing conditional accuracy functions. We found that low spans drop to chance-level performance before high spans. We also found that across nearly all RT bins, high spans outperformed low spans, for both congruent and incongruent trials. We conclude that differences in the ability to control visual attention accounts for the dissociation in performance.

(2059)

Sentence Regeneration and Multiple Repetition Blindness. STEPHEN MONDY & VERONIKA COLTHEART, *Macquarie Centre for Cognitive Science* (sponsored by Veronika Coltheart)—In accuracy of immediate recall, there is an advantage for meaningful sentences over unrelated word lists. This has been attributed to the regeneration of sentences from meaning via recently activated words (Potter & Lombardi, 1998). Repetition blindness (RB) for words is a difficulty in reporting repeated items in word sequences, including sentences (but only when repeated words are identical, not synonyms). A novel RB paradigm was devised in which sentences (up to 23 words long) had 6 additional words inserted. Inserted words were either 6 words from the original sentence (thus, 6 words each appeared twice) or 6 words that were semantically similar to 6 of the original words. Results showed RB can occur multiple times in a sentence. Furthermore, although identical and semantically similar inserted words were difficult to recall, type of inserted word had differential effects on overall sentence recall. Results support the regeneration hypothesis of immediate sentence recall.

(2060)

The Word Frequency Effect and the Mixed Lists Paradox: Importance of the Structure of the List. CAROLINE MORIN & CLAUDETTE FORTIN, *Université Laval,* MARIE POIRIER, *City University, London,* & ROBERT ROUSSEAU, *Université Laval* (sponsored by Robert Rousseau)—In many recall tasks, including immediate serial recall, when low- and high-frequency items are mixed within the to-be-remembered lists, the usual advantage found for the recall of high-frequency words is abolished or reversed. The present experiment was designed to verify the proposition of May, Cuddy, and Norton (1979), developed in a free recall setting, that the mixed lists paradox could be modulated in part by the structure of the list. According to these authors, the absence or reversal of the word frequency effect could be predicted by the number of frequency contrasts within a list. Accordingly, participants recalled lists containing one (e.g., HHHLLL), three (e.g., HHLLHL), or five (e.g., HLHLHL) frequency contrasts. Results show no word frequency effect with one contrast but a significant advantage for low-frequency words in lists containing three and five contrasts. This pattern is concordant with the proposition of May et al. (1979).

(2061)

Working Memory, Metacognitive Awareness, and Reading Comprehension. KANDI JO TURLEY-AMES & HEATHER M. THOMPSON, *Idaho State University*—The degree to which metacognitive awareness is related to executive function, as measured by assessments of working memory (WM), is unknown. High spans are more likely to report using a WM management strategy than are low spans (McNamara & Scott, 2001; Turley-Ames & Whitfield, 1998), but it is unclear whether high spans are more metacognitively aware and how such awareness influences WM performance. In the present study, we examined the extent to which WM span, metacognitive awareness, and reading comprehension are related, on the basis of self-report questionnaires and behavioral data. Although WM correlated weakly with overall measures of metacognitive awareness, specific components of metacognitive awareness were reliably related to WM span scores. When subjects read for comprehension, WM span, predictions about the ability to answer comprehension questions, and confidence ratings were related to comprehension accuracy. The relationship between these factors differed for topic and detail questions answered immediately after each passage.

• Attention •

(2062)

The Role of Selective Attention in Visual Short-Term Memory. Y.-Y. YEH & C.-T. YANG, *National Taiwan University* (sponsored by Pamela Tsang)—A series of experiments with a change detection paradigm investigated whether selective attention occurs in order to bind features in visual short-term memory or to prioritize sampling for memory encoding and retrieval decision. If selective attention is specific for feature binding, either focus or shift of attention should influence detection of conjunctive changes more than it affects detection of feature changes. The results of Experiment 1 showed that attentional shift during retention interval had similar effects on detecting feature and conjunctive changes. The data from Experiment 2 showed that spatial cuing had a similar impact on detecting these two types of changes, with performance enhanced by two cues that occurred 200 msec after stimulus offset. Results of Experiment 3 indicated that comparison characteristics between serial and parallel processes could not account for the difference in detecting conjunctive and feature changes in a whole display. Theoretical implications are discussed.

(2063)

Bottom-Up and Top-Down Control in Saccadic Target Selection. WIESKE VAN ZOEST, MIEKE DONK, & JAN THEEUWES, *Vrije Universiteit Amsterdam* (sponsored by Mieke Donk)—Observers had to

make a speeded saccade toward a predefined target singleton presented among nontarget elements. In some conditions, a salient distractor singleton was also present. The relative saliency of the target and the distractor singleton was manipulated within a dimension (orientation) or across dimensions (orientation and color). The results demonstrated that rapid oculomotor selection was completely data driven: The probability of making a correct eye movement to the target singleton depended on its relative saliency, and not on its identity. Top-down control occurred only with slow eye movements. Finally, slow eye movements were not affected by target or distractor saliency, suggesting that there exists no contingency between bottom-up and top-down influences. The results are in line with models that assume that bottom-up and top-down processes independently affect oculomotor behavior.

(2064)

Emotion Modulates Attention: The Effects of Emotional Stimuli on Orienting. HADAS OKON-SINGER & AVISHAI HENIK, *Ben-Gurion University of the Negev* (sponsored by Avishai Henik)—Motivational factors may influence the spatial distribution of attention. Recent findings demonstrate that stimuli with an emotional significance, especially threat-related stimuli, may influence attention differently than do neutral stimuli. There is a debate in the literature over whether emotional stimuli are detected faster than neutral ones or are detected at the same speed but capture attention at their location for a longer period of time. We used the spatial cuing paradigm (Posner, 1980) to investigate the influence of emotional valence of stimuli on capturing and holding attention. We used two sets of stimuli: schematic faces with three types of facial expressions (angry, happy and neutral) and schematic spiders, flowers, and abstract figures. Our results show that emotional stimuli modulate both early facilitation and inhibition of return.

(2065)

Attention Capture: Shifting or Spreading? JOEL LACHTER, ERIC D. RUTHRUFF, & ROGER W. REMINGTON, *NASA Ames Research Center*—Recent evidence shows that masked primes affect target response times only when the prime is attended. We use the observation that priming implies attending to investigate whether exogenous cues cause attention to shift away from an endogenously attended location, known to be the target location. In our experiments, targets always appeared in the lower of two vertically arranged locations, providing strong incentive to attend there (endogenous cuing). Exogenous cues appeared in either the upper or the lower location, followed by a lowercase prime word (59 msec) in either location. Primes in the irrelevant (upper) location produced priming effects only when cued, indicating that the exogenous cues attracted attention. Primes in the bottom (endogenously cued) location were unaffected by exogenous cuing. Although attention was allocated to the cued location, it also remained at the target location. This suggests that exogenous cues caused attention to spread, rather than to shift, to the cued location.

(2066)

ERP Correlates of Auditory Negative Priming. SUSANNE MAYR, MICHAEL NIEDEGGEN, AXEL BUCHNER, & REINHARD PIETROWSKY, *Heinrich-Heine-Universität, Düsseldorf* (sponsored by Axel Buchner)—Reaction times and event-related brain potentials (ERPs) were collected to investigate the processes underlying auditory negative priming. Reactions were slower in the ignored repetition condition than in the standard control condition or in a repetition control condition in which the attended prime was repeated as the to-be-ignored probe. The only ERP correlate dissociating the ignored repetition condition from both control conditions was an attenuation of a sustained parietal positivity extending from 350 to 800 msec. The ERP data are inconsistent with a frontal inhibition account commonly discussed in other paradigms investigating inhibitory processes. The results seem consistent with a nonfrontal inhibition or a memory-based episodic retrieval account. The observed parietal component could be related to the similar-looking ERP "old/new" effects that are assumed to reflect the familiarity status of a stimulus.

(2067)

Attention Network Task Performance by Children and Rhesus Monkeys. MICHAEL J. BERAN & DAVID A. WASHBURN, *Georgia State University,* & SANDRA KLEINMAN, *Howard School* (sponsored by David A. Washburn)—Posner's attention network task (ANT) is a computerized task designed to evaluate individual components of attention. Participants indicate whether an arrow presented at the top or the bottom of the monitor points to the left or the right. The alerting component consists of a visual cue indicating when the stimulus will be presented. The orienting component indicates cue location. The executive component involves the presentation of congruous or incongruous stimuli in conjunction with the focal stimulus. Typically, adults show independent effects on response time for each component. We tested 69 children 6 to 17 years of age, using the ANT task. Although there was a clear effect on response time from the executive component, the alerting and orienting components did not produce clear effects. We also tested two rhesus monkeys, using a joystick-based version of the ANT task, and found results comparable to those obtained with the children.

(2068)

Neural Networks Involved in the Attentional Blink. KLAUS KESSLER, FRANK SCHMITZ, JOACHIM GROSS, & ALFONS SCHNITZLER, *Heinrich-Heine-Universität, Düsseldorf,* BERNHARD HOMMEL, *Leiden University,* & KIMRON SHAPIRO, *University of Wales, Bangor* (sponsored by Bernhard Hommel)—In rapid serial visual presentation streams, it is difficult to report the second of two targets (T2) if it follows the first (T1) within 500 msec—the attentional blink (AB) effect. For AB to occur, it is essential that both targets be masked; without masks, the AB is attenuated, and the same is true for T2 at Lag1, provided that no attentional switch is required from T1 to T2. We have investigated the effect of the T1 mask by recording the cortical magnetic field (MEG). A network of occipital, temporo-parieto-frontal, and prefrontal neural sources was identified that is involved in AB. This network shows different dynamics, but not different amplitudes, for masked and unmasked T1 processing, which speaks against simple competition for resources between T1 and mask, while supporting the notion that the mask, similar to an attentional switch, induces a reconfiguration of the system which in turn causes the AB.

(2069)

An Effect of Multiple Targets on the Attentional Blink. JACQUELYN M. CREBOLDER & ALEXANDRA J. OSTANIEWICZ, *Defence R&D Canada, Toronto*—In previous work, we examined performance in an attentional blink (AB) experimental paradigm using three targets and observed an AB effect on the third target, with no such effect on the second. Additional data from randomly intermixed two- and three-target trials suggested that pretask preparation might play a role in the absence of AB on the second target. Two experiments presented here extend this work. In Experiment 1, pretrial cuing was used to provide knowledge about the number of targets to expect in each trial. Experiment 2 used a third task that was not susceptible to the AB to establish whether the lack of the effect on a second target was a function of processes specific to the AB itself or whether it was caused by other, undetermined factors.

(2070)

Practice and the Attentional Blink. CHRISTINE LEFEBVRE, PIERRE JOLICŒUR, DENIS COUSINEAU, & SERGE LAROCHELLE, *Université de Montréal* (sponsored by Serge Larochelle)—All extant models of the attentional blink (AB) hold that the performance deficit observed in Task 2 is caused by some aspect of the processing required to perform Task 1. Central bottleneck models of the AB ascribe a key role to the time at which central processing in Task 1 is complete; earlier completion should cause a shorter and smaller AB. Practice with the critical aspects of Task 1, by itself, should reduce the duration of precentral and central processing, caus-

ing an earlier completion of central processing, and thus should reduce the duration and magnitude of the AB when Task 1 is reintroduced in the dual-task AB paradigm. New results confirm this prediction of bottleneck models. We also briefly present a new and more sensitive method for the analysis of AB data, based on curve fitting.

(2071)

Auditory Attentional Blink: The Role of Masks and Distractors. FRANÇOIS VACHON & NADINE HAMEL, *Université Laval,* DYLAN M. JONES, *Cardiff University,* & SÉBASTIEN TREMBLAY, *Université Laval* (sponsored by Dylan M. Jones)—When a rapid presentation of auditory stimuli is listened to, processing of the second of two successive targets among distractors is often impaired, a phenomenon known as the attentional blink (AB). Two experiments were conducted to examine the functional characteristics of AB-like effects in the auditory modality in relation to the effects of masking and the presence of distractors. In the experiments, both target and probe required a two-alternative forced-choice discrimination following rapid auditory presentation. In the first experiment, a typical AB effect was found in the presence of distractors, but heterogeneous distractors failed to produce a greater deficit. In the absence of distractors and masks, there was little or no deficit. In the second experiment, the removal of distractors other than the masks resulted in a significant reduction of the deficit. The pattern of results is discussed in relation to the contribution of attentional and perceptual factors to the AB-like effects.

(2072)

RT Distributional Analyses of Parallel Response Selection in Dual Tasks: Distinguishing Strategic Alternation, Delay, and Grouping From Independent Subtask Performance. SCOTT WATTER, *University of Illinois, Urbana-Champaign* (sponsored by Gordon D. Logan)—Recent studies have shown evidence for simultaneous operation of response selection (RS) processes in the psychological refractory period paradigm. Task2 response information was observed to influence Task1 RS, implying that Task2 RS began prior to Task1 RS completion—that RS processes of both tasks are active in parallel. This interpretation depends on subjects' performing Task1 and Task2 in strict serial order, without attending to Task2 before responding to Task1. If subjects deliberately attend to both tasks prior to responding to Task1, no RS parallelism is required to explain these effects. The present study observed similar Task2 to Task1 response priming and assessed individual subjects' distributional RT and interresponse interval data for evidence of strategic alternation and/or delays and of response grouping. After excluding a subset of subjects with evidence of selectively delaying or grouping responses, Task2 to Task1 response priming effects were still observed.

(2073)

Task Switching and Illusory Conjunctions in the Time Domain. BEATRIZ T. GIL-GÓMEZ DE LIAÑO, *Universidad Autónoma de Madrid,* JAMES F. JUOLA, *University of Kansas,* & JUAN BOTELLA, *Universidad Autónoma de Madrid* (sponsored by Juan Botella)—Botella, Barriopedro, and Suero's model (*JEP:HP&P*, 2001) proposes an explanation for the formation of illusory conjunctions in the time domain. The typical task used in studies of temporal conjunction errors has been visual search in RSVP displays of stimuli with a target-defining dimension and a to-be-reported dimension (e.g., in presenting colored letters, participants are required to report the color of a prespecified letter, CL, or the letter name occurring in a prespecified color, LC). Since the role of each dimension is defined by the specific task, it is expected to reflect costs of task switching between CL and LC versions. In the present work, we studied the effects of task switching, analyzing performance in both within-block and between-block situations. The results show a task-switching cost for the CL task, but not for the LC task. Implications are discussed in terms of theories of task switching and illusory conjunction research.

• Cognitive Control •

(2074)

Negative Priming in Task Switching. MYEONG-HO SOHN & JOHN R. ANDERSON, *Carnegie Mellon University*—We examined whether negative priming is part of switch cost. On each trial, participants performed two tasks, prime and probe, randomly selected from three possible tasks. The prime task stimulus consisted of target and distractor. It was expected that the task-set associated with distractor should be more rigorously inhibited (negative priming) than the task not associated with either target or distractor (neutral). Negative priming (i.e., greater switch cost for the negatively primed task, as compared with the neutral task) was examined in two conditions. In the bivalent stimulus condition, the probe task stimulus contained both target and distractor. In the univalent stimulus condition, the probe task stimulus contained only target. Negative priming was found in the bivalent condition, but not in the univalent condition. This result suggests that task switch cost is due to both negative priming and positive priming and that the stimulus encoding may be the locus of the negative priming.

(2075)

The Relationship Between Rumination and Task Switching. REBECCA J. COMPTON & ROBERT P. OCAMPO, *Haverford College* (sponsored by Marilyn Boltz)—This study investigated the relationship between task-switching ability and individual differences in self-reported rumination. On alternating trials, participants judged either the emotional valence or the number of letters in a target word, with trial types following an AABB sequence. Switch costs were calculated by comparing performances on repeat- versus switch-decision trials. Overall, negative target words (as compared with positive words) facilitated the switch to emotion-based judgments and slowed the switch to number-based judgments. Increasing rumination was associated with smaller switch costs in women but larger switch costs in men. These group differences were more pronounced on emotion-decision trials than on number-decision trials. No group differences were found on a control task that involved switching between two types of nonemotional judgments (concreteness and number). The results indicate that the ability to switch between making emotional and nonemotional judgments is associated with coping preference, although in opposite directions for men and women.

(2076)

On the Relation Between Working Memory, Set Switching, and Conflict Resolution. DIEGO FERNANDEZ-DUQUE, *University of Toronto*—This research explored the interactions among three components of executive function. Working memory load was manipulated by the type of stimulus–response rule, which could be overlearned (low load) or arbitrary (high load). Conflict resolution was required when the distractor carried information incongruent with the target. Set switching was required every four trials, when a cue signaled a change in the color of the target. High working memory load slowed down overall response and increased the residual cost of set switching. In contrast, it left unaffected the ability to ignore distracting information. These results argue for a close link between working memory and set switching and for a relative independence between these two factors and conflict resolution. The findings are consistent with evidence of nonoverlapping activation in neuroimaging studies of congruency and working memory, and they challenge the popular view of conflict resolution as a working memory function.

(2077)

Is Inhibition of Return Solely a Reflexive Phenomenon? CHRISTINE M. TIPPER & ALAN F. KINGSTONE, *University of British Columbia* (sponsored by Alan F. Kingstone)—Response time (RT) to visual targets at peripheral locations can be delayed if attention was previously drawn to the cued location, a phenomenon called inhibition of return (IOR). Because this IOR effect is found when peripheral cues

are not spatially predictive, IOR is thought to be a reflexive phenomenon. However, this conclusion overlooks the fact that the peripheral cue has a predictable temporal relationship with the target. If the cue were not used by subjects as a temporal warning signal would IOR still occur? We tested this question by systematically decreasing the temporal predictability between the cue and the target. Our manipulation succeeded in eliminating the use of the cue as a temporal warning signal, but it failed to eliminate IOR (although it did reduce the magnitude of the effect). These results argue that IOR is solely a reflexive phenomenon.

(2078)

Bivalency Can Be Costly: Unexpected Bivalent Stimuli Elicit Cautious Responding. TODD S. WOODWARD, *University of British Columbia,* BEAT MEIER, *Universität Bern,* & PETER GRAF, *University of British Columbia* (sponsored by Peter Graf)—When tasks are performed in alternation, substantial slowing occurs when the stimuli have features relevant to both tasks (i.e., when stimuli are bivalent as opposed to univalent). One possible source of this slowing, herein called a bivalency cost, is that encountering bivalent stimuli leads to a more cautious task orientation. To investigate this, we employed a paradigm that required performing three simple tasks, with bivalent stimuli occasionally being encountered on one task. The results show that regardless of the feature overlap among the stimuli used for the different tasks, the introduction of bivalent stimuli slowed responding on all tasks. Moreover, when subjects were instructed to ignore the irrelevant dimension of the bivalent stimulus, the generalized slowing did not materialize. Overall, it appears that bivalent stimuli can induce a more cautious task orientation. However, this orientation can be moderated by subjects' expectations.

(2079)

Saccade Selection Signals Do Not Originate in Frontal Eye Fields (FEF). BONNIE M. LAWRENCE & LAWRENCE H. SNYDER, *Washington University School of Medicine* (sponsored by Lawrence H. Snyder)—Executing a goal-directed movement requires the selection of a spatial target and the selection of an appropriate effector. Target selection has been attributed to the posterior parietal cortex (PPC), whereas effector selection has been attributed to motor-specific areas of the frontal cortex. Research from our laboratory, however, suggests that PPC is involved in the selection of an effector, even when the spatial goal of the effector is not specified. Although surprising, this activity may simply reflect top-down influences of selection processes occurring in the frontal cortex. To address this issue, we compared the magnitude and the timing of the selection process in saccade-related areas of the monkey frontal cortex (FEF) and the parietal cortex (LIP). Surprisingly, the effect of selecting a saccade was smaller and occurred later in FEF than in LIP, indicating that saccade selection does not originate in FEF and, therefore, the effect in LIP does not reflect top-down influences from FEF.

(2080)

More Than Two Ways to Skin a Cat: Beyond Dueling Processes in Cognition. FREDERICA R. CONREY & JEFFREY SHERMAN, *Northwestern University* (sponsored by Jeffrey Sherman)—A great deal of effort has been devoted to developing "process-pure" measures of automatic associations. However, researchers have been less concerned with differentiating between the distinct processes within the automatic and controlled categories. A new multinomial model dissociates multiple controlled and automatic processes. The model was applied to the Implicit Association Test (Greenwald, McGhee, & Schwarz, 1998). Parameter estimates imply that a positive association with Whites has a greater impact on responses than does a negative association with Blacks and that controlled processing influences responses. The extent to which participants overcome their biases on the task is related to motivation to avoid looking prejudiced and to processing capacity. Results suggest that multiple types of controlled and automatic processes influence complex tasks and that assessing them simultaneously, rather than in impoverished process-pure measures, may provide more insight into the complexity of cognition.

(2081)

Simon, Stroop, and Flanker Effects Eliminated by Repeating Irrelevant Information. WIM NOTEBAERT & ERIC L. SOETENS, *Vrije Universiteit Brussel* (sponsored by Eric L. Soetens)—Congruency effects, such as the Simon, Stroop, and flanker tasks, demonstrate a failure in selective attention. Subjects are asked to focus on one dimension (e.g., color of the word) and to ignore another dimension (word meaning). Congruency effects show that ignoring this information is not possible and are assumed to reflect automatic processing. We have obtained data in serial reaction time tasks that are not in line with this assumption. When the irrelevant information is repeated in serial reaction time tasks, the congruency effects disappear. We claim that it is necessary to direct attention to the irrelevant information in order to obtain congruency effects. When the irrelevant information changes, this attracts attention; when it remains the same, it does not.

(2082)

Hypermnesia and Forgetting: Delay-Related Changes in Personal Memories for September 11, 2001. PETER J. LEE & NORMAN R. BROWN, *University of Alberta* (sponsored by Norman R. Brown)—This study examined people's personal recollections for September 11, 2001. The 1,502 participants who were surveyed either 4–24 h or 10 days after the event were retested again in April, 2002. Word counts for participants' open-ended descriptions revealed that people wrote significantly more about their personal circumstances 10 days after the event than respondents had on September 11 or 12. However, no word count difference was found at retest. Ratings for emotional reaction decreased monotonically over time, indicating that heightened emotions were not responsible for the increased length of people's reports. This hypermnesia effect does not support the existence of a special mechanism from the perspective of rapid encoding. Rapid changes in memory suggested elaboration and reconstruction as potential influences on flashbulb memories.

(2083)

Maintaining Standing Balance Requires Attention in Both Children and Adults. RONG-JU CHERNG, JUANG-TING HUANG, & ING-SHIOU HWANG, *National Cheng-Kung University,* & JENN-YEU CHEN, *National Chung Cheng University* (sponsored by Jenn-Yeu Chen)—This study examined the effect of a concurrent attentional task (tone localization) on the standing balance of 15 children (age, 8.7±3.2 years) and 10 young adults (age, 20.8±0.7 years) under four sensory conditions: (1) eyes open, fixed foot support, (2) eyes closed, fixed foot support, (3) eyes open, compliant foot support, and (4) eyes closed, compliant foot support. Two levels of difficulty (easy and hard) in tone localization were manipulated. A Kistler 9284 force platform system was used to measure standing balance. The results showed that the concurrent task improved the standing balance in both children and adults, and the effect did not vary with the difficulty of the concurrent task. We think the effect could be due to increased arousal. If the difficulty of the concurrent task is increased, a cost might be expected. In any case, our results indicate that maintaining standing balance requires attention.

• Lexical Processing •

(2084)

The Nature of Sublexical Processing in Reading Chinese Characters: An ERP Study. CHIA-YING LEE, *Academia Sinica,* JIE-LI TSAI, HSU-WEN HUANG, & DAISY L. HUNG, *National Yang-Ming University,* & OVID J.-L. TZENG, *Academia Sinica* (sponsored by Ovid J.-L. Tzeng)—Most of the Chinese phonetic radicals are legal characters on their own. Automatic semantic activation of phonetic radicals has been found for the reading of complex characters. Whether the validity of the phonetic radical in providing pronuncia-

tion clues would affect sublexical semantic activation remains to be addressed. The present ERP study examined this hypothesis by manipulating three different SOAs (50, 100, and 300 msec) and four types of prime–target relationships. Significant N400 differences between semantic related prime and unrelated control prime across three SOAs were found. The prime, which contained a phonetic radical that was semantically related to the target, showed the smaller N400 only for the shortest SOA or when the prime was a regular character (the prime sounded the same as its embedded phonetic radical). The implications for the competition model in Chinese lexical access will be discussed.

(2085)

Perceptual Units in the Reading of Chinese Sentences. JIE-LI TSAI, *National Yang-Ming University,* CHIA-YING LEE, *Academia Sinica,* MIAO-HSUAN YEN, *National Yang-Ming University,* OVID J.-L. TZENG, *Academia Sinica,* & DAISY L. HUNG, *National Yang-Ming University* (sponsored by William Prinzmetal)—Chinese text has no visual indicator of word units. It is not clear whether or not the characters constituting a word are perceived simultaneously. To investigate this, pairs of two-character words differing in one character (either the first or the second character) were identified, and sentences were written in which either member of the pair fit the context. While the text was read, the critical character changed during each saccade, causing the word to alternate on successive fixations. After reading, subjects indicated which word was in the text. The results showed that characters are discriminated up to two character positions to the right of the fixated character and one character to the left. The data pattern suggests that the character, rather than the word, is the perceptual unit when Chinese sentences are read.

(2086)

Age-of-Acquisition (AoA) Effects in Word and Object Naming in Turkish, Using Snodgrass and Vanderwart Pictures. ILHAN RAMAN, *Middlesex University* (sponsored by Bahman Baluch)—Evidence to date suggests that AoA plays an important role in word naming across a range of alphabetic writing systems with a varying degree of transparency between print and sound. This is contrary to the predictions of the arbitrary mapping hypothesis (Ellis & Lambon-Ralph, 2000), which argues that AoA effects should be stronger for tasks that involve arbitrary mappings between representations than for tasks that involve consistent mappings. Independent ratings were obtained for AoA, frequency, name agreement, and object familiarity from Turkish undergraduates for all items in the Snodgrass and Vanderwart (1980) line drawing set. The role of AoA was explored in atypically consistent Turkish in object- and word-naming tasks using the same subset of stimuli. The findings dispute the claim that AoA effects should be reduced for orthographies with consistent mappings between print and sound; these are discussed with reference to the arbitrary mapping framework.

(2087)

The Poor Temporal Fidelity of Binding Word Parts Into Words. ALEX O. HOLCOMBE & JEFF JUDSON, *University of California, San Diego* (sponsored by Harold Pashler)—RSVP and single masked presentation results have long been taken as measures of temporal limits in word perception. Yet neither technique provides a focused test of the temporal fidelity of perceptual binding of word parts. On each trial of my method, two four-letter strings alternated in one location for several cycles. Observers previewed two pairs of letter strings indistinguishable at high temporal frequencies. Then observers discriminated them—for example, *tank* alternating with *mope* from *tape* alternating with *monk*. Success required binding the letters presented simultaneously—in this case, forming a word. Temporal thresholds were limited to low temporal frequencies, but varied substantially across subjects, from 7 Hz (71 msec/word) to as low as 2 Hz (250 msec/word). Mean temporal thresholds for unpronounceable four-letter words were twice as long. Comparison with other limits suggests that perceptual access to higher temporal frequencies occurs only when perceptual mechanisms turn dynamic information into a constant percept.

(2088)

Reading Aloud: Evidence for a Phonologically Based Neighborhood Density Effect. CLAUDIO MULATTI, *University of Padua & University of Trento,* DEREK BESNER, *University of Waterloo,* & REMO JOB, *University of Padua & University of Trento* (sponsored by Remo Job)—*N* (for neighborhood density) refers to the number of words than can be made by changing one letter at a time in a stimulus. It is well known that the higher the *N*, the faster both words and nonwords are named. It is widely assumed that this effect is orthographic in nature, but this conclusion is premature given that orthography and phonology are correlated. The present work holds orthography constant and manipulates phonological density. The results are discussed in the context of an interactive activation framework.

(2089)

Phonological and Associative Priming Effects Following Letter Search on the Prime. TODD A. KAHAN, *Bates College,* & JOHN J. SELLINGER & JOSHUA BROMAN-FULKS, *University of Southern Mississippi*—Responses to target words are typically faster and more accurate following associatively related primes (e.g., ORANGE–JUICE), as compared with unrelated primes (e.g., TABLE–JUICE). This priming effect has been used as an index of semantic activation and its elimination has often been cited as evidence against automatic semantic activation. When participants are asked to perform a letter search on the prime, associative priming is typically eliminated, whereas repetition priming remains (see Maxfield, 1997). Because repeated prime–target pairs share semantic, orthographic, and phonological codes, it is difficult to determine which is responsible for the enduring repetition priming following letter search. The present experiment examined associative and phonological priming to determine whether pure phonological priming would remain following letter search (e.g., MOOSE–JUICE). When participants read the primes, equivalent associative and phonological priming effects were obtained; both of these effects were eliminated following letter search. Implications for the automaticity of phonological activation are discussed.

(2090)

Word Predictability Can Influence Word Skipping Independent of Word Length Information. SARAH J. WHITE, *University of Durham,* KEITH RAYNER, *University of Massachusetts, Amherst,* & SIMON P. LIVERSEDGE, *University of Durham* (sponsored by Susan Elizabeit Gathercole)—Previous studies show that predictable words are more likely to be skipped than unpredictable words. This experiment tested whether word length information is necessary for context to influence word skipping. Participants read sentences including a critical 4-letter word followed by a 5-letter word. The sentential context up to the critical 4-letter word made this word either predictable or unpredictable. Before these words were fixated, either the preview of the critical and following words was correct (e.g., *bomb under*), or they appeared as a single 10-letter string (e.g., *bombsunder*). A saccade-contingent change ensured that word length was correct when the eye moved to the 4-letter word. The critical 4-letter words were more likely to be skipped when they were predictable, independently of the word length preview. The results show that word length information is not necessary in order for word predictability to influence word skipping.

(2091)

Parafoveal Processing of Vowel Contexts: Evidence from Eye Movements. JANE ASHBY, *University of Massachusetts, Amherst,* REBECCA TREIMAN & BRETT KESSLER, *Washington University,* & KEITH RAYNER, *University of Massachusetts, Amherst* (sponsored by Arnold D. Well)—How do readers assign vowel sounds during silent reading? We measured readers' eye movements to determine whether parafoveal information about the consonant contexts in which

vowels occur facilitates word recognition. Target words, such as *pool*, were preceded by nonword previews in which the coda suggested the same vowel sound as the target (*poon*) or a different vowel sound (*pook*; cf. *look*). Targets preceded by previews in which the coda suggested a different vowel sound were read 20 msec more slowly than targets preceded by same-vowel-sound previews. The results suggest that readers use parafoveal information about the coda consonant to narrow the range of vowel pronunciations. Readers preserve that information during the saccade to the target and use it to complete lexical access. This early and complex integration of consonant and vowel information challenges theories that claim that vowel processing occurs much later than consonant processing during reading.

(2092)

An Eye-Tracking Study of Ambiguity Processing by Children and Adults. KEVIN FIELDS, CLINTON SCHLENKER, & PING LI, *University of Richmond* (sponsored by Ping Li)—We examined the processing of lexical ambiguity in an eye-tracking study of children and adults in their reading of grammatically ambiguous words. Words such as *crack* (ambiguous between a noun and a verb interpretation, e.g., in *crack on the wall* vs. *crack the nut*) were embedded in sentence contexts that biased toward either a noun reading or a verb reading or in a neutral context. The sentences were presented to sixth graders and normal college students with an ASL eye-tracker. Fixation durations were measured for the target ambiguous word, the duration from the offset of the ambiguous word to the end of the sentence, and the total reading time of the whole sentence. ANOVA and regression analyses reveal interesting differences between children and adults in the processing of noun–verb homographs. Implications of these results are discussed with respect to an activation-based model of ambiguity processing.

(2093)

Inducing Letter-by-Letter Dyslexia in Normal Readers. DANIEL FISET, FRÉDÉRIC GOSSELIN, & MARTIN ARGUIN, *Université de Montréal* (sponsored by Martin Arguin)—Letter-by-letter (LBL) dyslexia results from left temporo-occipital lobe lesions and is characterized by an abnormally large word-length effect (reading latencies for single words proportional to the length of these words). Most LBL individuals are also right hemianopic and, therefore, must read words with their right hemisphere (RH). There is ample evidence that the RH is specialized in the processing of low spatial frequencies (Ivry & Robertson, 1998). However, reading is most efficient in the mid spatial frequency range (Pelli, Burns, Farell, & Moore, in press). We contend that the LBL strategy is aimed at increasing spatial resolution in the RH. We tested this hypothesis by asking five normal readers to name low-contrast high-passed words (mimicking the poor mid- to high-frequency processing capability of the RH), controlled for lexical and bigram frequency, *N* size, and letter confusability. As was predicted, all participants displayed word-length effects of a magnitude comparable to LBL individuals (500 msec/letter).

(2094)

Competition Effects in Written Word Perception. JASON F. SMITH, GREGORY O. STONE, & STEPHEN D. GOLDINGER, *Arizona State University* (sponsored by Stephen D. Goldinger)—The study of spelling–sound correspondences in written word perception has typically focused on effects at two grain sizes: word body consistency and grapheme regularity. We investigate consistency effects at the novel grain size of the word subbody. The word subbody is the vowel and initial coda grapheme in a body with a complex coda (e.g., _EN_ in the body _ENCH as in BENCH). Subbody consistency is the consistency of the subbody when it serves as the full body in other words (e.g., _EN in HEN). Does subbody consistency impact performance on word perception tasks when a word's full body is consistent? The experiments suggest that words with more consistent subbodies are responded to more slowly than words with more inconsistent subbodies. This counterintuitive pattern of results is discussed in terms of models incorporating competitive interactions.

(2095)

Using a High-Dimensional Model to Capture Semantic Distinctiveness and Consolidation in Bilingual Memory. ZANA DEVITTO & CURT BURGESS, *University of California, Riverside,* & CATHERINE DECKER, *Chaffey College*—Most models of bilingual processing either are localist or utilize arbitrary or overly simplistic semantic representations. High-dimensional context theory suggests that each language system has a mapping from distinct lexical information (orthographic and phonological) to its associated conceptual information. As experience accrues, specific contextual co-occurrence information consolidates to form higher level associative structures. It is these higher level associative structures from L1 and L2, not the lower level global co-occurrence information, that provide the interlanguage mapping. Whether mediation from the global co-occurrence structures or a direct mapping occurs via the consolidated structures during language processing is a function of experience. Such a model should be able to reflect the distinction between "native" and "dominant" languages and a range of basic semantic priming effects. The model is similar to that of Li and Farkas (in press) in that it learns from a natural corpus of language.

• PSYCHOLINGUISTICS •

(2096)

Abstracting Meaning From Sound: Interactions Between Concreteness and Phonology. CHRIS F. WESTBURY, *University of Alberta,* & JEFF R. BINDER, *Medical College of Wisconsin*—We used functional magnetic resonance imaging to examine the neural resources recruited for accessing abstract and concrete words. We found that a network of frontal and temporal regions associated with phonological processing is recruited during the processing of abstract words. This finding raises the possibility that abstract words may be more sensitive to phonological manipulations than are concrete words. We examined this possibility in a series of experiments that factorially manipulated concreteness and phonological neighborhood (PN). The results support the inference from the imaging study, demonstrating that when phonological processing is strongly stressed, PN plays a much more salient role in lexical access of abstract words than of concrete words.

(2097)

Refractory Effects in Repeated Lexical-Semantic Retrieval. EVA BELKE & ANTJE S. MEYER, *University of Birmingham,* MARKUS F. DAMIAN, *University of Bristol,* & GLYN W. HUMPHREYS, *University of Birmingham* (sponsored by Glyn W. Humphreys)—In the cyclic semantic blocking paradigm, where speakers repeatedly name the same objects, naming latencies are longer for sets of objects with semantically related names than for unrelated sets. We investigated the origin of this semantic blocking effect. Experiment 1 assessed the roles of presentation mode (simultaneous vs. sequential presentation of objects) and object repetition. We obtained blocking effects for both presentation modes. Furthermore, the results showed that the observed semantic blocking effect was due to an attenuation of repetition priming in related sets, relative to unrelated sets. Experiments 2 and 3 examined the importance of repeating the same items. The results showed that the blocking effect was initially confined to the tested set of items but soon generalized to new members of the same semantic category. We propose that the effect is due to refractory behavior in the semantic system and discuss its implications for models of lexical-semantic retrieval.

(2098)

Effects of Modest Exposures to Infrequent Syntactic Structures on Sentence Comprehension. BRETON BIENVENUE & GAIL MAUNER, *SUNY, Buffalo* (sponsored by Gail Mauner)—The results of four experiments show that exposure to infrequent but known syntactic structures leads to rapid learning of cues that facilitate their processing but that can also lead to competitive inhibition in more frequent

syntactic structures. Infrequent *wh*-questions with prepositional-phrase fillers (*To which professors do college libraries provide on-line databases each semester?*) occurring at late serial list positions were processed faster than similar sentences at early list positions. Increasing experience with this structure through distractor stimuli speeded the onset of this change. In contrast, exposure to a greater number of *wh*-questions in which a noun-phrase (NP) filler was associated with a gap in an indirect object rather than with the probabalistically more likely direct object position (*Which professors do college libraries provide on-line databases to each semester?*) led to slower processing in NP filler *wh*-questions. These results support a dynamic model of sentence processing that is constantly tuning itself in relation to input.

(2099)

Do Simple Recurrent Networks Learn Syntactic Structure? Experiments With Anaphora. ROBERT FRANK, DONALD MATHIS, & WILLIAM BADECKER, *Johns Hopkins University* (sponsored by Michael McCloskey)—We tested the claim that simple recurrent networks (SRNs) can induce syntactic structure, in the domain of obligatory coreference. Reflexives like *herself* must be coreferential with a c-commanding antecedent in the same syntactic domain. We first trained an SRN to perform word prediction with simple sentences such as *Alice told Sue's mother about herself*. Once the network achieved success, its weights were frozen, and the hidden units (the locus of the putative grammatical representation) were used as input to another SRN whose task was to activate a unit representing each NPs referent. The network was able to reliably assign referents to nonreflexive NPs (e.g., *Alice* and *Sue's mother*), but not to reflexives: The network converges to a solution that uses linear rather than hierarchical properties to determine coreference. This suggests that the network's representation is not a syntactic structure, since it does not provide the right inductive bias for learning grammatical dependencies.

(2100)

Eye Movement Development in Reading. GARY FENG, *Duke University,* & KEVIN F. MILLER, *University of Illinois, Urbana-Champaign* (sponsored by Kevin F. Miller)—As children become proficient readers, their reading eye movements undergo substantial changes. This study investigates whether the development is driven by general developmental changes or experiences specific to reading. Cross-cultural developmental studies looking at the course of reading acquisition in different orthographies are crucial to disentangling these hypotheses. Chinese characters and English alphabetic orthographies provide a good comparison for looking at how orthography affects the development of reading eye movements. Third-grade, fifth-grade, and undergraduate students who were native speakers of English or Chinese were asked to read age-appropriate texts while their eye movements were recorded. Results indicated that the basic mechanisms of eye movement control are in place very early and that some, but not all, aspects of these mechanisms can be modified by development and reading experience.

(2101)

How the Reading Circuit Learns: A Contrast of Different Training Conditions. REBECCA SANDAK, W. EINAR MENCL, STEPHEN J. FROST, & DINA L. MOORE, *Haskins Laboratories,* STEPHANIE A. MASON, *Yale University School of Medicine,* JAY G. RUECKL & LEONARD KATZ, *Haskins Laboratories & University of Connecticut,* & KENNETH R. PUGH, *Yale University School of Medicine & Haskins Laboratories*—A series of studies has examined how practice with unfamiliar words changes the relative activation of the cortical systems underlying reading. In an earlier study, we found that when participants acquired familiarity for novel words by attending to their phonological features, the subsequent (more efficient) naming of those items was associated with reduced activation in left-hemisphere dorsal (SMG), anterior (IFG), and occipitotemporal (VWFA) regions; attention to semantic features during training increased activation in anterior ventral areas (MTG/ITG). Because the development of reading skill is associated with a shift from dorsal to ventral regions, we hypothesized that training requiring attention to both phonological and semantic attributes would optimize learning. A behavioral study confirmed this hypothesis. An fMRI experiment explicates the effects of this mixed training on the cortical regions recruited for naming trained items, demonstrating additive effects of combined training. Theoretical implications and implications for reading instruction and dyslexia are discussed.

• Discourse Processing •

(2102)

Do Component Text Processes Share Resources? KATHERINE A. RAWSON & WALTER KINTSCH, *University of Colorado* (sponsored by Walter Kintsch)—Several text-processing theories assume that the component processes involved in comprehension must share limited processing resources (i.e., the shared resource assumption), but scant research has empirically evaluated the assumption. The present research tested the assumption by examining whether the demands of syntactic parsing can interfere with the success of causal inferencing. Each text contained two critical sentences that warranted a causal inference, and the syntax of the second sentence was either more or less difficult to parse. Results suggested that causal inferences were made with less difficult syntax but that inferencing was constrained with more difficult syntax. Follow-ups suggested that this interference was not due to inferior output of syntactic processes or to increased demands of difficult syntax interfering with maintenance of information needed to form the inference. Results suggest insufficient resources were available for the operation of inference processes, due to the increased demands of syntactic parsing.

(2103)

Top-Down and Bottom-Up Processes During Text Integration. CHRISTOPHER A. KURBY, MARY A. BRITT, & JOSEPH P. MAGLIANO, *Northern Illinois University* (sponsored by Joseph P. Magliano)—The roles of bottom-up and top-down processing were investigated in the extent to which readers integrate information from two related texts as a function of type of overlap and order of presentation of text. Participants read pairs of ambiguous and descriptive texts that described the same event. Order of presentation for each pair was either ambiguous or descriptive text first. The degree of overlap between critical sentences in the ambiguous texts and disambiguating sentences in the descriptive texts was varied such that there was either both surface and situational overlap or just situational overlap. Sentence reading times for the ambiguous critical sentences were recorded, and after reading all texts, the participants made speeded judgments to determine whether a noun phrase from the descriptive and the ambiguous texts referred to the same entity. These data suggest that both bottom-up and top-down processing are involved in the integration of texts.

(2104)

What Determines the Use of Common Ground in Language Production? SHALI WU & BOAZ KEYSAR, *University of Chicago* (sponsored by Boaz Keysar)—We propose that speakers' propensity to consider their audience's needs changes depending on the level of knowledge overlap between interlocutors: the larger the overlap, the less speakers engage in audience design. In our study, pairs of participants played a two-stage referential communication game. First, they learned names for odd figures together. While one participant learned all the names ("the speaker"), the other learned either a small proportion (low-knowledge overlap) or a high proportion (high-knowledge overlap) of the names. Then the speaker attempted to identify each figure for the other, who tried to select the target from a set of distractor figures. Results show that speakers in the high-overlap condition produced less clear instruction than did those in the low overlap condition, resulting in more turns, more requests for clarification, and more errors. This suggests that speakers' descriptions become more egocentric the more they share knowledge with their addressees.

(2105)

Impact of Conversational Perspective and Interpersonal Relationship on the Perception of Irony. JEFFREY T. HANCOCK, *Cornell University,* & ELAINE BOUCHER & PHILIP J. DUNHAM, *Dalhousie University* (sponsored by Philip J. Dunham)—The role of conversational perspective (speaker, addressee, overhearer) and participant relationship (strangers vs. friends) on the perception of spontaneously produced literal and ironic remarks was examined. Participants reported their perceptions of sarcasm, humor, sincerity, and criticalness for both literal and ironic utterances. No perspective effects were observed for sarcasm or humor, but speakers and addressees viewed utterances as more sincere than overhearers did. Also, addressees viewed literal remarks as more critical than did speakers and overhearers, but viewed ironic remarks as less critical, suggesting that irony may reduce the degree of criticism perceived by addressees. Correlational analyses revealed that participants' co-perceived the level of sarcasm, humor, and criticalness more accurately for literal than for ironic remarks. Friends co-perceived the critical intent of utterances more accurately than strangers, especially in the case of ironic remarks, suggesting that interpersonal relationships play a role in the mutual understanding of the pragmatic intent of ironic utterances.

• Category Learning & Categorization •

(2106)

Thematic Processing Preferences in Relational Concepts. KATJA WIEMER-HASTINGS & XU XU, *Northern Illinois University*—Relational concepts have strong links to related concepts. Judgments of their similarity may thus be frequently infiltrated by thematic relations, whereas for concrete items, this occurs when property alignment fails (Wisniewski & Bassok, 1999). We conducted two similarity judgment experiments with relational and concrete items. Participants predominantly integrated relational concepts but taxonomically compared the objects. This difference was robust after participants were primed to use alternative processing strategies. Experiment 3 compared common and different properties of the item pairs to explore explanations. While relational pairs had significantly lower numbers of listed properties than did concrete items, integration frequency was not significantly correlated with numbers of properties. However, integrations of concrete items were independent of shared features, whereas properties shared by relational concepts were often part of their integrations. So, in contrast to concrete items (Gentner & Brem, 1999), integration of relational concepts may indeed be a function of their similarity.

(2107)

Guilt by Association: Gleaning Meaning From Contextual Co-occurrence. LERA BORODITSKY, *MIT,* & MICHAEL RAMSCAR, *Stanford University*—What makes two things similar? Is the similarity of two objects fully determined by intrinsic properties of the objects themselves? Could spurious aspects of experience or certain statistical properties of the environment contribute to our perceptions of similarity? In this paper, we explore the possible environmental influences on the perceived similarity of objects. We explore (1) the effects on similarity between words when those words appear in the same contexts (without co-occurring directly) and (2) the effects on similarity between objects when the names of those objects appear in the same linguistic contexts (without co-occurring directly). In both of these cases, similarity increased as a function of contextual co-occurrence (even when the context consisted of novel words without any preassigned meanings). It appears that human minds not only track contextual co-occurrence statistics between words, but also allow these co-occurrence statistics of words to inform their representations of the words' referents.

(2108)

Initial Symmetry in Metaphor Processing. PHILLIP WOLFF, *University of Memphis,* & DEDRE GENTNER, *Northwestern University*—Metaphors are strongly directional. For example, "A rumor is a virus" is easily interpretable, whereas the reversed version, "A virus is a rumor" is not. Some theorists have modeled metaphoric processing as a directional projection process (e.g., from virus to rumor). We present evidence that the initial process is a symmetric alignment of the representations and that directional processing occurs later. We collected comprehensibility judgments for forward (e.g., "A rumor is a virus") and reversed (e.g., "A virus is a rumor") metaphors at early and late stages of processing, using a deadline procedure. The results show no difference in comprehensibility between forward and reversed metaphors in early processing but an advantage for forward metaphors later in processing. These results support the structure-mapping process model of metaphor comprehension, as simulated by SME, over models that propose a directional process throughout.

(2109)

Empirical Studies on Attention Processes in Category Learning. TOSHIHIKO MATSUKA, *Rutgers University, Newark,* & JAMES E. CORTER, *Teachers College, Columbia University* (sponsored by James E. Corter)—Previous empirical and theoretical studies have suggested that selective attention processes play a key role in category learning. However, to date, no direct empirical data on attention processes in category learning have been reported. Here, three new empirical studies of category learning are reported, in which data were collected on individual subjects' attention allocation processes during learning. The measures of attention used were based on feature-viewing time, as measured in a Mouselab-type interface. The aspects of the stimulus manipulated were the diagnosticity of dimensions, interdimensional correlations, and category base rates. The results indicated that the amount of attention allocated to a dimension was proportional to the informativeness of the dimension. Simulation studies were also conducted, using several well-known models of category learning (ALCOVE, RASHNL, and SUSTAIN). Results of the simulations suggested that the empirical attention data were more informative in evaluating predictions of the models than were the observed learning curves.

(2110)

A Memory and Contrast Model of Binary Classification. NEIL STEWART & GORDON D. A. BROWN, *University of Warwick* (sponsored by Evan Heit)—We present a memory and contrast (MAC) model of classification. The model assumes that only ordinal information about the differences between the current stimulus and, at most, a few of the immediately preceding stimuli is available. Furthermore, the model assumes that this information is used selectively and that the selection depends on the context provided by recent trials. Despite the paucity of stimulus information, this MAC model accounted for sequential effects in a binary classification of 10 tones varying in frequency. Stimuli up to two trials back in the sequence had a significant effect on the response to the current stimulus. Furthermore, the effects of previous stimuli interacted with one another. These results are inconsistent with extant exemplar and decision-bound models.

(2111)

Concurrent Basic and Superordinate Categorization of Photographic Images by Pigeons. OLGA F. LAZAREVA, KATE L. FREIBURGER, & EDWARD A. WASSERMAN, *University of Iowa* (sponsored by Edward A. Wasserman)—We studied categorization in pigeons, using carefully controlled photographs. Within daily sessions, 4 pigeons had to classify each of 32 photographs either into its proper basic-level category (cars, chairs, flowers, or people; four-key forced-choice procedure) or into its proper superordinate-level category (natural or artificial; two-key forced-choice procedure). The pigeons were able to classify the same stimuli at both levels; but, like human children, they learned the basic discrimination faster than the superordinate discrimination. The pigeons also exhibited reliable discrimination transfer to novel photographs, attesting to the open-endedness of these categories. The training data suggested that the pigeons may have used different visual features to classify the same stimuli at different levels of categorization. In follow-up experiments, to examine this possibility, we examined which properties of the stimuli con-

trolled discrimination performance in the basic and the superordinate categorization tasks.

(2112)

Sequential Contrast and Assimilation Effects in Categorization of Perceptual Stimuli. MICHAEL N. JONES & DOUGLAS J. MEWHORT, *Queen's University* (sponsored by Douglas J. Mewhort)—In absolute identification, subjects are biased to respond as if the current stimulus is closer to the previous stimulus than it actually is (an assimilation effect; e.g., Holland & Lockhead, 1968, *P&P*). When the same stimuli are used in a categorization task, however, a contrast effect occurs (e.g., Stewart, Brown, & Chater, 2002, *JEP:LMC*). An opposite effect in similar tasks is problematic for models that account for identification and categorization with the same process. We examined the effect of the previous stimulus on category representation, using an exemplar production task: Subjects produced exemplars from requested categories and were provided feedback. Stimulus classification and feedback pushed the memory representations of other categories away from the response category, but it pulled the memory representation of the response category toward the produced stimulus. The opposite sequence effects in identification and categorization reflect a within-category representation shift in categorization that cannot occur in identification.

(2113)

Perceptions and Conceptions of Time. SHULAN LU, ARTHUR C. GRAESSER, & PHILLIP WOLFF, *University of Memphis* (sponsored by Arthur C. Graesser)—In psychology and linguistics, it has been proposed that temporal relations between events can be captured in terms of the primitives *before*, *after*, and *during*. Models in artificial intelligence (AI; e.g., Allen, 1984, 1991), in contrast, have proposed as many as seven temporal primitives. The predictions of these two perspectives were tested in a series of experiments in which people described, judged, and drew relationships between events. In Experiment 1, participants sorted words, encoding temporal relations in a manner consistent with the three primitives, whereas in Experiment 2 participants distinguished drawings of temporal relations into finer categories, consistent with models in AI. In Experiment 3, participants' picture drawings and judgments clustered around the three primitives, whereas in Experiment 4 participants' event perceptions revealed more complex distinctions. The results suggest that people make some of the temporal distinctions hypothesized in AI models but that the three primitives are cognitively preferred.

• Reasoning, Problem Solving, & Judgment •

(2114)

The Effect of Conceptual Distance on Analogical Problem Solving. CYNTHIA M. SIFONIS, *Oakland University*—Anecdotal accounts suggest that analogies involving conceptually distant source and target domains are frequently associated with innovative problem solving. The present study empirically examines the effect of conceptual distance between a source and a target domain on the quality of the solutions generated in an analogical problem-solving task. Participants were asked to use analogy to generate solutions to the parking problem at their university. They were given one of three source domains to use. The source domain was either similar, moderately dissimilar, or very dissimilar to the target domain. The results support anecdotal accounts. Participants using very dissimilar source and target domains during analogical problem solving generate the most creative solutions. The results suggest that providing people with a source domain that is conceptually distant from the target domain during analogical problem solving increases the likelihood that an innovative solution to the problem will be generated.

(2115)

Multidigit Addition: Solution Strategies and Working Memory. TINA SHANAHAN & JO-ANNE LEFEVRE, *Carleton University* (sponsored by Jo-Anne Lefevre)—Researchers have demonstrated that both phonological and visuospatial working memory are involved in multidigit mental arithmetic. The use of phonological versus visual memory appears to vary with presentation format (i.e., vertical vs. horizontal). The present study further evaluated the mental processes underlying adults' performance in mental arithmetic. In addition to speed and accuracy measures, we examined participants' self-reports of what they did to solve multidigit addition problems presented (1) vertically and horizontally, (2) double digit first and single digit first, and (3) with and without carrying. There was more reported use of a visually dependent (columnar) unit-to-decade algorithm and less of other, more phonologically based strategies in solving vertical problems, and the reverse was true for horizontal, especially for carry, problems. In general, the presence or absence of carrying in the problem was a significant factor in the choice of solution strategies.

(2116)

Animals and Alcohol: The Role of Experience in Inductive Reasoning Among College Students. OLGA A. STEPANOVA & JOHN D. COLEY, *Northeastern University* (sponsored by John D. Coley)—Previous research indicates that novices utilize categorical relations, such as similarity, typicality, and diversity, when making inductive inferences, whereas experts use a variety of other strategies—often considering causal relations—and show increased sensitivity to the context of the inference. In this study, the impact of experience on induction was assessed by comparing college students' inferences about animals (a "novice" domain for this population) versus alcohol (an "expert" domain). We also manipulated property being inferred, and pretrial training conditions were used to prime categorical or causal relations. For alcohol, students showed "expert-like" reasoning; inferences varied by priming condition and property type, and causal explanations were common. In contrast, for animals, neither priming nor property had an effect, and explanations were overwhelmingly categorical. Results indicate that domain-specific experience may weaken reliance on taxonomic relations in induction and increase sensitivity to the context in which inductive inference takes place.

(2117)

Insight and Set. MICHAEL ÖLLINGER & GÜNTHER KNOBLICH, *Max Planck Institute for Psychological Research* (sponsored by Günther Knoblich)—Insight problems lead the problem solver into impasses. During impasses, open problem-solving activity ceases, and in order to resolve them, representational changes affecting the representation of the situation or the goal are necessary (Ohlsson, 1992). Another source of problem difficulty is the current problem-solving context. In particular, Luchins and Luchins (1942) demonstrated that the repeated application of the same solution procedures reduces the flexibility for alternative solutions (set effect). In three experiments (N = 288), we used matchstick arithmetic tasks to address the interplay between set and representational change. The main results were as follows. The repeated solution of familiar problems did not increase the difficulty of solving problems that required a representational change. However, the repeated solution of problems that required a representational change created a set effect for familiar problems. Possible mechanisms for this surprising asymmetry will be discussed.

(2118)

Instructional Interference Effects in Symbolic Comparisons. SAMUEL SHAKI & WILLIAM M. PETRUSIC, *Carleton University* (sponsored by William M. Petrusic)—Participants compared the sizes of animals from memory. In one experiment, on experimental trials, the instructional display was defined by two rows with three instructional words in each row, with five of one kind and one of the other. All six instructions were the same on control trials. When the display contained one instructional word that differed from the others, participants based their discrimination on the instruction that occurred more frequently on one half of those trials and on the instruction that occurred less frequently on the other half. A second experiment em-

ployed a temporal parallel of the first, with participants using the instruction that occurred more frequently in a sequence of three 300-msec letter strings. The SCE was reduced with the mere presence of a single occurrence of an irrelevant instructional word. These reductions in SCE are not readily permitted by the existing theories of the SCE.

(2119)

Minerva DM and Age Differences in Judgments of Frequency and Conditional Probability. JULIA SPANIOL, *Duke University,* & GORDON PITZ, *University of North Carolina, Chapel Hill* (sponsored by Gordon Pitz)—Age differences in bias in conditional-probability judgments were investigated with predictions derived from the Minerva decision-making model (MDM; Dougherty, Gettys, & Ogden, 1999), a global-matching model of likelihood judgment. Younger and older adults completed frequency judgment and conditional-probability judgment tasks. Age differences in the frequency judgment task are interpreted as an age-related deficit in memory encoding. Older adults' stronger biases in the probability judgment task point to age differences in criterion setting. Age-related biases were eliminated when age groups were equated on memory encoding via a study time manipulation. The author concludes that older adults' stronger judgment biases are a function of memory impairment. Implications for cognitive-aging theories and for the MDM model are discussed.

(2120)

Price Attractiveness Perception: Evidence for Multiple Reference Points. JING QIAN & GORDON D. A. BROWN, *University of Warwick* (sponsored by Gordon D. A. Brown)—Current models typically assume that price evaluation involves comparison with a single reference price. Here, alternative models derived from psychophysics are explored. Range frequency theory (Parducci, 1965, 1995) predicts, in contrast to previous models, that price perception will be influenced by multiple reference prices. More specifically, it predicts range dependence and rank dependence (effects of distribution). Two experiments tested these predictions. The perceived attractiveness of simultaneously presented prices was measured in Experiment 1. The price distributions were varied, and the results were consistent with range frequency theory. Experiment 2 tested a further prediction, derived from psychophysics, that sequence effect, will be observed when prices are presented in succession. Results were again consistent with the predictions. It is concluded that multiple reference points are used in price perception and that psychophysical principles can motivate novel hypotheses within consumer research.

SYMPOSIUM I: Attention in Mind and Brain
Regency CD, Friday Afternoon, 1:00–3:05

Chaired by John Jonides, University of Michigan

1:00–1:20 (65)
Common Mechanisms for Switching Attention. JOHN JONIDES & TOR D. WAGER, *University of Michigan,* & JAMES K. KROGER, *New Mexico State University*—We switch our attention constantly to make information accessible to processes that manipulate that information. Switches of attention are made on the basis of a number of qualities of external stimuli (e.g., location), and they are also made on the basis of qualities of internal representations (e.g., one item in working memory vs. another). Are the mechanisms of switching distinguishable as a function of the type of information between which attention is being switched? We conducted a meta-analysis of studies in which investigators collected neuroimaging data as participants switched attention between locations, attributes, objects, rules, or tasks. This analysis revealed substantial common activation arising from these various kinds of attention-switching. In a follow-up experiment pitting switches of attention between two objects in working memory and two operations applied to those objects, we also found common activations, but ones that were modulated by the type of switch required.

1:25–1:45 (66)
Cortical Mechanisms of Attention Shifts: Space, Features, and Objects. STEVEN YANTIS, *Johns Hopkins University*—We have investigated the time course of attentional control signals in the human cortex, using rapid event-related fMRI during tasks that require shifts of visual attention between locations, features, objects, or sensory modalities (vision/audition). Observers view displays containing two or more continuous streams of stimuli that change identity one to four times per second. At any given moment, observers monitor one of two streams. Occasional targets appear within the attended stream. One target instructs the observers to maintain attention; another target instructs them to shift attention to the other stream. In each domain, strong attentional modulation of the visual or the auditory sensory cortex was observed. Furthermore, transient increases in activity time-locked to attention shifts were observed in the superior parietal and prefrontal cortex. These temporal profiles suggest a consistent role for subregions of the parietal and frontal cortex in shifting and maintaining the locus of attention.

1:50–2:10 (67)
Dividing the Spotlight of Spatial Attention. STEVEN A. HILLYARD, *University of California, San Diego,* MATTHIAS M. MÜLLER, *Universität Leipzig,* PETER MALINOWSKI, *University of Liverpool,* & THOMAS GRUBER, *Universität Leipzig*—A long-standing controversy has centered on the question of whether the spotlight of spatial attention has a unitary beam or whether it can be divided flexibly to disparate locations. Evidence supporting the unitary spotlight view has come from numerous behavioral and electrophysiological studies. Recent experiments, however, indicate that the spotlight of spatial attention may be divided between noncontiguous zones of the visual field for brief stimulus exposures (<100 msec). The present study used an electrophysiological measure of attentional allocation (the steady-state visual evoked potential) to show that the spotlight may be divided between spatially separated locations (excluding interposed locations) over more extended time periods. This spotlight division appears to be accomplished at an early stage of visual-cortical processing.

2:15–2:35 (68)
The Primate Prefrontal Cortex and the Executive Control of Attention. LESLIE G. UNGERLEIDER, ANDREW ROSSI, & LUIZ PESSOA, *NIMH*—Many objects in natural visual scenes compete for attention. To identify the neural mechanisms involved in the top-down control of attention, we prepared monkeys with unilateral lesions of the prefrontal cortex in combination with section of the forebrain commissures and examined their performance in the affected and unaffected hemifields on a variety of attention-demanding tasks. The results showed that, when a target stimulus is surrounded by irrelevant distractors, the prefrontal cortex is critically involved in the selection of the behaviorally relevant target for processing resources and in updating this information from moment to moment. Parallel imaging studies reveal the focus within the human prefrontal cortex for these attentional effects.

2:40–3:00 (69)
Brain Correlates of Search and Detection by Linear Modeling of BOLD-fMRI Signals. MAURIZIO CORBETTA & GORDON L. SHULMAN, *Washington University* (sponsored by Gordon L. Shulman)—Linear models were used to quantify the contribution of temporally overlapping processes (sensory, search, detection) to the BOLD signal variance within/across brain regions during visual search. Subjects searched noise to detect targets defined by either motion direction or alphanumeric characters. The model accounted for large fractions of the BOLD signal variance over the whole brain. Search-related activity was observed in the intraparietal cortex and the frontal eye field, consistent with a role of these regions in top-down control. Conversely, the temporo-parietal junction, a region implicated in target reorienting, was deactivated during search, suggesting that stimulus-driven mechanisms are suppressed during the application of top-down sets. Target detection triggered both task-specific (e.g., MT + for motion targets) and task-general modulations. Finally, activity in occipital visual and frontal premotor regions were modulated by both "hits" and "misses," which is consistent with a continuous flow of sensory signals into motor stages of processing.

Recollection and Familiarity
Regency AB, Friday Afternoon, 1:00–3:10

Chaired by William E. Hockley, Wilfrid Laurier University

1:00–1:20 (70)
What Do Recognition Memory ROCs Tell Us About Recollection and Familiarity? ANDREW P. YONELINAS, NEAL E. A. KROLL, & JOEL R. QUAMME, *University of California, Davis*—There is a rapidly growing body of research using receiver-operating characteristics to examine the processes supporting recognition memory. Several regularities have now been established that place critical constraints on theories of human memory. We examine the current theories in light of these findings and argue that dual-process and, possibly, multiprocess theories are necessary in order to account for the existing results.

1:25–1:35 (71)
***A′*, *d′*, and the One-Dimensional Model of Remember–Know Judgments.** NEIL A. MACMILLAN, *Brooklyn College, CUNY,* & CAREN M. ROTELLO & MICHAEL F. VERDE, *University of Massachusetts, Amherst*—A recent meta-analysis of remember–know–guess experiments (Gardiner et al., 2002), as well as our updated version of Donaldson's (1996) meta-analysis of remember–know experiments, compared sensitivity based on remember responses alone with sensitivity based on remember and know responses combined. The one-dimensional model of remember–know judgments predicts that these estimates should be equal, but they are not: An analysis based on A' shows that the addition of know responses produces an increased estimate of memory strength, whereas one based on d' concludes the opposite. We show that this discrepancy arises naturally from the psychophysics of the two measures. The signal detection approach is more consistent with ROC data from rating experiments and is, therefore, preferred. However, the ROC slope inferred from remember–know experiments differs from that obtained in rating experiments.

1:40–1:55 (72)
The Neural Basis of the Butcher-on-the-Bus Phenomenon: Brain Potentials Associated With Pure Familiarity in a Face Recognition Test. KEN A. PALLER, *Northwestern University,* & GALIT YOVEL,

MIT—Two qualitatively different experiences associated with episodic memory are pure familiarity (an unsubstantiated impression that something was experienced previously) and recollection (remembering some information plus the spatiotemporal context of the episode in which it was acquired). The epitome of pure familiarity—the butcher-on-the-bus phenomenon—occurs when one believes that a person is familiar (often upon seeing a face in an atypical context) while simultaneously failing to recall any information about that person whatsoever. To induce pure familiarity of this sort, we presented photographs of unfamiliar faces, each paired with a unique occupation. When participants subsequently recognized a face, recollection was inferred if they also remembered either the associated occupation or any other episodic detail. Pure familiarity was inferred when recognition occurred in the absence of any such contextual retrieval. Analyses of brain potentials suggested that a subset of the neural processing responsible for recollection supports pure familiarity.

2:00–2:15 (73)

The Correlated-Processes Signal Detection Model of Recognition Memory. EDGAR ERDFELDER, *University of Mannheim,* & AXEL BUCHNER, *Heinrich-Heine-Universität, Düsseldorf*—Dual-process models of recognition memory presume that both a controlled recollection process and an automatic familiarity process contribute to memory performance. The models differ in whether controlled and automatic processes are assumed to be uncorrelated (independence model), positively correlated (redundancy model), or negatively correlated (exclusivity model). Unfortunately, the measurement models suggested to date do not provide for measuring the correlation between processes. As a response to this problem, we present a generalization of the dual-process signal detection model of Yonelinas (1994) that can be used for assessing empirically whether the probability of recollection tends to increase, to decrease, or to remain unaffected when the familiarity level increases. Applications of this model show that the independence assumption routinely employed in dual-process measurement models is not always adequate.

2:20–2:40 (74)

What Signal Detection Theory Predicts About Remember/Know Judgments. JOHN T. WIXTED, *University of California, San Diego,* & VINCENT STRETCH, *University of Southern Mississippi, Gulf Coast*—Dual-process theories of recognition memory generally hold that (1) familiarity is a fast process, whereas recollection is a slow process, and (2) familiarity fades rapidly with increasing retention interval, whereas recollection fades more slowly. If "remember" responses reflect recollection and "know" responses reflect familiarity, then, according to these standard tenets of dual-process theory, know responses should (1) be made faster than remember responses, and (2) fade away more quickly than remember responses with increasing retention interval. A signal detection analysis of remember/know judgments requires the exact opposite outcomes. Such an analysis also suggests that remember hit and false alarm rates will be positively correlated across individuals, a correlation that would be somewhat odd on the basis of the notion that remember responses accurately reflect recollection of the study episode. New data will be presented (and old evidence will be reviewed) bearing on these predictions.

2:45–3:05 (75)

Reducing False Memories: Recollection Rejection, Distinctiveness, and Metacognition. CHARLES J. BRAINERD, VALERIE F. REYNA, & RON WRIGHT, *University of Arizona,* & AMBROCIO H. MOJARDIN, *Free University of Sinaloa*—Attention has recently turned to cognitive mechanisms that subjects use to weed out false memories. There are three distinct mechanisms that are often conflated: recollection rejection, the distinctiveness heuristic, and metacognitive judgment. Different experimental paradigms have been devised to study these mechanisms—namely, conjoint recognition/recall (recollection rejection), within- versus between-subjects variations in stimulus salience (distinctiveness heuristic), and forced versus optional reporting (metacognitive judgment). We argue that these mechanisms are distinct because they differ in their representational assumptions, in whether they are thought to suppress the reporting of individual false items or entire classes of false items, and in whether they are thought to suppress the reporting of true as well as false information. They also follow a natural ontogenetic ordering. Implications for recollection and familiarity in dual-process models of recognition and recall are discussed.

Reasoning
Georgia, Friday Afternoon, 1:00–2:55

Chaired by Debi Roberson, University of Essex

1:00–1:20 (76)

The Transfer of Scientific Principles Using Concrete and Idealized Simulations. ROBERT L. GOLDSTONE, JI Y. SON, & ZACHARY PATTON, *Indiana University*—Participants in two experiments interacted with computer simulations designed to foster understanding of scientific principles governing complex adaptive systems. The quality of participants' transportable understanding was measured by the amount of transfer between two simulations governed by the same principle. The perceptual concreteness of the elements within the first simulation was manipulated. The elements remained concrete throughout the simulation, remained idealized, or switched midway into the simulation from concrete to idealized or vice versa. Transfer was better when the appearance of the elements switched, consistent with theories predicting more general schemas when the schemas are multiply instantiated. The best transfer was observed when originally concrete elements became idealized. These results are interpreted in terms of tradeoffs between grounded, concrete construals of simulations and more abstract, transportable construals. Progressive idealization ("concreteness fading") allows originally grounded and interpretable principles to become less tied to specific contexts and, hence, more transferable.

1:25–1:45 (77)

Acquiring Mental Models and Scientific Reasoning Skills. DANIELLE E. KAPLAN & JOHN B. BLACK, *Teachers College, Columbia University* (read by John B. Black)—Two experiments with middle-school students showed that providing facts and images relevant to constructing mental models of ecological systems improved student learning about the phenomena and also improved students' scientific inquiry about the phenomena. Students in the experiments interacted with a graphic computer simulation program to investigate which of five factors affected the amount of flooding a geographic area would get. Half of the students were presented with a few facts and images (e.g., sand has bigger grains than does clay) relevant to the acquisition of mental models related to flooding, whereas the other half were not. The students who received these extra facts and images both learned more about what causes flooding and learned better scientific inquiry skills (e.g., varying only one variable at a time). This was consistent with our hypothesis that in scientific inquiry, people test mental models, rather than just verifying propositions.

1:50–2:10 (78)

Reasoning About Possible Worlds. RUSSELL REVLIN, DUSTIN P. CALVILLO, & PATRICIA MAUTONE, *University of California, Santa Barbara*—Counterfactual reasoning is a universal phenomenon of human inference from childhood to adulthood. Yet the prevailing explanations seem able to capture only a limited aspect of the process and are in need of an overarching framework. We propose that David Lewis's possible-worlds analysis offers a first approximation to such a framework and gives a psychologically plausible account of counterfactuals. It identifies the unique properties of our ability to reason from false assumptions—whether talking about pretense or revising our beliefs. Three experiments are offered to suggest the plausibility of this account across age span.

2:15–2:30 (79)

Monkeys Linking Serial Lists: Test Cues and Link Training. F. ROBERT TREICHLER & MARY ANN RAGHANTI, *Kent State University*—Four adult, task-sophisticated macaques were initially WGTA trained on three 5-item serial-list tasks. Subsequently, in counterbalanced order, subjects got tasks that either did or did not provide linkage training to attach list-end items. Integration of short lists into a 15-item series was assayed via novel inter-list pairings. In separate tasks, selective, six-session, initial test exposure to pairs made up of objects from list positions conforming to their relative locations in training were compared with exposure to pairings with nonconforming locations. After linkage training, experience with only conforming locations slightly impaired long-list integration, relative to a control condition. However, without linkage, presenting only nonconforming pairs enhanced integration, relative to controls. These outcomes offer further specification and clarification of the interactive roles of knowledge of list positions from original learning and the nature of post-training information sufficient for list integration.

2:35–2:50 (80)

Relative Magnitude Judgments by Deaf and Hearing Individuals: Surprising Similarities and Surprising Differences. MARC MARSCHARK, *National Technical Institute for the Deaf & University of Aberdeen,* GARY BLATTO-VALLEE, *National Technical Institute for the Deaf,* REBECCA BULL, *University of Aberdeen,* & CESARE CORNOLDI, *University of Padua*—A series of experiments examined relative magnitude judgments by deaf and hearing individuals across several dimensions. Results consistently showed equivalent accuracy but longer RTs by deaf students (not found in nonmagnitude judgments). Symbolic distance effects for the two groups suggested similar processes underlying comparisons, even when judgments involved loudness. RT differences with word stimuli in size judgments were not surprising, but differences with picture stimuli and geometric figures suggested that deaf and hearing individuals may differ in the organization of magnitude information in associative memory. A search for SNARC effects found surprising similarities and differences in the mental number lines apparently held by individuals in the two populations, as did estimates of length and number of stimuli. The results are discussed in terms of experiential and knowledge differences in deaf and hearing individuals and the implications of the findings for explaining other educational differences observed between deaf and hearing individuals.

Semantic Processing of Words
Plaza, Friday Afternoon, 1:00–2:55

Chaired by Brenda C. Rapp, Johns Hopkins University

1:00–1:20 (81)

Semantic Effects in RSVP Target Search. MARY C. POTTER & JODI L. DAVENPORT, *MIT,* & DANIEL H. O'CONNOR, *Princeton University*—Does a semantic benefit for targets in an RSVP stream occur before word identification or later in processing? Potter, Staub, and O'Connor (2002) presented target words (T1 and T2) in two streams of symbols for 53 msec per item. SOAs between the targets were 53, 107, and 213 msec. An attentional blink (diminished performance on T2) was obtained at 213 msec, but at 53 msec, T2 was reported more accurately than T1. This crossover interaction was interpreted as reflecting a preidentification stage of target competition followed by a serial postidentification stage. When targets were semantically related, only T2 showed a benefit. When a related word signaled which target to report and when one target was primed by a category or an associated word, the benefit to that target was of the same magnitude regardless of SOA or whether the primed word was T1 or T2, suggesting a late locus in processing.

1:25–1:45 (82)

Semantic Processing of Unconsciously Perceived Words. KENNETH I. FORSTER, *University of Arizona*—Recently, there has been some debate about whether truly unconsciously perceived words receive a semantic interpretation. Evidence from masked semantic priming experiments is ambiguous, since priming in lexical decision is obtained only with relatively long SOAs (60 msec), suggesting the possible involvement of awareness. Congruence effects in semantic categorization tasks (slower responses when the prime belongs to a different category than the target) are also problematic in that the effects apparently require pretraining on the words that will later be used as primes. Several experiments will be reported that show unambiguously that semantic congruence effects can be obtained at short SOAs (55 msec) without pretraining. However, these effects depend on the type of category involved.

1:50–2:05 (83)

Enemies and Friends in the Neighborhood: Orthographic Similarity Effects in a Semantic Categorization Task. RENÉ ZEELENBERG, *Indiana University,* DIANE PECHER, *Erasmus University Rotterdam,* & ERIC-JAN WAGENMAKERS, *University of Amsterdam & Northwestern University*—Studies investigating orthographic similarity effects in semantic categorization tasks have produced inconsistent results. The present study investigated orthographic similarity effects in a semantic categorization task (animacy decision), and in contrast to previous studies, we took semantic congruency into account. In Experiments 1 and 2, performance to a target word (e.g., CAT) was better if a previously studied neighbor (e.g., RAT) was congruent (i.e., belonged to the same *animate/inanimate* category) than if it was incongruent (e.g., MAT). Experiment 3 investigated the influence of the preexisting orthographic neighborhood structure (i.e., neighbors were not previously studied). Performance was better for targets with more congruent neighbors than for targets with more incongruent neighbors. These results demonstrate that the effects of orthographic similarity in semantic categorization are conditional on semantic congruency. This strongly suggests that semantic information becomes available before words have been uniquely identified.

2:10–2:25 (84)

Competition Doesn't Reduce the Spread of Priming. KIMBERLY WEAR, DAVID S. GORFEIN, & HARRIETT AMSTER, *University of Texas, Arlington* (read by David S. Gorfein)—Deciding that *seal* is related to *dolphin* facilitates the decision that *walrus* is related to *otter*. A homograph first paired with an associate of one meaning (*seal*–DOLPHIN) and, later, with an associate related to a second meaning (*seal*–ENVELOPE) shows a performance decrement on the second pair. Several theories of ambiguity processing suggest that the selection of a homograph meaning inhibits associates of the alternative meaning. We tested the effect of repeated homograph trials on transfer of priming to related pairs such as *walrus*–OTTER and *glue*–SHUT. Processing a second occurrence did not turn off the effects of the first occurrence meaning but, instead, added facilitation to the second meaning processed. A further repetition of the homograph with the contrasting meaning (*seal*–STAMP) indicated competition by showing a further increase in response time for that pair, but associate pairs for both meanings were facilitated. Competition among meanings does not reduce the priming observed with associated pairs.

2:30–2:50 (85)

Electrophysiological Measures of Masked Word Priming. PHILLIP J. HOLCOMB, *Tufts University,* JONATHAN I. GRAINGER, *CNRS, &* MAYA MISRA & LINDSAY REDER, *Tufts University*—A host of studies over the past 2 decades have suggested that the N400 component of the event-related potential is sensitive to certain cognitive processes involved in word recognition (N400 amplitude being proportional to the difficulty of word processing). Although most studies have supported a postlexical locus for the process(es) reflected by the N400, recently a few studies have argued that the presence of N400 priming effects on target words following prime words masked below recognition levels is evidence that the N400 is directly sensitive to lexical or prelexical processes of a more automatic nature. We will report on several experiments from

our laboratory that have also found N400 masked priming effects (both repetition and semantic priming). However, we will argue that the presence of these effects does not support the argument that the N400 itself necessarily reflects an automatic lexical process.

Perception of Complex Visual Information
Regency E, Friday Afternoon, 1:00–3:00

Chaired by Maria Kozhevnikov, Rutgers University

1:00–1:15 (86)

The Perception of Whole-Body Expressions. BEATRICE DE GELDER, *Tilburg University & NMR-MGH*—Arguments for natural expertise for facial expressions can be applied seamlessly to whole-body expressions. Facial expressions are often produced and perceived as part of movements of the whole body. As was noted quite a while ago, "a great deal is added to facial expressions by the accompanying movements of the body and in many cases [body movements] enable us to read significance in to the facial aspects which we otherwise should miss" (Allport, 1924). Our goal was to investigate some of the procedures whereby body expressions are recognized and their relationship with facial expressions. In one set of experiments, recognition of basic body expressions was investigated by contrasting emotional and neutral expressions. In the second set, configural processing was probed with the body inversion effect. Like face expressions, body expressions are perceived automatically and configurally. Finally, the interaction between facial expressions and whole-body movements was explored using CP.

1:20–1:35 (87)

Turning Configural Processing Upside Down: Part- and Whole-Body Postures. CATHERINE L. REED, *University of Denver,* VALERIE E. STONE, *University of Denver & University of Queensland,* & JEFFERSON D. GRUBB, *University of Denver*—Like faces and unlike most objects, body postures are susceptible to an inversion effect in untrained viewers (Reed, Stone, Bozova, & Tanaka, 2003). The inversion effect is indicative of configural processing. We investigate the type of configural processing used to process static body postures by manipulating the presence of body parts, body hierarchy, and template information. Using a classic inversion effect paradigm, we compared the presence and magnitude of the inversion effect for body parts, scrambled bodies, and body halves relative to whole bodies, as well as to corresponding conditions for faces and houses. Our results suggest that although local part position information is not enough to evoke configural processing, body hierarchy information is necessary. Furthermore, the results indicate that the presence of all face or all body parts are not required for configural processing, arguing against a strong template version of configural processing.

1:40–1:55 (88)

Integration of Conceptual and Perceptual Information in Degraded Pictures: Evidence from EEG. BETHANY R. KNAPP, ROBERT L. GOLDSTONE, & THOMAS A. BUSEY, *Indiana University* (read by Thomas A. Busey)—Interpretation of degraded pictures often occurs only after it has been paired with the undegraded version. We examined the neural correlates of image understanding, using EEG recording. Knowledge of the picture's content produces strong activity in a central-frontal component, which separates from activity produced by uninterpreted images at about 400 msec from stimulus onset. In a second experiment, we preceded each degraded stimulus with either a correct or an incorrect text-based description of the image that served as a prime. We found that presenting the correct prime resulted in earlier differences between the interpretable and the uninterpretable conditions, beginning around 300 msec. A third experiment with neutral primes confirmed that the effect of the prime is facilitatory. Together, all three experiments support the view that conceptual information can be integrated with perceptual input to speed the interpretation of the degraded picture as early as 300 msec after stimulus onset.

2:00–2:10 (89)

Perceptual and Conceptual Contributions to the Picture Superiority Effect. GEORG STENBERG, *Växjö University*—Pictures are typically better remembered than words, but explanations for this fact diverge. Some attribute picture superiority to more distinctive perceptual qualities, others to more efficient conceptual processing. In an effort to separate perceptual and conceptual factors, two groups were presented with mixed lists of pictures and words and were subsequently tested for recognition in either the original or the opposite (picture/word) format. One group, the format inclusion group, was instructed to endorse both formats of a studied item; the other, the format exclusion group, was instructed to endorse only the original format. Multinomial models were fitted to the response data, with separate parameters for a high-threshold process (recognizing items of high familiarity) and a low-threshold process (rejecting items of low familiarity). Model testing showed that both conceptual and perceptual processing was more efficient for pictures than for words. Especially, the low-threshold process showed dramatic picture superiority.

2:15–2:30 (90)

Use of View-Based and Structure-Based Cues in Object Recognition. WILLIAM G. HAYWARD, *Chinese University of Hong Kong,* SIN CHI CHEUNG, *Vanderbilt University,* & MICHAEL J. TARR, *Brown University*—Recent studies suggest that both view-based and structure-based information are used in object recognition decisions. We tested this idea by varying the number of geons in an object and the variability of the cross-sections with which those geons were created. In the one-geon object set, the central part of each object was a geon, with two identical cylinders on either side (as in Biederman & Gerhardstein, 1993); in the five-geon set, all five parts were geons (as in Tarr et al., 1997). A sequential-matching task was used with rotations of up to 900. For the one-geon set, small viewpoint costs were observed. For the five-geon set, viewpoint costs were larger and were modulated by cross-section variability; when the variability of geon cross-sections was relatively constrained, viewpoint costs were higher. These results suggest that structure-based cues strongly influence recognition decisions but that this structural information retains view-based characteristics.

2:35–2:55 (91)

Shape Tuning in Macaque Inferior Temporal Cortex. IRVING BIEDERMAN, *University of Southern California,* & RUFIN VOGELS & GREET KAYAERT, *Katholieke Universiteit Leuven Medical School*—Single cells in the macaque IT are more sensitive to differences in nonaccidental properties (NAPs) than in metric properties (MPs), when the physical differences of the stimuli for the two types of changes are equated. Indeed, the magnitudes of MP stimulus differences have to be made about 50% larger than the NAP differences to yield equal differences in neural modulation. For equal stimulus changes, the modulation produced by depth rotation is equivalent to that produced by MP differences. The average greater sensitivity to NAP versus MP differences is (1) largely invariant of the surface character of the object (i.e., whether a 3-D rendered gray-level object, a silhouette, or an outline), (2) tied to a particular dimension (or dimensions) of generalized cylinders, and (3) maintained with nonsymmetric shapes of moderate complexity, but not for shapes resembling texture masses. Implications for theories of shape recognition will be discussed.

Movement and Action
Regency F, Friday Afternoon, 1:00–3:00

Chaired by Daniel Gopher, Technion–Israel Institute of Technology

1:00–1:15 (92)

What Did They Do, Feel, and Say? Interpretation of Human Movement. RUTH S. DAY, *Duke University,* & ROBERT HUBAL, *Research Triangle Institute International*—Much is known about the features used to perceive and interpret facial expressions. Less is known about the features used to perceive and interpret whole-body move-

ment. A series of experiments used both human and virtual figures to examine how people code, remember, and interpret movement sequences. We examined linguistic codability (the ease with which people can name simple movements), as well as identification (the content of the names). A novel linguistic prediction task was especially revealing—participants indicated what the silent figures might be saying as they moved. This research shows that multiple tasks are essential for examining movement perception and interpretation. It holds implications for theories of emotion and has applications to many situations in the everyday and virtual worlds—including how dancers learn and remember movement sequences, how police officers interpret the movements of alleged perpetrators, and how physicians interact with patients.

1:20–1:35 (93)

The Meaning of Action. BRIDGETTE MARTIN & BARBARA TVERSKY, *Stanford University* (read by Barbara Tversky)—Ordinary events performed by hands, such as doing the dishes, are segmented hierarchically, with the coarse level distinguished by objects or object parts and the fine level by fine-grained actions on objects. This research examined segmentation of abstract motion paths of geometric figures. Viewed once, they were interpreted as movements; viewed five times, as intentional actions. The same segments were selected with low and high experience, suggesting that for these events, bottom-up changes in physical action drove segmentation and experience led to deeper interpretations of the same actions.

1:40–1:55 (94)

Large Perspective Variations Yield Accurate Shape Perception as Shown by Reaching. GEOFFREY P. BINGHAM, *Indiana University*—Feedback has been found to calibrate distance and size perception, but not shape perception, when used to guide reaches (Bingham, submitted). Bingham, Crowell, and Todd (submitted) found that distance and shape perception are independent. When does shape perception become accurate? Large perspective variations (90º) are now found to yield accurate shape perception. Perception, not memory, is shown to be required for this in two ways. First, continuous 90º perspective changes enable observers to discriminate false rotations from true rotations and to use the latter to get shape right, but discrete 90º changes in perspective do not. Second, performance improves parametrically with increasing amount of continuous perspective change up to 60º.

2:00–2:15 (95)

Catching Fly Balls in VR: Manipulation of Ball Trajectory and Gravity. WILLIAM H. WARREN, JR., PHILIP W. FINK, & PATRICK S. FOO, *Brown University*—How do outfielders catch fly balls? Several visual strategies have been proposed (optical acceleration cancellation [OAC], linear optical trajectory [LOT], predicted distance [PD]), but none of them maps optics into action. We describe a second-order model in which the outfielder's radial acceleration (toward the ball) is controlled by OAC and the transverse acceleration is independently controlled by canceling the ball's horizontal optical velocity. Using an immersive virtual environment, we test the LOT theory by perturbing the ball's trajectory and test the PD theory by changing gravity. College players jogged freely in a 40 × 40 ft area while wearing a head-mounted display that included a virtual glove, while head and glove position were tracked. Their paths smoothly adapted to the optical manipulations in a manner consistent with the model. Radial and transverse velocity varied in ways inconsistent with LOT, and participants quickly adjusted to changes in gravity, inconsistent with PD.

2:20–2:35 (96)

Top-Down Effects on Search for Biological Motion. THOMAS F. SHIPLEY, MANDY J. MAGUIRE, & JONATHAN S. BRUMBERG, *Temple University*—To study how humans represent action, we developed a biological motion search task where subjects indicated which one of four regions had a coherent action (the other regions had the same local motions with locations and phases randomized). Additional noise dots were added to all regions to reduce overall accuracy. Fourteen actions (e.g., walking, crawling, kicking) were employed. To see whether representations of action could facilitate search, three types of primes—valid, neutral, and misleading words—were presented before a trial (e.g., RUNNING, XXXXX, or JUMPING JACKS before point-light running). Looking for a particular action influenced search accuracy: Relative to neutral primes, valid primes improved performance, and misleading primes substantially reduced performance. Facilitation effects were larger for intransitive verbs than for transitive verbs, suggesting that the object of an action (e.g., the ball being kicked), which was not visible in these point-light displays, is a critical part of some action representations.

2:40–2:55 (97)

The Effect of Movement on Intermodal Temporal Order Judgments. JAMES C. CRAIG, *Indiana University*—Subjects judged whether a visual pattern or a tactile pattern had been presented first. The patterns appeared to move across the visual and tactile displays. Although irrelevant to the temporal order, the direction of movement affected the temporal order judgments (TOJs). If the two patterns appeared to be moving downward, the top pattern tended to be judged as leading the bottom pattern. When the directions were reversed, subjects tended to judge the bottom pattern as leading. Changes in SOAs of nearly 80 msec were required to overcome the effect of movement. Changing the spatial position of the displays such that the patterns no longer appeared to move toward one another eliminated the effect of movement on TOJs. The results indicate that these stimuli share a common environmental representation of space.

SYMPOSIUM II: The Visual Cognition of Natural Scenes
Regency CD, Friday Afternoon, 3:20–5:25

Chaired by John M. Henderson, Michigan State University

Introduction: The Visual Cognition of Natural Scenes. JOHN M. HENDERSON, *Michigan State University*—Interest in the visual cognition of natural, real-world scenes has exploded in the past several years as it has become clear that scenes have unique properties that distinguish them from other sorts of natural visual stimuli (e.g., faces, objects), as well as from the simplified stimuli often employed in vision research. The talks in this invited symposium will focus on cutting-edge work in the visual cognition of natural scenes, bringing together established leaders in the field and young investigators who are breaking new empirical and theoretical ground. The symposium will present new perspectives, research methods, and empirical findings in scene recognition, representation, and memory. The reported research will be of interest to investigators in visual perception and visual cognition, as well as to researchers in such areas as memory and language, where the use of natural scenes as stimuli has recently become critical for distinguishing among competing theories.

3:25–3:40 (98)

A Neural Account of Spontaneous Visual Selection. IRVING BIEDERMAN, *University of Southern California*—Where we look with our next fixation or our selection of which movie to see or book to read is decidedly nonrandom. What controls this selection when an individual is not engaged in explicitly motivated search? And how can the selection be manifested in real time, at the rate of three visual fixations per second? The surprising discovery of a gradient of mu-opiate receptors in the macaque ventral cortical visual pathway, a system presumed to subserve visual recognition, may provide the key for understanding the spontaneous selectivity of perception and thought. Novel but interpretable perceptual inputs would lead initially to the most neural—and hence opiate—activity in the anterior regions of the ventral pathway, where the receptors are most dense. Repetition of a scene would result in less activity because of competitive interactions. The magnitude of the endomorphin (the effective ligand) activity would subserve preference, resulting in a preference for patterns that are

both novel and richly interpretable, because such patterns would initially activate many associations in memory. Ratings of scene preference and their decline with repetition reliably correlate with fMRI activity in the parahippocampal gyrus during passive 1-sec viewing of scenes. These are not feedforward effects in that nonpreferred and repeated scenes produce high activity in more posterior areas associated with attention.

3:45–4:00 (99)

Cognitive Influences on Gaze Control During Scene Viewing. JOHN M. HENDERSON, *Michigan State University*—In natural perception, the visual-cognitive system actively directs fixation through the current scene in real time. What factors determine where gaze is directed at any given moment? Recent work on this question has focused on the role of bottom-up, stimulus-driven variables in creating a saliency map to guide gaze. To the extent that top-down knowledge is considered in saliency-based models, it tends to be restricted to the visual properties of a specific search target. In this talk, I will discuss new eye movement data highlighting the critical and, in many cases, dominant influence of cognitive factors related to object and scene meaning on gaze control. An important challenge for current computational models is to incorporate such top-down knowledge into a more general account of gaze control in real-world scenes.

4:05–4:20 (100)

The Structure of Scene Representations. ANDREW HOLLINGWORTH, *University of Iowa*—Recent research has demonstrated that on-line visual representations of natural scenes are capable of accumulating information from many individual objects (Hollingworth & Henderson, 2002). But little is known about how this object information is structured. Are local objects represented independently of scene context, or are they integrated into a larger, scene-level representation? Are object representations maintained independently of spatial position, or are they bound to particular positions within the scene? In a series of experiments, participants viewed images of natural scenes. Each scene was followed by a test probing memory for the visual form of a single target object. Memory performance was reliably higher when (1) the target object was displayed at test within the original scene context versus in isolation and (2) the target object maintained its original spatial position at test. These results suggest that scene representations integrate information about the visual features and positions of local objects.

4:25–4:40 (101)

Recognition of the Gist of the Scene From Spatial Envelope Properties. AUDE OLIVA, *Michigan State University*—Studies in scene recognition have acknowledged that significant structural information is extracted within a glance to form a semantic "gist" of the scene. In this talk, I provide a theoretical framework of the "gist" based on experimental evidence that a scene can be recognized in a feedforward manner efficiently enough to influence object detection. The gist model is based on Oliva and Torralba's (2001) spatial envelope model showing that volumetric properties of scene image (e.g., its depth range, openness, and perspective—termed "spatial envelope" properties) can be extracted from a pool of low-level features and provide access to the scene category (e.g., street, forest). These scene primitives are preattentive primitives, computed holistically over the whole image without requiring any steps of scene segmentation and object recognition.

4:45–5:00 (102)

Perceptual and Conceptual Recognition of Scenes in Short- and Long-Term Memory. MARY C. POTTER, *MIT*—Recent work has shown that pictures presented in a rapid sequence can be retained for a few seconds, although most are then forgotten. This fleeting memory is at least partly conceptual. In new studies, we asked how readily pictures in LTM could be picked out from a rapidly presented sequence and whether conceptually similar pictures would be falsely recognized. Conceptually similar pictures produced false recognition with rapid testing, but not with slower testing. Pictorial details may be represented in LTM but are retrieved more slowly than conceptual gist.

5:05–5:20 (103)

Categorization Information in Scenes. PHILIPPE G. SCHYNS, *University of Glasgow*—Observers who categorize real-world scenes can use a wealth of information. Here, I will present an adaptation of Bubbles that sought to determine the luminance information that observers use to resolve abstract categorizations of a large database of real-world scenes. The technique is based on randomizing the phase of scene stimuli to understand which spatial frequencies must remain in phase to authorize a 75% categorization performance.

Producing Names
Regency AB, Friday Afternoon, 3:20–5:30

Chaired by Joseph Paul Stemberger, University of British Columbia

3:20–3:35 (104)

The Processing of Upcoming Targets in Multiple-Object Naming. ANTJE S. MEYER & JANE L. MORGAN, *University of Birmingham*—Speakers naming several objects fixate upon each object until they are about to initiate its name, suggesting that the objects and their names are processed in a highly sequential fashion. We examined how far the next object to be named is processed during the fixation of the current object. Participants saw and named arrays of three objects. During the saccade from the first to the second object, the latter object was replaced by a new one. The relationship between the old and the new second object was varied (unrelated, identical, homophonic, as in *buoy*/*boy*). The viewing times for the new objects revealed substantial preview benefits in the identical and the homophonic conditions, relative to the unrelated condition. It seems, therefore, that the phonological form of the original second object was retrieved, although it was only seen extrafoveally. The results of a second series of experiments using a probe paradigm support this conclusion.

3:40–3:55 (105)

Looking and Lying: Speakers' Gazes Reflect Locus of Attention, Not Content. ZENZI M. GRIFFIN, *Georgia Institute of Technology,* & DANIEL OPPENHEIMER*, Stanford University*—When people describe scenes, they gaze at each object that they mention for about 1 sec before referring to it (Griffin & Bock, 2000). The gaze durations are correlated with the difficulty of naming the objects (Griffin, 2001; Meyer et al., 1998). For 50% of scenes in a new experiment, speakers produced inaccurate but similar names for objects, such as intentionally calling a nurse "a doctor." Speakers gazed significantly longer at objects before saying inaccurate than before saying accurate names, both when fluent and disfluent. In an additional experiment, speakers gazed at objects for a similar duration before naming them accurately or with the nonword "blick." The results suggest that speech-related gazes are not motivated primarily by use of visual features in name retrieval. Instead, gaze locations reflect spontaneous allocation of visual attention to spatial locations that are associated with current cognitive processes.

4:00–4:15 (106)

Semantic Blocking and Item Repetition Effects in Object Naming. CATHERINE HODGSON, *University of Manchester,* & MYRNA F. SCHWARTZ, *Moss Rehabilitation Research Institute* (read by Myrna F. Schwartz)—M.P., a moderately severe nonfluent aphasic patient was exposed to a new object-naming paradigm, paced-cyclic naming, where a small set of items are presented repeatedly and at a fixed rate. The items were seen in both semantically blocked and unrelated conditions. Previous work with M.P. has shown that she is not influenced by semantic blocking on standard naming tasks even under speeded conditions (Schwartz & Hodgson, 2002). Recent work with nonaphasic speakers, using the paced-cyclic paradigm, indicates that participants may hold the items in working memory while doing the task and semantic interference stems from competition between items within

working memory (Pickard, Brandon, Hodgson, Schwartz, & Thompson-Schill, 2003). When encouraged to use working memory during the paced-cyclic naming task, M.P.'s naming performance was significantly influenced by the semantic-blocking manipulation.

4:20–4:40 (107)

Naming Difficulties in SLI and Dyslexia: Application of the Tip-of-the-Tongue Paradigm. MIRIAM FAUST, *Bar-Ilan University*—In a series of studies we used the "tip-of-the-tongue" (TOT) experimental paradigm to explore the source of naming difficulties of children and adolescents with specific language impairment (SLI) and dyslexia. As compared with typically developing children, the children with SLI and dyslexia had fewer correct responses and spontaneous recalls, more "don't know" and TOT responses, and less accurate "feeling of knowing" judgments.When they failed to retrieve a target word, the children with SLI and dyslexia did not differ from the control group in the partial semantic information that they provided but gave less valid and more invalid partial phonological information and benefitted less from phonological cues. These findings suggest that naming problems of children with SLI and with dyslexia arise because of difficulty in accessing the phonological word forms after the corresponding abstract lexical representation has been successfully accessed.

4:45–5:00 (108)

Production of Proper Names: Homophone Priming Effects in Young and Older Adults. DEBORAH BURKE, JILL LOCANTORE, & AYDA AUSTIN, *Pomona College,* & BRYAN CHAE, *Claremont Graduate University*—Familiar proper names are difficult to retrieve, especially for older adults. We investigated the role of phonological retrieval, using a homophone priming paradigm. Young and older adults produced a word for a definition and a proper name for a picture of a famous person. Prior production of a homophone (e.g., *pit*) for a definition increased correct naming and reduced tip-of-the-tongue experiences for a proper name (e.g., *Brad Pitt*). Among participants with no awareness of the homophone manipulation, older, but not young, adults showed homophone priming effects. The procedure in Experiment 2 reduced awareness. Prior production of a homophone improved correct naming only for older adults but speeded naming latency for both ages. We suggest that representations of proper names are susceptible to weak connections that cause deficits in the transmission of excitation, impairing retrieval especially in older adults. Homophone production strengthens phonological connections, increasing the transmission of excitation.

5:05–5:25 (109)

Homophone Production. MICHELE MIOZZO, *Columbia University,* & ALFONSO CARAMAZZA, *Harvard University*—We investigated the representation of homophones (e.g., *hair*/*hare*). Models that assume that homophones have distinct lexical representations predict that the processing of a homophone is affected by its specific word frequency. That is, the processing of *hare* should depend only on its frequency, and not on the frequency of *hair*. Models that propose that homophones share a lexical representation predict that the processing of *hare* depends on the summed frequencies of *hare* and *hair*. In one experiment, we examined how homophone distractors of different frequencies affected picture naming. The frequency of individual homophones, and not summed homophone frequency, predicted homophone interference. In a second study, we analyzed the responses of a brain-damaged patient who had problems accessing word phonology in speaking. The patient's naming accuracy depended on the frequency of the individual homophones. Our results support models that propose distinct lexical representations for homophone pairs.

Reasoning and Problem Solving
Georgia, Friday Afternoon, 3:05–5:00

Chaired by Russell Revlin, University of California, Santa Barbara

3:05–3:25 (110)

Tight Interactions Between Top-Down and Bottom-Up Processes in Causal Induction. WOO-KYOUNG AHN, *Yale University,* CHRISTIAN C. LUHMANN, *Vanderbilt University,* & JESSICAE K. MARSH, *Yale University*—Causal induction models (e.g., Cheng, 1997; Rescorla & Wagner, 1972) rely on information about whether the presence/absence of a causal candidate co-occurs with the presence/absence of a target effect. Although these models assume that the four types of information provide unequivocal and immutable evidence, we present two sets of experiments showing that a reasoner's initial hypothesis can dynamically change interpretations of data. Marsh and Ahn (2003) found that a causal candidate perceived as being equally similar to two polar values on a dimension is reinterpreted as being one of the two polar values when a dominant hypothesis is in place. Luhmann and Ahn (2003) found that unexplained effects presented early in a trial sequence encourage people to interpret later trials in favor of a hypothesis positing an alternative causal candidate. These results suggest that top-down and bottom-up processes in causal reasoning are not as separate as was previously assumed.

3:30–3:45 (111)

Effects of Time Pressure on Expert and Novice Category-Based Induction. JOHN D. COLEY, *Northeastern University,* & ELIZABETH BARAFF, *MIT*—This study examines expert/novice differences in categorical induction. In previous research, novices utilized taxonomic relations, resulting in similarity and diversity phenomena; experts showed similarity effects but not diversity, instead relying on specific relational knowledge. In the present study, music experts and novices rated the strength of categorical arguments about composers. In an unspeeded condition, novices exhibited similarity and diversity effects; experts exhibited similarity but not diversity. In a speeded condition, the relatively computationally complex diversity phenomenon should break down for novices, but the similarity phenomenon should persist. Results supported this prediction. For experts, time pressure might prevent the use of specific relational knowledge. Indeed, for experts in the speeded condition, both similarity and diversity effects were evident. Novice results support the relative computational complexity of diversity and similarity phenomena. Expert results suggest that specific relational knowledge supercedes but does not replace taxonomic relations, which are more accessible under time pressure for experts than for novices.

3:50–4:10 (112)

Why a Base Rate May Be Worth a Gazillion Words: EPIC Policy Development Experiments. EDWARD L. MUNNICH, JENNIFER M. GARCIA DE OSUNA, JANEK M. NELSON, & LAURA T. GERMINE, *University of California, Berkeley,* NICHOLAS LURIE, *University of North Carolina, Chapel Hill,* & MICHAEL A. RANNEY, *University of California, Berkeley* (read by Michael A. Ranney)—The numerically driven inferencing paradigm (NDI; Ranney et al., 2001) explores the relationships among estimation, preference, surprise, and conceptual change phenomena. A central question is, How do conceptions affect quantitative preferences about societal issues? Informed by literatures including attitude, social cognition, and judgment/decision-making, we employ variants of NDI's EPIC method, in which participants estimate quantities relevant to policies, state preferences for these values, receive actual base rate feedback to incorporate, and offer preferences again to exhibit any policy changes. Additional measures include caring and familiarity. Experiment 1 indicated that participants vastly underestimated the U.S. abortion rate, generally advocating a rate decrease, before and after feedback. However, feedback had dramatically divergent effects on most who initially had status quo preferences—bifurcating both their policies and their rationales. Experiment 2 contextualizes these findings, showing how alternative queries differentially frame estimates, preferences, and policy shifts. Finally, we introduce an EPIC-based curriculum designed to foster numeracy.

4:15–4:35 (113)

Diagram Construction Conventions and Their Effects on Diagram Use. SEAN M. HURLEY & LAURA R. NOVICK, *Vanderbilt University* (read by Laura R. Novick)—In order to successfully use abstract diagrams as an aid to problem solving, one must know the conventions for constructing the diagrams. We generated several hypotheses concerning the conventions for mapping problem information onto matrix, network, and hierarchy diagrams (e.g., objects are mapped onto nodes in networks and hierarchies and onto rows/columns in matrices). In two experiments, we determined the validity of the hypothesized conventions by analyzing (1) college students' verbal descriptions of how they would construct these diagrams for given situations and (2) their drawings of these diagrams. In Experiment 3, we examined the importance of the conventions for successful and efficient diagram use by evaluating students' reasoning time and accuracy when they had to answer questions by using diagrams that were constructed in a manner that either followed or violated the hypothesized conventions. We found strong effects of convention adherence on reasoning time and accuracy for matrices and networks.

4:40–4:55 (114)

Debiasing by Diagram in Judgments of Anaesthesia Risk. THOMAS C. ORMEROD & JENNIFER KOTULAK, *Lancaster University*—An ongoing debate concerns the effects of notations upon decision making—some studies showing facilitation (e.g., reduction in base rate errors) by frequency notations, as compared with probability notations, others suggesting an interaction between notation and numerical problem complexity. We report two experiments in which undergraduate participants tackled decision-making problems in the domain of anaesthesia risk. The first experiment replicated facilitating effects of frequency notations with complex numerical problem contents. In the second experiment, participants were shown diagrams that represented incrementally each piece of problem information in a notation-independent form. Diagrams facilitated performance only with probability notations, bringing performance up to the level of the frequency format. Analysis of error types suggest that diagrams encourage a strategic switch by participants reasoning with a probability notation, which does not occur when diagrams are presented with a frequency notation.

Divided Attention and Parallel Processing
Plaza, Friday Afternoon, 3:10–5:05

Chaired by Suparna Rajaram, SUNY, Stony Brook

3:10–3:30 (115)

Success and Failure in Promoting Parallel Central Processing With Incentives. ERIC D. RUTHRUFF, JAMES C. JOHNSTON, & ROGER W. REMINGTON, *NASA Ames Research Center*—Psychological refractory period (PRP) research has revealed severe limitations on the human capability for parallel processing. These limitations are most apparent for central operations, which queue up and proceed sequentially. Exceptions are rare and have been limited to performance after extensive practice or with extremely "natural" stimulus–response mapping rules. We recently uncovered a new exception, however, by providing unusually strong incentives for parallel processing. Two tasks that produced response time delays of several hundred milliseconds in a traditional PRP paradigm produced almost no interference under the new methodology. Traditional PRP studies, therefore, appear to have greatly underestimated human multitasking capability. Nevertheless, application of the new methodology to more difficult tasks shows that this multitasking capability is not unlimited. Thus, these experiments have extended our estimate of the parallel processing performance envelope but have also indicated that this performance space remains bounded.

3:35–3:55 (116)

Processing Limitations in Dual-Task Performance: Are Ideomotor-Compatible Tasks Special? MEI-CHING LIEN, ROBERT S. McCANN, & ERIC D. RUTHRUFF, *NASA Ames Research Center,* & ROBERT W. PROCTOR, *Purdue University* (read by Robert S. McCann)—The present experiments examined possible boundary conditions on the central bottleneck model of the psychological refractory period (PRP) effect. Two issues were addressed. Can the central bottleneck model account for the small PRP effects found with ideomotor-compatible (IMC) tasks? Are IMC tasks processed differently than non-IMC tasks? In four experiments, various combinations of IMC and non-IMC tasks were examined. In all cases, dimensional overlap existed between Task 1 and Task 2 response codes. PRP effects were small when both tasks were IMC and large when both were non-IMC. Cross-task correspondence effects were found only when both tasks were non-IMC. Analyses of response time distributions and model-based simulations suggest that, although the PRP effects were consistent with a bottleneck model, the locus of the bottleneck differs for IMC tasks, as compared with non-IMC tasks. These findings suggest that processing IMC tasks is a "special case" that is difficult to reconcile with the standard version of the central bottleneck model.

4:00–4:15 (117)

Neural Synchronization Predicts Performance in the Attentional Blink Task. JOACHIM GROSS, *Heinrich-Heine-Universität, Düsseldorf,* KIMRON SHAPIRO, *University of Wales, Bangor,* FRANK SCHMITZ & KLAUS KESSLER, *Heinrich-Heine-Universität, Düsseldorf,* BERNHARD HOMMEL, *University of Leiden,* & ALFONS SCHNITZLER, *Heinrich-Heine-Universität, Düsseldorf* (read by Kimron Shapiro)—The attentional blink (AB) is a deficit in accurately reporting a second target occurring within 100–500 msec of the first. Using magnetoencephalography (MEG), we sought to determine whether synchronization among brain regions is correlated with behavioral performance in the AB. Ten participants were required to identify either one or two specified letter targets, or none, from among a string of letter distractors, the latter condition separating the targets by both a short and a long lag to assess the occurrence of the AB. We find synchronization between occipital and left temporo-parietal regions in the beta (15 Hz) band to be involved in target identification and a synchronization among left temporal, right posterior parietal, and left frontal areas in the same frequency band that predicts when an AB will occur. Our results suggest that communication networks involved in dual-target identification may be an appropriate level of analysis to understand the AB phenomenon.

4:20–4:35 (118)

The Time-Window-of-Integration Model for Multisensory Integration. ADELE DIEDERICH, *International University, Bremen,* & HANS COLONIUS, *University of Oldenburg*—Saccadic reaction time to visual targets tends to be faster when stimuli from another modality (in particular, audition and touch) are presented in close temporal or spatial proximity. Here, we propose a quantitative stochastic framework, the time-window-of-integration (TWIN) model, to account for the temporal rules of multisensory integration. Saccadic responses collected from a visual–tactile focused attention task are shown to be consistent with the TWIN model predictions.

4:40–5:00 (119)

A Hemispheric Coactivation Hypothesis for Exaggerated Redundancy Gain in Split-Brain Individuals. JEFF O. MILLER, *University of Otago*—Recent studies indicate that redundancy gain is larger than normal when redundant visual stimuli are presented to different hemispheres of individuals without a functioning corpus callosum (e.g., Reuter-Lorenz, Nozawa, Gazzaniga, & Hughes, 1995). This result is surprising, because the disconnected hemispheres of such individuals should be incapable of pooling information about redundant stimuli and such pooling, or "coactivation," is thought to contribute to redundancy gain in normals. The surprising result can be explained by a "hemispheric coactivation" hypothesis, according to which both hemispheres contribute to the activation of a response: In split-brain individuals, both hemispheres are activated (and therefore, responses are fast) only when

stimuli are presented to both hemispheres. A formal model encapsulating this idea is developed. Its predictions are in good qualitative agreement with data from a number of sources, and its structure is supported by much existing neuroanatomical and psychophysiological evidence.

Language Research Methods
Regency E, Friday Afternoon, 3:10–5:30

Chaired by Victor S. Ferreira, University of California, San Diego

3:10–3:25 (120)
The English Lexicon Project: A Web-Based Repository for 40,481 English Words and Nonwords. DAVID A. BALOTA, KEITH A. HUTCHISON, & MELVIN J. YAP, *Washington University,* MICHAEL J. CORTESE, *College of Charleston,* JAMES H. NEELY, *SUNY, Albany,* & DOUGLAS L. NELSON, *University of South Florida*—Speeded naming and lexical decision data for 40,481 words were collected from 1,100 subjects across six different universities. The behavioral measures have been integrated with descriptive characteristics for every word and nonword used in the study and are now available at a user-friendly Internet-based repository (http://elexicon.wustl.edu). This Web site includes a search engine designed to generate lists of items with specific characteristics (e.g., length, frequency, orthographic neighborhood size, etc.) and access behavioral data for any subset of items. We will illustrate the types of questions that can be addressed via the ELP and will present first-pass regression analyses of targeted variables. These data represent the largest behavioral database on word recognition and are available to researchers to aid in selecting stimuli, testing theories, and reducing potential confounds in their studies.

3:30–3:50 (121)
SOA Does Not Necessarily Reveal the Absolute Time Course of Activation in Fast Priming Experiments. RAM FROST, *Hebrew University of Jerusalem*—Applying Bloch's law to visual word recognition research, both exposure duration of the prime and its luminance determine the prime's overall energy and, consequently, determine the size of the priming effect. Nevertheless, experimenters using fast priming paradigms traditionally focus only on the SOA between prime and target to reflect the absolute speed of cognitive processes. Some of the discrepancies in results regarding the time course of orthographic and phonological activation in word recognition research may be due to this factor. This hypothesis was examined by manipulating parametrically the luminance of the prime and its exposure duration, measuring their joint impact on masked repetition priming. The results show that small and unreliable priming effects can more than triple by simply increasing luminance, when SOA is kept constant. Moreover, increased luminance may substitute for additional exposure duration, and vice versa. The implications of these findings to the modeling of word recognition will be discussed.

3:55–4:15 (122)
FMRI Signal When People Generate Causal Inferences During Stories. MARK JUNG BEEMAN, *Northwestern University*—When people comprehend stories, they generate causal inferences as necessary to fill coherence gaps. Studies with neurological patients and with normal participants demonstrating inference priming of lateralized target words suggest that multiple, bilateral components of semantic processing are necessary for optimally drawing coherence inferences. For the present study, brain activity related to drawing inferences was assessed with functional magnetic resonance imaging (fMRI). Participants comprehended stories, and event-related fMRI signal at coherence breaks that followed text implying causal events was contrasted with the same points following explicit mention of the causal events. Results are interpreted in a framework positing bilateral activation, integration, and selection of semantic representations.

4:20–4:35 (123)
Results From an fMRI Language Identification Protocol Align Consistently With Those From Electrical Stimulation Mapping. KATHLEEN B. McDERMOTT & JASON M. WATSON, *Washington University,* MONICA V. BACIU, *Pierre Mendes-France University,* & JEFFREY G. OJEMANN, *Washington University*—Neurosurgical patients with seizure foci or tumors near presumed language cortex require precise localization of the neural substrates of language to define safe boundaries for excision. Cortical stimulation mapping (CSM) is used for this purpose but is suboptimal (e.g., requires awakening the patient during neurosurgery). Functional magnetic resonance imaging (fMRI) could provide preoperative assessment of language areas, but the inability of cognitive tasks to elicit robust fMRI activations within individuals has been an obstacle. Recently, McDermott, Petersen, Watson, and Ojemann (2003; *Neuropsychologia*) developed an fMRI protocol that identifies language regions in healthy young adults. In the present study, 20 neurosurgical patients (ages, 11–64) underwent this fMRI protocol and awake CSM in the operating room. On a case-by-case basis, language regions in the frontal and temporal cortex as identified with the fMRI protocol aligned with regions identified using CSM. Careful task analysis can lead to robust fMRI activations within individuals, which can have strong clinical implications.

4:40–5:00 (124)
Automated Discourse Analysis of Content: Schizophrenia and Team Cognition. PETER W. FOLTZ, *New Mexico State University,* BRITA ELVEVAAG, *NIMH,* & MELANIE J. MARTIN, *New Mexico State University*—Techniques to automatically analyze the content of discourse have typically relied on hand-coded methods. In this talk, we'll describe the use of latent semantic analysis to automatically analyze the content of spoken dialogue in order to measure cognition. We'll describe two separate domains in which transcripts have been analyzed (schizophrenia and team cognition). In schizophrenia, the coherence of the discourse from interviews with patients and controls was measured in order to predict the presence and severity of the disease. In team cognition, the discourse from teams interacting in flying a simulated unmanned air vehicle was used to predict their performance and types of cognitive processes during the task. In both cases, the techniques were able to provide accurate predictions. Implications for modeling and measuring cognitive processes as expressed through participants' dialogues will be discussed.

5:05–5:25 (125)
A Comparative Psychologist Looks at Language. HERBERT L. ROITBLAT, *DolphinSearch, Inc.*—Exposure to large language corpora and real-life language problems has shown that language is more complex than standard treatments suggest. For example, many approaches to characterizing human (as opposed to animal) language attach great importance to the criteria of systematicity, atomicity, and semantic transparency. Actual language use fails these three criteria. Instead, human language is often characterized by ambiguity, fuzzy representation, and semantic interactivity. Polysemy and synonymy are formidable problems. The Jabberwocky effect (creating new words) and the Humpty Dumpty syndrome (using old words in new ways) also challenge these criteria. Semantic illusions and semantic productivity also show that language is not fundamentally symbolic. Furthermore, language behavior is often formulaic and ritualistic, characteristics often attributed to animal "language." Finally, there is some evidence that syntactic complexity has been declining for the last 200 years, weakening another of the strong claims for human language as a unique system.

Associative Learning
Regency F, Friday Afternoon, 3:15–5:30

Chaired by William A. Roberts, University of Western Ontario

3:15–3:30 (126)
The All-or-None (A-O-N) Versus Incremental Learning Controversy: New Findings. CHIZUKO IZAWA, ROBERT G. HAYDEN, & MICHAEL FRANKLIN, *Tulane University*—HR (heart rate) and GSR

illuminated A-O-N versus incremental learning under Conditions ST, SSST, S, SSSSSSST, and STTTTTTT in paired-associate learning by 50 college students. No gradual learning occurred before or on the last error (unlearned state), decisively supporting A-O-N. Note: For Condition ST, criterion items (three consecutive correct responses, learned state) HR dropped within two to three trials from very high (intense concentration) to low (relaxed) a few trials before the criterion run. In the unlearned state, however, HR remained higher until the last error and dropped thereafter. Similarly, GSR among criterion items jumped from low to very high, then declined, reaching the criterion run level, again a few trials before the criterion run, and subsequently continued to decline. However, GSR in the unlearned state in general declined haphazardly until the last error and, thereafter, approximated the level of correct response(s). Notwithstanding design/observation limitations, the other four conditions supported these new findings.

3:35–3:55 (127)

Associative and Causal Reasoning Accounts of Causal Induction. FRANCISCO J. LÓPEZ, PEDRO L. COBOS, ANTONIO CAÑO, & JULIÁN ALMARAZ, *University of Málaga*—Associative and causal reasoning accounts are probably the two most influential accounts of causal reasoning processes. Only causal reasoning accounts predict certain asymmetries between predictive (i.e., reasoning from causes to effects) and diagnostic (i.e., reasoning from effects to causes) inferences regarding cue interaction phenomena (e.g., overshadowing effect). Given that the evidence gathered in the literature concerning this asymmetry is not conclusive, the four experiments reported here tried to delimitate the conditions under which these asymmetries do or do not occur. The results obtained showed that the causal scenario and the instructions provided to participants are relevant procedural factors for this delimitation.

4:00–4:20 (128)

Transfer Along a Continuum: More Than Just Generalization. I. P. L. McLAREN & M. B. SURET, *University of Cambridge*—We report a transfer-along-a-continuum effect in humans, dissociate it from perceptual learning, and show that it is unaffected by reversal after overtraining. These phenomena are modeled by adapting the Mackintosh (1975) associability algorithm so that it can be incorporated into the elemental model of associative learning developed by McLaren and Mackintosh (2000, 2002).

4:25–4:45 (129)

Is Spatial Learning a Special Case? OLIVER HARDT & LYNN NADEL, *University of Arizona* (read by Lynn Nadel)—The question of whether all forms of learning obey identical laws has been central to the field of animal (and now human) learning for decades. O'Keefe and Nadel (1978) proposed that the acquisition of cognitive maps involves a form of spatial learning that follows different rules and is subject to different constraints than traditional associative learning. This position has been challenged by studies claiming to show such associative-learning phenomena as blocking and overshadowing in spatial learning. We will discuss this theoretical debate, some recent experimental results, and our own studies of blocking in human spatial learning. We will argue that blocking occurs only when spatial learning is based on isolated cues, not on cognitive maps. Use of a cognitive map must be demonstrated, not assumed, before spatial learning and its properties can be investigated. We conclude that there is, in Tolman's words, "more than one kind of learning."

4:50–5:05 (130)

Superconditioning Under Three Conditions of Negative Patterning. DOUGLAS A. WILLIAMS, JAMIE L. DUMONT, & RICK MEHTA, *University of Winnipeg*—Three appetitive conditioning experiments with rats established that a complex XA+, XB+, XAB− negative patterning discrimination ("+" and "−" stand for reinforced and unreinforced, respectively) can be learned with either intermixed A+ and B+ trials (Experiment 1), AB+ trials (Experiment 2), or A+, B+, and AB+ (Experiment 3). In all three cases, differential responding emerged more slowly during learning of the negative patterning discrimination than during learning of an XA+, XB+, XC− control discrimination. In test, responding in the negative patterning group was always greater to X than to Y. This pattern was reversed in the control group. Results are consistent with a configural theory of associative learning.

5:10–5:25 (131)

Backward Blocking in Honeybees. P. A. COUVILLON, RACHEL E. BLASER, & M. E. BITTERMAN, *University of Hawaii*—Three experiments with foraging honeybees were designed to study the effect of A+ training on responding to B after AB+ training. In one experiment, responding to B after AB+ training was less in groups that also were given A+ training than in control groups that were equally often reinforced in the absence of A; whether the A+ training preceded, was concurrent with, or followed the AB+ training made no difference. In a second experiment, responding to B was less when the AB+ training was followed by A+ training than when it was followed by A− training (with exposure to reinforcement equated). The results suggest that responding to B after AB+ training is reduced by A+ training and may be increased by A− training, a relation opposite to that suggested by parallel experiments on within-compound association in honeybees. The same contradiction is to be found in the literature of vertebrate learning.

POSTER SESSION III
Fairmont Hotel–Conference Level, Friday Evening, 5:30–7:00

• PERCEPTION •

(3001)
Computer Users Do Not Use Oculomotor Resting States for Monitor Positioning. JEFFREY ANDRE, *James Madison University*—To investigate the relationships among resting states of the eye and computer monitor position, oculomotor resting states of the accommodative system (dark focus; DF), vergence system (dark vergence, DV), and resting gaze elevation (GE) were measured from college-aged participants. Similar to previous research, no relationship was found between DF and DV. Given the eye muscles used and the Heuer effect, it was somewhat surprising that a relationship was also not found between DV and GE. These resting states were then compared with the participant's preferred monitor-viewing distance and angle (from eye level) measured after a 15-min computer task. Monitor-viewing distance was not related to DF or DV distances, and GE was not related to monitor-viewing angle. This indicates that for short-term computer tasks, computer users do utilize their eyes' natural resting position when positioning the monitor. Research supported by the Office Ergonomics Research Committee.

(3002)
Interaction Between Vision and Audition in Face Recognition. ISABELLE BÜLTHOFF, *Max Planck Institute for Biological Cybernetics,* FIONA N. NEWELL, *Trinity College,* & HEINRICH H. BÜLTHOFF, *Max Planck Institute for Biological Cybernetics*—Face studies have shown that distinctive faces are more easily recognized than typical faces in memory tasks. We investigated whether a cross-modal interaction between auditory and visual stimuli exists for face distinctiveness. During training, participants were presented with faces from two sets. In one set, all faces were accompanied by characteristic auditory stimuli (d-faces). In the other set, all faces were accompanied by typical auditory stimuli (s-faces). Face stimuli were counterbalanced across auditory conditions. We measured recognition performance in an old/new recognition task. Face recognition alone was tested. Our results show that participants were significantly better [$t(12) = 3.89$, $p < .005$] at recognizing d-faces than s-faces in the test session. These results show that there is an interaction between different sensory inputs and that typicality of stimuli in one modality can be modified by concomitantly presented stimuli in other sensory modalities.

(3003)
On the Role of Voluntary and Involuntary Processes in the Perception of a Reversible Figure. THOMAS C. TOPPINO, *Villanova University*—In the course of investigating the mechanisms by which people exert voluntary control over the perception of a reversible figure (Necker cube), Toppino (in press) obtained the somewhat counterintuitive finding that the intent to maintain a particular orientation of a cube had a strong effect on the proportion of time during which observers perceived the desired alternative, while having relatively little effect on the number of reversals they experienced. This implies that involuntary mechanisms may play a dominant role in producing reversals and that reversal rate and the proportion of time each alternative is seen may be determined, at least partially, by different processes. These possibilities were investigated more systematically in two experiments assessing the effect of instructions to intentionally hold one perceptual alternative (vs. neutral instructions) and the effect of stimulus characteristics predicted to affect reversal rate (size in Experiment 1 and completeness in Experiment 2).

(3004)
Why Apparent Size of Afterimage Changes. LIANG LOU, *Grand Valley State University*—A series of experiments were conducted to explore how visual and proprioceptive cues influence the apparent size of afterimages, and how well Emmert's law characterizes the change of afterimage size with perceived distance under various cue combinations. Negative afterimages generated with a studio flash or prolonged staring were viewed against looming or receding optic flows that were either realistic or schematic, under conditions that controlled for accommodation and proprioceptive cues. Standard comparison methods were used for measuring the perceived afterimage size. Results suggest that (1) the effectiveness of optic flows in inducing the change of afterimage size is drastically reduced in the absence of proprioceptive cues and (2) both accommodation and depth attention may contribute to the change of the apparent size of afterimages. The implication of these results for theories of perceptual constancy will be discussed.

(3005)
Modal and Amodal Completion Generate Different Shapes. MANISH SINGH, *Rutgers University, New Brunswick*—Theories of visual completion posit that contour interpolation mechanisms operate independently of whether the completion is modal or amodal—thereby generating identical shapes in both cases. This identity hypothesis was tested using a two-overlapping-objects configuration and a modified Kanizsa configuration. Participants adjusted the shape of a comparison display in order to match the shape of perceived interpolated contours in a stereoscopically presented completion display. The separation and angle between the inducing edges and the completion type (modal/amodal) were manipulated. Results revealed large shape differences between corresponding modal and amodal contours. Amodal contours were perceived to be systematically more angular (i.e., closer to a corner), and modal contours more rounded, in all cases. The results falsify the identity hypothesis in its current form: Corresponding modal and amodal contours can have different shapes, and therefore, mechanisms of contour completion cannot be independent of completion type.

(3006)
Mislocalizations of the Onset Position of a Moving Target: Reconciling the Fröhlich and Onset Repulsion Effects. JOCHEN MÜSSELER, *Max Planck Institute for Psychological Research,* & DIRK KERZEL, *University of Giessen*—It has long been known that observers make localization errors in the direction of motion when asked to localize the onset position of a moving target (Fröhlich effect; e.g., Müsseler & Aschersleben, *P&P*, 1998). However, recent studies also have revealed the opposite: In the so-called onset repulsion effect, mislocalization was opposite to target motion when observers pointed to the initial position (Thornton, *Spatial Vision*, 2002). We demonstrate in two experiments that the conflict between these findings is resolved by considering the trial context: When the stimuli appeared at predictable positions to the left or right of fixation, pointing responses to the onset position were displaced in movement direction. In contrast, when the stimuli appeared at unpredictable positions in the visual field, pointing responses were displaced opposite to motion. Thus, localization errors vary with stimulus context. The theoretical implications of these findings are discussed.

(3007)
Mixed Messengers, Unified Message: Form From Temporal Synchrony. SHARON E. GUTTMAN, RANDOLPH BLAKE, & LEE A. GILROY, *Vanderbilt University*—By what mechanisms does the visual system group local features into global object representations? Previous research demonstrates that correlated temporal structure (*common fate*) supports the grouping of spatially segregated elements, suggesting a possible role for temporal synchrony in feature binding. By this proposal, the visual system should be sensitive to synchronized changes, abstracted from the nature of the changing stimulus attribute. Using objective grouping tasks, we investigate whether the visual system pools information across different *messengers* (e.g., orientation changes and spatial frequency changes) following the same point process. Our results indicate that observers effectively extract spatial structure from dynamic displays in which the relevant grouping emerges only by combining different types of synchronous changes;

furthermore, performance levels achieved when grouping across different messengers approaches levels achieved when all information resides within a single messenger. Evidently, the visual system abstracts temporal structure from the carrier of the dynamic change.

(3008)

Training Improves Reading Speed in Peripheral Vision: Is It Due to Attention? HYE-WON LEE, JOSHUA J. GEFROH, GORDON E. LEGGE, & MIYOUNG KWON, *University of Minnesota, Twin Cities*—Previous research has shown that perceptual training on a letter-recognition task in peripheral vision increases reading speed and letter recognition (Chung, Legge, & Cheung, 2002). We tested the hypothesis that enhanced deployment of attention to peripheral vision explains this training effect. Subjects were pre- and posttested with three tasks at 10º above/below fixation: letter recognition, RSVP reading speed, and attention. Attention was measured as the positional cuing effect on a lexical decision task in peripheral vision. Separate groups received 4 days of letter recognition in upper or lower fields or in central vision. A control group received no training. All groups exhibited a slight improvement in deployment of spatial attention to peripheral vision in the posttest, but this improvement does not account for the improved reading speed and letter recognition of the peripherally trained groups. Our results oppose an attentional account of the training effects on reading and letter recognition in peripheral vision.

(3009)

Expertise Perception of Karate Athletes in Realistic and Nonrealistic Displays. SHUJI MORI & YASUHIRO SEYA, *Tokyo Metropolitan University*—We report two studies that provided evidence for expertise perception in karate. In a first study (Mori et al., 2002), karate athletes were presented with videotaped scenes of opponent's offensive actions and were asked to judge whether the actions would be aimed at the upper or the middle level of their body. They judged faster and more accurately than novices. In a second study, karate athletes were presented with vertically moving random-dot patterns on which a target dot moved horizontally and were asked to point to a position at which the perceived path of the target motion was most distorted. The size of distortion represented the amount of induced motion that, in turn, was taken as an index of fixation against the moving background. The induced motion of karate athletes was larger and less variable than that of novices, suggesting the athletes' distinctive ability to fixate on a moving target (e.g., opponent's chest).

• Timing •

(3010)

An Indication for Process Switching: New Evidence for Subitizing. YU-CHI TAI & GEORGE W. McCONKIE, *University of Illinois, Urbana-Champaign*—The time required to enumerate a collection of items increases with its number. Responses are fast with little increase up to four items (<80 msec per item); above that, response time increases about 200 msec per item. Whereas some researchers take this as evidence for two different processes, subitizing and counting, others argue for continuity of a single process that is simply faster with small collections. We have observed a new phenomenon that supports the two-process position. In four experiments involving different presentation conditions and with different dependent variables (response time and eye fixation count) we consistently find that increasing the number from four to five produces a processing time increase that is greater than found with any other single-item increment. We suggest that this additional time indicates a transition between different types of enumerating processes, thus arguing for different processes being used with displays having few versus many items.

(3011)

Discrete and Continuous Cues to Quantity in Large Sets of Food Items. HILARY BARTH, *Harvard University*—Although large-number estimation systems appear to exist across many species, their biological relevance is not certain. To test the hypothesis that discrete number is used as a cue when total amount of food is judged, adult subjects were presented with two successive arrays of red circles, displayed too rapidly for counting. Subjects were told that the red circles represented food and that they were to choose which array they would want if they were hungry. An ideal forager should attempt to maximize overall amount independently of number; postexperiment surveys indicated that subjects did attempt to maximize total amount of food. However, performance demonstrated that discrete number often interfered, leading subjects to choose the smaller overall amount. As judgment by total amount became more difficult, dependence on discrete number became more frequent. Further studies exploring the contributions of additional quantity cues and comparing performance with other stimulus domains will be discussed.

(3012)

An Analysis of Interference Between Specific Processes Involved in Timing and Memory Tasks. LOBNA CHÉRIF, CLAUDETTE FORTIN, & JULIE CHAMPAGNE, *Université Laval*—Memory tasks involving encoding or retrieving information were performed during a time reproduction task involving the encoding and reproduction of a time interval. In Experiment 1, information on spatial order was encoded either during the encoding (E–E) or during the reproduction (E–R) phase of the time reproduction task. In Experiment 2, information on temporal order was retrieved from memory during the encoding (R–E) or the reproduction (R–R) phase of temporal reproduction. Overall, when either encoding or retrieving information from memory took place during the reproduction phase of the temporal task, reproduced durations were positively related to memory load. In contrast, increasing memory load did not affect reproductions when memory encoding or retrieval took place during the encoding phase of the temporal task. Together, these results suggest that the effect of memory processing on simultaneous timing varies depending on the specific operations required in the timing task.

(3013)

The Remembered Duration of Auditory and Visual Events. MARILYN G. BOLTZ, *Haverford College*—Two experiments examined whether the same mechanisms of duration memory apply to both auditory and visual events. Experiment 1 demonstrated that visual events containing a rhythmic array of information are better remembered than those displaying a less regular array—a result consistent with past research on auditory duration. Experiment 2 further revealed that retrospective duration judgments of events appearing in their auditory, visual, or audiovisual modalities yield a comparable level of accuracy and bias. These findings are discussed in terms of a theoretical framework that emphasizes the role of learning and event structure in the ability to encode and later remember the durations of various environmental events.

(3014)

The Perception of Filled and Empty Time Intervals By Rats. ANGELO SANTI, STEPHANIE HORNYAK, & JOANNA EIDSE, *Wilfrid Laurier University*—Rats were trained within sessions to discriminate filled intervals (2 and 8 sec of tone) and empty intervals (2 and 8 sec bound by two 500-msec tone markers). The houselight in the test chamber was illuminated during the intertrial interval. During the presentation of filled and empty time intervals signaled by tone, the houselight remained on for one group of rats (Group Same) but was turned off for a second group of rats (Group Different). Psychophysical testing indicated that the point of subjective equality was significantly lower for filled intervals than for empty intervals. Differentiating the intertrial interval from the trial itself did not significantly alter the perception of filled and empty intervals. Additional psychophysical test results at longer (4 and 16 sec) and at shorter (1 and 4 sec) anchor durations will be presented in order to confirm the reliability of a filled interval illusion in rats.

(3015)

Tempo Discrimination of Isochronous Tone Sequences: A Revised Multiple-Look Model. NATHANIEL MILLER & J. DEVIN McAULEY, *Bowling Green State University*—The present study examined whether improvements in tempo discrimination involving isochronous tone sequences are due to *multiple looks* at the time intervals comprising a standard sequence, a comparison sequence, or both. In the reported experiments, the number of intervals comprising standard and comparison sequences varied independently, and listeners judged the tempo (rate) of the comparison sequence relative to the standard sequence, responding "faster" or "slower." The results show that, in some instances, improvements in tempo discrimination are due to time interval repetitions within the comparison sequence, rather than within the standard sequence. The results of the present set of studies will be discussed in the context of a revised multiple look model, which takes into account the time intervals comprising both the standard and the comparison sequences.

(3016)

The Role of Guessing and Boundaries on Date Estimation Biases. PETER J. LEE & NORMAN R. BROWN, *University of Alberta*—The boundary effects (Huttenlocher, Hedges, & Prohaska, 1988) and associative models (Kemp, 1999) were compared using a dual-strategies approach. Participants provided knowledge ratings and date estimates for 64 news events. Four groups dated the same events under different boundary constraints. All responses showed that forward telescoping decreased with boundary age, concurring with the boundary effects position. However, when guesses were removed from the data set, backward telescoping (the tendency to provide relatively early dates for recent events) was greatly reduced, but forward telescoping (he tendency to provide relatively recent dates for older events) was not. In contrast, forward telescoping was reduced and backward telescoping increased when boundaries were not unspecified. This dissociation suggests that multiple factors (e.g., guessing and reconstructive strategies) are responsible for dating biases, argues against a boundary explanation of telescoping, and lends support for the associative approach.

(3017)

Self-Validating Presentation and Response Timing in Cognitive Paradigms. RICHARD R. PLANT, NICK V. HAMMOND, & GARY TURNER, *University of York* (sponsored by Jonathan Vaughan)—With the proliferation of commercial experiment generators and custom software within cognitive psychology, many have assumed that issues regarding millisecond timing have been largely solved. However, through empirical investigation of a variety of active researchers paradigms, we have discovered numerous sources of timing error. These range from poor scripting practices and incorrect timing specifications to hardware variability. In order to accomplish this, we have developed a low-cost portable device and associated software that enable researchers to benchmark most computer-based paradigms in situ and without modification. This gives them the opportunity to correct any timing errors, increase replicability, and reduce variability. For example, this can be accomplished by altering onset times for stimuli or post hoc statistical manipulation of response data. In this paper, we outline the features of the device and accompanying software suite, stress the importance of such independent validation, and highlight the main areas subject to error.

• Skill Acquisition •

(3018)

Introducing the "Sowing Method" for Controlling Occurrences of a Magnitude of Events: A Framework for Micro-Step Estimation. TAKAFUMI TERASAWA, *Okayama University,* TETSUYA YOSHIDA, *Tokoha Gakuen University,* & NOBUO OHTA, *University of Tsukuba*—This presentation introduces the sowing method, one of the micro-step estimation methods for accumulating personal data of responses to magnitude of events in daily life. In order to code personal "experiences" and draw accurate and useful inference for an individuals future, it is necessary to control occurrences of magnitude of events with regard to various contents. Up to now, most of the existing cross-sectional studies have accumulated data regarding a state of a person at a fixed time and have failed to provide any time series information. Longitudinal research requires a considerable effort to collect data through a long period. Moreover, longitudinal research is constrained by focusing on specific issues and particular groups of people. Thus, we introduce the sowing method to accumulate time series data by controlling timing factors in occurrences of individual events in daily life.

(3019)

Individual Differences Emerged in the Study Effect of 6-Month Learning of Second-Language Words by Using Tightly Controlled Learning Method. TETSUYA YOSHIDA, *Tokoha Gakuen University,* TAKAFUMI TERASAWA, *Okayama University,* NOBUO OHTA, *University of Tsukuba,* & YUKO IWAI, *Namiki High School, Japan* (sponsored by Nobuo Ohta)—This study examined individual differences in long-term effects of learning in second-language (English) word acquisition among senior high school students by using a new experimental design called the micro-step seeding method. The experimental design was developed to measure the effect of relatively long-term study for a continuous period. The principal feature of this method consists in employing subjective evaluation of students' achievement in English-word learning to measure the long-term effect of learning. We carried out English word learning for 6 months with 24 Japanese senior high school students. On the whole, the results clearly indicated the ascending effect of learning. The results also indicated large individual differences in the effect of study.

(3020)

A Statistical Model of Skill Acquisition. JEFFREY N. ROUDER, JUN LU, DONGCHU SUN, & PAUL L. SPECKMAN, *University of Missouri, Columbia*—Although researchers have long sought a functional form to describe the effect of practice in skill learning, finding one has been elusive. The main problem is that of statistical power. It is virtually impossible to learn a substantial amount from a single participant, and averaging across participants often distorts the functional form. We propose a Bayesian hierarchical statistical model for learning curve data that pools data across participants by jointly modeling between-subjects and within-subjects variability. Various hypotheses about the effect of practice on RT may be formulated and tested within the model. Analysis of math problem data (Reder & Ritter, 1992, *JEP:LMC*) reveals that the effect of practice is too steep to be fit with an exponential and is better fit with a power function. However, the estimated exponent in the power function is inconsistent with Logan's instance theory.

(3021)

Team Learning and Transfer in Different Contexts. ADRIENNE Y. LEE & GARY D. BOND, *New Mexico State University*—The goal of this research is to study the acquisition of knowledge for complex military tasks by both individuals within teams and by teams as a whole. In addition, this research (1) identifies places where individuals and teams have difficulty during the training session and with the transfer to a different context and (2) permits incorporation of those findings into computer tutoring systems. Initial research has tested transfer across contexts, where training occurs in either a face-to-face (co-located) or a remote (distance) manner and testing occurs in the opposite context. Results indicate that teams trained at a distance learned more quickly and, after the transfer to a new task (and/or context), recovered more quickly.

(3022)

Sorry, I Forgot Your Name: Comparing Name-Learning Techniques. JEFFREY S. NEUSCHATZ, *University of Alabama, Huntsville,* ELIZABETH L. PRESTON, *Vanderbilt University,* MICHAEL P. TOGLIA, *SUNY, Cortland,* JOSEPH S. NEUSCHATZ, *Roger Williams University,* & ANDREW FAIRLESS, *University of Alabama, Huntsville*—Two name-learning techniques were compared: expanding

rehearsal and name–face imagery. Participants studied name–face associations and were later given a cued recall test in which they were presented with a face and were to recall the name. Participants were presented with an expanding rehearsal schedule (expanding condition), a distinctive facial feature coupled with a word phonologically similar to the last name and an interactive image linking the name and the facial feature (name–face imagery condition), or no memory strategy. The expanding rehearsal schedule led to superior name learning, relative to the name–face imagery and control conditions after a 15-min (Experiment 1) or 48-h (Experiment 2) retention interval. In Experiment 3, these methods were combined, and the retrieval practice explanation was tested. Potential theoretical and applied implications are discussed.

(3023)

A Task Interrupted Becomes a Prospective Task. RAHUL M. DODHIA, *San Jose State University & NASA Ames Research Center,* & ROBERT KEY DISMUKES, *NASA Ames Research Center*—Interruptions to ongoing tasks are a special case of prospective memory (PM). In this situation, the prospective task is to remember to resume the interrupted task without prompting. PM performance depends heavily on the availability of cues associated with an intention to trigger its retrieval, but when real-world tasks are interrupted, individuals may not encode an association of the intention with potential cues. We present a flexible experimental design that can be used to explore features of common, real-world interruptions. The participant performs a series of naturalistic tasks, each of which must be completed before the end of the experiment. Occasionally, one task is interrupted by another task, in which case the participant must remember to return to the uncompleted task after the interruption. Using reminders to manipulate encoding, we show that weak or absent encoding of potential retrieval cues appears to be especially problematic in the case of interruptions.

• False Memories •

(3024)

Imagination Inflation in Memory for Real and Imagined Television Commercials. RICHARD D. PLATT & JULIA G. KURISCH, *St. Mary's College of Maryland*—During initial group sessions, undergraduate participants were asked to recall action figure (real) and cigarette (imagined) television commercials from childhood and to complete measures of dissociation and vividness of visual imagery. In two subsequent individual sessions, they were asked to use guided imagery to enhance recall for these two commercials. Memory detail, vividness, and confidence were assessed during each session. All three of these memory characteristics were higher in the guided imagery sessions for both types of commercials. Both dissociation and vividness of visual imagery generally exhibited negative correlations with all three memory characteristics for the cigarette commercial, but not for the action figure commercial. Amount of self-reported childhood television viewing was positively correlated with action figure commercial memory characteristics, but not with cigarette commercial memory characteristics. Results are interpreted in the context of source-monitoring theory.

(3025)

False Memories: The Effects of Encoding and Retrieval Manipulations. JEFFREY S. ANASTASI, *Arizona State University West,* MATTHEW G. RHODES, *Florida State University,* & FIONA QUINLAN, ANGIE GROCH, NADIA HAYAT, & JADE AVERY, *Arizona State University West*—Activation-based accounts of false memories argue that activation may occur at encoding, at retrieval, or at both. The present study investigates whether false memories are the result of encoding or retrieval factors. Four experiments are presented here in which encoding and retrieval manipulations are used to determine the primary cause of illusory memories. Results demonstrate that encoding manipulations seem to account for most of the false memory effect and that little activation seems to be occurring during retrieval.

(3026)

Effect of Speaker Gender on False Recall of Words. DAVID S. KREINER, ROBERT Z. PRICE, AMY M. GROSS, & KRISTY L. APPLEBY, *Central Missouri State University*—We investigated how the gender of the person reading a word list might interact with the listener's gender in affecting false recall. Sixty-five college students, ranging in age from 18 to 44 years, listened to eight word lists taken from Roediger and McDermott (1995) and attempted to recall the words immediately after each list had been presented. Each word list contained 15 words that were all associated with a nonpresented target word. Participants were randomly assigned to hear the word lists read in a female voice or a male voice. Participants recalled a mean of 3.61 (SD = 1.78) nonpresented target words out of 8 possible, indicating a false recall rate of 45%. There was no significant effect of participant gender and no significant effect of the gender of the presentation voice. Contrary to the hypothesis, participant gender did not interact significantly with presentation gender.

(3027)

The Modality Effect in False Recognition: Evidence for Retrieval-Based Monitoring. BENTON H. PIERCE, DAVID A. GALLO, & DANIEL L. SCHACTER, *Harvard University*—Prior work indicates that false recognition in the DRM paradigm is greater after auditory than after visual study. It is unknown whether this modality effect is attributable to activation and monitoring during study or to monitoring during the recognition test. In Experiment 1, we replicated the typical modality effect for DRM lists and extended it to categorized lists. Because activation and monitoring of lures is infrequent for categorized lists (Smith, Gerkens, Pierce, & Choi, 2002), this result suggests a retrieval-based monitoring process. In Experiment 2, we switched to a meaning-based test to remove the need for monitoring processes at retrieval. This manipulation eliminated the modality effect for both lists, which is again consistent with a retrieval-monitoring explanation. The modality effect may reflect retrieval-based processes similar, but not identical to, source-monitoring processes, such as the distinctiveness heuristic.

(3028)

Hierarchical Memory Distortions: The Mechanisms Underlying Basic-Level Convergence. AINAT PANSKY & ASHER KORIAT, *University of Haifa*—Whereas many findings suggest that memory may become more abstract over time, so that memory for gist outlasts verbatim memory, there are findings suggesting that abstract information may sometimes be instantiated in more specific terms. Our findings indicate that these two opposite trends may reflect a common tendency for retained information to converge at an intermediate level of abstractness—the basic level. In two experiments, we found bi-directional, symmetrical shifts in the memory for story material: Participants presented with either subordinate terms or superordinate terms tended to falsely report basic-level terms instead. The results suggest that the basic level, which has been considered cognitively optimal for perception, categorization, and communication, is also the preferred level for retaining episodic information. Additional studies were aimed at elucidating the mechanisms underlying this hierarchical distortion. In particular, we examined whether the same mechanisms underlie the upward and the downward shifts to the basic level.

(3029)

The Distinctiveness Heuristic in False Recognition and False Recall. DAVID P. McCABE & ANDERSON D. SMITH, *Georgia Institute of Technology*—The effects of generative processing on false recognition and recall were examined in four experiments using the Deese/Roediger–McDermott false memory paradigm. In each experiment, a generate condition, in which participants generated studied words from audio anagrams, was compared with a control condition, in which participants simply listened to studied words. False recognition and recall of critical lures associated with generated lists was lower than that of critical lures associated with control lists, but only for between-subjects designs. False recall and recognition did not differ when generate and

control conditions were compared on a within-subjects basis. This pattern of results is consistent with use of a distinctiveness heuristic (a decision-based strategy), rather than with changes in memory-based factors. These data also suggest that decision-based factors can operate in a similar fashion in reducing false recall, consistent with previous research examining false recognition.

(3030)

Can External Motivation Moderate False Memory? TERRI S. KRANGEL, RICHARD A. CHECHILE, SAL A. SORACI, & LISA M. SHIN, *Tufts University*—Our research demonstrated that encoding for strongly related but nonpresented critical words can be manipulated by presenting participants with payoff matrices that promote either lenient or stringent encoding. Participants were presented with lists of related words (e.g., *bed*, *rest*, *awake*) associated with nonpresented, critical foils (e.g., *sleep*) and were given a recognition list consisting of targets, critical foils, and noncritical foils. Among the incentive conditions, there were five payoff matrices that varied from lenient (i.e., low cost for errors) to stringent (i.e., high cost for errors). Signal detection analyses revealed that there was less false responding to critical foils in the stringent incentive conditions. Results indicated that the false memory effect can be attenuated, but not eliminated, by incentive manipulations.

• Memory •

(3031)

Hemispheric Activation Influences the Verbal Overshadowing Effect. MARTIN L. BINK, SARAH B. DAILEY, & PAUL LAMBERT, *University of North Texas*—The verbal overshadowing effect (VOE) refers to decrement in recognition of a target face following a verbal description of the target face. One recent explanation for the VOE suggested that verbalization causes a general processing shift that interferes with one's ability to process spatial information. The present study extended the general processing shift account by suggesting that the processing shift is mediated by cerebral hemispheric activation. To test this possibility, participants viewed a simulated bank robbery and then performed either a spatial task (right-hemisphere task) or a verbal task (left-hemisphere task). In addition, each task was presented in either the right visual field or the left visual field in order to produce hemispheric activation. Subsequent performance on identification of the bank robbery assailant indicated that best identification occurred when participants performed the spatial task with right-hemisphere activation and that poorest identification occurred when task hemisphere was inconsistent with hemispheric activation.

(3032)

Mediated Associations in Paired Associate Learning. MARC W. HOWARD & BING JING, *Syracuse University*—Double-function lists of paired associates include items that serve as both stimulus and response—for example, A–B, B–C, C–D, and so on. Slamecka (1976), using forced choice recognition, argued that double-function pairs are harder to learn as a consequence of associative interference between items. For instance, when tested with B–?, the correct answer (C) has to compete with a backward association (A) and remote associations (D). We examined both intrusion errors and results from final free recall to show that mediated associations indeed develop between words that were never presented together. Mediated associations are approximately symmetric among items that were never presented together and extend across several "links in the chain." This result provides a strong constraint on distributed memory models of cued recall.

(3033)

Conceptual Mediation Processes in Vocabulary Retrieval After Extended Practice. ROBERT J. CRUTCHER, *University of Dayton*—Employing an interference paradigm, two studies investigated the nature of mediated retrieval processes after extended retrieval practice (80 trials) of vocabulary pairs learned using keyword mediators. Following learning and retrieval practice, new associations to the original keyword mediators were acquired, followed by retesting of the original pairs. Experiment 1 tested a conceptual mediation hypothesis by having participants learn new associations to the original keyword mediators as well as to semantically related keywords. Experiment 2 tested a phonological mediation hypothesis by having participants learn new associations to the original keyword mediators as well as to phonologically related keyword mediators. Results supported conceptual, but not phonological, mediation after extended retrieval practice.

(3034)

Emotional Enhancement of Memory: Direct or Mediated? DEBORAH TALMI, MORRIS MOSCOVITCH, & ULRICH SCHIMMACK, *University of Toronto*—Is emotional enhancement of memory direct or mediated? Research has attributed the memory enhancement for emotional material to a direct influence of emotion on memory without exploring the alternative. Emotional material receives more attentional processing and is more organized than neutral material. Since these factors are known to improve memory independently of emotion, it is possible that emotion influences memory through its effect on attention and semantic organization, rather than directly. Experiment 1 showed that when semantic cohesiveness is controlled, emotional words are not remembered better than neutral words. Experiment 2 showed that the enhanced memory for emotional pictures is not due to the attentional capture for those pictures, as it is maintained even when attention is divided. Although the effect of emotion on attention is independent from its effect on memory, emotional influences on memory are at least partially mediated through the effects of emotion on semantic cohesiveness.

(3035)

Episodic Presentation Context Is Bound to Implicitly Activated Concepts. JEFFREY J. STARNS & JASON L. HICKS, *Louisiana State University*—Recent work (Hicks & Hancock, 2002) has demonstrated that falsely remembered concepts are associated with the contextual properties of studied concepts that caused their activation. Here, we report that this binding process causes source memory facilitation or interference when people experience a once implicitly activated concept in the same or a different presentation context (e.g., seen or heard) as its associative primes. People studied prime sets, such as DESK, SWIVEL, and ROCKING, implicitly activating targets such as CHAIR. The targets were always studied later in the encoding list. Three conditions were compared—prime sets were sometimes not presented (Case 1), presented in the same context as their eventual target (Case 2), or presented in the other context (Case 3). Source memory claims for the presentation context of target items was best in Case 2 and worst in Case 3, demonstrating binding of implicitly activated concepts to episodic contextual features.

(3036)

Adult Age Differences in Episodic Memory: Further Tests of an Associative Deficit Hypothesis. MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia, & Ben-Gurion University of the Negev,* JONATHAN GUEZ, *Ben-Gurion University of the Negev,* & ANGELA KILB, *University of Missouri, Columbia*—Extending Chalfonte and Johnson's (1996) work, Naveh-Benjamin (2000, 2002) advanced an associative deficit hypothesis to explain the episodic memory deficits seen in older adults. The hypothesis attributes a substantial part of this deficit to the difficulty older adults have in merging unrelated attributes/units of an episode into a cohesive unit. The reported work further tests this hypothesis, using different types of stimuli. In addition, several predictions of the hypothesis are evaluated. Finally, results are examined in an attempt to determine whether this deficit is mediated by depleted attentional resources or by a general slowing down of the old.

(3037)

In Search of an Optimal Intervention for Improving Older Adults' Cognitive Functioning. HELGA NOICE, *Elmhurst College,* & TONY NOICE, *Indiana State University*—Although it is widely accepted that performance of demanding mental activities is necessary

for maintaining cognitive health in older adults, researchers have tended to investigate the effects of cognitive stimulation in general. Relatively little is known about the comparative benefits of specific mental activities. The authors hypothesized that theatre training, due to the simultaneous cognitive–emotive–physiological activation required, should produce superior results, as compared with a widely used alternate intervention, visual arts. Results showed significant improvement for the theatre group after 1 month of instruction, as measured by batteries of four cognitive measures (recall, comprehension, memory span, problem-solving) and four affective measures (self-esteem, personal growth, positive relations with others, self-acceptance). Conversely, the results of visual arts instruction did not differ significantly from those observed with no-treatment controls. Thus, this study describes a short-term, cost-effective intervention that appears to elevate cognitive functioning in older adults.

(3038)

Adult Age Differences in Familiarity Depend on Which Process Estimation Method Is Used. MATTHEW W. PRULL, LESLIE L. CRANDELL, ARCHIBALD M. MARTIN III, & HEATHER F. BACKUS, *Whitman College,* & LEAH L. LIGHT, *Pitzer College*—Although age-comparative studies of recognition memory often reveal age-related reductions in recollection, the status of familiarity in normal aging is less clear. The divergent outcomes across studies for familiarity could be the result of differences in which a dual-process estimation method is used. Using the same groups of young (n = 36) and healthy older (n = 36) adults, we obtained process estimates from the inclusion/exclusion procedure, the two-stage remember/know procedure, and the dual-process analysis of receiver operating characteristics (ROCs). Recollection was diminished in older adults in all three methods, although the conclusion for familiarity depended on the specific estimation method. The inclusion/exclusion and remember/know methods revealed no significant age-related reductions in their estimates of familiarity, but the ROC method showed significant age-related decrements. Different methods of estimating familiarity in recognition memory, therefore, do not converge on a common conclusion in normal aging. Neuropsychological correlates of recollection and familiarity in older adults will also be presented.

(3039)

Free Recall for Common and Bizarre Dream Reports. JAMES B. WORTHEN, SARAH A. EISENSTEIN, SIOBHAN C. BUDWEY, & PAULA J. VARNADO-SULLIVAN, *Southeastern Louisiana University*—Previous research has indicated that bizarre dreams are better recalled than common dreams. However, interpretation of that research is complicated by different states of consciousness during encoding and retrieval. The present research was designed to test recall of bizarre and common dream reports encoded under either imaginal or non-imaginal conditions. In Experiment 1, participants were presented with either a purely common or a purely bizarre dream report. In Experiment 2, three different types of mixed (containing common and bizarre components) dream reports were tested: discontinuous reports, reports involving improbable identities, and reports depicting improbable combinations of stimuli. The results of Experiment 1 demonstrated that purely common dreams were recalled better than purely bizarre dreams when recall was scored strictly, but no differences were found when recall was scored leniently. Experiment 2 demonstrated that bizarre components of mixed dreams were recalled better than common components regardless of dream type and encoding condition.

(3040)

On the Formation of Collective Memories in Family Conversations. ALEXANDRU F. CUC & WILLIAM C. HIRST, *New School University*—The study examines the formation and transformation of collective memory in family conversation. People often jointly recount shared past events, and one possible resultant of this joint activity may be a consensual memory of what may have been initially quite distinct individual recollections. Family members were asked to read two stories and then recalled them individually (pregroup recollections), as a group, and then again individually (postgroup recollections). Although the pregroup individual recollections were distinct, the group recounting converged on a rendering of a group member (or two) identified as a *narrator*, someone who dominated the story telling. In the postgroup individual recollections, a mnemonic consensus arose with the consensus being greater the "stronger" the narrator. Not all conversations are equal in creating collective memories. Conversations are more likely to yield a subsequent increased mnemonic consensus if they are dominated by a single, strong narrator.

(3041)

How Common Are Memory Blends? KEVIN M. SAILOR & YANIRE ABREU, *Lehman College, CUNY*—Several recent theories of memory propose that memory is not a faithful reproduction of what was encountered but is a blend of what was encountered and knowledge about what is typically encountered (Estes, 1997; Huttenlocher, Hedges, & Vevea, 2000). We presented participants with simple pairings of a person's name and a height or weight or of a food name and a calorie count at study. Once veridical responses were removed, there was little evidence that the remaining responses were influenced by the specific value of the studied stimulus. These results suggest that the existence of memory blends may be substantially overestimated because of a number of methodological problems.

(3042)

Cues in Autobiographical Memories. KATINKA DIJKSTRA, *Florida State University*—Autobiographical memory research has shown that primes, lifetime periods, and cues ("what," "who") can facilitate memory retrieval (Conway & Bekerian, 1987; Wagenaar, 1986). This investigation examines the facilitation of primes, periods, and cues in a two-session experiment. In Session 1, participants elicited memories of general events during lifetime periods, as well as memories of specific events related to cue words. During Session 2, primes of the first session or fillers were shown to assess whether primes would lead to faster retrieval of specific events from that lifetime period. Retention for specific events was also assessed in Session 2, with and without cues (who, what, where, when) to determine which cues would provide better access to the memory from Session 1. Fifty undergraduate students (mean age = 20) participated. They showed benefits of cues and some primes for retrieval, which depended partly on remoteness and emotional intensity of the events involved.

(3043)

Intentional Use of Memory in the Autobiographical Task and the Self-Reference Effect. TAKASHI HORIUCHI, *Tokai Women's University*—The purpose of this study is to examine the influences of intentional use of memory in the autobiographical task on the self-reference effect. In Experiment 1, subjects were asked to judge each trait word in one of four conditions: autobiographical task, meta-autobiographical task, semantic task, and physical task. Then they were given the surprised recall task. Recall for the meta-autobiographical condition was less than that for the autobiographical condition and was not different from that for the semantic condition. In Experiment 2, subjects were asked to retrieve an episode associated with each trait word and reported "remember," "know," or "no." "Remember"-reported words were better recalled than "know"-reported words. These results suggest that intentional use of memory in the autobiographical task produces better performance in the following recall task.

(3044)

Event Memory in and out of Context. JULIE L. EARLES, ALAN W. KERSTEN, ELISSA KLEIN, & ANNEMARIE PHELAN, *Florida Atlantic University*—Accurate event memory includes memory for the features of the event (e.g., the person, the action, and the context) and for the conjunctions of those features. Sometimes, people incorrectly associate a familiar person with a familiar action, even though the familiar action was actually performed by a different person. In this

study, we found evidence that people are particularly likely to falsely remember an actor seen in one context (e.g., at school or at work) as performing other actions in that same context, even if the actor did not perform those actions. People are less likely to make errors in which they falsely remember an actor's performing actions in a context different from that in which they originally saw the actor.

• Working Memory •

(3045)

Generation and Distinctiveness Effects in Short-Term Recall of Order Information. THOMAS F. CUNNINGHAM, *St. Lawrence University,* & ALICE F. HEALY & JAMES A. KOLE, *University of Colorado*—We explored the effect of item generation and distinctiveness on the short-term recall of order information. Adults recalled the order of letters in one of two four-letter segments following a distractor task, knowing in advance the identity of the letters. A distinctive letter was either in red (read condition) or absent and replaced by a red dash (generate condition). We found a negative generation effect on trials with a distinctive letter, reflecting poorer recall of a segment containing a generated letter, and a positive distinctiveness effect in the generate condition, reflecting better recall of the position of the distinctive item within a segment. Responding in the regular (i.e., left-to-right) order was less likely on trials with a distinctive letter than on trials with no distinctive letter, especially in the generate condition. These effects are explained in terms of the extra processing requirements of the generate condition.

(3046)

What do Transposition Errors Tell Us About Retrieval in Serial Recall? KARL HABERLANDT, LAURA CENTOFANTI, & DANIEL KROCH, *Trinity College*—Using lists of four to six words, we examined the pattern of transposition errors in probed serial recall. In two experiments, the target word was cued by location. In two further experiments, the target was cued by the prior word (after probe) or the subsequent word (before probe). When participants committed transposition errors, they tended to overshoot the target, especially in longer lists. Regardless of probe type and direction, they erroneously selected a word further in the list than the target. In the case of location and after probes, these errors were based on words from later input positions than the target. In the case of before probes, errors represented words from earlier positions. The overshoot effect suggests item retrieval via a serial scan, starting at either the beginning or the end of the memorized list, and a directional momentum that is not always inhibited in time.

(3047)

The Irrelevant Speech Effect: What Does "Changing" Mean? AIMÉE M. SURPRENANT, MEGHAN SAWEIKIS, & IAN NEATH, *Purdue University*—Previous research has demonstrated that an irrelevant background stimulus must be changing over time in order to have a significant effect on memory. However, an exact determination of what it means to be "changing" has yet to be established. In addition, there is some controversy over whether speech materials interfere more than nonspeech materials. This has not been fully resolved, because the nonspeech materials used have generally been less physically complex than the speech materials. The experiments reported here compare the effects of frequency or amplitude modulation alone by constructing nonspeech stimuli that have the same amplitude envelope or frequency modulation rate as a speech signal. By holding one dimension constant and varying the other, we can determine which dimension carries the most disruptive information. In addition, we directly compare speech and nonspeech sounds of equal complexity, to determine whether the disruption is equivalent.

(3048)

Phonological Neighborhoods and the Phonological Similarity Effect in Short-Term Memory. STEVEN J. ROODENRYS & TIMOTHY P. BYRON, *University of Wollongong*—The detrimental effect of presenting phonologically similar words within a list on serial recall is a benchmark finding in the area of short-term memory. Recently, Roodenrys et al. (2002) found that the serial recall of words is also influenced by the similarity of the presented words to other words in the lexicon that are not presented in the list—a phonological neighborhood size effect. They found that when no neighbors are presented in the experiment, words with more neighbors, or higher frequency neighbors, are better recalled than those with fewer, or lower frequency, neighbors. In contrast, Goh and Pisoni (in press) report a study showing a detrimental effect of neighborhood size on serial recall when neighbors are presented in the experiment. We report two studies investigating this finding and argue that the Goh and Pisoni (in press) result is due to the phonological similarity effect.

(3049)

Phonetic Symbolism and List Learning. WILLIAM LANGSTON, NORM HUGHES, & ROBIN HUGHES-SPENCER, *Middle Tennessee State University*—Will list learning be influenced by phonetic symbolism (words with "small" vowels should name small objects and words with "large" vowels should name large objects)? Participants listened to one of three word lists. The lists were matched (e.g., small vowels with small objects), mismatched (e.g., large vowels with small objects), or mixed (no pattern). Participants then attempted to recall the list three times (with feedback on each trial). The results were that participants recalled more words in the matched condition than in the mixed condition; participants in the mismatched condition were intermediate. These data suggest that participants were sensitive to phonetic symbolism but that any regularity in the list (even mismatching) was better than no pattern.

(3050)

Identification and Binding of Elements and Relations. AARON S. YARLAS, *Grand Valley State University,* & VLADIMIR M. SLOUTSKY, *Ohio State University*—This research examines how elements (e.g., shapes of objects) and relations (i.e., spatial configurations among objects) are encoded. One possibility is that there is no direct detection of relations but that binding of elements to relations occurs only after elements are identified, at which point their configuration is encoded. A second possibility is that there is independent encoding of elements and relations, such that identification of relations does not require binding but, rather, involves matching a new stimulus to a relational template or schema, with binding occurring separately after identification. In the present study, undergraduate participants accurately recognized both elements and relations of object arrangements, but there was evidence of illusory binding: They often bound target elements to an earlier presented distractor relation, or vice-versa. In addition, frequency of these illusory bindings increased under dual-task conditions. These findings support the second possibility, that relation identification and relational binding are independent processes.

(3051)

A Challenge for the Narrow Memory Window Theory of Covariation Detection. WOLFGANG GAISSMAIER & LAEL J. SCHOOLER, *Max Planck Institute for Human Development*—Kareev et al. (1997) demonstrated that people with smaller short-term memory capacities perform better on some covariation detection tasks (e.g., predicting whether red envelopes contain coins marked x). They hypothesized that low-capacity individuals base their predictions on narrow memory windows (small samples), which tend to overestimate correlations. We replicated the Kareev et al. findings and modeled each participant's behavior with various sample sizes. Counter to the predictions of the narrow window theory, the window sizes that best predicted each individual's behavior did not correlate with memory capacity. Midway in the experimental sessions, we changed the correlations (e.g., increasing the proportion of red envelopes with coins marked x). According to the narrow window explanation, low-capacity subjects should be alerted earlier to these changes, but they were not. We consider alternative explanations for the low-capacity performance advantage.

(3052)

Change Deafness Rates and Working Memory Span. THOMAS A. FARMER, MELANIE A. LUNSFORD, SHEENA ROGERS, MICHAEL TOBIA, JEFFREY DAUBE, & RICHARD F. WEST, *James Madison University*—Unfamiliar conversation partners can be switched during a brief face-to-face interaction without notice by many participants (Rogers et al., Psychonomic Society meeting, 2002). Here we extend our research to brief, interrupted phone conversations. *Change deafness* occurred, although at lower rates than in some change blindness studies. A voice lineup revealed that neither change-deaf nor change-aware participants could identify the voices of their conversation partners with any confidence. Participants with lower working memory span were more likely to be change deaf, implicating working memory capacity as a variable in change blindness phenomena.

(3053)

Hold On to That Feeling: An Empirical Analysis of Affective Working Memory. JOSEPH A. MIKELS, PATRICIA A. REUTER-LORENZ, & BARBARA L. FREDRICKSON, *University of Michigan*—The notion of an affective working memory has been proposed to explain motivational phenomena and personality differences; however, the construct itself has received little empirical analysis. We investigated affective working memory experimentally and sought to dissociate it from working memory for nonemotional stimuli. On two delayed match-to-sample tasks, an emotion maintenance task and a brightness maintenance task, performance is remarkably similar, suggesting similar underlying processes. However, selective interference studies indicate that this is not the case. Concurrent visual and verbal processing interfere with brightness maintenance but do not disrupt emotion maintenance. Thus, emotion maintenance appears not to rely on either verbal or visual working memory but, rather, on separable memory processes. We propose that maintenance of emotion relies on a system highly resembling the standard working memory model, with the addition of an affective subsystem. We consider several modifications of current working memory models that could accommodate emotion.

• Selective Attention •

(3054)

A Neural Correlate of Visual Working Memory Maintenance. EDWARD K. VOGEL, MASAHIRO MACHIZAWA, & JASON A. FAIR, *University of Oregon*—Visual working memory (VWM) is a limited capacity system for maintaining on-line representations of visual information. Here, we recorded ERPs from subjects while they performed a VWM task in which they were presented a bilateral array of colored squares and were asked to remember the items in only one hemifield. Memory was tested with the presentation of an array that either was identical to the memory array or differed by one color. Two hundred milliseconds following the onset of the memory array, we observed a posterior negative wave over the hemisphere that was contralateral to the memorized hemifield in the array, which persisted throughout the entire duration of the memory retention interval. In subsequent experiments, we found that this component was strongly modulated by the number of remembered objects in the array up to the storage capacity limit (four items), suggesting that it reflects a specific process of maintaining representations in VWM.

(3055)

Fixed Resolution, Slot-Like Representations in Visual Working Memory. STEVEN J. LUCK & WEIWEI ZHANG, *University of Iowa*—Is the working memory system that stores object features (1) a set of discrete, fixed-resolution "slots" or (2) a resource that can be allocated flexibly to provide more or less accurate representations depending on the number of items represented? To address this question, we conducted a series of color change detection experiments in which difficulty was manipulated by varying the magnitude of the color changes. The flexible resource hypothesis predicts that memory capacity will gradually decline when greater resolution is needed for the task, whereas the fixed-resolution hypothesis predicts that increased difficulty will produce a decline in performance at all set sizes. The latter pattern was observed. In addition, we conducted a cuing experiment to determine whether attention can increase the resolution of the cued item, and we found no evidence for changes in resolution. We conclude that simple features are stored in fixed-resolution, slot-like representations.

(3056)

Magnitude Information Is Not Activated Automatically in Comparisons of Numerals. DANIEL ALGOM & DANIEL FITOUSI, *Tel-Aviv University*—Automatic activation of numerical magnitude is demonstrated when irrelevant magnitude affects comparisons of physical size of numerals. However, this application of the Stroop task concerned only single numerals with differences in numerical magnitude that were more salient than those in physical size. We presented one- and two-digit numerals for comparative judgment in a spatially separated version of the Stroop task. The numbers appeared in the same size, with the participants' comparing the length of lines presented below each number. We replicated previous results but showed that, when physical size is more salient than numerical magnitude, numerical magnitude does not intrude on judgments of size. The results challenge the notion that magnitude information is called up ineluctably whenever numerals are presented for view.

(3057)

Conversation Reduces Attention Through a Limit of the Useful Field of View. PAUL ATCHLEY & JEFF WHITE-DRESSEL, *University of Kansas*—In three experiments, we investigated a potential mechanism to account for an increase in crash risk with in-car phone use: a reduction in the useful field of view. In all experiments, participants performed a task designed to measure the useful field of view (UFOV) in isolation and while performing a hands-free conversational task. The addition of the conversational task led to large reductions in the UFOV, and the UFOV task reduced conversational task performance. In addition, increasing the complexity of the conversational task across experiments resulted in greater reductions to the UFOV. Since reductions in the UFOV have been shown to increase crash risk, reductions in the UFOV by conversation may be an important mechanism for increased risk for crashes with in-car phone use.

(3058)

Gaze-Triggered Reflexive Orienting to Socially Relevant Stimuli. PASCALE G. MICHELON, PASCAL R. BOYER, & JEFFREY M. ZACKS, *Washington University*—Gaze triggers reflexive orienting toward gazed-at objects, leading many authors to assume that gaze is a "special" attentional cue, different from, for example, arrows, presumed to be less biologically relevant. There is however little direct empirical evidence for gaze specificity, for two possible reasons: Either the tasks did not capture the effects of reflexive, imitative eye movements, or the stimuli were not socially significant. We compared gaze- and arrow-triggered cuing effects in tasks requiring eye movements directed at either meaningful words (Experiment 1) or faces (Experiment 2). To measure possible gaze-specific effects in terms of processing of the attended object, we also examined memory for gaze- and arrow-cued items (Experiment 3). Although gaze and arrows both produced reliable cuing effects, these were not dissociable and similarly influenced object processing. This suggests either that gaze is not special or that arrows (which may be interpreted as pointing hands) are also biologically relevant cues.

(3059)

Trait Depression and Cognitive Biases For Emotional Faces. YI-HSING HSIEH, *Kaohsiung Medical University*—This study examined the association between trait depression and information-processing biases. Thirty participants were divided into 17 high and 13 low trait depressive individuals on the basis of the median of their depressive subscale scores on Basic Personality Inventory. The information-processing

biases were measured by a deployment-of-attention task (DOAT) and a recognition memory task (RMT). In DOAT, participants saw one emotional pairing with a neutral face of the same person and then were forced to choose on which face the color patch occurred at first. The percentage of choices favoring the emotional face represents the selective attentional bias. In RMT, participants rated different types of emotional faces and subsequently discriminated the old from the new faces. The memory strength (d') was calculated from the hit and false positive rates. As a result, high trait depressive participants showed a negative cognitive style, which is weakened inhibition in attending to and enhanced recognition memory for sad faces.

(3060)

Does Loom Cuing Occur With Brightness-Defined Motion? ALEJANDRO LLERAS & ADRIAN VON MÜHLENEN, *University of British Columbia*—In loom cuing (a new kind of attentional cuing effect), participants view displays of random moving dots. Their task is to rapidly identify a target letter that can appear on either side of fixation. Prior to target onset, the motion of the dots on one side of fixation changes from random to coherent motion, where the dots move away from a center location (looming motion). Participants are up to 80 msec faster at identifying targets that appear on the side with looming motion than on the side with random motion, even when the looming motion does not predict target location, onset, or identity. This RT difference is called the loom cuing effect. Here, we studied whether loom cuing occurs with brightness-defined motion, for which the brightness of stationary dots dynamically changes either randomly or in a coherent fashion such that brightness (rather than dots) moves away from a center location.

(3061)

Individual Differences in Uncertainty Monitoring and X-Ray Threat Detection. DAVID A. WASHBURN, LAUREN A. BAKER, & JARED P. TAGLIALATELA, *Georgia State University,* & J. DAVID SMITH, *SUNY, Buffalo*—Airport baggage screeners perform a difficult task under challenging conditions. One could assume that no matter how skilled the screener is at detecting threat items in x-ray images, each individual must surely face occasional stimuli about which he or she is uncertain. Performance under such conditions was examined in a study involving 237 untrained undergraduates who performed a 20-min x-ray search task, a psychophysical task to measure responsiveness to uncertainty, and other cognitive tests and questionnaires. Individual differences were observed in the adaptiveness with which an untrained individual responded to uncertainty, and this measure was uncorrelated with performance on the x-ray search task. However, participants who detected threats best were significantly more responsive to their uncertainty than were people who performed poorly on the threat detection task. It seems likely that this relation is mediated by attention skills, included here, that are correlated both with threat detection and with metacognition.

(3062)

Effects of Age and List-Wide Versus Item-Specific Proportion Congruency in the Stroop Task. JEFFREY P. TOTH & LARRY L. JACOBY, *Washington University*—Manipulating the proportion of congruent trials in the Stroop task modulates the Stroop effect: As proportion congruency (PC) goes up, so does the size of the Stroop effect. Previous research has assumed that this modulation reflects strategic processing. Recently, however, Jacoby and colleagues showed that PC effects can also occur at the level of specific items, even when high- and low-PC items are mixed together within a single task. Item-specific PC effects argue against strategic-processing accounts, because subjects cannot set a single word-reading policy across trials. Such effects also raise the question of whether previous findings of "list-wide" PC effects were actually item-specific effects in disguise. The present study examined this possibility by orthogonally manipulating item-specific and list-wide PCs. Effects of aging on item-specific PC effects were also examined.

(3063)

Stroop-Like Interference With Vowel Sounds. MICHAEL D. HALL & MELISSA GRIFFITH, *University of Nevada, Las Vegas*—Recently, evidence of semantic, Stroop-like interference has been obtained within a domain of auditory information without words (musical instrument timbres; Hall & Koch, 2003). Three experiments conducted a similar evaluation for synthetic vowels (Experiment 1) and examined the possible role of proximity, which is known to influence traditional Stroop effects (Experiments 2 and 3). On each trial, listeners identified which of two vowels was presented to an assigned target location (left or right side). Contralateral distractor stimuli reflected vowels that were either the same as or different from the target, or white noise with a similar spectral slope. Evidence of Stroop-like interference was obtained across experiments; listeners took longer to identify targets that were accompanied by a different vowel. Experiment 2 revealed that interference increased when targets and distractors were temporally proximal. Furthermore, interference was greatest when stimuli were not completely lateralized (Experiment 3). Implications for models of auditory attention will be discussed.

(3064)

Finding Cued Targets in Objects That Change Identity. ANNE P. HILLSTROM, *University of Texas, Arlington, & University of Southampton,* & BRIAN NORRIS, *University of Texas, Arlington*—Most research on object-based attention uses spatiotemporal continuity as the primary force sustaining the object representation. Previous work in our lab showed that morphs, which change identity while maintaining spatiotemporal continuity, cause an attentional blink. The new research shows that morphs will disrupt another object-based attention effect. When an object morphs between the presentations of a cue and a target, responses to targets that appear away from the cue but in the cued object are no faster than responses to targets that appear in an uncued object.

• Automatic Processes •

(3065)

On the Automaticity of Transient Attention. ANNA MARIE GIORDANO, BRIAN McELREE, & MARISA CARRASCO, *New York University*—Transient covert attention improves discriminability and accelerates the rate of visual information processing in visual search. To evaluate the automaticity of an exogenous cue, we investigated whether discriminability and rate of information processing differ as a function of cue validity. We used a response-signal speed–accuracy tradeoff (SAT) procedure for an orientation feature discrimination task. A 40-msec cue, which varied in validity from chance to 100%, preceded a target presented with zero or seven distractors. A tone sounded after variable lags (40–2,000 msec), prompting observers to respond. Discriminability was 0.7 d' units higher and rate was 57 msec faster at the cued location, regardless of its validity, but discriminability was 0.2 d' units lower and rate was 35 msec slower at the uncued location. Surprisingly, covert attention improves discriminability and speeds up information accrual to a similar extent regardless of cue validity, thus providing evidence for the automaticity of the cue.

(3066)

Automatic and Intentional Processes in Face Encoding. RICHARD A. BLOCK, *Montana State University,* DAN ZAKAY, *Tel-Aviv University,* & AARON S. RICHMOND, *University of Nevada, Reno*—Do people encode human faces automatically, intentionally, or both? Participants viewed a series of previously unfamiliar faces. In order to prevent control participants from trying to remember the faces, we used a cover story: Only half the participants were told that we would test their memory for the faces. Another variable in the factorial design involved a secondary task: Some participants were told to attend to time (the total duration of the series of faces), and some were not told this. A face recognition test followed. Participants who were not told to perform the secondary task recognized presented faces better

if they had been told to try to remember the faces. Participants who were told to perform the secondary task showed no effect of face memory instructions. We discuss the implications for theories of face encoding.

(3067)

Simon Effect and Handedness: Evidence For a Dominant-Hand Attentional Bias in Spatial Coding. SANDRO RUBICHI, *University of Modena & Reggio Emilia,* & ROBERTO NICOLETTI, *University of Bologna*—In two experiments, the relation between handedness and the size of the Simon effect in each visual hemifield has been investigated. Experiment 1 showed that the Simon effect was larger in the right visual hemifield in right-handers and in the left visual hemifield in left-handers, whereas ambidextrous subjects showed a symmetric Simon effect. In Experiment 2, subjects performed the same Simon task as that in Experiment 1, but with crossed hands. The right- and left-handers group showed a reversed pattern of results with respect to Experiment 1. We explained this phenomenon as part of a more general account where perception and action are embedded in a perception-for-action system. In it, an attentional bias originating from the field of operation of the dominant hand would be at the base of the relationship between the asymmetry of the Simon effect and handedness.

(3068)

Angry Faces Do Not "Pop Out" of Ecologically Valid Crowds. D. VAUGHN BECKER & STEPHEN D. GOLDINGER, *Arizona State University*—Do angry faces "pop out" of crowds? Are they even detected faster? Five experiments involving visual searches for photographs of discrepant emotional expressions in heterogeneous crowds failed to find any "anger advantage." In Experiment 1, angry faces took longer to detect in neutral crowds as crowd size increased. The slope of this function argued against pop-out. Experiments 2 and 3 replicated these findings under different search conditions. Experiment 4 replaced neutral background faces with fearful faces, and happy faces again surpassed angry faces in detection latency and slope. Experiment 5 used the upper halves of faces to eliminate any confounding effect of smiling but again found no anger advantage. Together, the findings suggest that previous reports of anger detection advantages arose from stimulus confounds, ecologically invalid stimuli, and differences in background crowd characteristics. If there is an "anger effect," it is that angry crowds are searched more slowly than happy crowds.

(3069)

A Factor Influencing Age Differences in the Simon Effect. DAVID F. PICK, *Purdue University Calumet,* & ROBERT W. PROCTOR & KIM-PHUONG L. VU, *Purdue University*—When responding is based on a nonspatial stimulus attribute, performance is better when the stimulus location corresponds with the response location than when it does not, a phenomenon known as the Simon effect. The Simon effect is often larger for older adults than for younger adults. An exception to this finding was reported by Simon and Pouraghabagher (1978) when the relevant information was presented visually and the irrelevant location information aurally. We confirmed this finding and showed that it is due to presenting the relevant and the irrelevant information in different modalities. RT distribution analyses suggest that the temporal dynamics of information processing do not differ for younger and older adults and that the age difference in the visual Simon effect is due to stronger activation of the irrelevant location information.

(3070)

Semantic Activation Alone Is Insufficient to Produce an Involuntary Attentional Blink. VERONICA J. DARK, *Iowa State University*—Subjects imaged, categorized, or silently read a word before attempting identification of a digit embedded in the middle of an RSVP list of eight pictures. A critical picture of the object referenced by the word occurred either before or after the digit. With imagery, digit identification was worse when the critical picture was before than when it was after the digit, suggesting that the picture produced an involuntary attentional blink (Pashler & Shiu, 1999). No differences were found with categorization and reading, showing that semantic activation alone is insufficient to produce the effect. Follow-up studies using imagery showed that most subjects were aware of the critical pictures, even when they occurred in only half the RSVP lists. Surprisingly, performance without a critical picture was more similar to performance when the critical picture occurred before than when it occurred after the digit. Results are related to priming, masking, and attention.

(3071)

Mapping the Shift From Controlled to Automatic Processes of Cognition Using fMRI. JONATHAN A. FUGELSANG & KEVIN N. DUNBAR, *Dartmouth College*—We examined the brain mechanisms mediating the shift from controlled to more automatic processes, using a variant of the Stroop task (MacLeod & Dunbar, 1988). Participants learned to associate four shapes, each with a color (blue, green, red, and yellow) by responding to 960 shape trials per day for 15 days. Stroop-like stimuli (where ink color and shape were conflicting) were presented to participants on Day 1 and on Day 15 in an fMRI scanner. Reaction time analyses revealed that responding to shapes became reliably faster, and produced more interference with ink color responses on Day 15 than on Day 1. These behavioral effects were associated with reduced activations in an inferior frontal/temporal/fusiform network and increased activations in a medial frontal/basal ganglia network as a function of training. These findings have theoretical implications for understanding the functional anatomical substrates of automatic and controlled processing and executive control.

(3072)

Visual and Kinesthetic Cross-Modal Stroop Interference. CHRISTOPHER KOCH & CHRISTOPHER WATERS, *George Fox University*—Stroop interference is a highly reliable finding resulting from incongruent visual inputs of color and word information. This type of interference has been demonstrated in the auditory modality, as well as cross-modally between vision and audition. Recent research has shown an attentional blink, using a cross-modal vision and touch paradigm. The present study was conducted to determine whether Stroop interference could also be obtained cross-modally using visual and kinesthetic information (i.e., weight discrimination). Seven participants indicated whether a weight was lighter, equal to, or heavier than a standard weight while viewing the words LIGHT, STANDARD, or HEAVY on a computer monitor. Response times indicate that weight congruent pairings (M = 1,264.57) were responded to significantly faster [$t(6) = 2.77$, $p < .04$, $d = .97$, $r = .75$] than weight incongruent pairings (M = 1,493.21). This finding suggests that Stroop interference not only is reliable, but also generalizes to multiple sensory systems.

• Lexical Processing •

(3073)

Dynamic Decision-Making Processes in Changing Stimulus Environments. SCOTT BROWN & MARK STEYVERS, *University of California, Irvine*—Many information-processing models assume that subjects accurately shift a signal-detection criterion in response to changes in signal or noise distributions. We provide theoretical and empirical investigations of these criterion shifts, using lexical decision as an example. We found that subjects were able to alter a hypothetical decision making criterion but that this alteration took an appreciable time (between 5 and 50 trials). We present a generative process model of these effects. Our model is dynamic on two levels, within each decision as well as keeping track of stimulus properties. A corollary of our empirical results is that there may be very large carryover effects in any experiment where easier and harder stimulus conditions are blocked. Further experiments have shown that even when subjects are fully informed about the nature of the stimuli and the blocks, their decision-making processes are slow to change and, hence, carryover effects are a potential problem.

(3074)

Role of Decision Biases in Semantic Priming With Binary Responses. KATIA DUSCHERER & DANIEL HOLENDER, *Université Libre de Bruxelles*—Semantic priming effects in binary decision tasks are assumed to be caused in part by congruity effects stemming from incidental relatedness judgments: The presence of a semantic relationship between prime and target could bias towards a "yes" response to the target, whereas the absence of relationship would rather bias towards a "no" response to the same target. We tested this assumption in a semantic categorization experiment in which participants were induced to associate different values—positive, negative, or neutral—to each of the responses to the target. If the congruence between the value of the relatedness judgment and the value of the target response matters at all, faster reaction times should be observed when the value of the response matches that of the relatedness judgment. Although semantic priming effects were obtained even with negatively valued responses, they were substantially enhanced with positively valued responses, confirming the influence of decision biases.

(3075)

Preconscious Semantic Priming in Brightness and Duration Judgment Tasks. BART A. VANVOORHIS, PATRICK A. O'CONNOR, & DARIN D. KREBILL, *University of Wisconsin, La Crosse*—Vanvoorhis and Avant (1999, 2000, 2002) have shown evidence that participants are able to detect differences in subjective brightness and duration for inputs based on orthographic features of the inputs (i.e., case) as well as on letter-string type (i.e., word, nonword, pseudoword) and word type (i.e., high-image noun, low-image noun, or verb). In the present study, participants judged the subjective brightness or duration of related word pairs, unrelated word pairs, or nonword pairs. Related word pairs were judged to be brighter than their unrelated and nonword counterparts, which were in turn judged to last longer. These data converge with previous evidence to indicate that the effect is semantic and occurs preconsciously.

(3076)

Letter Identification: Contrast Polarity and Speed–Accuracy Tradeoff Strategies. ALBERT J. AHUMADA, JR., *NASA Ames Research Center,* & LAUREN F. V. SCHARFF, *Stephen F. Austin State University*—Observers were asked to identify 1 of 12 letters on a uniform background. The letters varied in contrast relative to the background (10%, 20%, or 40%) and contrast polarity (positive or negative) so that we could estimate the relative effectiveness of the two polarities. To allow observers to maintain a consistent perceptual strategy for each polarity, each observer ran the polarity conditions blocked—first five replications of all three levels at one polarity, then at the other. Strong differences in the speed–accuracy tradeoff strategies appeared across polarity for the two groups of observers. The observers who had the more difficult polarity first took more time (had longer latencies), but the observers who had the more difficult polarity second took less time. Combined speed–accuracy scores helped to assess quantitatively the increased identifiability of the negative contrast letters over that of the positive contrast letters in the presence of the changing strategies.

(3077)

Distinguishing Between Reactivation and Integration Mechanisms in Text Comprehension. SABINE GUÉRAUD & ISABELLE TAPIERO, *University of Lyon 2*—Albrecht and Myers (1998) showed that reading times on a target sentence were slowed when a contextual cue reactivated early information that was inconsistent with the target sentence. However, in our previous work (Guéraud & Tapiero, 2002), we found that reading times on the target sentences were not slowed when the contextual cue (e.g., *desk*) did not include the modifier mentioned earlier (e.g., *magnificent desk*).Two experiments are presented that measured the activation of this early information at several points, both before and after presentation of the contextual cue. The results from both experiments showed that the contextual cue did reactivate the early inconsistent information, but that this reactivation did not affect comprehension of the target sentence. The results are discussed in terms of the distinction between activation and integration.

(3078)

High-Level Effects of Masking on Perceptual Identification. ADAM N. SANBORN, *Indiana University,* KENNETH J. MALMBERG, *Iowa State University,* & RICHARD M. SHIFFRIN, *Indiana University*—The extent to which visual form versus higher level information is used to identify briefly flashed words is assessed in a perceptual identification task. In this task, a word is briefly flashed and postmasked, and a decision is made between two alternatives. The availability of low- and high-level visual information was manipulated by varying the type of information that discriminates the alternatives. A first experiment used form masks (@-signs), and observers performed better when the choices were in the same case but differed in spelling than when they differed in case but had the same spelling. A second experiment removed the mask, and the effects were reversed: Case differences produced better performance than did spelling differences. We conclude that identification of briefly flashed words can be based on several levels of information, the preferred level being determined by the diagnosticity of the information at each level, and on adaptive strategies.

(3079)

Facilitatory and Inhibitory Priming of Word Meanings. LING-PO SHIU, *Chinese University of Hong Kong,* SYLVAN KORNBLUM, *University of Michigan,* & TIN-CHEUNG CHAN, *Chinese University of Hong Kong*—After one of the meanings of an ambiguous word has been primed, would the other meanings of the ambiguous word become less accessible temporarily? To address this question, we presented an ambiguous word (e.g., *light*) twice as a target in a lexical decision task. On each presentation, the target was preceded by a prime either related or unrelated to it in meaning. But the two related primes (e.g., *lamp*, *heavy*) were associated with different meanings of the target. Results show that the related primes produced significantly faster lexical decision responses to the targets than did the unrelated primes. However, on the second presentation of the target, a related prime (*heavy*) produced significantly less facilitation if the prime shown on the first presentation was related (*lamp*) than if it was unrelated to the target. The effects have been replicated with sentences as primes and with both Chinese and English stimuli.

(3080)

Nonword Repetition Priming in Lexical Decision Reverses as a Function of Study Task and Speed Stress. ERIC-JAN WAGENMAKERS, *University of Amsterdam & Northwestern University,* & RENÉ ZEELENBERG & RICHARD M. SHIFFRIN, *Indiana University*—We argue that nonword repetition priming in lexical decision is the net result of two opposing processes. (1) Repeating nonwords in the lexical decision task results in the storage of a memory trace containing the interpretation that the letter string is a nonword; retrieval of this trace leads to an increase in performance for repeated nonwords. (2) Nonword repetition results in increased familiarity, making the nonword more "wordlike" and, hence, leading to a decrease in performance. The relative influence of these two processes determines whether facilitatory or inhibitory nonword repetition priming is obtained. Consistent with such a dual-process account, Experiment 1 showed a facilitatory effect in lexical decision for nonwords studied in a lexical decision task but an inhibitory effect for nonwords studied in a letter-height task. Experiment 2 showed an inhibitory effect at test when participants were instructed to respond very fast.

(3081)

Phonemic Serial Position Effects in Color Naming of Nonwords. HARVEY MARMUREK & CAROLINE C. PROCTOR, *University of Guelph*—Coltheart et al. (1999) found that color naming latencies of words were shorter when the initial phoneme of the word was congruent with the initial phoneme of the response (e.g., RAM in red) than when there was no phonemic overlap (e.g., HIP in red). Less facilita-

tion emerged for phonemic overlap in the final position (e.g., PAD in red), indicating the operation of both a serial nonlexical process and a parallel lexical process. The present study examined those routes by replacing words with pronounceable nonwords (e.g., ROJ in red) and, in some conditions, coloring only one letter, under the assumption that both manipulations would impair the activation of a lexical process (Besner, 2001). The facilitation pattern found with nonword displays was similar to that for words, and coloring only one letter amplified facilitation for initial phonemes. These results support the claim that print-to-speech conversion includes a serial nonlexical process.

(3082)

The Influence of Number and Summed Frequency of Word Body Neighbors on Pseudoword Naming. DEBRA J. JARED, *University of Western Ontario*—A series of pseudoword naming experiments was conducted to better understand how skilled readers represent their knowledge of the correspondences between spellings and sounds. The results of previous studies suggest that when readers pronounce unfamiliar letter strings, they use their knowledge of the pronunciations of known words having the same word bodies. The issue addressed here was whether the strength of a particular pronunciation of a word body is best characterized by the number of different word body neighbors with that pronunciation or by the sum of their frequencies. One approach was to use pseudowords with inconsistent word bodies that contrasted these alternatives directly. The second approach was to use pseudowords that had consistently pronounced word bodies and to vary the number and frequency of word body neighbors. The results indicated that it is too simplistic to think of either types or tokens as being the best measure; both measures are important in determining the impact of word body neighbors.

(3083)

Ambiguity Effects in Lexical Access: Do Blends Exist? C. DARREN PIERCEY, *University of New Brunswick,* DAVID A. MEDLER, *Medical College of Wisconsin,* & BRYEN E. HEBERT, *University of New Brunswick*—According to Piercey and Joordens (2000), ambiguous words often end in a "blend state" that can aid lexical decisions but hinder semantic relatedness decisions. Blend states occur when multiple meanings of an ambiguous word are activated simultaneously; this leads to a slowdown in semantics during resolution of these meanings. An alternative hypothesis is that only one meaning is activated at any one time and that the slowdown occurs because of switching between alternative meanings until the meaning is congruent with the current context. We present experiments that differentiate between these two hypotheses. Participants were given three different primes prior to a lexical decision that was then followed by a relatedness decision. Primes were congruent, incongruent, or neutral with respect to the relatedness decision. A Monte Carlo simulation determined whether the neutral RT distribution was simply a combination of the congruent and the incongruent RT distributions.

(3084)

Modeling the Ambiguity Effect: To Blend or Not to Blend? DAVID A. MEDLER, *Medical College of Wisconsin,* & C. DARREN PIERCEY, *University of New Brunswick*—A previous model of the ambiguity effect (Besner & Joordens, 1994) showed that, on a majority of trials, ambiguous items settle into a "blend state" of their two meanings. It has been suggested that this blend state actually aids lexical decisions for ambiguous items, since the blend state creates a larger "feeling of familiarity" that lexical decisions may exploit. Here, we use a symmetric diffusion network (SDN) to effectively learn and retrieve multiple mappings for a single input (i.e., ambiguous items). The model consists of three main processing regions—orthography, phonology, and semantics—and is trained on a corpus of unambiguous items and ambiguous items that range in their degree of balance (probability distribution) between the multiple meanings. Because the SDN is able to reproduce the correct probability distributions for the ambiguous items, the notion of a blend state's being used for LD is reevaluated.

• Discourse Processes •

(3085)

Semantic and Causal Influences on Text Processing and Memory. MICHAEL B. WOLFE, *Grand Valley State University,* & JOSEPH P. MAGLIANO & BENJAMIN LARSON, *Northern Illinois University*—Processing time and memory for sentences were examined as a function of the degree of semantic and causal relatedness between sentences in short narratives. In Experiments 1–3, semantic and causal relatedness between sentence pairs was independently manipulated. Causal relatedness was assessed through pretesting, and semantic relatedness was assessed with latent semantic analysis. Causal relatedness influenced processing time and memory. Semantic relatedness influenced memory and influenced processing time when causality was not manipulated within an experiment, and the situation described by the sentence pairs was somewhat difficult to construct. Experiment 4 utilized naturalistic texts. Semantic and causal relatedness between sentences influenced on-line judgments of fit and free recall. Results are discussed in terms of bottom-up and top-down theories of text processing.

(3086)

Eye Movements During Poetry and Prose Reading. MARTIN H. FISCHER, MARIA N. CARMINATI, JANE STABLER, & ANDREW ROBERTS, *University of Dundee*—We compared eye movements during the reading of authentic poems presented in their original layout (poetry format) and in a prosaic layout (prose format). Twelve participants read the texts of four poems in the two formats in counterbalanced order. We hypothesized that readers would adjust their reading strategies to the type of text being read on the basis of the format in which it was presented. The poem format was associated with slower reading rates, more eye fixations, longer fixation durations, shorter forward saccade sizes, and more regressions than was the prose format. Because the two formats had identical lexical processing requirements, this result is interpreted as evidence for a global adjustment of the readers' strategies.

(3087)

Haiku Electrified: ERP Indices of Listening to Haiku Poetry. DAWN G. BLASKO, VICTORIA A. KAZMERSKI, MATTHEW R. STEVENSON, DOTTY SHAFFER, & KRISTEN SHAFFER, *Pennsylvania State University, Erie*—Little is known about the brain processes involved in understanding creative language. In the present study, participants listened to haiku poems and to literal sentences matched for length and final word. All sentences were read in a three-phrase prosodic structure. Participants were asked about their experience with creative writing, and those that had written poetry at least monthly for 2 or more years were classified as poets. Participants were asked to judge whether or not each utterance was a real poem. ERPs were continuously recorded from 64 channels and were analyzed time locked to both stimuli (last word) and to response. The results showed that participants were very accurate at distinguishing the real poems. The waveforms showed a late frontal positivity that was uniquely associated with the poems and was larger for the poets. This may be because poetic language evokes greater emotional processing.

(3088)

Cognitive Versus Aesthetic Influences on Cultural Differences in Proverb Evaluation. MICHAEL FRIEDMAN, JYOTSNA VAID, HSIN-CHIN CHEN, FRANCISCO MARTINEZ, & HYUN CHOI, *Texas A&M University*—Recent research has argued for eastern versus western cultural differences in reasoning styles, as revealed, for example, in a relative preference among easterners for dialectical (e.g., "too humble is half proud") versus nondialectical (e.g., "for example is no proof") proverbs (Peng & Nisbett, 1999). The present research sought to replicate this finding and to determine whether the observed preference reflects a reasoning style effect or an effect of the manner of expressing the proverb's content. Participants from eastern versus western cultures were tested on a proverb preference task in which their

preference judgments for proverb meaning and form were elicited for different renditions of dialectical and nondialectical proverbs. In addition, an incidental free recall task was given to determine whether the more highly preferred proverbs were also more memorable. The results are discussed in terms of expanding the scope of the study of cultural differences in cognition to include aesthetic variables.

(3089)

The Neural Basis of Metaphor Interpretation. ROBERT A. MASON & MARCEL ADAM JUST, *Carnegie Mellon University,* & ZOHAR EVIATAR, *University of Haifa*—With fMRI, levels of cortical activity were measured during the processing of sentences that contained phrases that were used either literally or in a figurative manner. The figurative phrases were either well-known *frozen* metaphors or *novel* metaphors. Brain activity was measured every second during the processing of passages. The passages contained a two-sentence introduction section in which two characters interacted. A third sentence followed, in which one of the characters used the critical phrase. Cortical activity related to the reading of the critical phase was examined. Higher levels of activation occurred during the reading of critical phrases that were metaphors than during the reading of critical phrases that were literal statements. This was true in both hemispheres. We propose that involvement of the right hemisphere in integrating new information in order to understand metaphoric use of language is similar to its role in integrating causal inferences.

(3090)

Coherence in Language in Schizophrenia. BRITA ELVEVAAG, *NIMH,* PETER W. FOLTZ, *New Mexico State University,* & JOSCELYN E. FISHER, DANIEL R. WEINBERGER, & TERRY E. GOLDBERG, *NIMH*—Communicating ideas and thoughts through the medium of language is a fundamental aspect of human behavior. Incoherent discourse, with a disjointed flow of ideas, is a cardinal symptom in psychosis and is probably due to a deviation in the neural organization of language. Antipsychotic medication can improve coherence in communication, but problems operationalizing this symptom has limited its use in treatment and in examining the relationship to cognition and underlying neural substrates. Our research synthesizes a cognitive approach to schizophrenia with a computational modeling approach to semantics. Consequently, we have developed and validated an objective, reliable, and automatic computational tool with which to measure coherence in discourse. The resulting methodology provides a useful theoretical framework with which to explore the nature of cognitive dysfunction underlying incoherent discourse in schizophrenia.

(3091)

Can Listeners Inhibit Privileged Knowledge? DALE J. BARR, *University of California, Riverside*—During comprehension, listeners experience interference from privileged knowledge, accessible knowledge that is not part of common ground. However, it is not clear whether such interference stems from mere inattention or whether it has a more systematic source. An eyetracking study was conducted in which listeners interpreted references to objects (i.e., click on the bucket) in the context of a critical object that was either a competitor (e.g., buckle) or a control object (e.g., stepladder). It was found that listeners were unable to inhibit fixations to a competitor in privileged ground despite clear evidence that they attempted to do so. On this basis, it is argued that privileged ground effects are not merely the result of inattention but, instead, reflect automatic processing in the comprehension system.

(3092)

Predicting When People Will Say "Um" or "Uh." JEAN E. FOX TREE, *University of California, Santa Cruz*—Are *ums* and *uhs* redundant with the meaning, syntax, or prosody of speakers' utterances? Can listeners anticipate when a speaker is about to produce an um or an uh, and which it will be? Listeners used the prolongation of words and the existence of prior fillers in rating the likelihood of an upcoming filler, but their accuracy at determining which filler was to follow was at chance. Listeners did not use where the fillers fell in tone units or in syntactic clauses in making their judgments. There was no relationship between these results and earlier results on listeners' uses of *ums* and *uhs* in the on-line speech processing of the same materials (Fox Tree, 2001). Results are discussed with respect to the hypothesis that ums and uhs anticipate upcoming delays.

(3093)

Why Do People Say "Let's Do Lunch Sometime"? The Discourse Goals of Ostensible Speech Acts. KRISTEN E. LINK, AMANDA W. PARKER, NATALIE R. GRACIN, & STEPHANIE L. DALEY, *SUNY, Oswego*—Previous research (Link & Kreuz, in preparation) has shown that speakers' primary goal in uttering ostensible speech acts (OSAs) is achieved off record, whereas the primary goal of sincere speech acts is achieved on record. We examined the particular goals that are achieved by speakers of OSAs in two experiments. In Experiment 1, participants read conversations containing either a sincere, an ambiguous, or an ostensible speech act and indicated the primary reason for the speaker's making the remark. Judges developed a goal taxonomy, using a portion of the responses, and categorized each response, using this taxonomy. In Experiment 2, participants read the same conversations and indicated all the goals that might be achieved by making the remark, using the taxonomy developed in Experiment 1. Although a variety of goals are achieved when ostensible speech is used, the majority of the participants indicated that people use ostensible speech to be polite and to fulfill an addressee's expectation.

(3094)

Stimulus Deconstruction and Lexical Ambiguity Resolution in the Cerebral Hemispheres. HOANG VU, *Saint Mary's College of California,* & GEORGE KELLAS & KIM METCALF, *University of Kansas*—Three lexical decision experiments examined the effects of systematically deconstructed priming contexts on lexical ambiguity resolution in the left versus the right hemisphere. Priming contexts were presented centrally and were immediately followed (0-msec ISI) by presentation of a target string to the left or the right visual field. Ambiguity resolution was examined using (1) strongly biased intact sentences (Experiment 1), (2) deconstructed contexts in which the syntactic structure (S–V–O) was preserved but the full sentences were stripped of their function words (Experiment 2), and (3) deconstructed contexts in which both function words and syntactic structure were eliminated (Experiment 3). The results showed dissociations in the pattern of priming for the left versus the right hemisphere, depending on the type of priming context employed. These results were discussed in light of previous findings on lexical ambiguity resolution in the cerebral hemispheres (e.g., Faust & Chiarello, 1998; Titone, 1998; and others).

(3095)

When Do You Put on Snoopy's Hat? Multimedia Influences on Procedural Learning. TAD T. BRUNYE & HOLLY A. TAYLOR, *Tufts University,* & DAVID N. RAPP, *University of Minnesota, Twin Cities*—The application of multimedia technology for learning has proceeded largely without systematic examination of the construction and application of mental representations. We addressed this issue by examining participants' memory for procedural instructions following three presentation formats. In two experiments, participants learned procedures for assembling toys, with instructions presented in text-only, picture-only, or multimedia formats. Testing examined recall, serial order knowledge, and source knowledge. In Experiment 1, multimedia learning produced faster and more accurate serial order determinations and greater recall but higher source-monitoring error rates, as compared with the other formats. Experiment 2 demonstrated that additional multimedia exposure following initial learning can further influence learning. Contrary to Baddeley's (1992) working memory model, a verbally based divided-attention task failed to selectively interfere with text processing in either experiment. These results provide empirical support for the underlying nature and potential benefits of mental representations following multimedia experiences.

• PSYCHOLINGUISTICS •

(3096)

Plausible Dual Interpretation: Effects on Garden Pathing. MARY MICHAEL & PETER C. GORDON, *University of North Carolina, Chapel Hill*—Garden path sentences employing the direct-object/complement ambiguity were used in this eye-tracking project to examine the interaction of early and late reading comprehension processes in circumstances where the initial garden path reading may influence the final interpretation of the sentence. Participants read sentences that either were clearly disambiguated on both syntactic and semantic grounds or had two possible interpretations, one requiring a plausible inference. Readers who tended to make the plausible inference read the dual-interpretation sentences more quickly overall (due to less rereading) than the single-meaning sentences; readers who did not generally make the inference read both types of sentences in a similar manner. The relative contributions of initial interpretation due to garden pathing and plausible inference due to the events described in the sentence were assessed by manipulating whether or not sentences describing the same events had syntactic structures leading to garden pathing.

(3097)

Number-of-Meanings and Relatedness-of-Meanings Effects in Lexical Decision: Does the Relatedness of the Multiple Meanings Matter? YASUSHI HINO, *Chukyo University,* & STEPHEN J. LUPKER, *University of Western Ontario*—Number-of-meanings (NOM) and relatedness-of-(those)-meanings (ROM) effects were examined for Japanese Katakana words, using lexical decision tasks. Only a NOM advantage was observed when the stimulus set consisted of Katakana words and nonwords. In a second experiment, a NOM advantage and a ROM advantage emerged for those same Katakana words when Kanji word and nonword fillers were included. A third experiment tested whether the results of Experiment 2 were due to a basic difference between the Kanji words and nonwords. Because the Kanji nonwords consisted of unrelated characters, whereas the Kanji words consisted of related characters, subjects may have used the relatedness of activated meanings as a cue in making lexical decisions. A third experiment using Kanji nonwords specifically constructed so that their characters would have similar meanings produced the original pattern of results. As before, we conclude that ROM has an effect only under very constrained circumstances.

(3098)

The Cross-Linguistic Cognitive Bases in the Processing of Complex Sentences. CHINLUNG YANG & CHARLES A. PERFETTI, *University of Pittsburgh,* & PETER C. GORDON, *University of North Carolina, Chapel Hill*—The present study examines the universal and language-specific characteristics of the cognitive bases for the processing of syntactic and semantic information over the course of language comprehension by conducting reading time experiments in order to examine the relative ease of comprehension of different kinds of restrictive relative clauses (RCs) in Chinese. The RC construction is driven by a head-final parser in Chinese, but by a head-initial parser in English, and thus results in distinct patterns of embeddedness of the RC across Chinese and English. Thus, these two languages present language comprehension processes with different moment-to-moment tasks that offer a unique opportunity to test current theories of the cognitive and linguistic processes that contribute to the understanding of the processing of complex sentences. The results suggest language-specific properties for the cognitive mechanism of sentence processing in Chinese, which sheds light on the evaluation of the relative merit of contrasting theories in terms of the cognitive architecture for language comprehension.

(3099)

Individual Differences in Working Memory (WM) and Sentence Comprehension Under Load. MARC F. JOANISSE & ANETA KIELAR, *University of Western Ontario*—We assessed subjects' reading and digit spans, and tested them on a sentence–picture matching task. Stimuli consisted of sentences with simple (actives, subject relatives) and complex (passives, object relatives) word order. Baseline performance was compared with performance under auditory load (acoustically distorted sentences) and digit load (maintaining six digits in memory during each trial). We observed a significant reading span × complexity interaction in the digit load condition, although not in the baseline or the auditory load condition. However, we also observed a significant digit span × complexity interaction in both the digit load and the auditory load conditions. These findings conflict with the predictions of a multistore model of WM and syntax; however, the finding that different span capacities interact with different types of interference also defies a single-capacity explanation. Instead, the results seem to be consistent with the theory that syntactic processing is achieved using multiple types of interactive processes.

(3100)

Differences in the Processing of Volitional and Nonvolitional Implicit Agents. KATHY CONKLIN, GAIL MAUNER, & JEAN-PIERRE KOENIG, *SUNY, Buffalo*—The goodness of fit between a referent associated with an agent role and a described event has been shown to influence processing. However, it has not been demonstrated that language-processing mechanisms are sensitive to different types of agent roles associated with particular verbs. We examined the processing of rationale clauses, whose successful interpretation depends on there being a volitional agent in an adjoining clause, when they followed short passives whose verbs either required or did not require volition of their implicit agents. Reading times were longer following short passives that did not require volition of their implicit agents. The fact that some processing cost is incurred when a needed entailment of volitionality must be inferred, as compared with when it is lexically encoded, indicates that language-processing mechanisms are sensitive to differences in lexical entailments associated with agent roles.

(3101)

The Influence of Situation-Specific Information in On-Line Pragmatic Implicatures. DANIEL J. GRODNER & JULIE C. SEDIVY, *Brown University*—How can the flexibility and speed of pragmatic inferences be reconciled? One possibility is that only a limited amount of relevant information influences early inferencing. This paper explores what types of information enter into the computation of contrastive inferences (CIs). CIs can occur when a prenominal modifier is used for referring (e.g., *tall cup*). In this case, comprehenders typically infer that the modifier signals a contrast between multiple objects of the noun class (cups) that differ along the modifier dimension (height). Crucially, CIs are computed rapidly (200–400 msec from adjective offset) and are not tied to the lexical-semantic properties of any particular modifier. Rather, CIs arise whenever speakers elaborate on the default description used to label an object in isolation. We present two eye-tracking experiments investigating how situation-specific information affects CIs. Experiment 1 demonstrates that perceivers do not project CIs when the speaker is unreliable. Experiment 2 extends and specifies the mechanisms underlying this effect.

(3102)

The Effect of Memory Demands on Audience Design. WILLIAM S. HORTON & RICHARD J. GERRIG, *SUNY, Stony Brook*—How do memory demands affect the capacity of speakers to design utterances for particular audiences? To address this issue, we had triads of participants carry out a referential communication task in which one *director* repeatedly instructed two *matchers* in how to arrange sets of picture cards. Only one matcher was present at a time, each for four consecutive rounds. For half the groups, the matchers had orthogonal card categories (e.g., one matcher had all four birds and all four dogs, whereas the other matcher had all four fish and all four frogs). For the other groups, card categories overlapped across matchers (e.g., each matcher had two different tokens of each type). In two final rounds, the directors matched the complete set of 16 critical cards with each matcher. In line with the memory demands of each circumstance, directors were more sensitive to audience design in orthogonal versus overlapping situations.

(3103)

An fMRI Investigation of How Sentence Constraint Influences Semantic Integration Processes. STELLA ARAMBEL LIU & MARK JUNG BEEMAN, *Northwestern University*—The present experiment tested the effects of sentence predictability, as indexed by cloze probability, on how the brain performs semantic integration. During MRI scanning, subjects read sentence stems and made decisions about sentence-final target words. During alternating blocks, they made fit decisions, which required semantic integration, on the target words, or lexical decisions, which did not require semantic integration. Within each block, sentence predictability was randomly varied. FMRI signal indicated different areas of brain activity across tasks, as well as different influences of sentence predictability within each task. The results will be related to hemispheric asymmetries in sentence processing, as suggested by previous behavioral and neuroimaging studies.

(3104)

Capturing the Meaning of Novel Contexts: Evidence From Event-Related Brain Potentials. DOROTHEE J. CHWILLA & HERMAN H. J. KOLK, *NICI, University of Nijmegen*—In everyday life, meanings are often constructed de novo. We investigated this creative process by recording ERPs while participants read sentences that described sensible novel situations (e.g., "The boys searched for branches with which they went drumming.") or nonsense novel situations. After reading, participants judged how meaningful the sentence was. We tested whether the situations were novel in two ways. First, the critical words were not produced in a cloze test. Second, the semantic similarity between the critical words for the sensible sentences and for the nonsense sentences (e.g., *to drum*/*branches* vs. *to drum*/*bushes*), as computed with latent semantic analysis, was matched. Sensible novel situations were judged as more meaningful than control situations (see also Glenberg & Robertson, 2000) and elicited N400-like effects in terms of timing and scalp distribution. These N400 effects cannot be explained by current measures of semantic similarity but reflect the flexibility of the human mind.

(3105)

Where in the Brain is "It"? Does It Depend on What "It" Is? NATASHA TOKOWICZ, SUSAN DUNLAP, & CHARLES A. PERFETTI, *University of Pittsburgh*—The well-documented concrete-word speed advantage in such language tasks as lexical decision disappears when abstract words follow meaningful sentence contexts (Schwanenflugel & Shoben, 1983). In this study, we investigated whether this speed-of-processing similarity results from identical processing in the brain by comparing the event-related brain potential (ERP) responses to concrete and abstract words in isolation and in sentence context. We selected concrete and abstract words and wrote sentence frames, such that the critical word was the last word of each sentence. The timing and source generators of the ERPs in response to concrete and abstract words will be compared, to determine whether processing of the two word types is in fact identical when reaction times are similar. The results will be discussed in relation to existing models of concreteness and context availability (e.g., Paivio, 1971; Schwanenflugel & Shoben, 1983).

(3106)

Semantic Constraints on Spelling-to-Sound Consistency Effects. STEPHEN J. FROST, W. EINAR MENCL, REBECCA SANDAK, & DINA L. MOORE, *Haskins Laboratories,* STEPHANIE A. MASON, *Yale University School of Medicine,* JAY G. RUECKL & LEONARD KATZ, *Haskins Laboratories & University of Connecticut,* & KENNETH R. PUGH, *Haskins Laboratories & Yale University School of Medicine*—Using fMRI, we examined the modulation of the consistency effect for low-frequency words by imageability, demonstrated behaviorally by Strain, Patterson, and Seidenberg (1996, 2002). We replicated their behavioral findings with simple naming and extended them to go/no-go naming, showing that responses to low-frequency, low-imageable inconsistent words were slower and less accurate than those for either low-frequency, low-imageable consistent words or low-frequency, high-imageable inconsistent words. Neurobiologically, activation in the inferior frontal gyrus, thought to be critical for articulatory recoding of print for speech output, mirrored behavior, both increasing with difficulty of phonological recoding and being reduced for conditions under which semantics alleviated demands on phonological processing. Several posterior areas, including the angular gyrus and the middle temporal gyrus, showed the complementary pattern, indicating that these areas are important for lexical-semantic processing. The results refine our understanding of the functional architecture of the reading system and the interplay between phonology and semantics in the brain.

• Category Learning •

(3107)

Indirect Category Learning. JOHN P. MINDA, *University of Western Ontario,* & BRIAN H. ROSS, *University of Illinois, Urbana-Champaign*—Psychologists usually study categorization by training participants in a feedback-driven classification task. However, people often learn categorical information indirectly and often make predictions, rather than classifications, about stimuli. We investigated indirect category learning by showing participants a series of fictitious animals of various sizes and asking them to predict how much food each animal should receive. Correct responses were a function of size and category. However, participants were not told about the categories and they received no direct classification feedback, so category learning was assumed to be indirect. We contrasted the performance of participants in this prediction task with that of participants who first classified each item (with feedback) before making the prediction. Behavioral results and the results of computational modeling suggest that prediction learners showed a broader attentional focus, whereas classification learners tended to learn single features and showed a narrower attentional focus.

(3108)

Neural Correlates of Concept Learning. CAROL A. SEGER & CORINNA M. CINCOTTA, *Colorado State University*—A series of FMRI studies of concept learning will be presented, focused on the following questions. How do the hypothesis-testing and rule application phases of verbal rule learning differ? What role do the basal ganglia play in cue–outcome learning: processing feedback, learning probabilistic relationships, or some other role? How do observational and feedback-based concept-learning mechanisms differ, particularly in their reliance on basal ganglia systems?

(3109)

Detecting Category Structure in a Random Environment. JOHN P. CLAPPER, *California State University, San Bernardino*—Discovering categories in novel environments—for example, learning to recognize new kinds of trees or flowers while exploring an unfamiliar landscape—is an interesting but underinvestigated problem in unsupervised learning. In this experiment, members of a category with several overlapping properties were interspersed in a training sequence with an equal number of nonmembers composed of random feature combinations. A significant proportion of participants detected the target category in this situation, as was shown by improved memory and feature ratings for category members, as compared with nonmembers. In addition, the ease of detecting the category was affected by the distribution of properties (variability, familiarity) over the set of nonmember stimuli. This context sensitivity is inconsistent with models of unsupervised learning that focus on capturing consistencies within a category but neglect the background stimulus context in which that category is learned.

(3110)

Entrenched and Random Erroneous Feedback in Category Learning. DONALD HOMA & MARK BLAIR, *Arizona State University*—Last year, we reported that ill-defined categories could be learned as rapidly when instances never repeated as when the instances were repeated in each learning block. Although transfer performance to novel

instances was as good for the nonrepeating condition, subjects demonstrated no memory of the training instances. The present study again used the repeating versus nonrepeating manipulation but explored learning when instances were associated with occasional, erroneous feedback. For the repeating condition, the erroneous patterns functioned as exception instances, always associated with the erroneous label (entrenched); for the nonrepeating condition, the erroneous feedback mirrored a noisy system in which feedback was less than perfectly valid (random condition). The results showed retarded learning in the nonrepeating (random) condition, as was expected, and again, subjects showed no memory for any learning patterns. Memory for the repeating patterns was significant and better for the erroneous patterns.

(3111)

Features and the Diversity Effect in Category-Based Induction. AIDAN FEENEY, *University of Durham,* & EVAN HEIT, *University of Warwick*—We present three experiments that investigated whether diverse categories make for stronger arguments because they call to mind general features, whereas nondiverse arguments call to mind idiosyncratic features. In Experiment 1, we asked participants to hypothesize about the blank predicates in a set of arguments and found that the proportion of idiosyncratic versus general properties predicted their ratings of argument strength very well. In Experiment 2, we found that a general prime made nondiverse arguments stronger, whereas an idiosyncratic prime made diverse arguments weaker. In Experiment 3, we examined a set of diverse, causally connected arguments (e.g., horses and grass) previously found to be weaker than a control set of less diverse arguments. We observed an effect of prime, but not of causal relationship. These results support normative and psychological accounts of the diversity effect that emphasize the role of people's hypotheses about the features they are projecting.

(3112)

Cross-Classification and Category Learning. SETH CHIN-PARKER & BRIAN H. ROSS, *University of Illinois, Urbana-Champaign*—Many items belong to multiple categories, but this cross-classification has been largely ignored in investigations of category learning. The present research examines whether learning to classify an item into one category can affect knowledge about other categories the item also belongs to. In the experiments, the participants learned about fictional creatures that could be classified into two category sets. One category set was learned initially, and participants were tested on their knowledge of the categories. Following the learning of a second category set for the same items, participants were tested again on the initial category set. The analyses focus on whether there is a systematic effect of the secondary classification learning on decisions made about the initial category set. The results indicate that there is an influence of later classification learning and that the effects are dependent on what the participant learned during the initial category learning.

(3113)

Origins of Cross-Linguistic Similarities and Differences in Naming. BARBARA MALT, *Lehigh University,* MUTSUMI IMAI, *Keio University,* SILVIA GENNARI, *University of Wisconsin, Madison,* & RUOHONG WEI, *Lehigh University*—Both similarities and differences are striking in how languages carve up the world by name. We investigated their origins by studying naming in the domain of human locomotion. This domain is highly structured and universally experienced, but some parts of it are much more central to the human experience than others. Furthermore, some languages tend toward naming manner of motion, and others tend toward naming path. We hypothesized that domain structure interacts with cultural importance and linguistic constraints to produce variable degrees of universality across the domain. Data from speakers of English, Spanish, Japanese, and Chinese support our hypothesis. These speakers had largely, but not entirely, comparable lexical categories for the most central portions of this domain, and they diverged more markedly in the peripheral parts, a divergence that can be accounted for, in part, by the syntactic habits of the languages.

(3114)

Linguistic Diversity and Object Naming by Dutch-Speaking, French-Speaking, and Bilingual Belgians. GERT STORMS & EEF AMEEL, *University of Leuven,* BARBARA MALT, *Lehigh University,* & STEVEN SLOMAN, *Brown University*—Languages vary idiosyncratically in the sets of referents to which they apply common nouns. We investigated whether linguistic boundary diversity can be found in a bilingual country (Belgium). Three groups of subjects were of interest: Dutch-speaking Belgians, French-speaking Belgians, and bilingual Belgians whose fathers were Dutch, whose mothers were French, or vice versa, and who had been raised in both languages. Our main question was, Do bilinguals preserve the naming patterns of native monolinguals in each language, or does their naming converge on a single pattern? We asked the three groups to name household objects in their native language, to provide similarity ratings, and to judge the objects' typicality with respect to Dutch or French names. French and Dutch naming patterns of the bilinguals were compared with the naming patterns of French- and Dutch-speaking Belgians, respectively. On the basis of the similarity and typicality judgments, an underlying MDS representation for the three groups was revealed. Results will be discussed.

• Representation of Concepts •

(3115)

The Role of Task in Representation Change. DORRIT BILLMAN, *Stanford University and ISLE,* & CARL BLUNT, *Georgia Institute of Technology*—Most models of concept learning assume fixed elements in the representation of instances. In contrast, development of expertise seems to involve change in representation of individual instances or cases, particularly when the domain is perceptually rich. We sought to create such changes in an artificial domain designed to resemble microscope slides of "alien cells." We looked for evidence of forming new relational attributes and perceptual regrouping by looking for changes in what participants identified as an organism and in how participants generalized to displays with completely novel features. Performance differed across our three exposure tasks: relevant classification, irrelevant classification, and attractiveness ratings. We consider how to assess representation change and how tasks mediate attention, which, in turn, may lead to changed representation.

(3116)

When Categorization Meets Memory: Evidence Against Category-Based Induction in Young Children. VLADIMIR M. SLOUTSKY & ANNA V. FISHER, *Ohio State University*—Inductive inference is crucial for learning: Upon learning that a cat has a particular biological property, one could expand this knowledge to other cats. We argue that young children perform induction on the basis of similarity of compared entities, whereas adults may induce on the basis of category information. If different processes underlie induction at different points in development, young children and adults would form different memory traces during induction and would subsequently have different memory accuracy. Experiment 1 demonstrates that after performing an induction task, 5-year-olds exhibit more accurate memory than do adults. Experiment 2 indicates that after being trained to perform induction in an adult-like manner, memory accuracy of 5-year-olds dropped to the level of adults. These results indicate that category-based induction attenuates memory for individual items and that spontaneous induction of young children is based on similarity, rather than on categorization.

(3117)

A Subjective Utility Based Model of Base Rate and Payoff Effects in Perceptual Classification. COREY J. BOHIL, *University of Illinois, Urbana-Champaign*—A new version of Maddox and Dodd's (2001) hybrid model was developed to account for base rate and payoff effects in perceptual classification. The model instantiates simultaneously the flat-maxima hypothesis and the main premise from utility theory—that reward values are subjective. Consistent with the flat-maxima hypothesis,

steepness of a reward function drives the selection of the decision criterion. The new version of the model, however, posits that the criterion depends on the steepness of a "subjective" reward function that reflects values the individual places on rewards gained for correct responses, rather than the "objective" function used in previous model versions. The new model accounted well for conservative cutoff placement in general, greater conservatism in payoff than in base rate conditions, and other factors that affect the steepness of the reward function, such as category discriminability (d') and payoff matrix multiplication.

(3118)

Individual Differences in Conditioned Blocking of Socially Relevant Stimuli. TERESA A. TREAT, *Yale University,* & JOHN K. KRUSCHKE & RICHARD M. McFALL, *Indiana University*—The present research suggests that (1) learned inattention is involved in blocking of associative learning, (2) individual differences (IDs) in the perceived salience of stimulus dimensions influence blocking, and (3) associative-learning paradigms can be useful for examining individual differences in complex social perception. Stimuli were photographs of undergraduate females who varied along body size and facial affect dimensions. Two hundred forty-two female undergraduates completed a prototype classification task, which assessed IDs in dimensional attention, and a phased-learning task, in which either affect or body size was blocked. Results were consistent with expectations: (1) The blocking manipulation influenced transfer and attenuated later learning; (2) IDs in dimensional attention affected initial learning, transfer patterns, and later learning; and (3) IDs in dimensional attention influenced the magnitude of blocking effects on transfer and later learning. These findings support Kruschke's (2001) learned-inattention explanation of blocking and demonstrate the potential utility of examining IDs in complex social perception, using associative-learning paradigms.

(3119)

Why Are Artificial Polymorphous Concept Discriminations Hard for Birds To Learn? STEPHEN E. LEA, ANDY J. WILLS, & CATRIONA M. RYAN, *University of Exeter* (sponsored by Shepard Siegel)—Artificial polymorphous concepts, in which category membership depends on *m* out of *n* features' having appropriate values, have been widely used as models of natural concepts in experiments on concept discrimination learning. However, birds typically learn to discriminate such artificial concepts much more slowly than natural concepts. A series of experiments involving successive go/no-go discriminations with chickens investigated several aspects of the *m*-out-of-*n* concept that might cause this difficulty. These included the presence of multiple features simultaneously in each stimulus (complexity), the need to learn to discriminate multiple features within each session (load), and the inconsistent reinforcement of individual features (unreliability). Results suggest that unreliability on its own is sufficient to cause the observed difficulty of learning to discriminate the *m*-out-of-*n* concepts used but that complexity and perhaps load also have an effect.

(3120)

Increased P300 Amplitude During a Self-Consciousness Task. JOEL E. ALEXANDER, *Western Oregon University,* RONALD G. ALEXANDER, *Wartburg College,* & KELLY A. MACHAN & BENJAMIN W. CROWSON, *Western Oregon University*—The effects of a self-consciousness cognitive task on the P300 cognitive component were explored. The tasks included (1) a standard ERP auditory oddball (15% target, 85% standard) task, (2) the oddball task plus maintaining mental count of the target tones, and (3) the oddball task with a self-consciousness cognitive task. During the self-consciousness task, the subject was instructed to indicate any surprise at the occurrence of the target tone in the series of target and standard tones. Across all recording locations, P300 amplitude during the self-consciousness task was significantly larger than that during the oddball or the oddball + count task. It appears that the self-consciousness (introspective) task requires more cognitive resources than do the oddball and the oddball + count tasks, which do not direct the subject to engage in a self-evaluation of a first-order mental event. These results are similar to previous findings in which stimuli of personal relevance to the subject evinced greater P300 amplitude.

Distinctiveness and Recognition Memory
Regency CD, Saturday Morning, 8:00–9:50

Chaired by Stephan Lewandowsky, University of Western Australia

8:00–8:20 (132)
Hybrid-Similarity Exemplar Model for Predicting Distinctiveness Effects in Recognition. ROBERT M. NOSOFSKY, *Indiana University,* & SAFA R. ZAKI, *Williams College*—The authors investigated the basis for old-item distinctiveness effects in perceptual recognition, whereby distinctive old items are recognized with higher probability than are typical old items. In Experiment 1, "distinctive" items were defined as those lying in isolated regions of a continuous-dimension similarity space. In this case, any beneficial effects of distinctiveness were small, regardless of the structure of the test list used to assess memory. In Experiment 2, "distinctive" items were defined as those containing certain discrete, individuating features. Here, large old-item distinctiveness effects were observed, with the nature of the effects being modulated by the structure of the test lists. A hybrid-similarity exemplar model, combining elements of continuous-dimension distance and discrete-feature matching, was used to account for these distinctiveness effects.

8:25–8:40 (133)
Why Distinctive Information Reduces False Memories: Evidence for Both Impoverished Encoding and Distinctiveness Heuristic Accounts. CHAD S. DODSON & AMANDA C. HEGE, *University of Virginia*—The past several years have witnessed a growing interest in mechanisms that minimize the occurrence of false memories. In part, this interest has been fueled by the DRM paradigm (Deese, 1959; Roediger & McDermott, 1995; see also Read, 1996) that typically generates robust false memories. We focus on two different false memory reduction mechanisms within the DRM paradigm that are the consequence of studying source or distinctive information: the distinctiveness heuristic and the impoverished encoding account. The distinctiveness heuristic is an inferential retrieval strategy whereby the absence of memory for expected distinctive information is taken as diagnostic of an event's nonoccurrence. By contrast, the impoverished encoding account argues that studying distinctive information impairs memory for relational information that typically underlies false memories for the related lure in the DRM paradigm.

8:45–9:00 (134)
Generation Effects on Item and Source Memory Are Modulated by List Composition. HASAN G. TEKMAN, *Middle East Technical University*—Memory for list membership in a mixed list that included both read and generated words depended on the method of study for the items in the contrasting list. Within participants, although generation resulted in better item memory with contrasting lists of both completely read and completely generated items, generation facilitated source memory only if the contrasting list consisted of read items. Between-participants comparisons revealed that the generation effect was larger for item memory if the items on the contrasting list were studied in a different manner, as compared with the critical items, but a generation effect was observed for source memory only if items on the critical and the contrasting lists were studied in the same manner. Results support the hypotheses that generation increases item distinctiveness and reduces processing of read items in the same list and that generation influences source memory through both more accurate list membership identification and response bias.

9:05–9:20 (135)
A Multidimensional Detection Analysis of Recognition Memory. WILLIAM P. BANKS & ADOLFO RUMBOS, *Pomona College*—To learn to recognize an item is to acquire the ability to discriminate it from other items. We have found that a felicitous way to describe this ability is with a multidimensional signal detection representation, much like that used by general recognition theory (GRT). We describe our simplified version of GRT and show how it can be used to predict the differences in performance that are obtained as noise items and the recognition task are varied. We analyze memory discriminations with several sorts of multidimensional stimuli, including textured tactile surfaces. The approach could be viewed as a psychophysical analysis of memory. We offer the multidimensional approach as an alternative to dual-process theories, which seem to require ad hoc assumptions to explain effects of differences in instructions and multiple sources of information.

9:25–9:45 (136)
Nonmonotonic False Alarm Rate Functions in Recognition. AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—Claims about selective process deficits in various populations, such as the elderly, are based in large part on empirical dissociations in which false alarm rates increase with the effects of a manipulated variable in one group but decrease in the other. The alternative explanation discussed here is that false alarm rates are nonmonotonically related to manipulations of learning and that the empirical dissociations reveal a global deficit in learning for one group. This view follows naturally from extensions of global match models of recognition and makes strong predictions about conditions in which it should be possible to observe nonmonotonic false alarm rate functions. New experiments that reveal such data are presented here.

Processing Linguistic Structure
Regency AB, Saturday Morning, 8:00–10:05

Chaired by Laurie B. Feldman, SUNY, Albany

8:00–8:15 (137)
Making Syntax of Sense. KATHRYN BOCK, *University of Illinois, Urbana-Champaign,* KATHLEEN M. EBERHARD, *Notre Dame University,* & JOHN COOPER CUTTING, *Illinois State University*—In some linguistic theories, verb agreement and pronoun agreement are regarded as fundamentally the same. As carriers of number features, both verbs and pronouns tend to display number values consistent with their superficial agreement controllers. Yet with the same superficial controllers, verb and pronoun number can differ. To establish the range and systematic nature of the variation, we manipulated the notional and grammatical number properties of normal and spurious agreement controllers for verb and pronoun targets. Across six experiments, verb and pronoun number were differently sensitive to notional number variations in normal agreement controllers (subject noun phrases) but were similarly insensitive to notional number variations in spurious controllers. Notably, verbs and pronouns were equally attracted to the grammatical number of spurious controllers. To account for this pattern, we distinguish psycholinguistic mechanisms for control and concord that differ in where agreement features originate and how they are transmitted during sentence formulation.

8:20–8:35 (138)
Syntactic Persistence: We Repeat What We Learn. VICTOR S. FERREIRA, *University of California, San Diego*—Speakers' current descriptions tend to have the same syntactic structures as sentences they have recently been processed. Learning-based approaches to language production attribute such syntactic persistence to the strengthening (learning) of message-to-syntax mappings—the knowledge that certain kinds of messages can be expressed with the primed syntactic structures. Such learning-based approaches predict that less-preferred outcomes should show greater persistence than do more preferred outcomes. Three experiments using recall-based syntactic persistence tasks showed that reduced embedded clauses show more syntactic persistence to the extent that they are less preferred and that this pattern cannot be explained as resulting from lexical repetition or syntactic similarity. This suggests that syntactic persistence results from the strengthening or learning of message-to-syntax mappings and reveals why such learning-based persistence does not lead to the unlearning of less preferred outcomes.

8:40–8:55 (139)

The Nature of the Classifier–Noun Agreement in Chinese Word Production. JENN-YEU CHEN & TSAN-YU WANG, *National Chung Cheng University*—In Chinese, a noun requires a specific classifier to go with it. We ask whether this agreement is syntactic, semantic, or both. Experiment 1 employed the picture-naming and word-naming tasks with picture-only, word-only, and picture–word stimuli. The participants had to say the noun or its classifier in response to the picture or the word. We hypothesized that if the classifier bears a syntactic relationship with the noun, it would be encoded as a syntactic diacritic in the noun lemma, and therefore, retrieving the classifier from the word of the noun should be faster than from the picture of the noun and a distracting picture should be more disrupting than a distracting word. On the other hand, if the classifier–noun agreement is semantic, the above predictions would be reversed. Results were consistent with the semantic hypothesis. A further experiment demonstrated that this agreement was categorical in nature.

9:00–9:15 (140)

The Production of Diminutives in Dutch. NIELS O. SCHILLER, *University of Maastricht,* & ALFONSO CARAMAZZA, *Harvard University*—We investigated grammatical feature selection during noun phrase production in Dutch. Pictures of simple objects paired with a gender-congruent or a gender-incongruent distractor word were presented. Auditory (Experiment 1) or visual (Experiment 2) cues indicated whether participants had to name the noun with a standard noun phrase including the appropriate determiner or in its diminutive form. Results revealed a three-way interaction between gender (common or neuter), condition (gender congruent or gender incongruent), and format (standard or diminutive). This replicates earlier results showing that congruency effects are due to competition during the selection of determiner forms rather than gender features. The overall pattern of results supports the view that grammatical feature selection is an automatic consequence of lexical node selection and, therefore, not subject to interference from incongruent grammatical features. Selection of the correct determiner form, however, is a competitive process, implying that lexical node and grammatical feature selection operate with distinct principles.

9:20–9:35 (141)

Role of Exemplar Frequency in Linguistic Category Induction. ROMAN TARABAN, *Texas Tech University*—Exemplar frequency is a factor in the emergence of linguistic structure. Its role in the induction of gender-like subcategories was examined in three experiments in which participants learned artificial language locative phrases, like *garth eef* (*to* [the] *car*), one at a time via computer. In Experiment 1, all pseudo-nouns were unmarked (i.e., no pseudo-inflection endings). Participants showed more category induction when some exemplars had a higher frequency than others, as compared with a condition in which all exemplars occurred with equal frequency. In Experiment 2, the effect of exemplar frequency was compared with that of pseudo-inflection marking. There were larger category induction effects when exemplar frequency was manipulated than when *-o* and *-a* pseudo-inflections were used to mark the two gender-like subcategories. Experiment 3 compared the effects of exemplar frequency with those of more salient pseudo-inflections (*-oo*, *-aik*). The exemplar frequency effects in these experiments pose problems for traditional syntactic theories of acquisition and for connectionist models.

9:40–10:00 (142)

Semantic Similarity and Grammatical Class in Action Naming. GABRIELLA VIGLIOCCO, DAVID P. VINSON, FEDERICA PAGANELLI, & NORIKO IWASAKI, *University College London*—Grammatical class has been argued to be an organizational principle of lexical knowledge, and patients have been described who are selectively impaired in their knowledge of nouns or verbs. Grammatical class is, however, highly correlated with semantic class (i.e., objects are nouns, and actions tend to be verbs). We present a series of cross-linguistic production experiments that address the question of under which conditions grammatical class effects arise when the semantic correlates of grammatical class are controlled for.

Judgment and Decision Making
Georgia, Saturday Morning, 8:00–9:55

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

8:00–8:15 (143)

Goals Are Specific: Evidence From Patterns of Valuation and Devaluation. ARTHUR B. MARKMAN & KYUNG IL KIM, *University of Texas, Austin,* & C. MIGUEL BRENDL, *INSEAD*—Theories of motivation have difficulty defining the term "goal," because people do not have access to the end states of their goals. In previous research, we found that activating a goal leads to valuation of goal-related objects (they are more strongly preferred when the goal is active rather than inactive) and devaluation of goal-unrelated objects (they are less strongly preferred when the goal is active rather than inactive). New evidence examining patterns of valuation and devaluation suggests that goals are specific. In one study manipulating strength of need to eat, participants run in the morning showed valuation for breakfast foods, devaluation for nonfoods, and an intermediate pattern for dinner foods. Participants run in the evening showed valuation for dinner foods, devaluation for nonfoods, and an intermediate pattern for breakfast foods. This technique provides information about people's goals and helps explain why valuation effects have been difficult to obtain in laboratory studies.

8:20–8:40 (144)

The Hot Hand in Basketball: Fallacious Belief, Adaptive Behavior. BRUCE D. BURNS, *Michigan State University*—Kahneman and Tversky showed that human reasoning is often not normative, but they retained the normative model as a prescription for what people should do. This retention has been challenged by the adaptive approaches of Gigerenzer and Anderson, who assessed reasoning with regard to behavior that achieves goals—that is, whether it is adaptive. I present an analysis of the "hot hand belief" that demonstrates how this distinction can be critical and how examining beliefs in terms of adaptivity leads to testable predictions. Gilovich, Vallone, and Tversky (1985) showed that basketball shots are independent; thus, the hot hand is a false belief. Mathematically, I show that the behavior that follows from this belief (a bias to allocate the next shot to a player experiencing a streak) *must* result in more team scoring—even if shots are independent. Thus, following the behavioral implication of the false belief is adaptive behavior.

8:45–9:05 (145)

Can I Believe Your Eyes? Eyewitness's Influence on Investigators. D. STEPHEN LINDSAY, LEORA C. DAHL, & C. A. BRIMACOMBE, *University of Victoria*—How do forensic investigators weigh eyewitness identification evidence in the context of other crime information? In a new procedure designed to explore this issue, subject/investigators interviewed confederate/witnesses regarding a videotaped crime, then searched a data base of potential suspects, selected a suspect, and rated their confidence in the suspect's guilt. Afterward, they administered a photospread lineup identification test to the confederate/witness and then rerated their confidence in the suspect's guilt. Investigators' belief in the guilt of the suspect was dramatically influenced by the witness's identification response (choose suspect, choose foil, or respond "not present") and by the witness's apparent confidence, even though a baseline study showed that real witnesses tested under the same condition performed extremely poorly on the lineup test. The effects of witness's responses on investigators' beliefs in the guilt of the suspect were independent of the prior odds that the suspect was in the lineup.

9:10–9:25 (146)

Weather Forecasting by Man and Machine. EARL HUNT & KARLA SCHWEITZER, *University of Washington*—We describe a situation in

which a decision maker receives advice from a machine—specifically, a weather forecaster who has available the prediction from a mathematical model. We describe how the forecaster makes use of this information and apply Brunswik's lens model to assess the efficiency of use of information.

9:30–9:50 (147)

Similarity-Based and Rule-Based Processes in Classification and Feature Inference. TAKASHI YAMAUCHI, *Texas A&M University*—A number of studies have indicated that people adopt different cognitive strategies to answer classification questions and feature inference questions. On a classification question, participants are asked to predict the category to which a stimulus belongs, and on a feature inference question, participants are asked to predict the feature value of a stimulus given the category membership of the stimulus. A series of experiments conducted in my laboratory suggest that people employ two different cognitive strategies to answer the two types of category questions. When participants answered classification questions, they were influenced significantly by manipulations introduced to the specific appearance of individual stimuli, but these manipulations were generally ineffective when they answered predictive inference questions. The results suggest that participants generally rely on a similarity-based associative process to answer classification questions, whereas they generally adopt a rule-based abstract process to answer inference questions.

Visual Selective Attention I
Plaza, Saturday Morning, 8:00–10:05

Chaired by James F. Juola, University of Kansas

8:00–8:20 (148)

Quantifying the Efficiency of Visual Attentional Selection. GEORGE SPERLING, *University of California, Irvine,* STEPHEN A. WURST, *Oswego University,* & ZHONG-LIN LU, *University of Southern California*—We measure attentional selection in a task in which characters flash on top of each other at 10/sec and observers must detect a repeated character. Even-numbered characters are red; odd-numbered characters are green. Attending to red in this alternating feature stream facilitates search relative to Control 1, a stream of exclusively red characters in which preattentional selection is impossible. If the observer could preattentively exclude green items perfectly, it would be equivalent to viewing a stream in which green items were replaced with blanks, Control 2. Where performance falls between Control 1 and Control 2 indicates the efficiency of attentional selection (after stimulus discriminability factors are removed). We found large individual differences in efficiency of attentional selection for color (0%–60%). The dimensions studied, in order of increasing selection efficiency (0%–70%), are left/right slant, black/white polarity, red/green color, small/large size, low/high spatial frequency bandpass, and polarity and size covaried.

8:25–8:40 (149)

Looking Without Seeing: Evidence of Visual Processing During Inattentional Blindness. BRUCE BRIDGEMAN & WILLIAM B. LATHROP, *University of California, Santa Cruz*—Inattentional blindness (IB) shows that participants are unable to report the appearance of patterns, or even simple features, when they are unattended and presented unexpectedly (Mack & Rock, 1998, 2000). Many theories of visual attention, however, do not predict that one should be able to report these items. In fact, feature extraction and texture segmentation are traditionally categorized as preattentive (see Julesz, 1981; Treisman & Gelade, 1980). Nevertheless, we should still be able to observe the products of these computations. Two experiments show that although one may remain phenomenally unaware of any perceptual qualities of a large illusion-inducing stimulus presented during conditions of inattention, such stimuli still influence perceived location (Experiment 1). Furthermore, the rate of IB can be increased by a more demanding visual discrimination task. Accumulating evidence of processing during IB bolsters theories of attention that assume extensive scene organization prior to the engagement of attention.

8:45–9:00 (150)

Covert Attention Alters Visual Appearance. MARISA CARRASCO, SAM LING, & SARAH READ, *New York University*—Covert attention improves performance in many visual tasks, but there is a long-standing debate as to whether attention alters appearance. When a location was precued, contrast thresholds decreased along the psychometric function. From such findings, it has been inferred that attention changes appearance. Here, we directly tested whether covert attention alters appearance. A 40-msec peripheral or neutral cue preceded two Gabors (2 or 6 cpd) tilted 45º to the left or the right, which appeared for 100 msec at 4º eccentricity. One of the Gabors was always presented at 6% contrast, and the other ranged from 1% to 30% in contrast. Observers performed an orientation discrimination task for the Gabor that they perceived to be of higher contrast, which allowed us to assess appearance. Attention decreased threshold in the psychometric function not only in contrast sensitivity, but also in appearance, thus showing that visual attention alters the appearance of attended stimuli.

9:05–9:25 (151)

Transient and Sustained Cognitive Control During Stroop Performance: Behavioral and Brain Imaging Data. TODD S. BRAVER & CHRISTINE M. HOYER, *Washington University*—Selective attention in the Stroop task might be accomplished via two different control strategies: (1) reactive control—involving transient, poststimulus activation of goal representations for interference suppression on incongruent trials—or (2) proactive control—involving sustained maintenance of goal representations across all trials for optimal preparation and attentional focus. An expectancy manipulation (probability congruence) was utilized to bias which control strategy was preferred. In the mostly incongruent (MI) condition, expectancies favored the proactive control strategy, whereas in the mostly congruent (MC) condition, expectancies favored a reactive strategy. The mostly neutral (MN) condition controlled for pure stimulus frequency effects. Behavioral data indicated expectancy effects on early versus late attentional selection and depth of processing of the irrelevant word information. Brain-imaging data indicated an expectancy-related shift in the location and dynamics of prefrontal cortex activity from left-hemisphere transient incongruent activation in the MC condition to right-hemisphere sustained activity in the MI condition.

9:30–9:45 (152)

What Counts as an "Object" of Object-Based Attention? BRIAN J. SCHOLL, OHAD BEN-SHAHAR, & ALEXANDRIA MARINO, *Yale University*—Recent studies of object-based attention (OBA) have concluded that the underlying units of attention are often discrete objects whose boundaries constrain the spread of attention through a scene. However, few studies have explored the particular stimulus cues that determine what counts as an "object" of attention. Here we report several studies—using both spatial cuing and divided-attention paradigms—that explore how attention spreads through static texture flows, across simple contours (with and without closure), and across texture boundaries defined by both orientation and curvature. We find that the spread of attention is influenced by closure, parallelism, proximity, and multiple types of orientation-based texture segmentation—but not by the general "grain" of a static texture flow. Collectively, these experiments begin to reveal how the "objects" of OBA are formed from simple visual features. We conclude that OBA is not an all-or-nothing phenomenon: Object-based effects can be independently strengthened or weakened by multiple cues to objecthood.

9:50–10:00 (153)

Low- Versus High-Feature Discriminability Results in Greater Object-Based Attentional Facilitation. AMISHI P. JHA, STEPHEN A. RAUCH, & JARED INSELMANN, *University of Pennsylvania*—Studies of spatial selective attention have observed that attentional fa-

cilitation is greater for stimuli with low versus high feature discriminability (e.g., low versus high luminance contrast). In the present ERP study, we hypothesized that similar to spatial attention, the degree of attentional facilitation would increase as feature discriminability decreased during tasks requiring attention to objects. Subjects (N = 7) viewed overlaid compound face/building images, during which attention was to be directed to the face or the house in the image. Feature discriminability was varied (low, medium, and high) from trial to trial. The amplitude of the face-sensitive N170 ERP component was larger during "attend face" versus "attend building" trials only when face discriminability was low. N170 responses did not vary across attention condition when faces had medium and high levels of discriminability. Thus, like spatial attention, attentional facilitation during attention to objects—specifically, faces—is modulated by feature discriminability.

Gestalt Principles
Regency E, Saturday Morning, 8:00–10:05

Chaired by James T. Todd, Ohio State University

8:00–8:15 (154)
Gestalt Perception of Emotional Expressions. ÅSE H. INNES-KER & JAMES T. TOWNSEND, *Indiana University* (read by James T. Townsend)—Gestalt processing of emotional expressions was investigated using a stochastic process model framework. In these models, processing varies on four logically distinct but interacting dimensions: architecture, independence, capacity, and stopping rule. Gestalt processing suggests a parallel or co-active architecture, positive dependence between channels, super-capacity, and an exhaustive stopping rule. Participants searched for expressive features in rapidly presented arrays. The features were the eyes, nose, and mouth isolated from two photographs of the same individual expressing different emotions (happy, fear, or neutral). Features were either pasted in gestalt configuration or scrambled. Both gestalt and scrambled stimuli revealed an underlying parallel architecture. Gestalt configuration afforded quicker and more efficient processing. Participants employed a self-terminating stopping rule whenever possible, suggesting an analytic approach toward the task. Gestalt-configured arrays processed exhaustively showed evidence for super-capacity, whereas scrambled arrays were processed with limited capacity. Minimum time processing resulted in limited to extremely limited capacity.

8:20–8:30 (155)
A New View of Perceptual Grouping by Proximity. HELENA KADLEC, *University of Victoria*—Multidimensional signal detection theory (MSDT) was used to assess perceptual and decisional processes in a set of stimuli constructed so that perceptual grouping by proximity could occur in some, but not in others. One advantage of using MSDT is that three types of dimensional interactions can be assessed simultaneously: a local, within-stimulus perceptual interaction; a global, across-stimulus perceptual interaction; and a global, across-stimulus decisional interaction. The hypothesis tested in the reported studies was that only the stimuli possessing "row-ness" and "column-ness," the stimulus properties that emerge from perceptual grouping by proximity, would show local perceptual interactions. The results support the hypothesis, but global perceptual and decisional interactions were also observed. A more dynamic processing perspective of the results is offered.

8:35–8:50 (156)
Completion of Occluded Contours: A Two-Stage Process. ANNE GIERSCH & SERGE CAPAROS, *INSERM*—We explored visual completion of occluded contours in healthy volunteers. A reference was matched with one of two lateral oblique lines on the basis of their common orientation. The reference line was (1) occluded by a foreground diamond (occluded condition), (2) composed of two line segments separated from the diamond by small gaps (fragmented condition), or (3) displaced relative to the diamond. The length of the lateral lines matched (1) the length of the occluded part, (2) the complete length of the reference line, or (3) an intermediate length. Performance was affected in the occluded condition when the length of the target corresponded to the occluded part of the reference, but only after a trial in the fragmented condition. This is consistent with the hypothesis that a completed contour is first separated from visible contours and then reaches consciousness when it is bound with visible contours and when top-down influences are integrated.

8:55–9:10 (157)
Perceptual Process and Knowledge Access in Early Perceptual Organization. PAUL C. QUINN, *University of Delaware,* & PHILIPPE G. SCHYNS, *University of Glasgow*—The relationship between perceptual categorization and organization processes in 3- to 4-month-old infants was explored. The question was whether an invariant part abstracted during category learning could interfere with subsequent Gestalt-based perceptual organization processes. Experiment 1 showed that the infants could parse a circle in accord with good continuation from visual patterns consisting of a circle and a complex polygon. In Experiments 2 and 3, however, this parsing was interfered with by a prior category familiarization experience in which infants were presented with visual patterns consisting of a pacman shape and a complex polygon. Part 1 of Experiments 2 and 3 showed that the infants recognized the pacman as familiar, and Part 2 demonstrated that the representation of the pacman blocked the subsequent parsing of the circle. The results suggest that a cognitive system of flexible feature creation can override organizational principles that a perceptual system may come preequipped with.

9:15–9:35 (158)
The Genesis of Perceptual Organization: Basic Emergent Features in Vision. JAMES R. POMERANTZ, MARY C. PORTILLO, & STEPHEN W. JEWELL, *Rice University,* & ALPNA AGRAWAL, *University of Texas School of Public Health*—When visual elements are combined in a display, Gestalt grouping effects sometimes arise. We conceptualize such grouping as the creation of emergent features (EFs). Previous experiments have examined such EFs as symmetry, closure, intersections, and parallelism, but each of these EFs has been studied using a different set of stimuli, thus making comparisons among EFs difficult (e.g., comparing strength of grouping factors). In a new approach, we create perceptual groupings from the ground up, starting with the most minimal configuration of just two points, which yields the EFs of proximity and orientation (as demonstrated by large configural superiority effects, or CSEs). Adding a third point creates the further EFs of collinearity, symmetry, and surroundedness. Adding a fourth point yields intersections, parallelism, closure, and curvilinearity. Our methodology allows direct comparison across stimuli and, thus, the possibility of measuring Gestalt effects along a common scale of the size of CSEs.

9:40–10:00 (159)
Perceptual Organization of Hierarchical Stimuli: A Developmental Study. RUTH KIMCHI & BAT-SHEVA HADAD, *University of Haifa*—We examined the development of perceptual organization of hierarchical stimuli that varied in number and relative size of their elements (few-element vs. many-element stimuli). Children 4–14 years of age and adults performed visual search for a globally or a locally defined target. Although overall search times improved with age, the pattern of results exhibited by the children was similar to the one observed for adults, indicating that search efficiency depended on number and relative size of the elements. For many-element stimuli, search for a global target was efficient, whereas search for a local target was slower, increased with number of items, and showed a distinct improvement between 5 and 6 years of age. For the few-element stimuli, search for a local target was efficient, whereas search for a global target was slower, increased with number of items, and also improved by age 6. These results show age-related changes in perceptual organization for those organizational processes that require attention.

Cognitive Control
Regency F, Saturday Morning, 8:00–9:55

Chaired by Gordon D. Logan, Vanderbilt University

8:00–8:15 (160)
Extensive Training in the *N*-Back Task Expands the Size of the Focus of Attention From 1 to 5. PAUL VERHAEGHEN, JOHN CERELLA, & CHANDRAMALLIKA BASAK, *Syracuse University*—We conducted an extensive training study (10 1-h sessions; 11,000 trials total; $n = 6$) on a self-paced identity judgment version of the *N*-Back task (*N* ranging from 1 to 5). Within Session 1, there was an abrupt increase in RT of about 300 msec in passing from $N = 1$ to $N > 1$, in accordance with theories stating that the focus of attention can accommodate only a single item (Garavan, 1998; McElree, 2001). However, within Session 10, RT increased linearly with *N* (with a shallow slope of about 20–40 msec). Ex-Gaussian decomposition situates the effects mainly in the skew of the distribution. The dual effects of (1) expansion in the number of items spanned by the focus of attention and (2) the development of Sternberg-like retrieval occurred gradually and simultaneously over sessions. An alternative theory that fits the findings is Oberauer's (2002) embedded-process theory.

8:20–8:40 (161)
Control and Adaptation of the Speed–Accuracy Tradeoff: A Mathematical Theory. MICHAEL C. MOZER, *University of Colorado,* & SACHIKO KINOSHITA & COLIN DAVIS, *Macquarie University*—We propose a mathematical theory of response initiation in speeded stimulus–response tasks (e.g., word naming). The theory aims to explain blocking effects: When stimuli vary on a dimension of difficulty (e.g., word frequency in a naming task), mixing difficulty of items in a trial block results in slowdown of easy items and speedup of hard items, relative to pure-block response times. Blocking effects suggest that the speed of response is sensitive to the trial history. Our theory makes only weak claims concerning the temporal dynamics of information processing. The core of the theory concerns a decision criterion specifying when a response should be initiated. The criterion is framed in terms of utility maximization, where the utility increases with estimated accuracy and decreases with response time. We hypothesize that information from recent trials is incorporated into the utility estimate, allowing us to explain blocking effects.

8:45–9:00 (162)
Response Conflict Determines Interference Effects in Short-RSI Serial RT Tasks. INES JENTZSCH & HARTMUT LEUTHOLD, *University of Glasgow*—In choice reaction time (RT) tasks, the response on each trial is a function of the preceding event history. Here, we examined the mechanism underlying a RT sequence effect that specifically occurs with short response–stimulus intervals (RSIs)—namely, prolonged processing on current trial *N* if stimulus–response events alternate rather than repeat on trial $N - 1$ relative to trial $N - 2$. Five experiments tested different accounts of this alternation-based interference effect (AIE) in terms of perceptual noise versus conflict control. In Experiment 1, stimulus classification was manipulated, which resulted in an RT effect additive to the AIE. Manipulation of S–R compatibility in Experiments 2 and 3 revealed an increased AIE under conditions in which response conflicts were present. Experiments 4 and 5 used a speed–accuracy manipulation to influence response adjustment after conflict. The AIE was reduced under speed, as compared with accuracy, instructions. Together, the results support the conflict control hypothesis of the AIE.

9:05–9:25 (163)
A Differential Outcomes Effect Using Two Different Feeder Locations. ANDREA M. FRIEDRICH & THOMAS R. ZENTALL, *University of Kentucky* (read by Thomas R. Zentall)—If pigeons are trained to match to sample with differential outcomes (e.g., food vs. water or food vs. nothing) for the two sample correct comparison associations, outcome anticipation appears to become an effective cue for comparison choice. However, because pigeons generally prefer one of those outcomes over the other, the outcomes are likely to have different subjective values. If so, they may illicit different sample behavior, and differential sample behavior may mediate choice of the correct comparison. In the present experiment, we trained pigeons on two matching tasks. In each task, they received food at one location for correct choices following one sample and at a different location for correct choices following the other. Significant transfer was found when, on test trials, samples from one task were presented with comparisons from the other. Thus, different locations of food can serve as anticipatory cues for comparison choice in the absence of differential outcome value.

9:30–9:50 (164)
Cerebral Hemovelocity and the Signal Regularity Effect in Vigilance. TODD D. HOLLANDER, JOEL S. WARM, GERALD R. MATTHEWS, WILLIAM N. DEMBER, & LLOYD D. TRIPP, *University of Cincinnati,* & RAJA PARASURAMAN, *Catholic University of America* (read by Joel S. Warm)—The signal regularity effect—enhanced performance efficiency when critical signals for detection appear in a temporally regular, as opposed to a temporally irregular, manner—has a long history in vigilance research. Nevertheless, the precise psychophysical conditions under which this effect can be elicited have not been identified. Toward that end, this study demonstrates that the effect is limited to low-salience signals, perhaps because the effort needed to generate veridical temporal expectancies is unnecessary with high-salience signals. Additionally, using signal detection theory metrics (d' and c) and neuroimaging of cerebral blood flow via transcranial Doppler sonography, this study also shows that the signal regularity effect is rooted in sensing, rather than decision-making, factors and that it is lateralized to the right cerebral hemisphere.

Autobiographical and Event Memory
Regency CD, Saturday Morning, 10:00–12:00

Chaired by Aaron S. Benjamin, University of Illinois

10:00–10:15 (165)
Predicting Recollection and Belief of Autobiographical Memories. DAVID C. RUBIN & DANIEL L. GREENBERG, *Duke University,* SAMI GÜLGÖZ, *Koç University,* MAKIKO NAKA, *Tokyo Metropolitan University,* ROBERT W. SCHRAUF, *Northwestern University,* & ILENE C. SIEGLER, *Duke University*—Data from several unpublished and recently published studies show that recollection (as measured by participants' ratings of reliving the original event and mentally traveling back in time to when it happened) is predicted in multiple regressions by ratings of visual imagery, auditory imagery, and emotions. Belief in the accuracy of the memory (as measured by ratings of whether the event really occurred the way it was remembered, whether the memory is an accurate unbiased reflection of the event, whether one could be persuaded one's memory was wrong, and whether one would testify in court) is predicted by ratings of knowledge of the setting. As an individual-differences variable, belief is not predicted as well as recollection by cognitive measures but is predicted better by standard measures of depression, dissociation, and openness to feelings. A seven-point rating of remember versus know for autobiographical memory follows the pattern of belief, not recollection.

10:20–10:30 (166)
Inhibition of Autobiographical Memories. MARTIN A. CONWAY, *University of Durham,* & AMANDA J. BARNIER, *University of New South Wales*—In a series of directed forgetting and retrieval induced forgetting experiments, powerful inhibition of recently recalled autobiographical memories was observed. The findings are interpreted in an episodic memory account of inhibition that proposes that episodic memories of recalling autobiographical memories are inhibited, rather than inhibition of the actual memories themselves. It is suggested that

the process of episodic inhibition of autobiographical memories might form a basis for more long-lasting inhibition.

10:35–10:55 (167)

Improving Autobiographical Memory Recall in Surveys: Calendar Interviewing Methodologies. ROBERT F. BELLI, *University of Nebraska*—Researchers in the social sciences often ask survey respondents to provide life course retrospective reports on social, economic, and health behaviors and events. Although many of these events are very distinctive ones from a person's past, in traditional survey questionnaire methodologies, appreciable inaccuracies in reports are observed. Calendar interviewing methods are emerging approaches to collecting retrospective reports that are based on using thematic and temporal cues available in the structure of autobiographical knowledge. Methodological comparisons between traditional and calendar interviewing methods reveal that calendar methods are able to more accurately elicit (1) life course residential changes, (2) annual levels of work activity, (3) life course health status, and (4) first exposure to domestic violence. These results have implications toward a better understanding of the structure of autobiographical knowledge and of how conversational discourse can be used to improve the quality of life course retrospective reports.

11:00–11:10 (168)

Memory for Location: Where Were You When . . . ? STEVEN P. MEWALDT & BRIANNE T. ERWIN, *Marshall University*—Groups of students were taken on a tour of the Marshall University campus. During the tour, the guide presented 20 facts about the University. Students were instructed to remember these facts for a test. Each fact was presented at a different location. Half the participants were told that they would also be tested for recall of the location at which each fact was presented. Immediately following the tour, participants filled out a questionnaire consisting of 10 real and 10 foil sets of questions asking whether they (1) recognized being told a particular fact, (2) recalled some detail of the fact, and (3) recalled where they were when the fact was presented. One to 3 weeks later, participants were asked the same questions about the 10 facts not previously tested. Results suggest that location information was automatically encoded for the immediate memory test but required effortful processing for long-duration recall.

11:15–11:30 (169)

Memory for Fact and Fiction: A Cross-Cultural Examination of the Iraq War 2003. STEPHAN LEWANDOWSKY & WERNER STRITZKE, *University of Western Australia,* KLAUS OBERAUER, *University of Potsdam,* & MICHAEL MORALES, *SUNY, Plattsburgh*—During the closing phases of the Iraq War, we tested people's memory for events surrounding the conflict. We collected data from nearly 700 participants in Australia, Germany, and the United States. Questions probed, respectively, true events (e.g., suicide bombings), events that were initially presented as fact but subsequently retracted (e.g., the claim that allied POWs were executed after surrendering), and fictitious events invented by the authors (e.g., that Hungarian-trained Iraqi exiles joined U.S. forces). The results showed that true events were remembered better than retracted events, which in turn were remembered better than fictitious items. However, the judged truth of retracted statements was equal to (German respondents) or greater than (Australian and American sample) that of fictitious items, suggesting that many people did not discount information explicitly known to be false.

11:35–11:55 (170)

Positive and Negative Effects of Testing in Retention of General Knowledge. HENRY L. ROEDIGER III & JEFFREY KARPICKE, *Washington University,* & ELIZABETH J. MARSH, *Duke University*—The educational system can be considered a very large, badly controlled memory experiment. We investigated whether testing (shown to have powerful effects in experiments with word lists) would also have strong effects with educationally relevant prose materials. Subjects read passages about science and history and then were tested repeatedly on their knowledge. In general, prior testing aided later retention on delayed tests. However, repeated study of the material aided retention more than did studying and testing when the test was immediate. In other experiments, multiple-choice tests were shown to aid a later cued recall test, but the testing effect was diminished with increasing numbers of alternatives. A multiple-choice test with many similar alternatives can create interference. Still, in general, testing has a large positive effect on learning. Testing may be used in educational settings to enhance, as well as to assess, the acquisition of knowledge.

Mechanisms of Selective Attention
Regency AB, Saturday Morning, 10:15–12:00

Chaired by Charles L. Folk, Villanova University

10:15–10:35 (171)

Two Mechanisms of Attention. WILLIAM PRINZMETAL, *University of California, Berkeley,* CHRISTIN HANSEN, *University of California, Davis,* & SAMUEL PARK, *University of California, Berkeley*—Wündt (1897) described attention as voluntary or involuntary, but he thought that involuntary attention was only a simpler form of voluntary attention. Contemporary researchers have made similar distinctions (e.g., exogenous vs. endogenous attention). We propose that these two forms of attention are mediated by different mechanisms. Voluntary attention is mediated by a process that enhances the perceptual representation, and it affects the accuracy of perception. Involuntary attention is mediated by a process that selects which channel (i.e., location) to respond to and, under most circumstances, affects only response latency. In a variety of experiments using the spatial cuing paradigm, we illustrate that voluntary and involuntary attention have different effects on response accuracy and latency.

10:40–10:55 (172)

Spreading the Spotlight: Attentional Blink Across Time and Space. NIKOLAS B. LOWING, NINA H. LICHTMAN, & DAVID I. SHORE, *McMaster University* (read by David I. Shore)—The spatial extent and resolution of attention has been compared to the spread of a spotlight. Under this metaphor, processing capacity can be tightly focused on a single spot or spread widely across a larger area. The present experiment examines the temporal window over which this spreading action occurs, using an attentional blink preparation. The first target (T1) was presented within a stream of distractors at fixation. The second target (T2) was presented at various lags (125, 250, 375, or 500 msec) after T1, at either the same location, or one of three distances from the center. Surprisingly, the center location evidenced the opposite pattern to a traditional attentional blink. Performance declined as lag increased. This pattern was qualitatively different than that seen in the three outside rings, which was more akin to a traditional AB; however, there were quantitative differences for the three rings.

11:00–11:15 (173)

Dissociating the Effects of Perceptual and Working Memory Load Using fMRI. DO-JOON YI, *Yale University,* GEOFFREY F. WOODMAN, DAVID WIDDERS, & RENÉ MAROIS, *Vanderbilt University,* & MARVIN M. CHUN, *Yale University* (read by Marvin M. Chun)—We used functional magnetic resonance imaging to measure incidental distractor processing under different types of attentional load. The task was to discriminate a face stimulus embedded in the middle of a task-irrelevant scene background. In the low perceptual load condition, subjects performed one-back repetition detection of the faces. In the high perceptual load condition, subjects performed the one-back task on degraded faces. In the high working memory load condition, subjects performed a two-back repetition detection of undegraded faces. By measuring attenuation of the fMRI signal in the parahippocampal place area to repeating versus novel background scenes, we could compare incidental scene-specific processing across the three face–task conditions. Incidental processing of the task-irrelevant scene was evident in the low perceptual load condition but not with high perceptual load. Incidental scene processing occurred under high work-

ing memory load, dissociating the effects of loading working memory from loading perceptual attention on task-irrelevant processing.

11:20–11:35 (174)

Visual Persistence and Masking During RSVP. WILLIAM S. MAKI & JENNIFER HALEY, *Texas Tech University*—In sequences of numerals (10/sec), targets were marked by a key feature (white outline square or color) and identified by response features (visual elements of a numeral). Models of such tasks differ regarding the fate of items prior to appearance of the key feature; response features may persist beyond the temporal life of an item ("multientry") or may suffer "abrupt termination." We report experiments in which key and response features were desynchronized. The results confirm and extend those of Weichselgartner and Sperling (1987), thus showing evidence for persistence only when successive items are buffered by a blank interval. Repeating targets or distractors during the pretarget stream proved ineffective (but we found substantial repetition effects using the same materials in different tasks). In this attentional gating task, each pretarget item is perceived but is not processed deeply and has its effective duration terminated by the succeeding item.

11:40–11:55 (175)

Rapid Resumption: A New Form of Memory in Visual Search. JAMES T. ENNS, RONALD A. RENSINK, LISA VANDENBELD, & ALEJANDRO LLERAS, *University of British Columbia*—We report on a new visual search task in which observers make highly accurate two-alternative forced-choice responses within 100–400 msec of display onset. This is a striking result, since accurate responding in a difficult search of this kind is usually possible only after at least 500 msec from display onset. The conditions under which such rapid responses are obtained involve brief initial glimpses of a search display interrupted by either a blank screen or a glimpse of a second display. On re-presentation of the original display, a significant proportion of responses are made within 100–500 msec. Since these responses are never made in the absence of display re-presentation, they are evidence of 'rapid resumption' of the search task. We report experiments exploring the conditions critical for rapid resumption and consider its implications for memorial processes in visual search.

Assessment Under Uncertainty
Georgia, Saturday Morning, 10:10–12:00

Chaired by David Budescu, University of Illinois

10:10–10:30 (176)

Further Tests of a Bayesian Account of Covariation Assessment. CRAIG R. McKENZIE, *University of California, San Diego,* & SHLOMI SHER, *Princeton University*—When assessing the relationship between two binary variables, perhaps the most robust phenomenon is that witnessing the joint presence of variables (Cell A) affects behavior more than witnessing their joint absence (Cell D). This phenomenon is considered an error from the traditional normative perspective, but it is consistent with a normative Bayesian approach if it is assumed that the presence of the variables is rare. In fact, recent research has shown that joint absence is deemed most informative when absence of the variables, rather than their presence, is rare. However, that research manipulated rarity by exploiting participants' real-world knowledge and left open the possibility of alternative explanations. The present research provides additional evidence for the Bayesian account by using variables whose rarity is manifest in their descriptions (e.g., "rare" vs. "ordinary" personality types), thereby avoiding previous shortcomings.

10:35–10:50 (177)

Another Look at the Ambiguity Effect. GIDEON KEREN, *Eindhoven University of Technology*—I report two studies employing the experimental paradigm originally used by Elsberg (1961). Participants in Experiment 1 had to consider an urn with an unknown proportion of black and yellow balls. They could bet on one color and were asked to state which proportion of the two colors they would most prefer (without knowing the number assigned to each color). Participants in Experiment 2 had to choose the proportion of black/yellow balls such as to minimize the likelihood that a participant in Experiment 1 (not knowing the color he/she chose) will win. There was a high correspondence between the response patterns of the two experiments. Specifically, participants in both experiments tended to choose either a 50%–50% or a 0%–100% allocation. Implications for the study of probability judgments and, in particular, for ambiguity avoidance will be briefly discussed.

10:55–11:15 (178)

Cognitive Illusions in Subjective Estimate of Population Quantity and Composition. LAWRENCE M. PARSONS, *University of Texas Health Science Center,* & DOMINIQUE SHELTON, *Rice University*—Estimating quantity under uncertainty is an important skill used frequently in varied contexts. In six experiments, subjects estimated the quantity and composition of individuals in specific countries or professions. The proportions of US citizens in specific minority groups were overestimated (17%); the majority was underestimated (16%). The populations of developing countries were underestimated (55%); those of developed countries were overestimated (68%). The proportion of a gender in the minority for particular professions was overestimated (15%); the majority gender was underestimated (9%). These errors were independent of subjects' ethnicity or gender and persisted under various "reframing" conditions. No such errors occurred for analogous estimations of proportions of colored spheres in a transparent container. These findings suggest that there is a cognitive illusion in the subjective estimation of human populations. The illusion, likely due to the bias of saliency or lack thereof, may be common in everyday life, with ill effects.

11:20–11:35 (179)

HR-HPV Diagnosis Affects Patients' Probabilities of Steps to Cervical Cancer. ROBERT M. HAMM, KATY D. SMITH, & RILLA K. WALKER, *University of Oklahoma Health Sciences Center*—Few women know that some sexually transmitted types of human papillomavirus (HR-HPV) confer a "high risk" of cervical dysplasia, which in turn can develop into cervical cancer. How much do women learn about HR-HPV when they test positive? We asked women who had received an HR-HPV diagnosis ($n = 22$) or had not ($n = 38$) their beliefs about the likelihoods of events in the chain from HR-HPV to cancer. Participant responses were compared with those of an expert panel. Participants answered 12 questions by marking a probability line. Responses were highly variable, and participants' mean judgment was higher than experts' mean for 10 of the 12 questions. Comparing outcome probabilities with treatment, versus without, imputes a treatment efficacy belief, analogous to "absolute risk reduction." For three of the treatments, HR-HPV positive participants held an efficacy belief that was closer to the experts' efficacy than was the efficacy belief of the HR-HPV negative participants.

11:40–11:55 (180)

Absolute Judgments Are Relative: A Reinterpretation of Some Psychophysical Ideas. GREGORY R. LOCKHEAD, *Duke University*—Psychophysics assumes that people directly judge stimulus elements and that averaged data demonstrate this. Both assumptions are shown wrong. The suggestion here is to replace the laws of Weber, Fechner, and Stevens with the thesis that judgments are based on contexts and memory. This allows some ideas based on the classic view, such as channel capacity, to be reevaluated.

Speech Perception
Plaza, Saturday Morning, 10:15–12:00

Chaired by Jennifer S. Burt, University of Queensland

10:15–10:30 (181)

Language Perception During Concurrent Tasks: Evidence From ERPs. WERNER SOMMER & ANNETTE HOHLFELD, *Humboldt*

University, Berlin—Language perception as measured with the N400 component in the event-related brain potential (ERP) is delayed by temporal overlap with a primary task and by incompatible stimulus–response assignments for this task. Here, we compared primary task effects of symbolic and spatial stimuli, using either letters (L or R) presented at fixation or squares presented left or right. The stimuli were compatibly or incompatibly responded to with left or right pedalpresses. N400 was elicited by spoken noun pairs that were either synonymous or semantically unrelated. The peak of N400 was delayed at short, relative to long, SOAs (100 vs. 700 msec); the delay was more pronounced, however, for letters than for squares. Irrespective of stimulus type N400 was later in compatible than in incompatible conditions. Thus, interference with language perception occurs also for nonlinguistic stimuli and increases for more complex stimulus–response assignments.

10:35–10:50 (182)

Speech Segmentation: A Hierarchical Multicue Approach. SVEN L. MATTYS, *University of Bristol*—Research shows that speech segmentation is facilitated by both sublexical cues (e.g., stress, coarticulation, phonotactics) and lexical knowledge. However, few studies have so far indicated how these cues operate when combined. The present report focuses on the usefulness of word stress with respect to other sublexical cues and lexical knowledge. Cross-modal fragment priming experiments revealed strong limitations to stress-based segmentation. When stress was pitted against coarticulatory, phonotactic, or lexical cues, substantial facilitation from each of the nonstress cues was found, but there was no evidence for stress-based segmentation. However, when the stimuli were presented in a background of noise, the pattern of results was reversed: Stress facilitated segmentation regardless of the other cues. Furthermore, word-spotting experiments—in clear speech—revealed that lexical knowledge was, itself, a stronger cue to word boundaries than were coarticulatory and phonotactic cues combined. These results call for an integrated, signal-contingent, and hierarchical approach to speech segmentation.

10:55–11:10 (183)

Conditional Root Uniqueness Points in Spoken Dutch and English. LEE H. WURM, *Wayne State University,* & MIRJAM ERNESTUS, ROBERT SCHREUDER, & HARALD BAAYEN, *Max Planck Institute for Psycholinguistics*—The conditional root uniqueness point (CRUP) is the uniqueness point (UP) of the free root of a prefixed word, given the prefix in question (Wurm, 1997). A prefixed word's CRUP can either coincide with or precede its full-form UP. Stimuli were presented to native speakers of Dutch in an auditory lexical decision experiment. As was reported previously for English (Wurm & Aycock, 2003; Wurm & Ross, 2001), RTs were faster for words in which the CRUP precedes the UP. In addition, there was a significant negative linear relationship between RT and the temporal distance by which the CRUP precedes the full-form UP. Stimulus category (i.e., "CRUP precedes UP" vs. "CRUP coincides with UP") interacted with surface frequency and neighborhood density in similar ways in the two languages. However, the stimulus category × morphological family size interaction found in Dutch was quite different from that found in English.

11:15–11:30 (184)

Asymmetries Between the Left and the Right Sides of the Mouth for Lipreading. MICHAEL E. NICHOLLS, *University of Melbourne*—The right side of the mouth moves more than the left during speech—but what effect does this have on the visual expression and perception of speech? We investigated lipreading asymmetries, using the McGurk effect—an illusion where incongruent lip movements cause listeners to misreport sounds. Thirty right-handers watched film clips where the left, the right, or neither side of the mouth was covered. The McGurk effect was attenuated when the right-mouth was covered, demonstrating that this side is more important to lipreading. Mirror-reversed images tested whether the asymmetry was the result of an observer bias toward the left hemispace. The McGurk effect was stronger in the normal, as compared with the mirror, orientation when the mouth was fully visible. Thus, observers attend more to what they think is the right side of the speaker's mouth. Asymmetries in mouth movements may reflect the gestural origins of language, which are also right-lateralized.

11:35–11:55 (185)

Development and Evaluation of a Computer-Animated Tutor. DOMINIC W. MASSARO, *University of California, Santa Cruz*—Given the value of face-to-face interaction in communication and learning, our persistent goal has been to develop, evaluate, and apply animated agents to produce realistic and accurate speech. We have implemented these agents as computer-assisted speech and language tutors for hard-of-hearing and autistic children and other children with language challenges. Baldi is an accurate three-dimensional animated talking head appropriately aligned with either synthesized or natural speech. Our language-training program utilizes Baldi as the conversational agent, who guides students through a variety of exercises designed to teach vocabulary and grammar, to improve speech articulation, and to develop linguistic and phonological awareness. Some of the advantages of the Baldi pedagogy and technology include the popularity and effectiveness of computers and embodied conversational agents, the perpetual availability of the program, and individualized instruction. The science and technology of Baldi holds great promise in language learning, human–machine interaction, and education.

Imagery and Visual Processing
Regency E, Saturday Morning, 10:15–11:55

Chaired by Thomas A. Busey, Indiana University

10:15–10:30 (186)

Why Do Persons With Autism Avoid Eye Contact? MORTON ANN GERNSBACHER, RICHARD J. DAVIDSON, KIM M. DALTON, & ANDREW L. ALEXANDER, *University of Wisconsin, Madison*—A diagnostic symptom of autism spectrum disorders is gaze aversion, an aversion toward meeting the eye gaze of another person. Some theorists have speculated that autistic persons avert their gaze because they are indifferent to other humans. Others have speculated that autistic persons are missing or have damaged neural tissue that enables, or even promotes, attraction to and recognition of human eyes. We examined autistic adolescents' (and control participants') neural activation while they examined human facial photographs. We simultaneously recorded eye movements and electrodermal activity. We observed that the greater the probability that the autistic participants fixated the eye region, the greater their neural activation (e.g., right fusiform gyrus and amygdala) and their accuracy at judging the photographed human's emotion. However, this greater accuracy and amygdala activation came at a cost: Electrodermal activity increased dramatically. Thus, one explanation for why autistic persons avoid eye contact is to modulate arousal.

10:35–10:55 (187)

Individual Differences in Object Versus Spatial Imagery. MARIA KOZHEVNIKOV, OLESSIA BLAJENKOVA, & CORY FINLAY, *Rutgers University*—Recent theories of mental imagery distinguish between two types of imagery, visual-object and spatial. We found the same dissociation in individual differences in imagery. Two hundred undergraduate psychology students and 63 members of different professions were administered a computerized battery of spatial imagery (e.g., mental rotation) and object imagery (e.g., degraded pictures) tasks. The results show that some people are better at constructing vivid and detailed images (object visualizers), whereas others are better at constructing schematic images of spatial relations (spatial visualizers). Moreover, object visualizers usually perform below average on spatial imagery tests, whereas spatial visualizers perform below average on object imagery tests. The most significant distinction was found between scientists and visual artists: Visual artists were significantly better than scientists on object imagery tasks and reported object imagery preferences, whereas scientists outperformed visual artists on spatial imagery tasks and reported spatial imagery preferences.

11:00–11:15 (188)

Occurrence and Consequences of AHA Events in Mental Synthesis. RITA E. ANDERSON, M. KARL HEALEY, CHRISTINE ARLETT, & CATHERINE M. O'KEEFE, *Memorial University of Newfoundland*—An AHA event is an affective response to an unexpected, consciously experienced product resulting from relatively automatic, unconscious processing. We report two lines of research investigating the occurrence and consequences of AHA events in mental synthesis. First, consistent with evidence showing the disruptive effects of language on nonreportable processes, verbalizing while trying to create a recognizable figure from three or five simple shapes, using mental imagery alone, led to a decrease in both the number of described figures and the proportion of reported AHA events, relative to no-verbalization conditions. Second, consistent with evidence of AHA effects on memory for sentences and pictures, experiencing an AHA event during the synthesis of a figure enhanced later recall of the figure, but only for the person experiencing the AHA event. These results support the involvement of unconscious, automatic processes in mental synthesis and the use of mental synthesis to study AHA events.

11:20–11:35 (189)

Implicit and Explicit Recognition at Large Visual Eccentricity. MURIEL BOUCART & FATIMA NAILI, *CNRS, Université de Lille 2*—Because its low spatial resolution makes it unadapted to fine discrimination necessary for object identification, peripheral vision has been the object of very few investigations in this domain, as compared with central vision. We examined whether pictures of objects presented at large eccentricity (centered 30 or 470) access consciousness. Performance was compared in implicit and explicit recognition tasks. Participants performed a semantic categorization task in both the encoding and the test phase in implicit measures. For explicit recognition, participants were asked to decide, in the test phase, whether each picture had been presented before. Both implicit and explicit recognition were found at 300 and 470 eccentricity, but at large eccentricity, explicit recognition occurred only for the category of objects selected in the encoding phase and only for identical pictures. These results suggest that attention modulates perceptual priorities. Only features critical for identification of a category of objects are encoded.

11:40–11:50 (190)

What Does the Visual Buffer Tell the Mind's Eye? ADAM J. REEVES, *Northeastern University,* & AMEDEO D'ANGIULI, *University of British Columbia*—Kosslyn found that latency to generate visual images increased with *display size* (the area the image must fit into) and proposed (in his buffer theory) that larger images contain more detail, which requires extra time to fill in. However, we find that latencies for images of common objects are independent of rated image detail and are about the same for both of Kosslyn's display sizes (1.2º and 11º). When display size is stepped from 11º to 91º, latency increases considerably, although not for images repeated in the same session. In all cases, latency is strongly related to image vividness. We suggest that (1) vividness stands in for memory strength, (2) images are generated with an average size of about 11º and are shrunk or expanded as needed, and (3) the resized images can be stored in a temporary visual memory (not the buffer) for at least 20 min.

Discourse Comprehension
Regency F, Saturday Morning, 10:05–12:00

Chaired by Rolf A. Zwaan, Florida State University

10:05–10:25 (191)

On- and Off-Line Effects of Misconceptions on Comprehension of Scientific Text. PAUL VAN DEN BROEK & PANAYIOTA KENDEOU, *University of Minnesota, Twin Cities*—College students with misconceptions in science were asked to read and recall a text that contradicted their misconceptions. In Experiment 1, think-aloud results showed that readers with misconceptions failed to detect the inconsistencies between their prior knowledge and the text. In Experiment 2, reading time results showed that readers with misconceptions did not slow down reading information that contradicted their prior knowledge. Recall results from both experiments showed that readers with misconceptions included less textual information, more invalid inferences, and fewer valid inferences in their recalls than did readers with no misconceptions. These results suggest that inconsistencies between readers' prior knowledge and text information often do not affect online processing but may show off line in memory for the text. A computational simulation of the data, using the landscape model of reading, shows that this model captures important aspects of the cognitive processes during reading and of the resulting mental representation.

10:30–10:40 (192)

Application of the Landscape Model of Comprehension to TV News. BEVERLY ROSKOS-EWOLDSEN, MINA LEE, & DAVID R. ROSKOS-EWOLDSEN, *University of Alabama, Tuscaloosa*—The landscape model of text comprehension has been very successful in predicting readers' memory for text-based stories. The present research sought to determine how well the model accounted for viewers' memory of a news story that included both visual and verbal information. The model was applied to a 2½-min CNN news story concerning a robot expo. The text-based-only version of the model predicted moderately well participants' memory for the news story (R^2 = .21). However, when activation of the visual components was added to the text-based activation à la Paivio's dual code model, the model predicted very well participants' memory for the news story (R^2 = .70). If models of text comprehension are to be applied to TV stories or movies, activation for visual representations of the story must be added.

10:45–11:00 (193)

Texts, Pictures, Labels Versus Arrows in the Comprehension of Illustrated Text. ARTHUR C. GRAESSER & SHULAN LU, *University of Memphis*—We investigated how comprehenders inspect four different information sources while reading illustrated texts about everyday devices: texts, pictures, labels, and arrows. College students read illustrated texts about devices (locks, toasters, electric bells), and then were asked questions about device breakdowns (a problem-solving phase). Eye movements were recorded during these reading and problem-solving phases. Participants subsequently received a device comprehension test and a battery of individual-differences tests. Results showed that text and picture play somewhat different roles in reading comprehension versus problem solving. The text guided initial comprehension, whereas the picture became increasingly important as comprehension progressed. The arrows and labels had semiotic functions that facilitated particular components of information integration. We investigated how comprehenders alternated among the information sources in a computational model.

11:05–11:20 (194)

Indexing the Goals of Multiple Characters During Narrative Comprehension. JOSEPH P MAGLIANO, *Northern Illinois University,* HOLLY A. TAYLOR, *Tufts University,* & JOYCE KIM, *Rhodes College*—Most story plots contain multiple agents who are independent, interact, and often have conflicting goals. One would expect that narrative understanding requires one to monitor the goals, concerns, and situations of multiple agents. There is considerable evidence that understanders monitor the goal plans of the primary protagonists (e.g., Suh & Trabasso, 1993). However, there is relatively little research on the extent to which understanders monitor the goals of multiple agents. We investigated the impact of characters' roles and prominence in the plotline on the extent to which understanders monitor the goal plans of multiple characters while viewing a feature length film. In Experiment 1, participants made situation-change judgments while viewing a film, and in Experiment 2, they verbally described scenes. Both of these data indicated that viewers monitor the goal plans of multiple agents. However, they appear to monitor most closely the goals of characters that are prominent in the story plotline.

11:25–11:40 (195)

Memory-Based Contributions to Verification in Text Comprehension. MURRAY SINGER, *University of Manitoba*—The principle that each text clause provides retrieval cues for antecedent ideas suggests that passive memory retrieval during reading may resemble the processes of intentional text retrieval. In a reading-time analogue of sentence verification, people read texts with target sentences that were (1) either affirmative or negative and (2) either true or false about an antecedent sentence. For example, "He suspected that Jerry didn't fix the windowsill with a wrench" is a false negative with reference to "Finally, Jerry fixed the windowsill with the wrench." In two experiments, reading time was greater for true negative than for false negative sentences, mirroring a familiar verification pattern. Unlike verification, reading times for true and false affirmative sentences did not differ. However, additional experiments revealed that explicitly verifying sentences with reference to complex texts likewise yields the classic profile only for negative sentences. These results refine the principles of memory-based text processing.

11:45–11:55 (196)

Are Two Heads Better Than One? (Listening In on Overhearer Collaboration). CLAUDE G. CECH & ROXANNE B. BENOIT, *University of Louisiana, Lafayette*—Clark's collaborative conversation model asserts that people who participate in a conversation negotiate shared understandings at multiple levels. Thus, people who overhear a conversation ought to comprehend it less well than those who participate in it. But is this speaker–overhearer effect also moderated by the limited interpretational perspectives available to an overhearer? To see, we ask directors and matchers communicating over computers to coordinate placement of tangram figures so that the matcher matches the director's order. Two collaborating overhearers attempting to match the director's order can also send messages to one another to comment on the director's and the matcher's messages. In addition, some noncollaborating overhearers listen in on just the director's and the matcher's messages, whereas others listen in on all four sets of messages. Are there collaborating overhearer and overhearing overhearer effects?

POSTER SESSION IV
Fairmont Hotel–Conference Level, Saturday Noon, 12:00–1:30

• Imagery & Face Processing •

(4001)
Interrupting Mental Rotation: What We Know When. NATHAN JOHNSON, *University of Louisville,* & DALE J. COHEN, *University of North Carolina, Wilmington*—In a handedness decision task, participants are presented with pairs of stimuli in varying orientations, and their task is to decide whether the stimuli are the same or mirror images. The data commonly show a linear relation between angular disparity and reaction time. This pattern of data has been interpreted to indicate that participants make a handedness decision by imagining one stimulus rotate to the same orientation as the other stimulus (i.e., *mental rotation*). Nevertheless, when pushed to respond quickly in a handedness task, participants complete the task without evidencing mental rotation. This finding calls into question the necessity of mental rotation in identifying the handedness of a stimulus. The present experiments address this question by assessing whether participants know the handedness of a stimulus before they complete a mental rotation strategy.

(4002)
Visual/Spatial Representation Shifts in Anticipation of a Planned Eye Movement. HELENE INTRAUB, JAMES E. HOFFMAN, & STACY-ANN STOEHS, *University of Delaware*—Unlike pictures, real scenes surround an observer. Head and eye movements frequently bring new regions into view. Is the mental representation updated after each new fixation, or even sooner—for example, when the fixation is planned? In each of 30 trials, subjects centrally fixated a photograph. A brief cue indicated "maintain fixation" or "shift fixation to the far right (or left)," and a mask quickly followed (replacing the image before the eyes landed). After 2 sec, the photograph reappeared (same or different view, depending on experiment), and subjects adjusted its borders (revealing more or less of the scene) to match the studied view. When fixation was maintained, memory extended beyond the original borders. However, the "shape" of the extended region changed when fixations were planned: Extrapolation was greater on the to-be-fixated side than on the opposite side. Updating includes an anticipatory component that may guide and facilitate integration of views.

(4003)
Eye Movements and the Integration of Visual Imagery and Visual Perception. JAMES R. BROCKMOLE, *Michigan State University,* & DAVID E. IRWIN & RANXIAO FRANCES F. WANG, *University of Illinois, Urbana-Champaign* (sponsored by David E. Irwin)—Visual images can be integrated with visual percepts when an observer is afforded approximately 1,500 msec to generate the image. What factors determine this time course? We investigated the role of eye movements to determine whether integration relies on saccades to rehearse the image's structure. Subjects viewed two arrays of dots that filled all but one position in a grid, which they identified. Eye position was monitored during the ISI separating the arrays (range: 0–3,000 msec). As ISI increased, so did the number of fixations. However, only one third of the fixations visited novel grid positions, and no propensity to fixate positions occupied by the to-be-imaged array was observed. Rather, fixations were concentrated in the center of the grid. This pattern suggests that integration is not dependent on the time course of overt scanning and that image generation is not dependent on overt shifts of attention to regions of space.

(4004)
Task-Dependent Eye Movements During Face Perception. AARON M. PEARSON & JOHN M. HENDERSON, *Michigan State University,* PHILIPPE G. SCHYNS, *University of Glasgow,* & FRÉDÉRIC GOSSELIN, *Université de Montréal*—To what extent do task demands shape the way information is gathered? Earlier work used Bubbles, a spatial frequency filtering methodology, to identify the diagnostic visual information used in each of three face-judgment tasks. In the present study, eyetracking was used to examine information acquisition for the same three tasks: Identifying a face by name, determining gender, and distinguishing between two mood expressions. Direct comparison was made between the diagnostic information derived from Bubbles and the information actively gathered with eye movements during face viewing. For each task, the importance of specific face regions was indexed by several measures, including the probability of fixating, the total number of fixations, and overall fixation time spent on each facial feature. The results are consistent with those produced by Bubbles and confirm a task-dependent drive for information during active vision tasks.

(4005)
News on Views From Human and Computational Face Recognition. ADRIAN SCHWANINGER, *Max Planck Institute for Biological Cybernetics,* SANDRA SCHUMACHER, *University of Zurich,* CHRISTIAN WALLRAVEN & HEINRICH H. BÜLTHOFF, *Max Planck Institute for Biological Cybernetics,* & FRED MAST, *University of Zurich*—Although faces form a very homogenous stimulus class, adults are real experts in recognizing them. In the present study, we investigated to what extend the processing of such highly overlearned stimuli is dependent on viewpoint. Four experiments were conducted on the basis of the inter-extra-ortho experiments by Bülthoff and Edelman (1991), who used novel objects as stimuli (wire- and amoeba-like novel 3-D objects). First, in all experiments, systematic effects of viewpoint on face recognition performance were found that were consistent with computational approaches using interpolation of 2-D views. Second, sensitivity was better for horizontal vs. vertical views. Third, this effect was reduced in inverted faces, which indicates an important role of expertise in addition to effects of symmetry. The results are discussed within the framework of a new computational model based on key-frames, which entails local view interpolation and has been shown to be well suited to model human face recognition performance.

(4006)
Self–Other Recognition as a Function of Hemisphere. CLARK G. OHNESORGE, KATHLEEN JOHNSON, & GEMMA SODERHOLM, *Gustavus Adolphus College*—A recent study (Turk, Heatherton, Kelley, Funnell, Gazzaniga, & Macrae, 2002) addressed self-recognition in a split-brain patient. They used images created by morphing the patient's face together with that of a familiar other in proportions ranging from 10%-self/90%-other, through 90%-self/10%-other. The images were presented bilaterally and the subject judged whether each image was "self" or "other." They found more "self" identifications when the stimuli were processed in the left hemisphere than when processed in the right hemisphere. However, the literature on hemispheric differences in the processing of familiar or self-relevant stimuli seems to predict the opposite result. To investigate, we replicated the study, using 30 right-handed normal subjects, and manipulated which hand responded "self." We did find a left-hemisphere advantage when a right-hand response indicated "self," but the pattern reversed to right-hemisphere dominance when a left-hand response indicated "self."

(4007)
George Bush but Not a Happy Man: Processing Distractor Faces. JANICE E. MURRAY, *University of Otago*—In contrast to what is observed when letters and nonface objects serve as distractor stimuli, meaningful distractor faces are processed for identity independently of the attentional load associated with the relevant task (Lavie, Ro, & Russell, 2003). This privileged processing may reflect the special biological and social significance of faces. In addition to identity information, faces also yield important information about emotional state, and in this series of experiments, I investigated whether or not emotion is processed in unattended faces under different conditions of attentional load. Angry or happy distractor faces were either congruent or incongruent with the emotion evoked by target words pre-

sented in a vertical array of one-, two-, four-, or six-letter strings. The general finding that distractor faces did not produce interference effects at any attentional load supports a distinction between processing of identity and emotional expression in faces.

(4008)

Comparing UFO Occupant Faces to Faces Seen by Human Neonates: An Inborn Recognition Template? FREDERICK V. MALMSTROM, *U.S. Air Force Academy*—Typical UFO occupant faces reported by self-claimed abductees seem to have several rudimentary features. Hence, the question arises whether these rudimentary features are part of an inborn human facial recognition template. This search for the universal template face was approached by simulating a face that would be immediately seen by a newborn baby, that of its mother. This template face was approximated by transforming the digitally photographed face of a healthy young 30-year-old female into a smoothed, two-dimensional Fourier function and at a contrast sensitivity of 3 cycles/degree. The face that emerged from the transform seemed to approximate that of the typical UFO occupant, the face that is frequently reported post hoc and under hypnogogic states of awareness. Besides explaining the source of many reported UFO occupant faces, it is proposed that this transformed female face is a universal recognition template that is innate and, therefore, offers distinct survival advantages.

(4009)

An Anger Inferiority Effect With Schematic Faces. DEAN G. PURCELL, *Oakland University,* & ALAN L. STEWART, *Stevens Institute of Technology*—Ohman et al. (2001) designed a set of angry, happy, and neutral schematic faces to use as stimuli in investigating the face in the crowd effect (FCE). Unfortunately, with these stimuli, low-level stimulus features, rather than affect, governed search through a neutral crowd for an angry face. However, when using an affect discrimination task, we found that the Ohman stimuli can mediate affect-related behavior, depending upon instruction and workload. In agreement with previous research (Purcell & Stewart, 1998), we report an anger inferiority effect whereby the time to determine whether an angry face was not a neutral face was longer than to so judge a happy face. Rather than being automatically triggered, the processing of affect appears to be related to task difficulty and instructions. The more difficult the task, the more likely that an observer will use low-level stimulus features in visually searching through a crowd of faces.

• Spatial Cognition •

(4010)

Spatial Learning and Gender Differences. R. J. MILLER, MARGARET R. MORGANTI, STACEY L. CROSCUT, & KARYN M. WEEKS, *SUNY, Brockport*—In two experiments, a new spatial learning task was tested. The task consisted of 10 unique pairs of squares. Each square could have zero, one, two, or three lines extending perpendicularly from any of its sides. In Experiment 1, 11 males and 16 females were given up to 40 trials to learn the 10 pairs. The results showed incremental performance across trials and classic serial position effects. Males mastered the spatial task in fewer trials than did females and showed greater cumulative recall after 5 and 10 trials. Unexpectedly, similar differences were found for a control condition using verbal stimuli. Because it was suspected that the control condition had permitted spatial processing, in Experiment 2 the control condition consisted of 10 pairs of low-meaningfulness nonsense syllables. The results for 21 males and 27 females again showed gender differences in spatial learning. By the 5th trial, males showed greater cumulative performance than did females, although this difference had diminished by the 10th trial. The control condition showed no gender differences.

(4011)

Picture This: Imagined Environmental Perspectives. GARY L. ALLEN & ADAM HUTCHESON, *University of South Carolina*—Previously, Sholl and Bartels (2002) contrasted two means of maintaining orientation after travel, one process based on working memory and another based on imagined or "virtual" views of the environment. These two means were differentiated by alignment effects evident in participants' pointing performance under conditions of imagined movement. We looked for the same outcome, using a picture recognition procedure in which participants verified how the environment would appear from different perspectives. Results suggested sex-related differences compatible with previous findings.

(4012)

The Role of Working Memory in IOR at Multiple Locations. MICHAEL D. DODD, ALAN D. CASTEL, ELINA BIRMINGHAM, & JAY PRATT, *University of Toronto*—Numerous studies have shown that inhibition of return (IOR) can dwell at up to five sequentially cued locations and that the magnitude of IOR is greater for more recently cued locations. To examine how working memory contributes to tagging several inhibited locations, the present research asked two questions regarding the decline in IOR from last- to first-cued locations. Question 1: Does the decline in IOR occur for both "true" onset and offset cues (unlike the brief on–off cues previously used)? The answer is yes, indicating that the decline in IOR generalizes across visual events. Question 2: Is the decline in IOR due to the passage of time or the number of intervening cues between the first and the last cue? The answer is that the decline is due to time, and not to intervening items. The results are interpreted in terms of how memory may be involved in IOR.

(4013)

Dynamics of a Stationary Aesthetic Form: A Preliminary Study. TIMOTHY L. HUBBARD & JON R. COURTNEY, *Texas Christian University*—Arnheim (1974) and Freyd (1992) suggested that judgments of aesthetic quality are based on sensitivity to implied dynamics. In the present study, observers briefly viewed a target T'ai Chi tu (yin-yang) figure that possessed an implied rotary dynamic. There was a 250-msec retention interval; then a probe T'ai Chi tu was presented. Observers judged whether the probe was at the same orientation as the previously perceived target. Surprisingly, memory was displaced backward (in the direction opposite to the implied dynamic); control conditions examined explanations related to the "pointedness" of the parts, presence of curved boundaries, and differing lightness values. A distinction between perceptual dynamics and memory dynamics is proposed, and it is suggested the perceived forward dynamic of the T'ai Chi tu results from a mismatch between a veridical current perception and a displaced (backward) memory from a previous fixation. Such an account also explains previous findings on memory for angle size.

(4014)

Testing of Spatial Retrieval in Young and Older Adults: Interaction Between Stimuli and Retrieval Mode. SYLVAIN GAGNON, NICOLAS PAILLARD, MICHEL VOLLE, & ÉMILIE PICARD-BOYTE, *Université du Québec à Trois-Rivières,* & JONATHAN FOSTER, *University of Western Australia*—In the following set of four experiments, we report that young and older adults' ability to recall the spatial location of stimuli depends not only on the nature of stimuli to be encoded, but also on the nature of the memory test. We found that when the participants were asked to free recall, after a short delay, all the stimuli, their performance was higher when all the stimuli were identical (poker chips). In contrast, when asked to determine within a recognition task which of the stimuli (pictures or objects) remained at the same place after the delay (half of the positions were changed), better recognition rate was observed. The four experiments illustrate the interaction that prevails between the nature of the memory test and the stimuli used in a spatial memory assessment task.

(4015)

Up, Down, and In Between: Disorientation During Whole-Body Tilt. JOHN JEWELL, *St. Joseph's University*—The present investigation

examined the perceptual representation of whole-body tilt in space. In general, participants were tilted in pitch from a vertical starting position to a variety of orientations both forward and backward. In one experiment, participants made verbal estimates of perceived orientation in space. In a second experiment, estimates were made by having participants adjust a virtual room to match their perceived orientation in space. In a third experiment, the impact of expertise on spatial representations of whole-body tilt was examined by comparing estimates of whole-body orientation for naive participants, trained participants, and gymnasts. In general, participants appear to be sensitive to vertical and horizontal, with distortions in perceived whole-body tilt at intermediate orientations. Expertise did not have a marked influence on estimates of perceived body orientation. These findings provide evidence for a nonlinear spatial representation for whole-body orientation and further strengthen the notion of a multisensory representation of space.

(4016)

An Effect of Mood on Perceiving Geographical Slant. CEDAR RIENER, JEANINE STEFANUCCI, & DENNIS R. PROFFITT, *University of Virginia*—Previous research by Proffitt et al. (1995, 1999) showed that the perception of geographical slant is influenced by the observer's bodily state. For example, hills appear steeper to participants who are fatigued or wearing a heavy backpack. The present study investigated the role of mood state and arousal in the perception of spatial layout. Mood was induced by having participants listen to happy music (major key, upbeat) or sad music (minor key). A continuous measure of arousal was obtained through a heart rate monitor. While listening to the music, participants made three judgments of the slant of the hill: verbal estimate, visual matching, and a visually guided action measure (a haptic palmboard). The verbal and visual judgments of the sad participants were significantly steeper than those of participants in the happy condition. The visually guided action measure was unaffected. The effects of mood and arousal were separated using the heart rate data.

• Prospective Memory •

(4017)

Prospective Memory Retrieval in the Absence of Strategic Monitoring. MARK A. McDANIEL, *University of New Mexico,* RUTHANN C. THOMAS & GILLES O. EINSTEIN, *Furman University,* NOVA MORISSETTE, *University of New Mexico,* & GRIT RAMUSCHKAT, *University of Heidelberg*—In remembering to perform actions in the future, participants might strategically monitor the environment for the target event or instead rely on a relatively spontaneous process to retrieve the intention when the target event is encountered. Consistent with the spontaneous retrieval view, Experiment 1 showed no significant cost to the speed of performing the cover activity when a prospective memory task was added. An important prediction of the strategic monitoring view is that retrieval of an intention cannot occur without monitoring of the environment for the target event. In Experiment 2, we examined whether prospective retrieval would occur when participants were given a prospective memory intention for a later task and then were asked to ignore the intention while performing an intervening lexical decision task. Response times to prospective memory targets during a lexical decision task suggested spontaneous retrieval of the intention under conditions in which participants were not monitoring the environment for the target event.

(4018)

General and Specific Costs to Retaining and Fulfilling Prospective Memories. RICHARD L. MARSH & GABRIEL I. COOK, *University of Georgia,* & JASON L. HICKS, *Louisiana State University*—Possessing certain kinds of prospective memories has been demonstrated to interfere with ongoing cognitive processing. For example, response latencies are slower to certain ongoing activities until a previously established intention has been completed. We found that interference to ongoing activities is a relatively stable cost of possessing certain kinds of intentions and that cost appears to be independent of manipulated allocations of attention toward and away from ongoing processing. However, intention completion is associated as well with attentional allocation policies that vary across an ongoing activity. We have tentatively concluded that successfully fulfilling prospective memories can exert a general cost but is also sensitive to more local level variations in attentional sharing that are independent of the general cost.

(4019)

Prospective Memory Performance in Multiple Sclerosis Patients and Adult Controls. KATRINA S. KARDIASMENOS & DEBORAH M. CLAWSON, *Catholic University of America,* JEFFREY A. WILKEN, *Veterans Affairs Medical Center & University of Maryland,* & MITCHELL T. WALLIN, *Veterans Affairs Medical Center & Georgetown University*—Multiple sclerosis (MS), a progressive neurological disorder, often leads to obvious physical deficits and to less obvious cognitive deficits. We examined performance on prospective memory (PM), which is remembering to perform an action in the future (e.g., remembering to buy milk on the way home). We tested MS patients and controls (ages, 25–60) on time-based and event-based PM tasks, using a version of Rendell and Craik's (2000) virtual-week board game and the memory improvement technique of forming implementation intentions (Chasteen, Park, & Schwarz, 2001). Participants were tested both on noticing when an action was to be completed (prospective component) and on remembering the action itself (retrospective component). Findings indicate an MS deficit on PM, including the prospective component. Effects of association strength were examined, as were individual differences in attention, working memory, and paired-associate learning.

(4020)

Examining the Reliability of Event-Based Prospective Memory Tests. WILLIAM L. KELEMEN & WENDI S. BAILEY, *California State University, Long Beach*—Laboratory tests of event-based prospective memory require people to perform a specific action in response to infrequent cues embedded in the environment. For example, participants may be instructed to answer a series of general knowledge questions and press a certain key when a question concerns a U.S. president (Einstein, McDaniel, Richardson, Guynn, & Cunfer, 1995). Despite the increasing popularity of prospective memory research, little is known about the reliability of these procedures. We examined college students on two different days and found that the test–retest reliability of prospective memory performance was quite low. In contrast, the reliability of general knowledge performance was much higher. This increase was due in part to the large number of general knowledge questions, as compared with the relatively few prospective memory targets. Our data support the prediction that increasing the number of prospective memory targets improves test–retest reliability of event-based tasks.

(4021)

The Effects of Cue Factors and Priming on Prospective Memory Performance. JON B. HOLBROOK & ROBERT KEY DISMUKES, *NASA Ames Research Center*—We investigated the effects of cue frequency, cue specificity, and priming on performance of prospective memory (PM) and ongoing tasks. The small number of target trials per subject in typical PM paradigms requires large numbers of subjects and may obscure differences among subjects, such as the use of strategies. We manipulated cue frequency and specificity parametrically and "primed" some subjects during the retention interval with concepts related to conscientious performance. PM performance improved with cue frequency and with cue specificity. Ongoing-task response times slowed with a concurrent PM task; however, this effect declined with practice. Priming affected use of monitoring strategies; however, it is not clear whether this in turn affected performance. Results suggest that researchers should proceed cautiously when presenting multiple PM target trials per subject. Furthermore, PM per-

formance may be improved by increasing cue specificity at encoding and, perhaps, through priming of performance-related goals.

(4022)

When Strategic Monitoring Mediates Event-Based Prospective Memory. MELISSA J. GUYNN, *New Mexico State University*—Theorists have suggested that prospective memory tasks may be accomplished by strategic monitoring for the target events that indicate when to execute the intended actions. Two experiments were conducted to explore conditions under which strategic monitoring was expected to mediate versus not to mediate prospective memory. When participants were given a prospective memory task, costs on a concurrent task reflected strategic monitoring. Experiment 1 varied the relative importance of the prospective memory task. Participants monitored the most, and remembered the most, when the prospective memory task was most important, and this positive relationship suggests that strategic monitoring can mediate event-based prospective memory. Experiment 2 varied the perceptual salience of the prospective memory target events. Participants monitored the least, and remembered the most, when the target events were salient, and this inverse relationship suggests that strategic monitoring may not mediate event-based prospective memory if another process can support good prospective memory.

(4023)

Age-Related Differences in Visual and Auditory Event-Cued ProM Proper. BOB UTTL, *University of Tsukuba*—Younger and older adults participated in a study that examined age-related changes in visual an auditory event-cued prospective memory (ProM). To asses visual ProM, participants were required to make A/B decisions about stimuli displayed on a computer monitor. While making decisions, they were also shown a series of pictures, with one of them defined as the ProM cue. The cue display size increased across trials until they responded to it. Similarly, to asses auditory ProM, participants performed the same A/B decisions while various sounds were played through computer speakers, with one of the sounds defined as the ProM cue. The cue size and loudness at the time of response indexed ProM. The main results showed that both visual and auditory ProM declined with age and that visual and auditory acuity explained some of the age-related declines.

(4024)

Personality and Prospective Memory Failures. CARRIE CUTTLER, PETER GRAF, DEBRA YEW, & SASHA WANG, *University of British Columbia*—We used two questionnaires, the NEO-FFI and the MMQ, to explore the relationship between personality and prospective memory failures. The NEO-FFI is a standardized instrument that indexes five aspects of personality: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. The MMQ presents participants with scenarios, each describing an agreement-to-do-something (ATDS) that was broken either by the self or by another person. The ATDS scenarios were chosen to be either low or high impact, meaning that breaking them would cause either inconvenience only or significant harm. For each scenario, participants rated statements that explored their reasons for and reactions to breaking the ATDS. Subjects' ratings are illuminated by the correlations with the personality types revealed by the NEO-FFI.

• Eyewitness Memory •

(4025)

The Role of Self-Generation in False Eyewitness Memories. MARIA S. ZARAGOZA & JESSICA HANBA, *Kent State University,* & JENNIFER ACKIL, *Gustavus Adolphus College*—In Zaragoza et al. (2001), participants who had witnessed an event were exposed to suggestive interviews in which they were "forced" to answer questions about blatantly false events. Because participants were being queried about events they had never witnessed, answering these questions required that participants make-up, or confabulate, a response. Results showed that although participants strongly resisted generating these confabulations, they later came to develop false memories for the events they had earlier been forced to confabulate. In the present study, we assessed whether forcing participants to generate an answer to a blatantly false question (forced confabulation condition) leads to greater false memory than forcing participants to select an answer to a blatantly false question on a multiple-choice test (forced guessing condition). In addition, we manipulated interviewer feedback (confirmatory or neutral). The results showed that self-generating false information led to greater false memory than did selecting false answers, but only in the confirmatory feedback condition.

(4026)

Flashbulb Memories? Memory for Events Surrounding September 11. ELIZABETH ARNOTT, DAVID W. ALLBRITTON, & STEPHEN BORDERS, *DePaul University*—Questionnaires were administered to 27 DePaul undergraduates concerning their experience of the terrorist attacks of September 11, first on September 12, 2001, and again 2 months later. Results indicated that the students formed enduring flashbulb memories according to currently held criteria. However, less than half of the propositions recalled about the circumstances 1 day after the event were accurately reproduced 2 months later. Consistent with previous findings, participants' reports decreased in level of detail over time. Confidence was correlated with rehearsal, but no consistent relationship was observed between accuracy and either rehearsal or confidence. Perceived historical significance was associated with the presence of a flashbulb memory, suggesting that the perception of a global level of significance could be important in the development of a flashbulb memory.

(4027)

Retrieval Induced Forgetting in Investigative Interviewing. BETHANY CAUGHEY & ROBERT A. BJORK, *UCLA,* & THOMAS D. WICKENS, *University of California, Berkeley*—Standard practice in investigative interviewing (Fisher & Geiselman, 1992) begins by collecting from witnesses to a crime or an accident a full and free recollection of the event. They are then interviewed selectively, often repeatedly, about portions of what they have recollected. At issue in this research is whether such selective follow-up interviewing has a detrimental effect on later recall. Specifically, we ask whether investigative interviewing is subject to the retrieval-induced forgetting that has been demonstrated with simpler materials that have not previously been recalled (Anderson, Bjork, & Bjork, 1994). In our study, participants viewed 24 unrelated, noncategorical words. Some of these were reviewed by cued recall and recognition. This selective review diminished recall of nonreviewed words. Thus, retrieval-induced forgetting appears under conditions characterizing eyewitness recall when (1) a full attempt at recall has been made and (2) the information lacks semantic structure.

(4028)

Crossing Hypermnesia and Directed-Forgetting Paradigms to Examine the Accuracy of Eyewitness Memory. ROBERT L. WIDNER, JR. & PHILLIP GOERNERT, *Minnesota State University, Mankato,* & HAJIME OTANI, *Central Michigan University*—We crossed hypermnesia and directed-forgetting paradigms to examine eyewitness memory. Participants studied characteristics that described a robber and a cashier. Prior to study, participants were instructed to remember robber characteristics and forget cashier characteristics. Memory was assessed across three recall tests by having participants write down studied characteristics in one of two columns ("robber" or "cashier"). Across tests, we observed a larger increase in correct recall (i.e., hypermnesia) of cashier characteristics, relative to robber characteristics. Additionally, we observed directed forgetting—greater recall for robber characteristics than for cashier characteristics. Implications for eyewitness memory were obtained when we examined errors across tests. We observed hypermnesia for misattributing cashier

characteristics to the robber and a decrease across tests (i.e., intertest forgetting) for misattributing robber characteristics to the cashier. We use changes in memory trace strength and failures in source monitoring in accounting for these findings and extend our account to multitrial recall paradigms.

(4029)

The Characteristics of Accurate and Inaccurate Eyewitness Memories. SEAN M. LANE, *Louisiana State University,* DIANE VILLA, *St. Louis University,* & CRISTINE C. ROUSSEL, *Louisiana State University*—A variety of studies have demonstrated that witnesses can be led to confidently report having seen something during a witnessed event that was only suggested to them after the event occurred. One question about this finding concerns whether these memories have the same phenomenal characteristics as those that accompany accurate memories. Participants in this study viewed a simulated crime, answered a series of questions that included misleading event information, and received a source memory test. For each affirmative answer, they also answered a series of questions about the characteristics of their memory for the item. Results revealed that even though participants claim to have seen items that were only suggested to them, these memories are not necessarily as vivid or detailed as memories of items that were actually seen in the context of the witnessed event. The implications of these results for real-life eyewitnesses are discussed.

(4030)

The Postidentification Feedback Effect With Young and Elderly Adult Eyewitnesses. JEFFREY S. NEUSCHATZ, *University of Alabama, Huntsville,* MICHAEL P. TOGLIA, *SUNY, Cortland,* AMANDA BURKETT, *University of Alabama, Huntsville,* ELIZABETH L. PRESTON, *Vanderbilt University,* JAMES M. LAMPINEN, *University of Arkansas,* & JOSEPH S. NEUSCHATZ, *Roger Williams University*—Employing Wells and Bradfield's (1998) postidentification feedback paradigm, we examined the retrospective certainty of college students and older adults. Participants watched a brief surveillance camera video of people shopping, focusing on a man they later learned shot a security guard. Everyone identified the gunman from a target-absent lineup, with witnesses receiving no feedback or confirming feedback prior to answering 16 questions concerning identification certainty and memory for the perpetrator. The Memory Functioning Questionnaire (MFQ) was administered a week later. Positive feedback produced confidence inflation on most questions. Overall, younger witnesses were more confident, but age and feedback frequently interacted, since the elderly were less confident with no feedback, whereas they were as confident as young participants following confirming feedback. Significant relationships emerged among the 16 questions and the MFQ items. Results are discussed in terms of vulnerability to suggestion and false memories, with application to the judicial system.

(4031)

Adult Age Differences in Binding Actors and Actions in Eyewitness Memory. ALAN W. KERSTEN, JULIE L. EARLES, EILEEN S. CURTAYNE, & JASON C. LANE, *Florida Atlantic University*—This research examined the ability of young and older adults to remember which actors performed which actions in a series of events. Participants saw 30 actors perform 30 different actions. Recognition ability was later tested with five types of events. Old events were the events seen at encoding. New action events involved a familiar actor performing a new action. New actor events involved a new actor performing a familiar action. New events involved a new actor performing a new action. Finally, conjunction events involved a familiar actor performing a familiar action that had been performed by a different actor at encoding. Older adults were found to have greater difficulty than young adults at distinguishing the conjunction events from the old events, even when memory for the individual features (i.e., actors and actions) was equated. This result is consistent with prior research showing an age-related decline in binding features in memory.

(4032)

Consistency of Eyewitness Recollection as an Indicator of Accuracy. RONALD P. FISHER, NADJA SCHREIBER, MAYRA BURGUERA, & CYNTHIA ALVAREZ, *Florida International University*—During a criminal investigation, eyewitnesses may be asked repeatedly by police and attorneys to describe the crime details. During the cross-examination phase in court, defense attorneys attempt to discredit eyewitnesses if their earlier recollections were inconsistent over time. This is based on the intuitive assumption that inconsistent recollections are indicative of inaccurate memory. We have conducted several laboratory studies in which eyewitnesses observed a simulated crime and were tested on two occasions. In every study, inconsistency of recollection was only weakly correlated with inaccuracy, contradicting the intuitive assumption that directs cross-examination strategy within the courtroom. In a recent experiment, we found that inconsistency is moderately to highly correlated with inaccuracy. We attempt to explain theoretically why inconsistency is predictive of inaccuracy in some conditions, but not in others.

(4033)

The Influence of Stereotypes on Eyewitness Memory. HEATHER M. KLEIDER, *Claremont Graduate University*—The purpose of this research was to investigate the dynamics of stereotyping by extending the predictions of social memory models to include eyewitness accuracy. Of specific interest was whether social stereotypes would influence vulnerability to schema-consistent false suggestions. In Experiment 1, participants saw a slideshow of people doing role-consistent and role-inconsistent behaviors. A source memory (i.e., who performed it) test followed immediately or 2 days later. The results showed more misattributions of source for the consistent than for the inconsistent behaviors, but only after delay. In Experiment 2, both schema-consistent and schema-inconsistent behaviors were suggested prior to test. Results showed more false alarms to schema-consistent false suggestions, an effect that increased with a 2-day delay. These results suggest that when memory traces are weak, people rely on their stereotypes to remember a witnessed event.

(4034)

Eyewitness Memory in Civil Cases: Can Witnesses Correctly Identify Products Used in Prior Situations? CHARLES A. WEAVER III & KEVIN S. KRUG, *Baylor University*—Although research on the reliability of eyewitness memory for criminal events has been extensively studied, eyewitness memory in civil cases has not. We have developed a paradigm with which to study memory for product identification, a common question in civil cases involving product liability. Although participants recalled more brand names with cued instead of free recall format, accuracy was only slightly above chance. Furthermore, as in the criminal eyewitness literature, confidence regarding brand name recall was a poor indicator of accuracy. No differences were found between 1- and 2-week delays, although accuracy was somewhat higher with very brief delays. We discuss the significance of these results and describe future avenues of research we plan to pursue.

• Implicit Memory •

(4035)

Retrieval-Induced Forgetting in an Implicit Memory Task With Independent Cues. GINO CAMP, DIANE PECHER, & HENK G. SCHMIDT, *Erasmus University Rotterdam*—Retrieval practice with certain items may result in decreased recall of semantically related items. This retrieval-induced forgetting effect has been obtained in many studies using explicit memory tests. Anderson and Spellman (1995) attributed retrieval-induced forgetting to inhibitory mechanisms. Such an explanation would predict similar effects in implicit memory tasks. In our study, subjects studied category-exemplar pairs (e.g., COTTON–NAPKIN, COTTON–SHIRT, LEATHER–JACKET). Some exemplars received retrieval practice (e.g., COTTON–NA___). Implicit mem-

ory was tested using a category production task with an independent cue (e.g., CLOTHING). Results showed inhibition for the exemplars that did not receive retrieval practice (e.g., SHIRT), as compared with items from nonpracticed categories (e.g., JACKET).

(4036)

Photism Distinctiveness and Recall Accuracy in a Color–Grapheme Synesthete. MIRANDA SCOLARI, ABRIE SCHROEDER, & MARK STEWART, *Willamette University*—Color–grapheme synesthetes perceive colors (called photisms) when presented with achromatic letters or numbers. We report results from preliminary tests involving J.G., a color–grapheme synesthete, whose photisms to words are driven by the initial letter (e.g., F = green; thus, FEAR = green). Presenting lists of low-imagery, matched-frequency words, we find evidence to suggest that subsequent recall is impacted by the relative distinctiveness between photisms perceived during study. Results are discussed in the context of theories of implicit memory, especially as they pertain to word recognition processes.

(4037)

Spatial Contexts Transfer From Visual to Haptic Search. TOMOHIRO NABETA & JUN-ICHIRO KAWAHARA, *Hiroshima University*—Spatial layouts can be acquired implicitly and facilitate visual search under incidental learning conditions (contextual cuing effect). We examined whether the contextual cuing effect is specific to the visual modality or transfers to the haptic modality. The participants performed visual search trials based on a typical contextual cuing paradigm, followed by haptic search trials in which half of the trials had layouts used in the previous visual search trials. The visual contextual cuing effect was obtained in the learning phase. More important, the effect was transferred from visual to haptic searches; there was greater facilitation of haptic search trials in which the spatial layout was the same as that in the previous visual search trials, as compared with trials in which the spatial layout differed from those in the visual search. This suggests the commonality of spatial memory to allocate focused attention in both visual and haptic modalities.

(4038)

Conceptual Priming of Action and Color Knowledge in Picture Naming. IRENE P. KAN, MARTHA J. FARAH, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—We used a repetition priming paradigm to assess automatic retrieval of action knowledge and color knowledge during picture naming. During the exposure phase, subjects named black-and-white line drawings of common natural and man-made objects. In a subsequent priming phase, subjects were presented with both repeated and novel line drawings and were asked to verify whether an accompanying color word (or action word) was appropriate for that object. When compared with novel line drawings, significant priming was observed for repeated pictures on both the color and the action verification tasks. Furthermore, we observed a significant interaction, such that priming on the color task was greater for natural kinds and priming on the action task was greater for artifacts. These results indicate that color information is more likely to be retrieved during processing of natural objects and that action information is more likely to be retrieved during processing of man-made objects.

(4039)

Processes Contributing to Repetition Priming Endurance in Picture Naming and Translation. WENDY S. FRANCIS, SILVIA P. SÁENZ, & CASEY A. GUTIERREZ, *University of Texas, El Paso*—Repetition priming in picture naming has remarkable endurance over time (Mitchell & Brown, 1988). The component processes of picture naming responsible for the durability of priming and its decline across a 1-week delay were assessed in two experiments with Spanish–English bilinguals. In Experiment 1 ($N = 84$), selective facilitation of picture identification processes did not decline across the delay or differ across response languages. In contrast, selective facilitation of word retrieval processes declined substantially across the delay, with stronger priming and stronger reductions in priming with responding in the nondominant language. Experiment 2 ($N = 72$) included conditions to test the durability of repetition priming in translation and the contributions of the component processes of word comprehension and word retrieval. A mathematical process model was used to formalize and test key hypotheses and to clarify the influences of the component processes and retention interval on repetition priming. Supported by NIH Grant MH61765.

(4040)

A New Method for Measuring the Priming of Nonwords. JOSHUA S. REDFORD, ERIN HIGGINS, & BARBARA A. CHURCH, *SUNY, Buffalo*—Three experiments were conducted to develop a method for assessing nonword priming that uses an accuracy measure. The general method involved exposing participants to nonwords during a study phase and to the words containing those nonwords during the test phase. Initial experiments indicated that studying the final nonword component of a word (e.g., /seps/ from forceps) produced priming in a perceptual identification task. A second experiment showed that priming was significantly increased if both nonword components of a word were studied (e.g., /kfmo/ and /flag/ from camouflage). Presentations of words produced significantly greater priming than did all nonword conditions. A third experiment compared voice specificity effects for words and nonword components in this task. These results are discussed in terms of the role of sublexical representations in spoken word recognition.

• Working Memory •

(4041)

Where Does the Predictive Power of the Reading Span Test Come From? AKIRA MIYAKE, JEUNG-CHAN AHN, & NAOMI P. FRIEDMAN, *University of Colorado*—We examined why the Reading Span Test (RST; Daneman & Carpenter, 1980) is often a better predictor of complex cognitive abilities than are simple span measures. Participants performed the RST, several psychometric tests (e.g., reading comprehension, nonverbal reasoning), and a battery of tasks developed to measure component skills involved in RST performance. Although many component tasks (e.g., word span, sentence verification times, proactive interference, word knowledge) correlated with RST scores, no single measure completely eliminated the RST–cognitive-ability correlation when its effect was statistically controlled. However, partialling out a measure of cued retrieval, which required recalling a single memory item after a period of distractor activity, substantially reduced the RST–cognitive-ability correlation for both verbal and nonverbal tests. These results suggest that the RST's predictive power is multifaceted and that its important source may include an ability to use retrieval cues to reactivate or reconstruct target memory items from long-term memory.

(4042)

Proactive Interference in Verbal and Nonverbal Working Memory. MELISSA N. BRANDON, AMISHI P. JHA, JOHN C. TRUESWELL, LAURA H. F. BARDE, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Conflict introduced by presenting a recently seen, but incorrect, test probe is associated with longer response times and increased errors on verbal working memory tests. We conducted two experiments to further investigate this proactive interference effect. In Experiment 1, we examined the relation between proactive interference and executive function. We found that subjects with better executive control (assessed with Dex Questionnaire) had lower magnitudes of proactive interference on a letter recognition task ($r = .76$). In Experiment 2, we examined the generality of this interference effect to nonverbal working memory. We found significant proactive interference on a face working memory task. Furthermore, the magnitude of interference was uncorrelated with subjects' self-reports of verbal strategies. These two results indicate that proactive interference

is not solely related to verbal rehearsal but, rather, is a general property of working memory that may be related to other executive functions.

(4043)

Proactive Interference Effects on Working Memory Can Be Modulated by Expectancy. GREGORY C. BURGESS, RICHARD A. ABRAMS, & TODD S. BRAVER, *Washington University*—Recent working memory (WM) studies demonstrate that proactive interference (PI) can influence WM. We hypothesized that effects of PI on WM are under cognitive control and can be modulated by expectancy. When PI is expected, a proactive control strategy emphasizing active maintenance of WM is adopted. When PI is not expected, a reactive control strategy favoring reactivation of WM representations and evaluation of familiarity signals is implemented. In a probe detection task, 50% of probes were recent (presented in prior memory sets). In the reactive control condition, 80% of recent probes were targets. In the proactive control condition, 80% of recent probes were nontargets. A smaller PI effect was found in the proactive control condition than in the reactive control condition, suggesting that the expectancy of PI resulted in more robust maintenance of WM representations. We discuss the effect of individual differences (fluid intelligence) on the tendency to adopt a proactive control strategy.

(4044)

Asymmetrical Sample Training Produces Asymmetrical Retention Functions in Pigeons. DOUGLAS S. GRANT & CRAIG W. BLATZ, *University of Alberta*—Pigeons were trained in a matching task in which samples involved presentation of a white line on a green background (feature present) or on an otherwise dark key (feature absent). When trained with both samples from the onset of training, retention functions were symmetrical. However, after asymmetrical training in which one group was initially trained with the feature-present sample and another group was initially trained with the feature-absent sample, marked retention asymmetries were obtained. In both groups, accuracy remained high on trials involving the initially trained sample and dropped precipitously on trials involving the sample introduced second in training. It was concluded that asymmetrical training encouraged a single-code/default strategy in which only the sample trained initially was coded. Transfer tests were consistent with this conclusion in that changing attributes of the initially trained sample disrupted accuracy to a greater extent than did changing attributes of the sample introduced second in training.

(4045)

The Effects of Actively Maintaining the Meaning of a Word on the Performance of Concurrent Tasks. GEETA SHIVDE & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—When subjects maintain the meaning of a single abstract word over a delay in order to perform a synonym judgment, they are slower in responding to a semantically related item (as compared with an unrelated item) embedded in a concurrent lexical decision task. However, when subjects perform the same semantic maintenance task, they are faster to react to semantically related items in a concurrent naming task. The difference in the direction of the semantic relatedness effect could be due to a difference in the level of response confusion subjects encounter between the two different concurrent tasks and the synonym judgment. Alternatively, it may be that performing semantic maintenance with a concurrent lexical decision task induces the strategy of inhibiting competing, semantically related concepts, whereas naming does not. These alternative hypotheses can be distinguished by varying the level of response confusion in both the lexical decision and the naming concurrent task designs.

(4046)

Semantic Short-Term Memory Impairment in Childhood Autism. KATHARINA I. BOSER, *Johns Hopkins University School of Medicine,* HENK J. HAARMANN, *University of Maryland, College Park,* & BARRY GORDON, *Johns Hopkins University School of Medicine*—We investigated whether semantic short-term memory (STM) is impaired in childhood autism. Four 12-year-old children with autism and four without performed a cued recall task. Participants listened to lists of six words, each belonging to a different semantic category. A category name was presented immediately after the list or after a 1-sec delay with and without speech-like noise. Participants tried to recall the word in the list that belonged to the cued category. Recall accuracy was analyzed with by-items ANOVAs. As compared with controls subjects, children with autism showed (1) poorer recall overall, (2) a substantial drop-off in recall accuracy at the first of the last three recency items (Position 4), and (3) more same-category intrusions from previous lists. Across both subject types, recall declined across the no-delay, unfilled delay, and filled delay conditions. These results suggest that the storage capacity of semantic STM is pathologically reduced in childhood autism.

(4047)

Lexical-Semantic Working Memory and Sentence Production in Older and Younger Adults. MICHELLE D. MILLER, *Northern Arizona University,* & JEFFREY S. JOHNSON, *University of Iowa*—Evidence from brain-damaged patients suggests a link between lexical-semantic retention capacity and sentence production. The present study was designed to assess age differences in lexical-semantic retention capacity and to test whether lexical-semantic retention capacity relates to sentence production in healthy individuals. Healthy older (mean age = 68.82) and younger adults (mean age = 19.21) performed a picture-naming task designed to elicit sentences whose initial phrases contained either single nouns or two nouns; increased complexity of the initial phrase typically results in slower production times for this task. Lexical-semantic and phonological retention capacity were also measured. Older adults performed significantly better than younger adults on one of two tests of lexical-semantic retention and performed similarly to younger adults on tests of phonological retention. Lexical-semantic capacity, but not phonological capacity, predicted the magnitude of the initial phrase complexity effect in older adults, but not in younger adults.

(4048)

Does Domain Knowledge Moderate Effects of Working Memory on Cognitive Performance? DAVID Z. HAMBRICK, *Michigan State University*—Domain knowledge is a major determinant of complex cognition. However, an issue that has not received adequate attention is whether domain knowledge interacts with general aspects of cognition also hypothesized to play an important role. This study investigated the interaction between domain knowledge and one such aspect of cognition—working memory (WM). The question of interest was whether activation of domain-specific knowledge in a complex memory task would attenuate WM effects. Participants representing a wide range of knowledge about baseball performed a task in which the goal was to follow movements of baseball players, as well as an isomorphic task that disguised the baseball context. There were strong effects of WM in the nonbaseball task. However, moving to the baseball task, activation of domain-specific knowledge in high-knowledge participants did not reduce WM effects. Thus, for certain tasks, WM may constrain cognitive performance even at high levels of domain knowledge.

(4049)

Neural Correlates of Visual Short-Term Memory Capacity. JAMES J. TODD, RENÉ MAROIS, & ISABEL GAUTHIER, *Vanderbilt University* (sponsored by Isabel Gauthier)—Humans show a severe capacity limit in the number of objects they can attend to and maintain in visual short-term memory (VSTM). We used event-related fMRI to identify the neural substrates of this capacity limit. While engaged in a concurrent articulatory suppression task, subjects performed a delayed matching-to-sample task on the color and position of one to eight colored discs. Cowan's (2001) *K* formula indicated that VSTM capacity increased up to set sizes 3–4 and leveled off thereafter. A

GLM with *K*-weighted contrasts revealed activation in the intra-parietal and intra-occipital sulci (IPS/IOS). At lower thresholds, the anterior cingulate and the inferior temporal cortex were also observed, but only the IPS/IOS was activated during both VSTM encoding and maintenance. These results suggest that the IPS/IOS may correspond to the neural substrates that severely limit our capacity to hold in mind what and where objects are in a visual scene.

• Metamemory •

(4050)

Distinctive Orthographic Feature Processing of Words Greatly Reduces False Recall: A Transfer Appropriateness Explanation. JERWEN JOU, YOLANDA E. MATUS, & DAWN M. ROGERS, *University of Texas, Pan American*—Semantic or deep-level processing, although a more effective encoding strategy than orthographic processing, may not be beneficial for reducing false recall of the critical words in the Deese/Roediger–McDermott (DRM) task, because the critical words share a great deal of semantic attributes with the list words. In a DRM task, subjects were instructed to memorize the presented word, as well as to determine whether each word began with a particular letter (i.e., the initial letter of the critical nonpresented word for that list). The false recall of the critical nonpresented words was reduced by 75% from that of a usual encoding condition. In another experiment using the same procedure, but with half of the lists containing and the other half not containing the critical words, the effect of the first letter monitoring on the rate of recalling the critical words was striking. The effect can be explained by the concept of transfer-appropriate processing.

(4051)

Revisiting Age Differences in Tip-of-the-Tongue (TOT) States. ALAN S. BROWN, *Southern Methodist University,* & TAMAR H. GOLLAN, *University of California, San Diego*—The age-related increase in tip-of-the-tongue (TOT) states is a widely accepted experimental result. However, careful literature review reveals that this finding depends on how TOT rates are calculated. Brown (1991) suggested expressing TOT rates as a proportion of unrecalled targets, but this capitalizes on older adults' increased vocabulary (fewer unrecalled targets) to artificially inflate TOT rates. To test this proposal, we contrasted TOT rates in monolinguals to those in bilinguals who had relatively decreased vocabulary knowledge and found that the bilingualism-related increase in TOT states disappears or reverses using the Brown measure. The "fact" of age-related production deficits is subtler and more a function of age differences in vocabulary than was previously assumed (with the exception of proper name TOT states, where age differences are robust). Furthermore, the Brown adjustment may reflect verbal fluency instead of retrieval difficulty, and we recommend two alternative methods for calculating TOT rate to address this problem.

(4052)

Confidence Judgments by Rhesus Macaques on a Serial Memory Task. LISA K. SON, *Barnard College,* & NATE KORNELL & HERBERT S. TERRACE, *Columbia University*—Two rhesus macaques were trained previously to make confidence judgments about their perception of the relative size of lines and numerical stimuli. They earned 3 tokens if they chose a high-risk icon following a correct response but lost 3 tokens if they chose that icon following an incorrect response. One token was earned anytime they chose a low-risk icon. Food reward was provided after the subject collected 12 tokens. In this experiment, we evaluated subjects' confidence judgments on a serial probe recognition task. After observing six successive photographs, subjects were shown nine photographs simultaneously, only one of which appeared earlier. After learning to reliably select the correct photograph, they were presented with the risk icons. Subjects responded to the risk icons appropriately on the 1st day they were presented, thus showing transfer of their ability to make confidence judgments to a memory task.

(4053)

The Effect of Suggestion and Type of Intention on Prospective Memory. GIULIANA MAZZONI, *Seton Hall University,* IRVING KIRSCH, *University of Connecticut,* & MARIA MEO, *Università di Roma*—This study tested the effects of suggestion and type of instruction on a prospective memory task. Participants were asked to take one placebo pill per day for 3 weeks and to predict their performance. Half of them were instructed to form specific implementation intentions (i.e., to specify the exact place and time they would take the pill each day); the other half did not receive these instructions. Half of each instruction group was given a strong suggestion via hypnosis (i.e., the thought of taking the pill would come to mind at the appropriate moment). The other half did not receive any suggestion. The results indicated that, as compared with a very low performance in the control group, prospective memory was significantly enhanced by the use of the strong suggestion and by the use of a specific implementation intention. The theoretical implications of these results are discussed.

(4054)

Conditions Under Which Massed Practice Is Beneficial. JANET METCALFE, NATE KORNELL, & BRIDGID FINN, *Columbia University*—To understand whether people use their metacognitions to appropriately allocate study time, we investigated information uptake functions for materials that were easy or of medium difficulty. These functions showed a very steep initial uptake on the easy materials, followed by little additional benefit. With materials of medium difficulty, however, information uptake was more extended. We inferred that people should study easy items for only a very brief time, then switch to other items—returning to the easy items for restudy only at a spaced delay. However, with more difficult items, people should not defer study but, rather, should use massed practice until information uptake has reached a plateau. We present experimental evidence for the beneficial effect of massed practice when the presentation time was short and the materials were moderately difficult. Spacing helped only with easy materials and long presentation times. We relate these results to people's free-study strategies.

(4055)

The Contribution of Retrieval Fluency to the Underconfidence With Practice Effect. MICHAEL J. SERRA & JOHN DUNLOSKY, *University of North Carolina, Greensboro*—When students study paired associates during multiple study–test trials, judgments of learning (JOLs) made during each trial underestimate increases in recall performance across trials, which has been dubbed the underconfidence with practice (UWP) effect (Koriat, Sheffer, & Ma'ayan, 2002). In two experiments, we examined the contribution of retrieval fluency to the UWP effect by having participants make both immediate JOLs and delayed JOLs. The UWP effect was found for immediate JOLs and, for the first time, with delayed JOLs. Although a significant effect of retrieval fluency was found for both kinds of judgments, fine-grained analyses of performance across trials indicate that participants' reliance on retrieval fluency to predict performance cannot entirely account for the UWP effect.

(4056)

Differential Effects of the Amnesic Drug Lorazepam on Study Time Allocation and on Judgments of Learning. ELISABETH BACON, *INSERM,* & MARIE IZAUTE, *CNRS, Clermont-Ferrand*—We investigated the effects of lorazepam on the allocation of study time, memory, and judgments of learning, in a task including repetition of learning, following the procedure used by Moulins et al. (2000) with Alzheimer's patients. In a placebo-controlled design, all the subjects benefited from the repetition of learning, although the performances of the lorazepam-treated subjects remained lower than those of the placebo participants. The repetition of learning had an effect on JOL in both groups. Overall, the JOLs of the lorazepam participants were lower, but the predictive accuracy of the JOLs was preserved by the

drug. The lorazepam participants controlled differently the study time allocation, and no differences were reported between repetition trials in allocation of study time, whereas the placebo-treated participants discriminated significantly across repetition trials. These results suggest that lorazepam has a differential effect on monitoring and control. The implications of the findings are discussed.

(4057)

Dose-Effect Comparison of Lorazepam and Scopolamine on Metamemory. MIRIAM Z. MINTZER & ROLAND R. GRIFFITHS, *Johns Hopkins University*—Benzodiazepine and anticholinergic drugs both induce temporary amnesia when administered acutely to healthy volunteers. This double-blind, double-dummy, placebo-controlled experiment compared the dose effects of the benzodiazepine lorazepam (1.0, 2.0 mg/70 kg, orally administered) and the anticholinergic scopolamine (0.3, 0.6 mg/70 kg, subcutaneously administered) on performance in the judgment of learning (JOL) metamemory paradigm in an independent groups design in healthy volunteers (n = 12/group). Whereas both lorazepam and scopolamine produced orderly dose-related deficits in cued recall for the studied word pairs, neither drug impaired metamemory as measured by prospective (JOLs during study) and retrospective (confidence ratings during test) judgments, providing evidence for a pharmacological dissociation between effects on memory versus metamemory (item-by-item monitoring). However, results suggest that the high doses of both lorazepam and scopolamine impaired global metamnemonic monitoring as measured by prestudy recall predictions. Results do not provide evidence for differences between lorazepam and scopolamine in effects on metamemory.

(4058)

Metamemory Without the Memory: The Effect of Midazolam on Judgments of Learning. PAUL MERRITT, ELLIOT HIRSHMAN, JOHN HSU, & MICHAEL BERRIGAN, *George Washington University*—The benzodiazepine midazolam produces a dense anterograde amnesia, while permitting relatively well-preserved short-term memory, semantic retrieval, and other higher cognitive functions. In the context of these preserved abilities, an important question concerns whether participants are aware during study that midazolam will produce amnesia. In the present experiment, participants were given midazolam in one testing session and a saline placebo in another. Participants provided judgments of learning (JOLs) immediately following study of cue–target pairs. During the test phase of the experiment, retrospective confidence and feeling-of-knowing (FOK) judgments were collected. Although cued recall performance was substantially impaired in the midazolam condition, mean JOLs were unaffected, indicating that participants had little insight into their impairment during the study phase of the experiment. In contrast, participants were relatively well calibrated in retrospective confidence and FOK judgments in the midazolam condition. The clinical importance and implications of these findings for theories of metamemory will be discussed.

• Selective Attention •

(4059)

Object-Based Control Over Spatial Selective Attention via Retinotopic Maps of Distractor Probability. EDWARD AWH, ANTOINETTE SGARLATA, & JOHN KLIESTIK, *University of Oregon*—Most accounts of attentional control refer to on-line shifts in internal settings that accommodate changing task demands. For example, it is clear that observers can exert moment-to-moment control over where spatial attention is focused or which object properties will be analyzed. We present evidence that attentional control over distractor exclusion—a primary component of visual selective attention—does not entail on-line shifts in a global control setting. Instead, our data suggest that retinotopic maps of the prior probability of distractor interference allow the parallel maintenance of separate settings for distractor exclusion at each potential target location. These probability maps can be retrieved via object-based cues, and they interact with on-line shifts of attention to elicit increased levels of distractor exclusion when it is most needed. Thus, long-term records of prior visual experience provide an internal template for distractor exclusion during covert spatial orienting.

(4060)

Is Inhibition of Return to Onset Cues a Consequence of Attending? SHU-CHIEH WU & ROGER W. REMINGTON, *NASA Ames Research Center*—In cuing studies, inhibition of return (IOR) to onset cues at long cue–target intervals has been taken as evidence for attention to the onsets at short intervals. However, IOR to onsets could be due to saccade programming unrelated to attention shifts. We examined the relationship between IOR and attention by measuring IOR to an onset cue presented simultaneously with a color cue. These uninformative cues preceded a color target by 150 or 850 msec. The color cue should capture attention, leaving the onset location unattended. Confirming this prediction, at the short SOA, facilitation obtained for targets at the color, but not at the onset, location. At the long SOA, small inhibition obtained for targets at the onset, but not at the color, location. Inhibition also obtained for foils at the onset location, causing negative compatibility effects. It appears that IOR to onset cues does not necessarily involve an early attention shift.

(4061)

Location Cuing and Response Time Distributions in Visual Attention. LAWRENCE R. GOTTLOB, *University of Kentucky*—The allocation of visual attention was investigated in two experiments. In Experiment 1 (n = 24), a peripheral cue was presented, and in Experiment 2 (n = 24), a central cue was used. In both experiments, cue validity was 90%, and the task was four-choice target identification. RT distributions were collected for valid trials over five cue–target SOAs, and ex-Gaussian parameters were extracted. In both experiments, only the mean of the Gaussian component decreased as a function of cue–target SOA, which implied a strict time-axis translation of the distributions. Results were consistent with sequential sampling models featuring a variable dwell time during which no information is collected.

(4062)

Allocation of Attention in Object Perception and Recognition. SIMONE K. KEANE & STEPHEN PALMISANO, *University of Wollongong,* DARREN C. BURKE, *Macquarie University,* & WILLIAM G. HAYWARD, *Chinese University of Hong Kong*—What role does attention play in object perception and recognition? In three experiments, we examined the effects of the locus of attention, the spatial distribution of attention, and the detail level of attention on the processing of object properties (configuration, shape, and relative arrangement of parts). Experiments used 3-D novel object stimuli in both change detection and visual search tasks. Taken together, the results indicate that attention appears to be allocated to the configuration of the object parts before the shape or the relative arrangement of parts, regardless of attempts to manipulate the detail level, locus, or distribution of attention.

(4063)

The Role of Temporal and Spatial Factors on Attentional Cuing and Inhibition of Return. JIM E. McAULIFFE, *Lakehead University,* & JAY PRATT, *University of Toronto*—There is a biphasic pattern in response times to peripheral uninformative cues, with faster responses to targets at cued locations when the SOA is under 300 msec and slower responses when it is over 300 msec. The effect has typically been attributed entirely to the SOA while other aspects of the cues (duration, spatial configuration) have been ignored. To examine these other factors, along with SOA, the present experiments included manipulations of SOA (50, 100, 200, 400, and 800 msec), ISI (0, 50, 100, 150, 200, 300, 350, 400, 500, 600, 700, and 750 msec) and whether or not the cue and the target overlap in the same space. The results indicate that facilitation effects are dependent on spatial factors and that, for inhibition effects to be realized, both a longer SOA and a sufficiently short ISI must be used, adding further support to the notion that facilitation and inhibition effects are separate processes.

(4064)

Effect of Position Information on the Attentional Blink. DOMINIC CHARBONNEAU & DENIS COUSINEAU, *Université de Montréal*—The attentional blink (AB) effect is a drop in performance in reporting a second target within an RSVP from lags 2 to 5. According to many models, the processing order is fixed (ballistic hypothesis), creating unavoidable bottlenecks. In a first condition, we fixed the distance between the two targets, informing the subject on the relative position of the second target. In a second condition, we fixed both target positions, informing the subject on their absolute positions. The results show no reduction of the blink effect, supporting the hypothesis of a ballistic treatment in the AB. The only difference between the two conditions is the absence of lag 1 sparing in the second condition. This leads to the paradoxical observation that subjects trained on a specific condition are worse than subjects trained in variable conditions. Furthermore, there was a significant reduction of the number of inversions in the second experiment, as compared with the first.

(4065)

Illusory Conjunctions in the Time Domain and Event-Related Potentials. JUAN BOTELLA, MARIA EUGENIA RUBIO, & CARMEN RODRIGUEZ, *Universidad Autónoma de Madrid,* & JUAN LAMAS & FERNANDO VALLE-INCLAN, *University of La Coruña*—In rapid serial visual presentation (RSVP) tasks, features from different items are sometimes miscombined, producing illusory conjunctions in the time domain. Botella, Barriopedro, and Suero (*JEP:HPP*, 2001) proposed that participants in this task try first to focalize attention on the target. If focal attention fails, the decision is based on partial, degraded information of the features free-floating in the system. We presented colored letters and asked participants to report the color of a specific letter or the letter in a specific color. EEG was recorded continuously from 29 scalp electrodes. The ERPs were calculated from 500 msec before the first letter to 1,000 msec after the target. Recordings in the occipito-temporal region were more negative on the left than on the right, presumably reflecting letter processing. At midline, N200 and P300 amplitudes were larger for correct responses than for miscombinations, despite the fact that participants did not know if they were correct or not.

(4066)

Effect of Blocking on Control Trials in a Flankers Task: Does Being Careful Mean Motoric Suppression? PEGGY CHEN & J. TOBY MORDKOFF, *Pennsylvania State University*—In a flankers task, performance on control trials (no flankers) depends on whether these trials are run separately (blocked) or are mixed with the compatible and incompatible trials. Eriksen and Eriksen (1974) explained the slowing of control trials when they are mixed in terms of motor inhibition. Loosely speaking, in order to avoid errors on incompatible trials, the motor system begins each trial in a suppressed state, which costs time on all trials, including control trials. We tested this idea, using the lateralized readiness potential, which is thought to be an on-line measure of motor preparation. We replicated the difference between blocked and mixed control trials but found no evidence that motor-level inhibition was responsible.

(4067)

Attentional Rubbernecking: Negatively Valenced Images Induce Spontaneous Attentional Blinks. STEVEN B. MOST, *Vanderbilt University,* MARVIN M. CHUN, *Yale University,* & DAVID M. WIDDERS, DAVID H. ZALD, & DO-JOON YI, *Vanderbilt University*—In the competition for attention, unselected information often goes unnoticed. In the typical attentional blink, for example, people search for two targets within a rapidly streaming sequence of stimuli. If the two targets appear in close temporal proximity, one target is often perceived at the cost of the other. Given the behavioral relevance of emotional information, we hypothesized that task-irrelevant, emotionally negative images would spontaneously induce blinks even when subjects searched for a single predetermined target. In two experiments, subjects searched for an upside-down landscape photo among upright ones. Experiment 1 revealed decreased ability to detect the target when it was preceded by a negative image versus a neutral one. Experiment 2 replicated this finding while including scrambled negative images to control for low-level image properties. Through the collection of personality measures and subjects' ratings of the emotional images, additional evidence emerged for differences in susceptibility to such blinks.

(4068)

Localized Attentional Interference Reflects a Competition for Representation. JEFFREY R. W. MOUNTS, *SUNY, Geneseo,* & JASON S. McCARLEY, *Mississippi State*—Observers' ability to identify multiple visual objects improves as the spatial separation between the attended objects increases. Current models of perception and attention suggest that this effect reflects a competition between objects for the control of spatially restricted receptive fields, with levels of interference being modulated by the degree to which attended stimuli draw upon common pools of localized resources. This hypothesis predicts that making representational resources scarcer will increase the interference observed between spatially proximal targets. A series of experiments tested this hypothesis by manipulating the density and attentional salience of distractor objects vying with targets for representation in a same–different task. As was predicted, increases in the density and salience of visual noise magnified the interference observed between spatially proximal targets. Results support the hypothesis that localized attentional interference between nearby stimuli results from competition for localized perceptual resources.

(4069)

Probe Time Distractor Interference and Auditory Negative Priming. JASON P. LEBOE, TODD A. MONDOR, & LAUNA C. LEBOE, *University of Manitoba*—Not attending to a stimulus often results in a slowed response to that stimulus when it is repeated (Tipper, 1985). In previous research, we have demonstrated that this effect will as readily occur for auditory stimuli as it does for visual stimuli (Mondor, Leboe, & Leboe, 2003). In the present study, participants were presented with a single prime sound followed by a pair of probe sounds. On each trial, a cue indicating which of the two probe sounds should be identified was presented before, during, or after the probe display. This method allowed us to determine whether the magnitude of auditory negative priming is influenced by the degree to which the probe distractor is processed. As a result, this manipulation provides a strong test of the conventional view that the root of negative priming is a prior act of ignoring (e.g., Neill, 1997; Tipper, 2001).

(4070)

Time Course of Stimulus-Driven and Knowledge-Driven Auditory Attention. W. J. DOWLING, *University of Texas, Dallas,* & BARBARA TILLMANN, *Université Claude Bernard Lyon I*—Listeners judged the amplitude modulation rate (3 vs. 10 Hz) of warbles, maintaining a high proportion of correct responses while RT was measured. Each trial began with a 500-msec warble on a midrange pitch, followed by stimulus-driven or knowledge-driven cues that were either valid or invalid. The stimulus-driven cue was a 250-msec "beep" at the target pitch or a different pitch height; the knowledge-driven cue was a midrange "melody" pointing to the target pitch or not. A 500-msec target warble followed after delays of 0–1,000 msec. The listener pressed a key for "same" or "different." Listeners initially performed a warm-up session without cues and a practice session in the melody cue condition (learning the association of cues and targets). The most striking result was that responses following valid beeps at zero delay were slowed (a phenomenon similar to "attentional blink" in vision), whereas at 250- and 500-msec delays, valid beeps produced RT benefits.

(4071)

Listening in a Noisy World: Effects of Hearing Acuity and Cognitive Change in Aging Listeners. SANDRA L. McCOY, RAJ STEW-

ART, PATRICIA A. TUN, & MARIANNE COLANGELO, *Brandeis University,* L. CLARKE COX, *Boston University,* & ARTHUR WINGFIELD, *Brandeis University*—Older adults, even those with good hearing for their age, have greater difficulty than younger adults in focusing on a target speaker in background noise, with age differences dependent on the type of background noise (Tun & Wingfield, 1999). The suggested sources of these difficulties include changes in auditory acuity, decreased attentional control, and/or difficulty inhibiting irrelevant stimuli. We report a study examining recall performance of a group of older adults with a range of hearing acuity in four different types of background noise (one-talker, two-talkers, multitalker babble, and white noise). We demonstrated that different combinations of hearing acuity (both high and low frequency) and cognitive variables have different predictive value, depending on the type of background noise. These findings will be discussed in terms of sensory–cognitive interactions in an aging cognitive system.

• Lexical Processing •

(4072)

Sensitivity to Sublexical Statistics and Subject Variability in the Triangle Model of Reading. MARK S. SEIDENBERG, *University of Wisconsin, Madison,* & JASON D. ZEVIN, *Sackler Institute, Cornell Medical College*—Treiman et al. (2002) and Andrews and Scarrett (1998) examined the role of statistical properties of the lexicon in determining the pronunciations of ambiguous nonwords, such as MOUP. These studies indicate that (1) readers are sensitive to statistical regularities at several levels and (2) there is considerable variability among readers in how such nonwords are pronounced, implicating (3) individual differences in how the statistics of the spelling-to-sound system are encoded. The studies also called into question how well connectionist and other reading models can account for nonword performance. We explored these issues by conducting multiple runs of a PDP model of reading. Differences in the initial random weights and the sampling of words during training yield variability in model performance. The models provide a better account of modal pronunciations, effects of different types of sublexical structure, and individual differences in nonword pronunciation than has previously been recognized.

(4073)

Serial Effects in Pseudoword Reading. REMO JOB, *University of Padua & University of Trento,* FRANCESCA PERESSOTTI, *University of Padua,* & CLAUDIO MULATTI, *University of Trento*—We present two experiments and a simulation investigating pseudoword reading. We exploited context-sensitive rules of Italian to construct pseudowords consistent or inconsistent with the original word they derived from. The position of the inconsistency in the string was manipulated. Reading times were longer for stimuli with the inconsistency in earlier positions than for late positions. Furthermore, the size of the consistency effect itself decreased markedly from the earlier to the late positions of the string. A simulation with an Italian version of the DRC model (Coltheart et al., 2001) produced a qualitatively different pattern.

(4074)

A Comparison of Silent and Oral Reading. RALPH RADACH, *National University of Ireland, Maynooth,* DIETER HELLER, *Technical University Aachen,* & ALBRECHT W. INHOFF, *SUNY, Binghamton* (sponsored by Albrecht W. Inhoff)—Research using the naming task has contributed significantly to our understanding of word recognition. In contrast, little is known about the dynamics of continuous oral reading. In our study, participants were asked to read relatively large corpora of coherent text either silently or aloud. This approach combines two methodologies: a quasi-experimental analyses of reading natural text and the experimental manipulation of target words embedded in well-controlled sentences. The expected longer word reading times in oral reading resulted almost exclusively from an increased number of fixations. These extra fixations emerged from two sources: a general fixation position independent increase in refixation probability and a nearly invariant adjustment of initial landing positions. Word frequency effects on gaze durations were more pronounced when reading aloud. Taken together, results indicate that strategic adjustments affect both local oculomotor control and word processing. We consider implications for computational models of information processing and eye movement control in reading.

(4075)

Effects of cAsE mIxInG on Brain Activation Patterns. W. EINAR MENCL, STEPHEN J. FROST, & REBECCA SANDAK, *Haskins Laboratories,* ANNETTE R. JENNER, *College of the Holy Cross,* & STEPHANIE A. MASON & KENNETH R. PUGH, *Yale University School of Medicine*—Converging evidence from neuropsychology and neuroimaging has implicated a set of left-hemisphere cortical areas in printed word identification with dorsal (temporoparietal), anterior (inferior frontal gyrus), and ventral (occipitotemporal) components. Previous results suggest that the frontal and dorsal areas are pivotal in mapping visual percepts of print onto the phonological structures of language, whereas the ventral area appears to constitute a fast-activating word form system in skilled readers. Using fMRI, we examined the sensitivity of these regions to visual word form familiarity. We manipulated familiarity by presenting stimuli in lowercase letters (“strange”) or in mixed case (“sTrAnGe”). Subjects were asked to ignore the case but to respond as to whether each stimulus was a word or a pseudoword (lexical decision). The results indicate strong increases in activation for mixed-case stimuli, largely restricted to the left inferior frontal gyrus, bilateral extrastriate/occipitotemporal junction, and bilateral supramarginal gyrus, and suggest functional distinctions of the neurocircuitry for reading.

(4076)

fMRI Preoperatively Identifies Language Regions in Pediatric Neurosurgical Patients. JASON M. WATSON & JEFFREY G. OJEMANN, *Washington University*, MONICA V. BACIU*, Pierre Mendes-France University*, & KATHLEEN B. McDERMOTT & JEFFREY R. LEONARD*, Washington University*—Neurosurgical procedures that involve the dominant hemisphere frontal and temporal cortex can put language function at risk. Presently, these operations are done with intraoperative cortical stimulation to determine areas of the cortex that are responsible for language function. Recently, McDermott, Petersen, Watson, and Ojemann (2003; *Neuropsychologia*) developed an fMRI protocol that elicits robust activity in language regions of healthy young adults. In the present study, this protocol elicited activation in language regions across four pediatric neurosurgical patients that varied in gender, age (range of 11–17 years), tumor location (frontal vs. temporal), handedness, and native language (English vs. Spanish). In cases that have since gone to surgery, fMRI correlated with language regions positively identified with intraoperative cortical stimulation mapping in both the frontal and the temporal cortex. These findings suggest that the McDermott et al. fMRI protocol may be useful in planning neurosurgical procedures for pediatric epileptic and/or brain tumor patients who may be at risk for language impairment.

(4077)

Preschoolers Show Higher Receptive Vocabulary for Nouns Than for Verbs in a Picture-Pointing Task. SARA E. CARRIERE & LAREE A. HUNTSMAN, *San Jose State University*—In the present experiment, it is hypothesized that when compared with a baseline measurement, preschoolers participating in a reading program will show a significant improvement in their ability to recognize pictures. It is also hypothesized that preschoolers will identify more pictures of nouns correctly than pictures of verbs. Nouns are concrete and are easier for preliterate children to grasp; verbs are abstract and, therefore, harder to comprehend (Gillette, Gleitman, Gleitman, & Lederer, 1999). Thirteen 4-year-old preschool children participated in the study. They

were assessed at baseline and 8 weeks. The assessment included picture recognition of nouns and verbs. At 8 weeks it was found that, although there was improvement, there was not a significant improvement in picture recognition from pretest to posttest but that there were significantly more pictures of nouns identified than of verbs. The results are discussed in terms of Gillette et al.'s (1999) vocabulary acquisition theory.

(4078)

The Influence of Frequency, Consistency, and List Composition in Processing Grammatical Gender Information. ALAIN DESROCHERS, *University of Ottawa,* STEPHEN J. LUPKER, *University of Western Ontario,* & ISABELLE GONTHIER, *University of Ottawa*—The present research investigated the effect of three factors on the processing of gender information in French: (1) the printed frequency of inanimate nouns, (2) the consistency of the relationship between noun endings and gender classes, and (3) the composition of the stimulus list (mixed vs. pure). These variables were examined in two tasks, requiring either explicit or implicit retrieval of gender information (gender decision vs. grammaticality judgment). Responses were faster and more accurate for high-frequency nouns and for endings perfectly predictive of their gender class. These two factors did not interact in mixed lists. When either consistent or inconsistent nouns or high- and low-frequency nouns were presented in pure (vs. mixed) blocks of trials, the response latency was lower for the easy items and greater for the hard items. This pattern provides further evidence for the action of a time criterion mechanism in speeded response tasks.

(4079)

The Acquisition of the Past Participle of Italian Verbs. LUCIA COLOMBO & MARGHERITA PASISI, *University of Padua*—Italian verbs are organized into morphological classes (conjugations) characterized by the thematic vowel in the infinitive and other inflected forms and differing in many respects, such as degree of productivity and regularity. A computational model of the production of the past participle of Italian verbs is presented, in which several variables are investigated, among which are token frequency, root frequency, and consistency in the phonological mapping among inflected forms. The main aim of the study is to explore the extent to which the latter variables are used by the network to learn to produce the correct forms. A complex pattern of results emerges, but in particular, phonological consistency and root frequency provide important predictive information to the network.

(4080)

Effect of Relation Availability on the Access of Compound Words. CHRISTINA L. GAGNÉ & THOMAS L. SPALDING, *University of Alberta*—Research on conceptual combination has demonstrated that relation availability affects the ease of interpreting novel combinations (Gagné & Shoben, 1997). We examine whether interpreting familiar compounds (*snowball*) also involves the selection of a relation (noun MADE OF modifier) by manipulating relation availability. Target compounds were preceded by one of three primes. The same-relation prime shared the same first constituent and same relation as the target (*snowfort*). The different-relation prime shared the same first constituent as the target but used a different relation (*snowshovel*). The unrelated prime was semantically unrelated to the target. Relation priming was evaluated by comparing response times to the target in the same-relation condition with response times to the target in the different-relation condition. Relation priming was observed in both a sense–nonsense task and a lexical decision task. This finding has important implications for how compounds are accessed and processed in the lexicon.

(4081)

The Role of Metrical Stress in Learning an Artificial Lexicon. SARAH C. CREEL, RICHARD N. ASLIN, & MICHAEL K. TANENHAUS, *University of Rochester*—The role of metrical stress in word learning was assessed using an artificial lexicon in a referential context. Target lexical items were three-syllable nonsense words (PAbaku). Foils consisted of cohort items with matched (PAbake) and mismatched (paBAka) stress patterns and items with embedded part-words (diPAba). Learning consisted of 480 trials in which each of 48 target words was presented at the end of a multisyllabic nonsense string of variable length, accompanied by an unfamiliar picture. In testing, target or foil items were presented as word-terminal nonsense strings, and participants chose one of four pictures that matched the test item. Cohort competitor foils were often confused with their targets, but there was no effect of stress mismatch, suggesting that metrical stress did not differentially affect segmentation. However, stress-initial bisyllables embedded in medial-stress words (diPAba) were confused with the embedded cohort competitor, suggesting that segmentation did occur at the onset of the stressed syllable.

(4082)

Bilingual Equivalence Priming: Apparently a Brittle Phenomenon. IRA H. BERNSTEIN & KAY R. ERUSU, *University of Texas, Arlington*—Possible equivalence priming by language-equivalent numerals was examined in Hindi–English bilinguals. Arabic numeral targets were classified as odd versus using Arabic numerals, Hindi numerals, or a control configuration (dots) as primes. The experimental primes could be identical to the target, different but of the same parity (leading to the same response), or of different parity (leading to potentially conflicting responses). This design was employed last year and failed to produce priming when the various prime/target combinations occurred at random. This year, trials were blocked by prime type. Responses were facilitated only when the prime was an Arabic numeral, so no cross-language facilitation was found. However, Hindi primes of different parity produced more interference than did Arabic primes of different parity. Having previously found that cross-language priming occurs, our more recent results show it to be a brittle phenomenon.

(4083)

Measuring Personality Connotation in Proper Names Using High-Dimensional Memory Models. JON WILLITS, CURT BURGESS, CHRISTINA ANDREWS, ADAM KHAN, & ALEX HATSOPOULOS, *University of California, Riverside,* & PATRICK CONLEY, *University of Western Ontario*—For a set of proper names, subjects were asked to rank a list of personality adjectives according to how the name reflects the connotation (e.g., *Charles is ranked as sophisticated and thorough, but not outgoing or cooperative*). These rank-ordered adjectives were then analyzed for systematicity with regard to the gender and formality of the name. Strong correlations were found for many of the adjectives with respect to gender and formality. The hyperspace analogue to language (HAL) model was then used to compare the semantic similarity of the proper names and the adjectives; the model also found relationships between the names and the adjectives with respect to gender and formality. Furthermore, the correlation between HAL's rankings of the names with adjectives and the human subjects' rankings was also strong. These results suggest that mental representations based on global contextual co-occurrence may underlie the connotations we have for proper names and personality adjectives.

(4084)

Case-Independent and Case-Specific Repetition Blindness in the Cerebral Hemispheres. ALISON L. MORRIS, *Iowa State University,* & CATHERINE L. HARRIS, *Boston University*—Repetition blindness (RB) is the selective difficulty in reporting the presence of repeated items from brief visual displays. RB paradigms can be used as tools for investigating the nature of mental representations in the right and left hemispheres. Participants viewed groups of three upper- and lowercase letters displayed briefly in the right or the left visual field and typed the letters they saw. The amount of RB for same-case letters did not differ between the visual fields; however, RB for different-case letters was significantly greater for letters displayed in the right visual

field. These results provide further evidence in support of the existence of a case-specific system in the right hemisphere and an abstract, case-independent system in the left hemisphere.

(4085)

An fMRI Study of Phonological Processing in Visual Word Recognition. JODI D. EDWARDS, BRADLEY GOODYEAR, PENNY M. PEXMAN, & CRAIG CHAMBERS, *University of Calgary*—We investigated the claim that readers can strategically deemphasize phonological processing if task demands discourage the use of phonological information. Some evidence suggests that pseudohomophone foils (e.g., BRANE) encourage deemphasis in lexical decision tasks (e.g., Davelaar et al., 1978; Pugh et al., 1994), whereas other studies show that phonological activation always occurs in such tasks (e.g., Pexman et al., 2001). To investigate whether there is neurological evidence for strategic control, we conducted a functional magnetic resonance imaging study, using a series of tasks presented inside a 3T magnet. Tasks differed in terms of their putative involvement of phonological information and included a rhyme judgment task (e.g., LEAT–JETE) and three lexical decision tasks: one with consonant string foils (e.g., BVRNT), one with pseudoword foils (e.g., BLINT), and one with pseudohomophone foils. The pattern of activation in phonological regions across tasks suggests that readers do not strategically deemphasize phonological information.

(4086)

Lexical/Sublexical Interaction During Spelling: Further Evidence From Dysgraphia and Articulatory Suppression. JOCELYN R. FOLK & ANGELA M. CANDA, *Kent State University*—Most spelling models propose two processes for translating between phonology and orthography: a lexical process involved in retrieving spellings of familiar words and a sublexical process involved in assembling spellings for unfamiliar letter strings on the basis of phonology–orthography correspondences. We investigated how the lexical and the sublexical processes interact in spelling by interfering with the sublexical process in a dysgraphic patient, using an articulatory suppression task. Using a similar task, Folk et al. (2002) found evidence that the sublexical process interacts with the lexical process by strengthening a target word's graphemes. A comparison of error patterns produced under normal spelling conditions versus spelling during articulatory suppression was consistent with Folk et al., revealing that by strengthening a target's graphemes, the sublexical process helps to create an advantage for the target over form-related word neighbors that compete with it for output. Furthermore, evidence concerning the nature of "word neighbors" is discussed.

• Psycholinguistics •

(4087)

Are Phonological Markedness Constraints Innate? Evidence From the Restrictions on English Onset Clusters. IRIS BERENT & MICHAL MAROM, *Florida Atlantic University,* & DONCA STERIADE, *MIT*—Onsets with a large sonority rise (e.g., *blaf*) are unmarked—that is, cross-linguistically frequent and asymmetrically implied by onsets with a smaller rise (e.g., *bnaf*). In turn, the *bnaf*-type onsets are unmarked, as compared with onsets with a sonority plateau (e.g., *bdaf*) and onsets that fall in sonority (e.g., *lbaf*). We examine whether this markedness hierarchy is available to English speakers—speakers whose linguistic experience offers little evidence for the ranking of sonority plateaux versus falls. The results of phonological lexical decision and rating experiments demonstrate that unfamiliar clusters of rising sonority (*bnaf*) are preferred to unfamiliar clusters with sonority plateaux (*bdaf*) or falling sonority (*lbaf*). However, participants did not discriminate among sonority plateaux and sonority falls. Thus, in the absence of experience, speakers fail to exhibit certain markedness distinctions observed cross-linguistically. However, their knowledge of linguistic principles clearly goes beyond lexical evidence. We discuss different options in identifying these principles.

(4088)

The Time Course of Lexical Competition in Spoken Word Recognition. JAMES S. MAGNUSON, *Columbia University,* & MICHAEL K. TANENHAUS & RICHARD N. ASLIN, *University of Rochester*—The temporal nature of speech poses challenges for studying similarity of spoken words. Most spoken word processing tasks provide measures of recognition, rather than continuous time course. We present results from an eye-tracking experiment in which high and low levels of frequency, and neighborhood (global similarity) and cohort (onset overlap) density were used. We found recognition time advantages for high-frequency and low cohort density items, but only a weak advantage for low neighborhood density. Time course, estimated from eye-tracking data, showed an early advantage for high-density items and a cross-over to a late low-density advantage. Despite being matched in cohort density (summed frequencies of onset competitors), more low-density neighbors were also cohorts (58%) than were high density neighbors (32%). This "front-loaded" competition effect was masked in overall recognition time but was revealed by the time course measure. We will discuss the implications for models of spoken word processing.

(4089)

The Constraint Against Regular Plurals in Compounds: Phonological or Grammatical? IRIS BERENT, *Florida Atlantic University,* STEVEN PINKER, *Harvard University,* & GILA GHAVAMI, *Florida Atlantic University*—English speakers disfavor compounds containing regular (e.g., *rats-eater*), as compared with irregular (e.g., *mice-eater*), plurals. The words/rules account (Pinker, 1999) attributes this preference to the distinction between the grammar and the lexicon. Conversely, Haskell, MacDonald, and Seidenberg (in press) propose that the phenomenon reflects unfamiliarity with the phonological form of compounds containing regular plurals. To test this proposal, we compared compounds including irregular plurals that are phonologically illicit and, hence, statistically rare in compounds (e.g., *pteen*, plural of *ptoon*) and regular plurals whose phonological form is attested in the language and, hence, are relatively frequent (e.g., *ploons*). Despite the rarity of their sound patterns, phonologically illicit irregular plurals (e.g, *pteen-eater*) were preferred over licit regular plurals (e.g, *ploons-eater*); moreover, the preference for irregular over regular plurals in compounds did not interact with phonological unfamiliarity. The morphological constraint against regular plurals in compounds thus cannot be reduced to the statistical properties of speakers' experience.

(4090)

Verb Aspect and the Retrieval of Events From Autobiographical Memory. TODD R. FERRETTI, *Wilfrid Laurier University,* & ALBERT N. KATZ, *University of Western Ontario* (sponsored by Albert N. Katz)—We examined the temporal structure of autobiographical memory by combining the use of verb-aspect morphemes with an "event-cuing" procedure. That is, participants first recalled some personal events that subsequently were employed as cues for remembering other events. The cues were paired with different verb-aspect markers (e.g., ongoing, "I was writing an exam in high school"; completed, "I wrote an exam in high school"). Participants were asked several questions about the relation between the cues and the retrieved events. The main findings were that (1) people are more likely to recall an autobiographical event as seeing it unfold before their eyes, and rated the events as more vivid, when the cuing events were marked as ongoing versus completed and (2) they retrieved events from the end of an overall activity more often when the cuing event was marked as completed.

(4091)

Modeling Category-Specific Deficits Using Topographic, Corpus-Derived Representations. DAMIAN JANKOWICZ, SUZANNA BECKER, & STEVE HOWELL, *McMaster University*—We argue that category-specific deficits emerge as a result of damage to a topo-

graphically organized semantic system. To test this hypothesis, we implemented a neural network model, which spontaneously developed topographic representations for meanings of words on the basis of the words' co-occurrence patterns in a large corpus of text. The model was lesioned, and the performance of the lesioned model was compared against patient data. It was found that the model accounts for a wide range of semantic, as well as grammatical, category-specific deficits reported in the literature, including (1) basic impairments to artifacts, animals, and plants, (2) noun–verb dissociation, (3) specific patterns of semantic deficits, (4) preponderance of patient cases exhibiting selective loss of living things, and (5) interaction between feature and category impairments. Additionally, the model reconciles a number of competing theories of semantic organization and provides a unifying framework in which to view different category-specific deficits.

(4092)

The Influence of Age of Acquisition in Word Reading and Other Tasks: A Never-Ending Story? PATRICK BONIN, *Université Blaise Pascal,* CHRISTOPHER BARRY, *University of Kent,* & ALAIN MÉOT & MARYLÈNE CHALARD, *Université Blaise Pascal*—The present study follows the initial work of Zevin and Seidenberg (2002) about the influence of age of acquisition (AoA) in word reading and other tasks. Preliminary analyses performed on AoA norms show that the frequency trajectory of the words is a reliable predictor of the order of acquisition of the words, which validates its use as a variable to examine age-limited learning effects. Three word-reading experiments conducted in French and certain reanalyses of previous published data on adult picture naming, lexical decision, and spelling-to-dictation latencies are reported. The critical test of frequency trajectory effects in word reading, picture naming, spelling to dictation, and lexical decision reveals that frequency trajectory has a reliable influence in picture-naming latencies and lexical decision RTs, but not in word-reading or in spelling-to-dictation latencies. Cumulative frequency has a reliable effect in all tasks. The methodological and theoretical implications of the findings are discussed.

(4093)

Attention Influences Word Order. ANDRIY V. MYACHYKOV, *University of Oregon* (sponsored by Michael I. Posner)—My research is an experimental analysis of the attentional mechanisms in their relation with syntactic patterns in languages with fixed and flexible word order. My aim is to compare assignment of the syntactic subject in English and Russian in narratives biased by narrator's attending to one of the stimuli presented in a dynamic event. The study uses a film showing one fish being eaten by another fish. Tomlin showed that the subject assignment in English is explained by which of the two fish is briefly cued and, thus, attracts attention. I have used the film to study subject assignment in bilingual Russian and English speakers. The results of my study suggest that although the flexibility of Russian word order allows for a greater variety in preferred syntactic structures than English does, there is a strong relation between subject assignment and cuing of attention both in Russian and in English.

(4094)

Span, Stroop, and Second-Language Acquisition. ERICA B. MICHAEL & BRIAN MacWHINNEY, *Carnegie Mellon University*—We examined the role of suppression at early stages of adult second-language (L2) acquisition, proposing that learners might be able to strengthen links between concepts and L2 words by suppressing the associated first-language (L1) words. Participants were native English speakers who were taught 20 Dutch words and 20 English-like nonwords during three training sessions. Words were presented auditorily with line drawings, and participants completed picture–word recognition and L2 production tasks. High- and low-familiarity pictures were selected to see whether low-familiarity pictures would facilitate L2 learning by slowing access to L1 words and, thus, minimizing the demands on suppression. Participants completed two measures of suppression ability in English: working memory span and color–word Stroop tasks. Picture familiarity did not influence learning, but better performance on the Stroop task and, to a lesser extent, the span task were associated with more successful L2 vocabulary learning.

(4095)

Spoken Gesture: Analogue Expression of Meaning in Speech. HADAS SHINTEL, ARIKA OKRENT, & HOWARD NUSBAUM, *University of Chicago*—When people speak, they express information analogically in the manual gestures accompanying speech (McNeill, 1992). Although speech has been viewed as expressing meaning through arbitrary lexical-propositional forms, meaning can be analogically expressed through "spoken gesture"—through an analogue mapping of meaning onto systematic modifications of acoustic properties of speech, such as the prosodic dimensions of pitch, loudness, and duration. We show that speakers spontaneously express information through spoken gesture and that listeners are sensitive to this information. In a production and comprehension study, talkers viewed animations of dots moving left or right at various speeds and were instructed only to verbally describe the direction of motion. Listeners, presented only with these utterances, were significantly better than chance at guessing the speed of motion, which was not lexically described. Results demonstrate that spoken gesture conveys analogical information that is independent of the consciously intended linguistic content of the utterance.

(4096)

Echoes in Conversational Speech: Who Has the Final Word? JENNIFER S. PARDO, *Columbia University*—Physically, no two speech sounds are identical, yet variants of a word are readily perceived as instances of a single lexical category. Despite consistent lexical identification, some intracategory differences are preserved in perception. If such variation is due to important factors, it may be exploited by a talker/listener for nonlexical means. To test this proposal, this study assessed phonetic similarity among interacting talkers. Twelve talkers provided speech before, during, and after performance of a paired conversational task (same-sex pairs). Repeated phrases from the corpus made up the materials for AXB similarity tests performed by separate listeners. These tests found that the talkers became more similar in phonetic content over the course of conversational interaction, and the degree of convergence was influenced by task role and talker sex. These findings imply an important role for social factors in any account of speech production and perception.

(4097)

U.S. Presidential Use of Name Calling and Criticism. RICHARD S. CIMBALO & GINA SMITH, *Daemen College*—Our research examined the use of name calling and criticism of the last four U.S. presidents as well as the first U.S. president. A text analysis of the first State of the Union Address given by these five presidents showed that George Bush, Jr. used significantly more name calling and criticism than did any of the other four (z values $< .05$). The most recent four presidents used name calling and criticism significantly more than did George Washington. George Bush, Jr. also used more power and strength terms than did any of the other presidents studied, but the difference was significant only for the George Washington comparison ($z < .05$). Implications of this behavior for the successful resolution of problems among nations and the possible influence on such behavior in children and the population in general is considered in the light of current psychological theory.

• Language Production •

(4098)

The Role of Semantic Short-Term Memory in On-Line Sentence Production. HENK J. HAARMANN, *University of Maryland,* RANDI C. MARTIN, *Rice University,* & EDDY J. DAVELAAR & MARIUS USHER, *University of London*—Martin, Miller, and Vu (in press) reported neuropsychological evidence that semantic short-term memory (STM) supports conceptual planning during on-line sentence

production. Patients with a semantic STM deficit showed a much larger effect of the memory load of a sentence-initial noun phrase on voice onset latencies (slower for a noun phrase with two nouns than with one noun), as compared with patients with a phonological STM deficit and normal controls. In the present study, we examined how individual differences in semantic and phonological STM in normal adults modulate the effect of the memory load of the sentence-initial noun phrase. We found that this load effect was larger for participants with a mid than with a high conceptual span (indexing semantic STM), absent for participants with a low conceptual span, and not related to nonword span (indexing phonological STM). These findings provide further evidence that semantic STM supports conceptual planning during on-line sentence production.

(4099)

Neural Substrates of Lexical-Semantic Working Memory: Imaging Speech Planning With fMRI. RANDI C. MARTIN & PHILIP C. BURTON, *Rice University,* & EDWARD F. JACKSON & SRIKANTH MAHANKALI, *University of Texas M.D. Anderson Cancer Center*—Aphasic patients with lexical-semantic retention deficits have great difficulty comprehending and producing sentences in which several lexical/semantic representations must be held simultaneously (Martin & Freedman, 2001; Martin & Romani, 1994). There is some evidence that these deficits are associated with left frontal brain lesions (e.g., Romani & Martin, 1999), but this evidence is based on a limited number of subjects. In the present fMRI study, normal adult subjects performed overt and covert picture description tasks that varied the load on lexical-semantic working memory (i.e., single-word, phrase, and sentence response conditions, with words least taxing and phrases most taxing). Phrases yielded greater activity in a left inferior frontal region, relative to single words, whereas the sentence versus single-word comparison did not show this effect. Relative to covert responses, overt responses produced stronger activation in language-related areas (e.g., Broca's area, superior temporal gyrus) and additional activation in motor areas.

(4100)

The Time Course of Picture–Word Interference in Chinese. HSUAN-CHIH CHEN & SIU-YU WU, *Chinese University of Hong Kong*—Two experiments explore the cognitive processes involved in speaking Chinese, using a picture-naming task. In this task, a target picture and a distractor word are presented either simultaneously or sequentially, and participants are asked to name the picture and to ignore the word. The main manipulations include (1) various dimensions on which picture–word relatedness is realized, including orthography, phonology, and semantics, and (2) stimulus onset asynchrony between a picture and its distractor. We observe the following picture–word effects: semantic inhibition, phonological facilitation, and orthographic facilitation. Furthermore, in terms of the time course, the semantic effect appears first, the orthographic effect second, and the phonological effect last. Implications of these findings in lexical processing in Chinese are discussed.

(4101)

Effects of Associatively and Semantically Related Distractors in Picture–Word Interference. JENS BÖLTE, ANNETT JORSCHICK, & PIENIE ZWITSERLOOD, *Westfälische Wilhelms-Universität Münster*—We contrasted effects of associative or semantic relationships in a picture–word interference paradigm in four experiments. Distractors and picture names were associatively related (*yellow–banana*) or belonged to the same semantic category (*plum–banana*). The onset of distractor and picture were systematically varied with four different stimulus onset asynchronies (SOAs; −300, −150, −20, or +150 msec). Associated distractors facilitated picture naming, whereas semantic distractors slowed down picture naming. Moreover, different time courses emerged: Semantic distractors influenced picture naming over a longer negative SOA range than did associative distractors. No effects at all were observed at a positive SOA of +150 msec. Associative and semantic effects are clearly distinct in direction and time course in picture–word interference. The way in which associative and semantic distractors are linked with the picture's concept and its lexical entry is responsible for the different direction and time course of effects.

(4102)

Early Visual Encoding of Complex Scenes in Speech Production. CHRISTIAN DOBEL, *Westfälische Wilhelms-Universität Münster,* ANTJE S. MEYER, *University of Birmingham,* & SONJA EISENBEISS, *Max Planck Institute for Psycholinguistics*—In a series of experiments, we presented subjects with complex scenes involving two or three participants. Speakers had to describe these events with either a sentence or a list of words while their eye movements were monitored. Corroborating earlier research on multiple-object naming (Meyer et al., 1998), we found an alignment of fixation and speech, so that the order of speaking became visible in the order of fixating. However, a preview phase before speech onset could be seen that is characterized by order, number, and duration of fixations on scene participants, depending on the type of stimulus (two or three participants), the type of task (sentence or list production), and the eventfulness of the stimulus. (Eventfulness was manipulated in a factorial design in two ways: by insertion of lines between participants and by turning agent and recipient away from each other.)

(4103)

How Does Prearticulatory Speech Monitoring Work? Predictions From Three Models. CHARLES A. METZING & SUSAN E. BRENNAN, *SUNY, Stony Brook*—Three prevailing theories compete to explain how speakers can detect and repair speech errors before articulation. Levelt's (1983) perceptual loop theory proposes a single inner monitor, dependent upon an intact comprehension system. Production-based theories (e.g., Laver, 1980) propose multiple monitors at various stages of production. Connectionist models (e.g., MacKay, 1987) propose no monitoring device per se; monitoring emerges from a network when it becomes manifest that an incorrect phoneme or word has been activated. Neuropsychological data are inconsistent, with various patients displaying intact monitoring but severely impaired comprehension or production. Of the competing alternatives, production-based models enable the most independence between monitoring and processes of comprehension or production. We compared the three models by having speakers describe visual displays, in order to determine (1) whether error detection and repair times depend upon planning load and (2) whether such times differ for errors originating at different stages of production.

(4104)

The Self-Concept in Sentence Production. RONALD T. KELLOGG & HEATHER MERTZ, *St. Louis University,* & DONNA EISENSTADT, *Saint Louis University*—The self-concept is important in social perception, affect regulation, memory encoding, and other aspects of human behavior. Here, we explored its role in language production. In Experiment 1, participants were asked to write a simple sentence that included two noun prompts that were either semantically congruent or incongruent. Participants made about twice as many references to the self with the meaningful, congruent pairs than with the incongruent word pairs. The same effect was obtained for more elaborate sentences in Experiment 2. Various kinds of concurrent loads on working memory failed to diminish the difference in both experiments, suggesting automaticity. Participants also used emotion-related words to a greater extent with the congruent, as compared with the incongruent, word pairs. The results are discussed in terms of Duval and Wickland's (1972) self-awareness theory and the affective consequences of processing information using the self as a central organizing structure.

(4105)

A Comparison of Children's and Adults' Use of Hyperbole. HERBERT L. COLSTON & JERI M. MADSON, *University of Wisconsin, Parkside*—In two experiments, the extent to which middle childhood

figurative language is similar to that in adulthood was investigated. Two novelties were present in this work: (1) The study was directed at the production of figurative language because most work to date has been based on comprehension, and (2) one of the lesser studied figurative forms, hyperbole, was investigated because the development of that form, due to the nature of children's common everyday experience and the pragmatic functions of the form, might behave differently than that of other figurative language types. As the results demonstrate, children's use of hyperbole is in many ways very similar to that of adults. Implications for claims regarding the development of figurative language in middle childhood are discussed.

(4106)

Priming of Low-Frequency Spellings in Smaller and Larger Neighborhoods. DUNJA LUND & LISE ABRAMS, *University of Florida*—This experiment investigated priming of low-frequency spellings. During the priming phase, college students typed the spelling of auditorily presented primes containing a low-frequency spelling (e.g., the /i/ spelled as [ai] in "chaplain") or a high-frequency spelling (e.g., /i/ spelled as [i] in "bulletin"). Primes were further categorized as having smaller or larger neighborhoods, which represent the relative number of words that contain a particular spelling pattern. For example, many words contain [ant] as in "resistant," whereas fewer words have [ain] as in "chaplain." During the test phase, participants typed the spellings of different auditorily presented words containing the low-frequency spelling (e.g., "porcelain"). Priming high-frequency spellings had no effect on spelling low-frequency spellings at test. However, both good and poor spellers correctly spelled low-frequency spellings more often when primed with words containing the same low-frequency spellings, relative to low-frequency spellings not presented. Priming also interacted with neighborhood size and type of speller.

(4107)

Forests or Trees? Collective Nouns and Number Agreement in British and American English. KARIN R. HUMPHREYS & KATHRYN BOCK, *University of Illinois, Urbana-Champaign,* KATHLEEN M. EBERHARD, *Notre Dame University,* SALLY BUTTERFIELD, *MRC Cognition and Brain Sciences Unit,* JOHN COOPER CUTTING, *Illinois State University,* & ANNE CUTLER, *Max Planck Institute for Psycholinguistics*—Speakers of British and American English notoriously show differences in subject–verb agreement with collective noun subjects: The sentence *The government are unpopular* is usually judged as acceptable by British, but not by American, speakers. Underlying this dialect variation could be either notional disparities (British speakers may view collectives as many things, Americans as single things) or grammatical disparities in the classification of collectives (as plural or singular). To test these explanations, we gave British and American speakers experimental tasks requiring production of verb or pronoun number agreement. The results show that pronoun agreement with collectives calls more on notional number than does verb agreement, but equivalently for British and American speakers. With the same collectives, British and American speakers produced different patterns of verb agreement. The experimental findings converge with parallel norming and corpus data to suggest that the dialect differences are not conceptual but grammatical in nature.

(4108)

Automatic Speech Recognition for the Analysis of Laboratory Speech. DOUGLAS J. DAVIDSON, *University of Illinois, Urbana-Champaign*—Chronometric measures of speech timing have proven to be important for speech production research since Donders pioneered the method in the 1860s. Currently, most researchers use a voice key to measure speech onset, but a disadvantage of this technique is that only the onset of speech is measured. Most utterances contain multiple words, however, and a major bottleneck in the analysis of multiple-word utterances is the time required to segment the speech by hand. A comparison of human versus machine segmentation using Viterbi forced alignment shows that automatic speech recognition techniques can be used to measure the timing of word onsets, as well as word duration. The results show the practical utility of applying engineering techniques from computational linguistics to measurement problems in experimental cognitive psychology.

• Category Representation •

(4109)

Measurement of Implicit Fear Associations in Spider Phobia and Spider Enthusiasm. MIKE RINCK, THOMAS ELLWART, & ENI S. BECKER, *Dresden University of Technology*—To study cognitive fear networks, indirect experimental paradigms such as the Implicit Association Test (IAT) may be helpful tools, because they promise to assess the structure of specific associations. Therefore, we used the IAT to investigate cognitive structures in fear of spiders. We measured fear associations towards spiders among spider phobic and nonphobic participants, as well as among spider enthusiasts, determining how fear associations measured with the IAT are related to explicit fear reports and to behavior. Results indicate that the IAT is a suitable experimental paradigm for the assessment of fear associations. As was expected, fearful participants exhibited strong fear associations toward spiders. Interestingly, there was a dissociation in the nonphobic group, because they reported no explicit fear but showed implicit fear associations nevertheless. In contrast, there were neither implicit nor explicit fear associations among spider enthusiasts.

(4110)

Induction of Hierarchical Organization in High-Dimensional Memory Models. JON WILLITS, CURT BURGESS, & KYMBERLIE SCHELLIN, *University of California, Riverside*—The induction problem in psycholinguistics is the assumption that a person cannot create abstractions without some a priori knowledge about different categories. Today, researchers are becoming more hesitant about criticizing induction outright, but there is implicit assumption in many cognitive models that induction alone is not up to the task of many cognitive phenomena. It is suggested that perhaps this is because previous cognitive models have not incorporated the true richness of the environmental stimulus. In cognitive models in which context is operationalized and implemented, a representation that includes the richness of context can overcome many of the traditional problems induction has encountered. Empirical results to illustrate this will include semantic and grammatical categorization, typicality effects, and other effects representing hierarchical organization. We conclude that there is a strong advantage of using a contextually driven operationalization of prior knowledge with regard to the context sensitivity of many categorical and hierarchical decisions.

(4111)

ANCHOR: A Dynamic, Memory-Based Model of Psychophysical Scaling. ALEXANDER A. PETROV, *University of California, Irvine*—We propose ANCHOR, a memory-based model of category rating and absolute identification. It gives a principled quantitative account of over a dozen empirical phenomena (Petrov & Anderson, 2000, submitted). The stimuli are represented stochastically by internal magnitudes that must then be mapped onto the overt response scale. ANCHOR's defining claims are that this mapping is (1) memory based and (2) stabilized by explicit corrections. Specifically, magnitude-response associations—"anchors"—stored in memory compete to match the target. Anchor selection is stochastic and depends on the similarity with the target and the base-level activations of the anchors, which in turn track their frequency and recency. These memory mechanisms integrate ANCHOR with the cognitive architecture ACT–R. Explicit correction strategies promote homomorphism and ensure stability even in the absence of feedback. A competitive learning mechanism updates the anchor locations, producing context effects that contradict earlier instance-based models. Three experiments confirm ANCHOR's predictions.

(4112)

Investigating Prototypes of Nonlinguistic Spatial Categories. DALE S. KLOPFER, *Bowling Green State University*—In studies of memory for the locations of individually presented dots in circular and elliptical fields, errors are biased away from the horizontal and vertical axes of the fields and toward the diagonals, indicating that prototypes for nonlinguistic spatial categories lie along the diagonal axes, with the vertical and horizontal axes serving as category boundaries (e.g., Crawford, Regier, & Huttenlocher, 2000). In the present experiments, distances between dots spanning the vertical axes and along the horizontal axes were to be remembered, as well as the individual locations of those dots. Remembered horizontal and vertical distances were extremely accurate, with no migration of the remembered location of the dots toward the diagonals. If nonlinguistic spatial category prototypes lie along the diagonals, bias toward category prototypes is not obligatory. Additional experiments examine the possibility that prototypes for nonlinguistic spatial categories are inferred from the range of stimuli presented.

(4113)

Feature Dependence in Prototype Concepts. JAMES A. HAMPTON & CLAIRE L. SIMMONS, *City University, London*—Three types of features were identified for eight artifact concepts—appearance, original intended function, and current use. Likewise, three types of features were identified for eight biological kind concepts—appearance, hidden biological functions, and appearance of offspring. The eight possible combinations of feature present or absent were constructed for each concept and given to different groups to categorize. Current use was much the strongest feature for artifacts, whereas the three features were more equal for biological kinds. Appearance and offspring interacted in their effect on categorization probability for biological kinds.

(4114)

Selective Attention and Category Representation in the Inverse Base Rate Effect. MARK K. JOHANSEN, NATHALIE FOUQUET, & DAVID R. SHANKS, *University College London*—The inverse base rate (IBR) effect (Medin & Edelson, 1988) occurs after participants learn to assign pairs of symptoms to high- and low-frequency diseases. Each disease has one unique symptom and another symptom that is shared with another disease. Participants tend to respond contrary to the base rates with the low-frequency disease when given the novel pairing of the unique symptoms from both the high- and low-frequency diseases, even though the two symptoms are equally predictive of their respective diseases. The IBR effect has been replicated many times with training stimuli composed of nonperceptual features which are "present/absent." We report the results of an IBR effect experiment in which every training stimulus had a feature from every continuous stimulus dimension ("present/present" features; see also Kalish, 2001). This design contrasts selective attention to individual features versus entire feature dimensions, evaluated using configural-cue (exemplar) and independent-cue models of category representation.

(4115)

Using fMRI to Examine Representational Shifts During Category Learning. MARCI A. FLANERY & THOMAS J. PALMERI, *Vanderbilt University*—Johansen and Palmeri (2002) reported a series of experiments that attempted to track the kinds of representations used to categorize objects as a function of category learning. Empirical evidence and theoretical modeling were consistent with a shift from simple single-dimension rule-based generalizations to multidimensional exemplar-based generalizations as subjects gained experience with the categories. The present experiments extend the Johansen and Palmeri study by using functional MRI to reveal changes in brain activity as subjects gain experience with the categories. We specifically examine changes in the frontal cortex, the anterior cingulate, the basal ganglia, and the hippocampal complex as a function of learning and relate these changes in brain activity to possible changes in category representations and processes. Results are interpreted with respect to various hybrid models of category learning (e.g., Ashby et al., 1998; Erickson & Kruschke, 1998; Palmeri, 1997) and various single-system accounts (e.g., Nosofsky & Johansen, 2000).

(4116)

Knowing What Others Know and What They Can Learn: Generality and Specificity of the Illusion of Explanatory Depth. LEONID ROZENBLIT, ALEXANDRA JESTER, & FRANK C. KEIL, *Yale University*—Earlier work has demonstrated that people think they understand devices and natural systems better than they really do—an illusion of explanatory depth (IOED) not found for ratings of procedures, facts, or narratives. Three new experiments explore the IOED when rating understanding in others. The results indicate that the IOED is actually stronger for others' knowledge than for one's own knowledge. A fourth experiment examined whether overconfidence about understanding will generalize to assessment of others' ability to learn or whether it is specific to assessment of existing knowledge. The results mirror the classic overconfidence effects—they are stronger for self-ratings—for males, but not for females. The effects suggest that the structural properties of explanatory understanding create an IOED regardless of whether one is evaluating that knowledge in oneself or in others. The findings suggest that the IOED is qualitatively different from self-enhancement motivated overconfidence.

(4117)

Caricature in the Recall of Recently Learned Categories. ROGER DUNN, LEOLA ALFONSO-REESE, BRIAN SPIERING, & BOYAN RADAKOVICH, *San Diego State University*—We investigated the extent to which category prototypes are distorted by category overlap during learning. Undergraduates classified dot-filled squares into two categories. The categories comprised dot frequencies drawn from two different distributions. Category overlap was manipulated by varying the difference between category means and by varying the standard deviations in the two categories. Feedback (correct/incorrect) on every trial enabled participants to learn the categories. Once they sorted the patterns accurately, participants generated patterns that best represented the two categories. In between-subjects comparisons, recalled patterns were caricaturized (i.e., shifted away from category means) in an inverse relationship to the difference between category means during training. The effect of standard deviation (overlap due to the width of the distributions) depended on the difference between category means. With smaller mean differences, caricature varied with standard deviation. With larger mean differences, caricature varied inversely with standard deviation. Results extend the learning and categorization literature.

(4118)

Evolution and Categorization. ZACHARY ESTES, *University of Georgia*—Two experiments investigated the influence of the theory of evolution on the mundane categorization of artifactual (e.g., FURNITURE) and natural (e.g., FRUITS) objects by undergraduate participants. Experiment 1 ($N = 84$) revealed that the belief in evolution is manifest in categorization behavior: Participants who accepted evolution ($n = 56$) differentiated between artifactual and natural categories to a lesser extent than did participants who rejected evolution ($n = 28$). Experiment 2 ($N = 80$) indicated that simply rendering the concept of evolution more accessible, via priming, elicited categorization behavior similar to that of one who explicitly accepts evolution, whereas rendering the concept of evolution less accessible elicited categorization similar to that of one who rejects evolution. Thus, the cognitive accessibility of a theory (in this case, evolution), rather than belief in that theory, may explain its effects on cognition (in this case, categorization).

(4119)

Expert Versus Novice Categorization of Food Items. SHARON LEE ARMSTRONG & KRISTIE RUSSO, *La Salle University*—This research extends work by Ross and Murphy (1999) on the mental representation of the cross-classified category domain of food. Ross and Mur-

phy, studying naive subjects, found that they tended to categorize foods within two systems: taxonomically (e.g., meats, fruits) and according to their role in daily life scripts (e.g., breakfast, snack). This study found that nutritionists additionally use macronutrient categories. When given the opportunity to rate food items as members of various taxonomic, script, or macronutrient categories, undergraduates and nutritionists rated foods as good members of only one taxonomic category but also allowed that foods could be good examples of several script categories. Nutritionists were even more likely than novices to assign multiple script membership to foods. Furthermore, nutritionists were likely to rate more foods as uniquely belonging to a macronutrient category. Expertise regarding foods appears to engender both more flexibility and more precision, depending upon the categorization framework.

(4120)

Conceptual Combination in Context. HEATHER BORTFELD & STEVEN M. SMITH, *Texas A&M University,* RACHEL G. HULL, *Rice University,* & JASON LEDLIE, *Texas A&M University*—Novel conceptual combinations often occur in contexts that are either explicit or implied, but experimental studies of noun–noun interpretations typically provide no such contexts. The comparative effects of supportive discourse contexts versus noun–noun similarity on noun–noun interpretations were examined. Noun similarity affects the proportions of relational and property interpretations for novel noun–noun combinations seen without supportive discourse contexts. Brief texts were used to bias interpretations that are rarely given when noun–noun pairs are read out of context. Although pairs of dissimilar nouns received predominantly property interpretations out of context, they were given overwhelmingly relational interpretations when we biased them with appropriate discourse contexts. Similar noun–noun pairs with predominantly relational interpretations out of context were almost always given property interpretations with supportive contexts. This biasing of rare out-of-context interpretations persisted even after a brief delay. The out-of-context characteristics of noun pairs appear to have little or no effect on interpretations when supportive discourse contexts are provided.

SYMPOSIUM III: Animal Conditioning and Human Causal Judgment: Common Mechanisms?
Regency CD, Saturday Afternoon, 1:30–3:40

Chaired by Lorraine G. Allan, McMaster University

Introduction: Animal Conditioning and Human Causal Judgment: Common Mechanisms? LORRAINE G. ALLAN, *McMaster University*—Many studies with humans have varied the contingency between two events (a cue and an outcome) and examined how such variations influence judgments about the relationship between the two events (the judgment that the cue influences the outcome). Similarly, many studies with nonhuman animals have varied the contingency between two events (CS and US) and examined how such variations influence the association between the events (CR strength). These two research traditions proceeded independently until the mid 1980s, when a number of researchers interested in conditioning suggested that similar mechanisms were involved in judgments of contingency by humans and CR acquisition by nonhuman animals. This insight resulted in collaborative initiatives between the two research traditions. The participants in the symposium will discuss the synergistic interaction between the human research in contingency judgments and causal learning and the nonhuman research in conditioning, and evaluate the current status of associative accounts of causal learning.

1:35–1:55 (197)
Retrospective Revaluation: Challenges to Associative Accounts of Causal Learning. EDWARD A. WASSERMAN, *University of Iowa*— Causal judgment and associative learning have been intimately interrelated since David Hume famously argued that causation is a psychological impression that results from paired presentations of cause and effect. This associative analysis of causation faces a stiff challenge from experiments reporting that, in response to new contingency information, people's ratings of causal effectiveness change for both presented and nonpresented stimuli. We show how a modification of associative learning theory can account for these findings and experimentally explore that modified account in a series of four empirical investigations in a medical diagnostic setting. The results of these investigations cannot be explained by the Rescorla–Wagner (1972) model of associative learning, but they can be explained by the revised model of Van Hamme and Wasserman (1994); this revised model assigns nonzero salience to nonpresented target stimuli whose memories or representations are retrieved by competing stimuli that have previously been paired with those target stimuli.

2:00–2:20 (198)
Predictors and Causes: What's the Difference? RALPH R. MILLER & OSKAR PINENO, *SUNY, Binghamton*—Humans learn not only that cues predict outcomes but also that cues can sometimes cause outcomes. Animals can also learn that cues predict outcomes; but whether they have a sense of causality is unclear. However, by examining the relationship between predictors and causes in humans, we can surmise something about causal attribution in nonhumans. Appeals to causal mechanisms are circular because causal mechanisms must be learned, save possibly in a select few simple cases. Verbal assessment of causal attribution in humans is flawed; causal action is a better index and can be used as readily with both humans and nonhumans. The possibility that the same learning process underlies both types of learning will be considered. Possibly the only difference between causal judgment and predictive judgment is that there is a lower threshold for associative strength to accept predictive judgment in cue competition. Data consistent with this view will be discussed.

2:25–2:45 (199)
Effects of Probe Question on Causal Judgments. DAVID R. SHANKS, *University College London*—Cheng's power PC theory of causal induction proposes that causal estimates are based on the power p of a potential cause, where p is the contingency between the cause and effect normalized by the base rate of the effect. In the present experiments participants were required to judge the strength of generative causes and were probed by either a causal or a counterfactual test question. Estimates violated the power theory when made in response to causal questions. However, when responding to a counterfactual probe, participants based their judgments on p. The present experiments suggest that counterfactual questions encourage participants normatively to consider the base rate of the effect. The results provide constraints on the nature of the computation that describes causal judgments. I discuss the extent to which that computation is best understood in terms of associative learning theory or alternative cognitive approaches.

2:50–3:10 (200)
A Deductive Reasoning Account of Cue Competition in Human Contingency Learning. JAN DE HOUWER, *Ghent University,* TOM BECKERS, *University of Leuven,* & STEFAAN VANDORPE, *Ghent University*—Several studies have demonstrated that contingency judgments for a cue T are lower when AT+ trials are preceded by A+ trials than when only AT+ trials are presented. Although these findings have commonly been interpreted as evidence for associative models of human contingency learning, we argue that they can also be explained on the basis of a deductive reasoning account. According to this account, participants reason that T cannot be a cause of the outcome if the likelihood or intensity of the outcome does not differ on AT and A trials. The deductive reasoning account is compatible with most findings in the literature, even those that seem to favor associative models. We will also discuss new evidence that uniquely supports the model.

3:15–3:35 (201)
Judging Relationships Between Events: How Do We Do It? LORRAINE G. ALLAN & JASON M. TANGEN, *McMaster University*— A decade ago, Allan (1993) concluded that associative models provided the best account of the data generated in tasks that require human observers to judge the relationship or contingency between binary events. In the intervening years, a wealth of new data have been reported and alternative theoretical accounts have been proposed. We will consider the impact of the new data on the associative account, and we will evaluate how well the associative account does relative to the competition.

Individual Differences in Memory
Regency AB, Saturday Afternoon, 1:30–2:25

Chaired by Martin A. Conway, University of Durham

1:30–1:45 (202)
Gender Effects on Prospective Memory: The Role of Task, Metamemory and Automatic Noticing. LIA KVAVILASHVILI, JAMES A. K. ERSKINE, & EVELYN TAN, *University of Hertfordshire*—Although everyday observations suggest that women may be better than men at prospective memory tasks (i.e., remembering to do things in the future) the experimental evidence is scarce. Two experiments were conducted to address this issue. In Experiment 1, women significantly outperformed men at remembering an event-based prospective memory task with a categorical target word (*animals*). In Experiment 2, women were also reliably better at remembering event-based tasks with specific targets (both distinctive and nondistinctive), but there were no gender effects in remembering a time-based task. The analysis of self-report measures of prospective memory rehearsal suggest that women may have better metamemory awareness about the difficulties of remembering event-based tasks with categorical and nondistinctive targets. In addition, they may also be better at automatically noticing distinctive targets in event-based tasks. Finally, it appears that this female advantage in remembering event-based tasks disappears when the task is deemed unimportant.

1:50–2:05 (203)
Gender Differences in Personal Flashbulb Memories. MATTHEW D. SCHULKIND & NATASHA S. SUNDERAM, *Amherst College*—We

examined college students' memories for their admission to college. This event fulfilled the major criteria for "flashbulb memories" (high in both consequentiality and emotionality) and was experienced in comparable ways across our subject population. These personal memories showed the characteristics of flashbulb memories in that subjects answered questions about the event ("Who?" "Where?" "How?" "When?" etc.) with a great deal of confidence. Although women rated the event as more emotional and more consequential than men did, gender differences were not observed in ratings of clarity or confidence. Gender differences were also absent in the emotional content of the narratives. The only significant gender difference in the narratives was length: Women told longer stories than did men. These data indicate that memory for important personal events show "flashbulb" qualities similar to those observed for important public events and that men and women differ in how they construct narratives of personal events.

2:10–2:25 (204)

Individual Differences in Episodic Memory: Handedness and Interhemispheric Interaction. STEPHEN D. CHRISTMAN, *University of Toledo,* & RUTH E. PROPPER, *Merrimack College*—Recent behavioral (Christman & Propper, 2001) and brain imaging (Cabeza & Nyberg, 2000) data suggest that episodic/explicit memories are associated with coordinated activity across both hemispheres of the brain, whereas implicit memories are associated with unilateral left-hemispheric processing. Since mixed-handedness is associated with a larger corpus callosum (Witelson, 1985) and with greater interhemispheric interaction (Christman, 2001), it was predicted that mixed-handedness would be associated with superior explicit memory. Participants were administered tests of explicit recall or implicit fragment completion. Signal detection analyses for the recall task indicated that mixed-handers had significantly higher values of d' (M = 1.44) than did strong right-handers (M = 0.94). There were no handedness differences on the implicit memory task for the total number of fragments completed or in implicit memory for previously studied items (all Fs < 1). These results indicate that strength of handedness is an important variable of individual difference in explicit tests of episodic memory.

2:30–2:40 (205)

Episodic-Like Memory in the Rat. STEPHANIE J. BABB & JONATHON D. CRYSTAL, *University of Georgia* (read by Jonathon D. Crystal)—We investigated episodic-like memory in rats (n = 5) using an eight-arm radial maze. The rats received daily training consisting of forced-choice visits to four baited arms, one of which was randomly chosen each day to contain chocolate (Phase 1). In Phase 2, all eight arms were available. After a short (30-min) retention interval (RI), the four arms that were not available in Phase 1 provided food. After a long (4 h) RI, the four remaining arms plus the arm containing chocolate provided food (i.e., chocolate replenished). The rats visited the chocolate location more frequently after the long RI than after the short RI. Next, chocolate was paired with LiCl, and subsequent testing used the long RI. Following the taste-aversion manipulation, the rats visited the chocolate location less than in previous training. These data demonstrate that the rats had knowledge of the what, when, and where components of episodic memory.

2:45–3:00 (206)

Selective Attention and Priming in AD, Elderly, and Young Healthy Controls. SOLEDAD BALLESTEROS, JOSÉ M. REALES, JULIA MAYAS, & ALICIA SÁNCHEZ, *Universidad Nacional de Educación a Distancia*—In a previous study, we found intact haptic priming for both AD patients and elderly controls that did not differ from that for young participants. However, AD patients were highly impaired in recognition in comparison with the other groups. These results suggest that priming reflects the participation of a preserved object representation system that is different from the medial-temporal lobe system underlying episodic memory. Two new experiments investigated the role of selective attention in visual and haptic object priming. In one study, AD patients, elderly controls, and young adults performed a picture fragment completion task for attended, unattended, and new pictures, followed by a recognition test. In the other haptic study, participants performed a speeded object naming task for attended, unattended, and new objects. The results support previous findings from our laboratory suggesting that selective attention at encoding is necessary for both implicit and explicit memory tests in the three groups.

3:05–3:20 (207)

The Role of Color in the Implicit Memory Performance of Healthy Older Adults and Individuals With Alzheimer's Disease. TOBY J. LLOYD-JONES, *University of Kent*—Effects of color transformation on priming of diagnostically colored objects (e.g., banana) were examined in naming and colored object decision ("Is this a correctly or incorrectly colored object?") tasks. Although severely impaired in recognition memory performance, Alzheimer's disease (AD) patients demonstrated normal priming across color transformations in naming. This demonstrates preserved implicit shape-based memory performance in AD. For colored-object decision, healthy older adult controls, but not AD patients, showed priming for new associations between object shapes and colors. We argue that AD deficits do not allow shape and color to be integrated to form a novel unitized representation that can benefit performance. AD patients also showed inhibitory priming, which is discussed in terms of effects of familiarity on decision processes.

Spatial Navigation
Georgia, Saturday Afternoon, 1:30–3:25

Chaired by Amy Lynne Shelton, Johns Hopkins University

1:30–1:50 (208)

Spatial Models in Motor Control. JOHN R. PANI, NATHAN JOHNSON, & JULIA H. CHARIKER, *University of Louisville*—Objects change orientation in accordance with a variety of mechanical systems of motion. Airplanes have object-relative control axes, tripods have nested control axes, and various systems are capable of motion around independent fixed axes. In addition, these spatial models for motion can be aligned with different reference systems, including the environment, the egocentric visual frame, and the spatial/motor frame of a hand controlling the motion. We report a series of experiments of remote control in stereoscopic virtual reality with a three-dimensional pressure-sensitive controller. These experiments examined the relative ease of using different spatial models in reorienting objects, for abstract pointers in free space and for familiar objects in visible mechanical systems, with alignment to the three basic reference systems. People are naturally good only with independent fixed axis control aligned with the spatial/motor frame of the controller unless there is clear perceptual/object support for an alternative mechanical system.

1:55–2:15 (209)

Cellular and Oscillatory Activity Underlying Human Spatial Navigation. MICHAEL J. KAHANA & ARNE EKSTROM, *Brandeis University,* JEREMY CAPLAN, *University of Toronto,* JOSEPH MADSEN, *Children's Hospital Boston,* & ITZHAK FRIED, *UCLA*—The place cells of the rodent hippocampus and the 4- to 10-Hz hippocampal theta rhythm constitute two of the most striking examples of correlations between neuronal activity and complex behavior in mammals. Using human intracranial recordings, which can be ethically obtained as part of standard neurosurgical evaluations, we examined the neurophysiological basis of human spatial cognition. Field recordings from depth electrodes while subjects actively explored a virtual town revealed increased theta activity associated with movement and with searching for objects whose locations were not known. Single cell recordings from the hippocampal, parahippocampal, and frontal regions revealed cells in the hippocampus that respond at specific spatial locations and cells in the parahippocampal region responding to views of landmarks. These data suggest that the hippocampus is specialized for spatial position, whereas the parahippocampal region is specialized for spatial views. Cells also responded to the subjects' navigational goals, and to conjunctions of place, goal, and view.

2:20–2:40 (210)

Body Heading and its Relation to Sense of Direction. M. JEANNE SHOLL & KATHERINE A. DELLAPORTA, *Boston College* (read by M. Jeanne Sholl)—Recent neuropsychological reports of a small number of "heading disorientation" cases suggest a selective impairment in the ability to retrieve information about body heading from recognized landmarks (Aguirre & D'Esposito, 1999). We report two experiments that tested the ability of normal adults to retrieve body heading from local views (pictures) of a highly familiar environment and relate this ability to self-reported sense of direction. In one experiment, participants judged whether or not pairs of pictures were taken from the same body heading. In a second experiment, participants produced the body heading from which a picture was taken. The findings are discussed in the context of animal models of sense of direction.

2:45–3:00 (211)

Encoding Constraints for the Perception of Heading from Static Scenes. GEORGE J. ANDERSEN, ANNJUDEL ENRIQUEZ, & CRAIG SAUER, *University of California, Riverside*—Recently we have shown that observers use a scene-based analysis for the perception of heading in the absence of apparent motion (Hahn, Andersen, & Saidpour, in press, *Psychological Science*). In the present study, we examined the encoding limitations by varying the number of landmarks within a scene. Two frame sequences of computer-generated scenes were presented that simulated a change in observer position through the scene. Participants judged whether they moved left or right from the initial position depicted on the first frame. Scenes were presented with either a short interstimulus interval (ISI) of 50 msec to maximize apparent motion or a long ISI of 1,000 msec to eliminate apparent motion. Accuracy increased with an increase in the number of landmarks in the scene, with a greater effect of the number of landmarks for long ISI conditions.

3:05–3:20 (212)

Sex Differences in Spatial Abilities, Sense of Direction, and Spatial-Layout Learning. MARY HEGARTY, DANIEL R. MONTELLO, & ANTHONY E. RICHARDSON, *University of California, Santa Barbara*—We measured differences between males (n = 83) and females (n = 135) on pencil-and-paper measures of spatial ability, self-reported sense of direction, and learning the layout of novel experiments. Sex differences in pencil-and-paper measures were consistent with those documented in previous research. Differences in favor of males were found in some but not all measures of spatial-layout learning. Males' self-reports of their "sense of direction" were also higher on average than those of females. We will address three questions about sex differences in spatial cognition. First, what are the relative magnitudes of the differences between males and females in various aspects of spatial cognition? Second, do sex differences in learning of spatial layout reflect sex differences in spatial abilities, as measured by pencil-and-paper tests, or do they depend on different factors? Third, is self-reported sense of direction equally related to objective measures of spatial cognition for males and for females?

Capture of Attention
Plaza, Saturday Afternoon, 1:30–3:30

Chaired by William Prinzmetal, University of California, Berkeley

1:30–1:45 (213)

Attentional Capture in Singleton-Detection and Feature-Search Modes. DOMINIQUE LAMY, *Tel-Aviv University,* & HOWARD E. EGETH, *Johns Hopkins University* (read by Howard E. Egeth)—What determines whether or not a salient but irrelevant stimulus will capture attention? Current theories give different answers: Some stress bottom-up salience; others, top-down control. Subjects searched for a target while ignoring a salient distractor that appeared at different SOAs prior to the search display. Attentional capture was assessed using two measures: spatial congruence of distractor and target (same location vs. different location trials) and interference effects (distractor vs. no-distractor trials). Strategies that could be used to find the target (i.e., singleton detection vs. feature search) were controlled by the experimenter. The results (1) support the distinction between singleton-detection mode and feature search mode, (2) suggest that resistance to capture is mediated by inhibition, (3) support the special status of abrupt onsets, and (4) are inconsistent with a strong form of contingent attentional capture.

1:50–2:05 (214)

Top-Down Attentional Control During Singleton Detection. BRADLEY S. GIBSON & TED BRYANT, *University of Notre Dame*—*Singleton detection* refers to a form of visual search in which observers explicitly search for a target that is known to be unique in some feature dimension (e.g., form). Singleton detection tasks have been used extensively to study stimulus-driven attentional capture by irrelevant singletons. Such studies have shown that when observers are engaged in singleton detection they are unable to ignore the appearance of another singleton that appears in an irrelevant feature dimension (e.g., color). These findings have been interpreted as suggesting that attentional control during singleton detection is driven primarily by bottom-up sources of information and is invulnerable to top-down knowledge about relevant and irrelevant feature dimensions. The present series of experiments investigated the extent to which attentional control during singleton detection is invulnerable to other forms of top-down knowledge. These experiments provide clear evidence that attentional control during singleton detection can be modulated by top-down knowledge.

2:10–2:30 (215)

How Do You Keep Attention From Straying? Get Engaged! CHARLES L. FOLK & KRISTOF TROEMEL, *Villanova University*—Previous research suggests that focusing spatial attention eliminates capture by irrelevant stimuli (e.g., Yantis & Jonides, 1990). However, recent work using an RSVP task (Folk, Leber, & Egeth, 2002) shows that the focusing of attention is not sufficient to eliminate capture by stimuli that share the defining features of the target. The present study tested the hypothesis that capture is eliminated not by the focusing of attention but by the engagement of attention. Subjects identified a colored target letter in an RSVP stream appearing within a box at fixation. Although a peripheral distractor matching the target color produced evidence of capture, this effect was eliminated when the distractor was preceded by a brief change in the color of the central box from gray to the target color. The results support a distinction between attentional focus and attentional engagement and suggest that the latter eliminates capture by irrelevant peripheral stimuli.

2:35–2:50 (216)

Looming Motion With Random Dot Patterns Attracts Attention. ADRIAN VON MÜHLENEN & ALEJANDRO LLERAS, *University of British Columbia*—Spatial attention can be attracted by a variety of cues (e.g., brightness changes, arrows, auditory tones). This paper will present a series of studies that explored the ability of moving random dot patterns to attract attention. The task required the speeded detection or discrimination of a target stimulus. A trial started with 400 random dots moving linearly in random directions. After 1 sec, a subset of dots randomly selected on one side of the display began to move coherently: They moved in a given direction (up, down, to the left, to the right), toward a core location (receding motion), or away from a core location (looming motion). The results showed that directional or receding motion did not attract attention; however, looming motion produced a strong advantage for targets presented inside the core. The influence of other factors, such as cue onset (sudden or gradual), cue coherence, cue durations, or cue–target SOA, will be discussed.

2:55–3:10 (217)

What Should You Pay Attention to During Visually Guided Action? ROB GRAY, *Arizona State University East*—A simulated baseball

batting task was used to compare the relative effects of attending to extraneous information (tone frequency) and attending to skill execution (direction of bat movement) on performance and to evaluate how these effects differ as a function of expertise. To address limitations of previous research, our skill-focused task required continuous monitoring of limb movements and we measured kinematics. The extraneous dual task degraded batting performance in novices but had no effect on experts. The skill-focused dual task increased batting errors and movement variability for experts but improved performance for novices. Expert batters were more accurate in the skill-focused dual task when they were in a batting slump, suggesting that self-focused attention increases during a period of subaverage performance. Expert batters were significantly more accurate in the skill-focused dual task when placed under pressure. These findings indicate that the attentional focus varies substantially across and within performers with different levels of expertise.

3:15–3:25 (218)

Evidence for Memory and Order in a Visual Search Task. GREGORY J. ZELINSKY, CHRISTOPHER A. DICKINSON, & XIN CHEN, *SUNY, Stony Brook*—The search literature has been captivated by two controversial ideas: (1) that no memory exists for rejected distractors in a search task, and (2) that, in the absence of a guidance signal, search moves randomly between display objects. We introduce a single gaze-contingent paradigm to dispel both of these myths. Each display item visited by gaze during search was explicitly marked after gaze shifted away from the object. Search efficiency in the marking condition was compared with a no-marking baseline for a variety of search stimuli (Os and Qs, real-world objects, and realistic scenes). The data converge on two clear conclusions: (1) that there is memory during visual search, evidenced by the infrequent refixation of previously inspected distractors, and (2) that this memory reflects an ordered search of a display, not a random process. Implications of these data will be discussed in terms of low- and high-level search processes.

Reading
Regency E, Saturday Afternoon, 1:30–3:05

Chaired by Joseph P. Magliano, Northern Illinois University

1:30–1:50 (219)

Reading Disappearing Text. SIMON P. LIVERSEDGE, *University of Durham,* KEITH RAYNER, *University of Massachusetts, Amherst,* SARAH J. WHITE, *University of Durham,* DORINE VERGILINO-PEREZ, *Université de Paris V,* & JOHN M. FINDLAY, *University of Durham*—We report four experiments on the influence of making the words of a sentence disappear during reading. Experiment 1 investigated how sentences containing high- and low-frequency and long and short words were read under normal or disappearing text conditions (in which the fixated word disappeared after 60 msec). There was no difference in reading speed under either condition, but fixations were longer on low- than on high-frequency disappearing words, indicating that cognitive processes influenced fixation durations. In Experiment 2, we replaced words with X strings instead of making them disappear, to control for iconic memory effects. In Experiment 3, participants scanned arrays of Xs so that we could investigate the effects in a nonlinguistic task. In Experiment 4, we made two words rather than one disappear, to determine the influence of disruption to nonfoveal preprocessing. The results will be discussed in relation to current models of eye movement control during reading.

1:55–2:10 (220)

Parafoveal Pragmatics Again. WAYNE S. MURRAY, *University of Dundee*—There has been much controversy, and conflicting evidence, related to the existence of "parafoveal pragmatic effects," where the plausibility of the combination of a currently fixated noun and a yet-to-be-fixated "parafoveal" verb appears to influence fixation time on the noun. A genuine effect of this sort would raise serious difficulties for the class of serial attention shift models of eye movement control in reading, such as E-Z Reader (Reichle et al.). One possibility is that effects of this sort could arise, instead, from subtle sublexical differences in the classes of "plausible" and "implausible" nouns used in previous studies. In this paper, I examine that possibility and report the results from two studies where such a confound cannot have been involved. The results suggest that while parafoveal pragmatic effects are not ubiquitous, genuine examples can be found.

2:15–2:35 (221)

Neuroimaging Studies of Word Reading: A Revised Neurobiological Theory. KENNETH R. PUGH, *Haskins Laboratories & Yale School of Medicine,* W. EINAR MENCL, STEPHEN J. FROST, REBECCA SANDAK, & DINA L. MOORE, *Haskins Laboratories,* & JAY G. RUECKL, *Haskins Laboratories & University of Connecticut*—We have completed a series of functional neuroimaging and behavioral experiments to assess and refine a new model of the neurobiological basis of skilled reading. We posit two posterior circuits in the left hemisphere: a dorsal (temporoparietal) and a ventral (occipitotemporal) circuit. We theorize that the dorsal circuit recognizes printed words by means of a slow, attentional algorithmic process. In contrast, the ventral circuit is a fast, automatic pattern-matching system. A third area, anterior to the other two (the inferior frontal gyrus), is active in the articulatory recoding of print for speech output and appears to act in close concert with temporoparietal areas during phonologically analytic processing critical in word learning. We have examined practice-related learning in several studies, orthographic/phonological priming, and phonological/semantic tradeoffs in word identification. A more precise account of brain/behavior relations has emerged.

2:40–3:00 (222)

Evaluating Computational Models of Reading Using Evidence From Acquired Dyslexia. MAX COLTHEART, *Macquarie University*—One way of evaluating computational models of reading is to investigate how well such models, when artificially "lesioned," can simulate the various different patterns of impaired reading performance seen in previously literate people whose reading has been impaired by brain damage—that is, people with acquired dyslexia. This has been investigated both with connectionist models of reading (the triangle models) and nonconnectionist models of reading (the DRC model). Old data from surface dyslexia and phonological dyslexia, and new data from reading by people with semantic dementia—particularly "lexical nonsemantic reading"—will be used to compare the success enjoyed by these two classes of model in explaining acquired dyslexia.

Selective Attention
Regency F, Saturday Afternoon, 1:30–3:15

Chaired by David I. Shore, McMaster University

1:30–1:50 (223)

Selective Listening to Simple Tone Sequences. MARI R. JONES, JENNIFER K. PUENTE, & HEATHER MOYNIHAN, *Ohio State University*—Of interest are influences of dynamic expectancies in pitch space and time on pitch judgments. First, a theoretical context is briefly reviewed; it involves assumptions about the dynamics of attending selectively in time to tone sequences. Next, three experiments are described in which musically untrained listeners identified the pitch of a probe tone embedded within simple auditory sequences. Sequences differ systematically in pitch interval structure (e.g., large vs. small pitch intervals) and timing (rate, probe tone time). The first was a baseline experiment, using isochronous pitch sequences in which probe timing was not varied. The following two experiments used the same pitch sequences, but probe timing was varied. In the latter, pitch identifications were significantly affected by both the pitch structure and relative probe timing (early, on-time, late) given the rhythmic context. This pattern of outcomes was modulated by instructions (implicit vs. explicit knowledge of probe time variations).

1:55–2:05 (224)

Auditory Negative Priming in Younger and Older Adults. AXEL BUCHNER & SUSANNE MAYR, *Heinrich-Heine-Universität, Düsseldorf*—Two experiments are reported in which performance of old and young adults in an auditory negative priming task was compared. Auditory negative priming was not smaller in old than in young adults. This result was independent of whether or not conditions were present that had previously been assumed to favor episodic retrieval, as opposed to inhibitory processes, as a basis of the negative priming phenomenon. The data from the present auditory negative priming experiments are incompatible with the global assumption that the efficiency of inhibitory attentional processes in general diminishes across the adult life span. It is argued that findings of reduced negative priming in old adults may represent a methodological artifact.

2:10–2:25 (225)

Haptic Priming for Attended and Unattended Stimuli Interacts With "Viewing" Condition. EMILY W. BUSHNELL, *Tufts University,* SOLEDAD BALLESTEROS & JOSÉ M. REALES, *Universidad Nacional de Educacion a Distancia,* JONATHAN COHEN, *Tufts University,* & NOELLE C. CHIANG, *Temple University*—In previous research, we have found robust priming for haptic stimuli attended during study. However, there was priming for simultaneously presented unattended stimuli only when the object was grasped with the same hand at test as during study, These results suggest two separate representations for haptic stimuli, as in vision (see Stankiewicz, Hummel, & Cooper, 1998). We further explored this idea in two additional studies. In one, participants explored the stimuli haptically during study but visually during test; in the other, participants explored the stimuli with one hand during study but bimanually during test. In both studies, there was robust priming for attended stimuli but no priming for unattended stimuli. These results indicate a perceptual store that forms automatically but demands a replica of the initial experience for activation, and also a more abstract store that forms only with effort (attention) but is invariant across viewing hand and modality for activation.

2:30–2:50 (226)

Relations Between Emotion, Memory, and Attention: Evidence From Taboo Stroop Tasks. DONALD G. MacKAY, *UCLA,* MEREDITH A. SHAFTO, *Oxford University,* JENNIFER K. TAYLOR, *UCLA,* DIANE E. MARIAN, *University of California, Berkeley*, & LISE ABRAMS, *University of Florida, Gainesville*—The taboo Stroop effect occurs when people name the color of taboo words; it illustrates effects of emotion on memory and attention. Three taboo Stroop experiments indicated longer color-naming times for taboo than for neutral words, a difference that diminished with word repetition but was not due to retrieval factors, attentional disengagement processes, response inhibition, or strategic attention shifts. However, in surprise memory tests following color-naming, participants more accurately recognized colors consistently associated with taboo as opposed to neutral words, an experimentally established flashbulb memory effect. A fourth experiment demonstrated impaired immediate recall of neutral words before and after a taboo word in rapidly presented lists. The present results comport with three hypotheses: that taboo words trigger specific emotional reactions that habituate with repeated activation; that amygdala-to-hippocampus connections facilitate the binding of taboo words to the context of their occurrence; and that binding processes for taboo words impede the rapid encoding of immediately prior and subsequent neutral words.

2:55–3:10 (227)

Affective Consequences of Visual Search. JANE E. RAYMOND, MARK J. FENSKE, & MELINA KUNAR, *University of Wales, Bangor*—When abstract stimuli are emotionally evaluated after just having been seen in a simple two-object feature-based visual search task, prior distractors are devalued in comparison with prior targets, perhaps because of persistent inhibition (Raymond, Fenske, & Tavassoli, *Psychological Science*, in press). Here we measured emotional evaluation of complex images previously viewed in a color–texture conjunction search task using larger set-sizes (4, 8, 16) and a visual marking paradigm. In the search task, items were displayed either simultaneously or with half the distractors previewed before the rest of the display. After search, one item from the search display was emotionally rated. As expected, preview improved search efficiency. Interestingly, previewed distractors were devalued in comparison with distractors from the simultaneous condition, in spite of their being viewed longer and the task's being easier. This result is consistent with inhibitory accounts of visual marking and supports the view that persistent inhibition has emotional consequences.

Divided Attention in Dual Tasks
Regency CD, Saturday Afternoon, 3:55–5:30

Chaired by Linda M. Rueckert, Northeastern Illinois University

3:55–4:15 (228)

Resource Allocation in a Dynamic Task Environment. PAMELA S. TSANG, JEFF T. FLINN, BRYAN V. STORK, ANDREW R. SCHIELTZ, & RAFAEL RANIERI, *Wright State University*—The study examines the attentional mechanism that governs time sharing in a dynamic task condition. A continuous tracking task is time shared with a discrete spatial processing task. A dynamic task difficulty manipulation and the relative priority manipulation are used to induce resource allocation. Task difficulty is manipulated dynamically within a trial by varying the proportion of second-order control dynamics of the tracking task at a slow or a fast pace. The more difficult the task and the higher its priority, the more the resources that are required to maintain its performances, the greater the cost to the low-priority task, and the larger its decrement. Thirty-six participants completed approximately 20 h of task performance. Moment-by-moment performance analysis affords an opportunity to examine the dynamics of control and granularity of performance tradeoffs. A difficulty × priority interaction is a necessary prediction of resource theory. Alternative theoretical accounts are discussed.

4:20–4:40 (229)

Parallel Time Reproduction and Visual Search Revealed by Selective Influence. RICHARD J. SCHWEICKERT, *Purdue University,* CLAUDETTE FORTIN, *Université Laval,* & KYONGJE SUNG, *Purdue University*—Subjects were given the dual task of reproducing a given time interval and searching a visual array for a target. If the underlying mental processes are arranged in a directed acyclic activity network, factors selectively influencing pairs of processes in the network are predicted to lead to certain patterns in the response time cumulative distribution functions. The patterns are different for pairs of sequential and concurrent processes. Interaction contrasts formed from cumulative distribution functions are predicted to be positive for concurrent processes, but to start positive and then change sign for sequential processes. The results support the hypothesis that processes associated with time reproduction were carried out concurrently with processes associated with visual search.

4:45–5:05 (230)

Balance and Cognition: Executive Control and Age in Dual-Task Settings. RALF T. KRAMPE, *Max Planck Institute for Human Development,* MICHAEL A. RAPP, *Mount Sinai School of Medicine,* & PAUL B. BALTES, *Max Planck Institute for Human Development*—We investigated simultaneous sensorimotor (walking, balance) and cognitive performance (working memory, word fluency). Sensorimotor performance was assessed through posturography measurements of bodily sway or the speed of walking a narrow parcours. Cognitive demands induced dual-task costs (DTC) in sensorimotor performance with decreasing effects from ages 9–11 years to young adulthood. In older adults the effect was again pronounced and similar to that for 9-year-olds. Increased balance demands (moving platform) induced higher DTCs in older adults; however, older participants protected their balance at the cost of cognitive performance. Evidence for the involvement of executive functions came from a sample of Alzheimer's patients di-

agnosed with a dysexecutive syndrome who showed pronounced DTCs over and above the effects of psychometric intelligence and age. At the same time, AZ patients also showed preserved self-protecting tendencies. The pattern of DTCs in different modalities points to different underlying causes in childhood, old age, and dementia.

5:10–5:25 (231)

Age Differences in the Attentional Demands of Lexical Access. PHILIP A. ALLEN, *University of Akron,* MEI-CHING LIEN & ERIC D. RUTHRUFF, *NASA Ames Research Center,* JEREMY GRABBE, *University of Akron,* & ROBERT S. McCANN & ROGER W. REMINGTON, *NASA Ames Research Center*—Can words be recognized while central attention is devoted to a different task? If so, then manipulations of word recognition difficulty (e.g., word frequency) on Task 2 should interact underadditively with stimulus onset asynchrony (SOA) in a psychological refractory period study. Two recent tests of this prediction yielded discrepant conclusions. To resolve this issue, the present study focuses on two potentially critical factors: aging (or increase in the automaticity of lexical access) and input modality conflicts. For older adults, word frequency and SOA interacted underadditively, suggesting that they can recognize words without central attention. For younger adults, however, there was relatively little evidence of underadditivity. These results suggest that older adults tend to have more efficient lexical access than younger adults.

Eyewitness Memory
Regency AB, Saturday Afternoon, 3:35–5:30

Chaired by Sean Michael Lane, Louisiana State University

3:35–3:50 (232)

Eyewitness Identification: A General Procedure and Model. STEVEN E. CLARK, BRYNN NODARSE, SHERRIE DAVEY, & ALLISON ABBE, *University of California, Riverside*—Eyewitness identification experiments use a fairly standard procedure and obtain consistent patterns of results. We propose that the consistency in results is due to the decision structure of the lineup testing procedure and the response options, rather than anything special about eyewitness memory. Four eyewitness identification experiments, using forensically irrelevant materials such as word lists and photographs of houses, produced patterns of results consistent with those of staged-crime eyewitness identification experiments. A memory and decision model called Witness was fit to the data of these experiments and to data from staged-crime experiments, showing correspondence between staged crimes and word lists.

3:55–4:10 (233)

What Makes a Police Photo "Lineup" Suggestive? ELIAS WEINGARTEN & DANIEL REISBERG, *Reed College* (read by Daniel Reisberg)—In criminal investigations, eyewitnesses are often shown a photo lineup (or *photospread*) with six pictures in it, and asked whether they can identify the culprit within this group. It is essential that this photospread not be suggestive in a way that might guide the eyewitness's selection. But what makes a photospread suggestive? We report three experiments tracking participants' eye movements as they examine a photospread, allowing us to ask whether the background color of the photos has any influence on how participants scan the displays. In all three experiments, the photospread in one condition showed the six photos on the same colored background; in the second condition, the photospread showed one suspect on a distinct background. Participants' eye movements were influenced by this manipulation, suggesting that background color can bias a photospread. However, Experiment 3 indicates that this effect (at least with our participants) can be overcome with suitable instructions.

4:15–4:35 (234)

Holistic and Recollective Processes in Face Recognition. JAMES C. BARTLETT, HERVÉ ABDI, MARSHA NEVILLE-SMITH, & KALYAN SHASTRI, *University of Texas, Dallas,* & AMINA MEMON, *University of Aberdeen*—A prior factor-analytic study showed that face recognition involves two factors. The first factor showed a near-zero loading for correct recognitions of study-list faces, but showed identical strong loadings for false recognitions of (1) new faces, and (2) conjunctions that recombined the features of study-list faces. The second factor showed a strong loading for correct recognitions, a weaker loading for conjunction false-alarms, and a reversed-sign loading for new-face false alarms. Facial inversion affected Factor 1 much more than Factor 2, suggesting that the factors reflected holistic face processing and part-based processing, respectively. Four additional experiments replicate these effects, showing that, at higher levels of learning, both factors mediate recognition of upside-down faces. Moreover, when new faces are repeated within the recognition test, false recognitions of these "new-repeat" faces load on Factor 1 like new faces and conjunctions. Factor 1 appears to reflect recollection of contextual information as well as holistic information.

4:40–5:00 (235)

Model for the Sequential Lineup Advantage: Contributions of Distinctiveness and Recollection. SCOTT D. GRONLUND, CURT A. CARLSON, & SHAWN R. SINGER, *University of Oklahoma*—A sequential lineup (view suspects one at a time) is thought to be superior to a simultaneous lineup (view all suspects at the same time) because it leads a witness to compare each successive person in the lineup to their memory of the perpetrator. In contrast, a simultaneous lineup leads a witness to choose the person in the lineup who looks most like the perpetrator, which is problematic if the police have the wrong man. A quantitatively specified model for the sequential lineup advantage was developed from Estes's (1997) perturbation model. According to modifications to this model, the sequential lineup advantage results when (1) distinctive information is encoded and, (2) a recollection process is used to access that information. This model was evaluated in a series of experiments. An understanding of the mechanisms responsible for the sequential advantage will aid adoption of sequential lineup procedures in the courts.

5:05–5:25 (236)

Dissociations Between Memory Encoding and Retrieval. NEIL W. MULLIGAN & JEFF LOZITO, *University of North Carolina, Chapel Hill*—Standard processing accounts describe memory performance in terms of the overlap in encoding and retrieval processes, and stress the similarity of these processes. This view implies that experimental manipulations should produce similar effects on encoding and retrieval. Drawing on research on the generation and revelation effects, we report a limitation of this view by demonstrating manipulations that produce opposite effects when implemented at encoding versus retrieval. In one experiment, study words were presented intact or as anagrams, to be solved. On a subsequent recognition test, test items were likewise presented intact or as anagrams, prior to recognition judgment. Recognition accuracy was greater for anagram study words than for intact study words, whereas recognition accuracy was worse for test items presented as anagrams than for those presented intact. Thus, the same manipulation produced opposite effects when implemented at encoding versus retrieval. Similar results were found with the perceptual-interference manipulation.

Reasoning and Decision Making
Georgia, Saturday Afternoon, 3:35–5:30

Chaired by Valerie F. Reyna, University of Arizona

3:35–3:50 (237)

Preference Reversals With Directional Verbal Probabilities. KIMIHIKO YAMAGISHI, *Tokyo Institute of Technology*—Verbal probabilities may bear directional connotations. "Ascending" words such as *almost certain* draw the communicators' attention toward expecting that the uncertainty may materialize in the future, whereas "descending"

words such as *little hope* suggest opposite implications. This research examined reversals of preferential orders among gambles between choice and bidding. Previous research on preference reversals of verbal probabilities has overlooked the distinction between ascending and descending phrases, and concluded that preference reversals are less common in verbal than in numerical probabilities. In contrast, the present results show that decision makers are risk averse when faced with descending verbal probabilities. Consequently, preference reversals (between choice and bidding) were more commonly observed when descending verbal probabilities were used. In turn, decision makers showed infrequent preference reversals with ascending verbal probabilities, suggesting that decision makers are more risk seeking and strongly prefer $-bet in choice.

3:55–4:15 (238)

Decision Field Theory Explanation for Preference Reversals Between Buying and Selling Prices. JOSEPH G. JOHNSON & JEROME R. BUSEMEYER, *Indiana University* (read by Jerome R. Busemeyer)—Decades of research have shown differences in participants' stated minimum selling price (willingness-to-accept, or WTA), maximum buying price (willingness-to-pay, or WTP), and paired choice among the same gambles. These phenomena are traditionally explained by changes in decision weights in a utility framework. Here, we offer a new processing account of these robust findings, without assuming any changes in decision weights. We begin with a brief introduction to decision field theory, the computational model upon which this analysis is based. Then, we show how this theory can be used to account for preference reversals between pairwise choices and WTA, as well as preference reversals between WTP and WTA. Furthermore, we not only model the means of these dependent variables but also test specific predictions regarding entire price and choice distributions. Thus, we show how a dynamic, stochastic model can provide a single parsimonious explanation for conflicting measures of preference.

4:20–4:40 (239)

Do Markets Facilitate Reasoning in the Wason Selection Task? DAVID V. BUDESCU, *University of Illinois,* & BORIS MACIEJOVSKY, *Max Planck Institute, Jena*—Individuals often fail to identify the normative solutions in reasoning tasks, but little is known about the effects of institutional settings on reasoning. We address this question by embedding the Wason selection task in a market to determine how much, and what type of, information is necessary to improve reasoning: The four cards were traded over multiple periods in anonymous continuous double auctions, with real financial incentives. The results of three experiments involving 40 markets indicate that the errors persist and are reflected in variables such as prices, volume, and liquidity. The rate of errors is reduced when subjects receive immediate payoffs, or when informed traders are present. These "insiders" know the correct solution and trade on their informational advantage, ensuring that market reflects the normatively correct outcome. However, we observe no informational spillovers; the presence of the insiders does not necessarily cause the uninformed traders to reconsider their strategies.

4:45–5:05 (240)

Status Quo Bias in Policy Choice. MAYA BAR-HILLEL & AVITAL MOSHINSKY, *Hebrew University of Jerusalem*—Status quo bias (SQB) is the advantage that an option has when it is the status quo. In choice between goods, the SQB is tantamount to the endowment effect, which is the enhanced value of owned goods. Both effects have been experimentally confirmed. Policies, however, differ from goods in several important ways, which perhaps accounts for the paucity of studies on SQB in choice between policies. This paper will describe a paradigm for studying SQB in policy choice, and present controlled and semicontrolled experimental proof that SQB also exists in choice between policies.

5:10–5:25 (241)

Throwing a Bomb on a Person Versus Throwing a Person on a Bomb: The Role of Causal Models in Bioethical Judgments. MICHAEL R. WALDMANN & JÖRN DIETERICH, *University of Göttingen*—Most people consider it morally acceptable to redirect a train that would kill five people to a track where the train would only kill one person. In this situation, people follow the guidelines of consequentialism by minimizing the number of victims. However, most people would not consider it moral to have a visitor in a hospital killed to save the lives of five patients who are otherwise going to die. We have conducted several experiments in which we pinpointed one factor behind these intuitions. We have shown that bioethical intuitions are influenced by the locus of the causal intervention in the underlying causal model. Consequentialist reasoning is more likely in situations in which the intervention targets the cause of harm as opposed to the potential effect (i.e., the victims).

Executive Control
Plaza, Saturday Afternoon, 3:40–5:30

Chaired by Marilyn Hartman, University of North Carolina, Chapel Hill

3:40–3:55 (242)

Working Memory Capacity and Executive Control in Search and Switching. MICHAEL J. KANE & BRADLEY J. POOLE, *University of North Carolina, Greensboro*, STEPHEN W. TUHOLSKI, *Southern Illinois University, Edwardsville,* & RANDALL W. ENGLE, *Georgia Institute of Technology*—Our executive attention theory of working memory (WM) capacity proposes that WM span tasks' predictive power derives from individual differences in low-level attention control. Evidence comes, first, from memory tasks where WM span scores predict vulnerability to interference, and dividing attention of high-WM subjects simulates performance of low-WM subjects. Second, WM span predicts performance in "simple" attention tasks where habitual responses must be blocked in favor of novel ones. We claim that the joint executive capabilities of goal maintenance and competition resolution drive WM-related differences when the context elicits interference or conflict. The present studies investigated whether WM capacity would also affect performance on two paradigmatic tests of controlled processing that nonetheless present limited response conflict: visual search and task-set switching. A series of search and switching experiments with varied stimuli and methods yielded no evidence for a relation to WM capacity, suggesting important boundary conditions for the WM/executive-control construct.

4:00–4:15 (243)

Is Response Selection a Component of Executive Control? ANDRÉ VANDIERENDONCK & ARNAUD SZMALEC, *Ghent University,* & EVA KEMPS, *Flinders University*—In an attempt to specify the processes involved in the executive control of working memory, this paper tested the hypothesis that response selection is one of the component processes of executive control. Experiments are presented which were based on the selective interference paradigm with concurrent execution of a memory task and a task taxing a particular working memory function. First, it is shown that an increase of the executive load of a verbal span task resulted in a larger impairment of short-term memory performance due to continuous choice reaction and continuous simple reaction tasks, whereas the impairment due to articulatory suppression did not change as a function of executive load. Subsequent experiments revealed a similar pattern of results in a visuospatial span task with forward and with backward recall. Finally, it is shown that verbal fluency was impaired by the choice reaction task but not by the simple reaction task.

4:20–4:35 (244)

Dual Task Coordination as an Executive Function: Evidence From Alzheimer's Disease and Healthy Aging. ROBERT H. LOGIE & SERGIO DELLA SALA, *University of Aberdeen,* & SARAH E. MACPHERSON, *University College London*—When single task baseline performance is equated across groups, healthy younger and older

participants show little impact of performing digit recall and tracking concurrently, but individuals in the early stages of Alzheimer's disease (AD) show a very substantial dual task decrement. However, these earlier results might have arisen from combining a memory task with a perceptual motor task. New sets of data will be described showing that combining two memory tasks (digit recall and visual pattern recall) results in a lack of an effect on dual task performance of healthy aging, but shows a specific and clear dual task impairment in AD. The results are interpreted as consistent with the operation of a multiple-component working memory system that includes domain-specific temporary memory functions, together with a dual task coordination function in the healthy brain that is specifically impaired in AD and is insensitive to the effects of healthy aging.

4:40–5:00 (245)

Working Memory and Domain-Specific Inhibition. ANDREW C. HAMILTON & RANDI C. MARTIN, *Rice University* (read by Randi C. Martin)—Inhibition is considered to be one of the major components of central executive function, and correlations between working memory span and inhibition have been reported for normal subjects. This study addresses the relation between working memory and inhibition for a patient (M.L.) with a left fronto-parietal lesion who shows a semantic short-term memory deficit. Despite having well-preserved semantic knowledge, M.L. has reduced span and shows an absence of semantic effects on span. He demonstrates much greater than normal difficulty on verbal tasks involving inhibition (i.e., Stroop task and short-term recognition probe tasks that assess proactive interference). In contrast, on nonverbal tasks requiring inhibition (i.e., spatial Stroop and antisaccade tasks), he performs at a normal level. The results raise questions about the relation between working memory and inhibition and suggest that inhibition is not represented globally in frontal areas but rather that different regions may be involved in domain-specific inhibition.

5:05–5:25 (246)

A Recurrent Neural Network Model of Immediate Serial Recall. MATTHEW BOTVINICK, *University of Pennsylvania,* & DAVID C. PLAUT, *Carnegie Mellon University* (read by David C. Plaut)—In a classic study of immediate serial recall, Baddeley (1968, *QJEP*) found no influence of intervening nonconfusable items on the magnitude of interference among confusable items. Henson et al. (1996, *QJEP*) replicated this result and interpreted it as incompatible with all "chaining-based" models, including, in their view, recurrent neural networks. Instead, they adopted the increasingly common view that individual list items are transiently associated with content-independent representations of temporal context. However, such accounts have difficulty explaining well-established effects of background knowledge of temporal structure on ISR, such as an advantage in recalling letter strings conforming to English bigram frequencies. We apply a recurrent network to ISR and demonstrate that it accounts not only for the bigram frequency effect, but also for Baddeley's and Henson and colleagues' findings. We conclude that simple recurrent networks provide a natural account of human short-term serial memory phenomena because, although they take advantage of temporal structure when it is available, they need not rely on such structure to encode temporal information in unstructured contexts.

Object Recognition
Regency E, Saturday Afternoon, 3:15–5:30

Chaired by Zenon W. Pylyshyn, Rutgers Center for Cognitive Science

3:15–3:35 (247)

Attentional Factors in Object Substitution Masking. W. TRAMMELL NEILL, DONALD F. GRAVES, PETER B. WALKER, ERIK L. OLHEISER, & JACQUELYN BERRY, *SUNY, Albany*—Identification of a brief target in a search array can be impaired by four flanking dots that appear with the target but are delayed in offset relative to the target. Phenomenally, the target is replaced by an illusory square defined by the dots. This "object substitution masking" has been shown to increase with the number of nontargets present in the search array. We find that object substitution masking depends on search-set size (2 or 4) even when the number of items in the perceptual array is held constant (4). However, we also find object substitution masking for a lone, spatially certain, foveated target (array size 1). Contrary to the CMOS model proposed by Di Lollo, Enns, and Rensink (2000), divided attention is not a necessary condition for object substitution masking.

3:40–3:55 (248)

Object Substitution and the Flash-Lag Effect. CATHLEEN M. MOORE, *Pennsylvania State University,* & JAMES T. ENNS, *University of British Columbia*—The flash-lag effect (FLE) involves the systematic misperception of the spatial relations between a moving stimulus and a briefly flashed stationary stimulus. Observers perceive the moving stimulus as farther along in its trajectory than at the time of the flash. We propose that the FLE involves a process of substitution whereby positional information associated with the moving object is continually updated. In agreement with this view, we find that disrupting the continuity of the moving object eliminates the FLE. The disruption causes the perception of two distinct objects; one object that comes to a halt at the moment of the disruption, and another object that continues on the original motion path. The disruption also prevents the positional information for the initial object from being updated, because the new positional information can now be attributed to a separate object.

4:00–4:20 (249)

Moving With the MILO Task. IAN M. THORNTON, *Max Planck Institute for Biological Cybernetics,* & TODD S. HOROWITZ, *Harvard Medical School*—Thornton & Horowitz (*P&P*, in press) recently introduced a new task for exploring the temporal context of search. In this multi-item localization (MILO) task, observers search for an ordered sequence of targets, allowing us to assess both the influence of past actions and future plans on search behavior. Using static displays, we found that (1) responding to a target eliminated it from future search as effectively as removing it from the screen, demonstrating some form of memory for old targets; (2) observers consistently plan at least one target into the future. In the present work, we set the stimuli in motion. Our question was whether the memory and planning effects were location- or object-based. We found that observers can still plan ahead almost as effectively in this dynamic environment. However, memory for previous targets is essentially eliminated, suggesting that locations, not objects, were being tagged in our previous work.

4:25–4:45 (250)

Perceptual Errors in Object Recognition Are Reduced by the Presence of Context Objects. MARK AUCKLAND, *University of Southampton,* KYLE R. CAVE, *University of Massachusetts, Amherst,* & NICK DONNELLY, *University of Southampton* (read by Kyle R. Cave)—Previous experiments show that object recognition improves when the object appears within a semantically appropriate scene. However, the facilitation generally disappears in controlled conditions with responses constrained by a forced choice, suggesting that context affects only a late decision stage. We conducted a six-alternative forced choice experiment designed to allow both semantic and perceptual errors. A target object was presented briefly, surrounded by four context objects. The target was more accurately identified, with fewer perceptual errors, when the context consisted of objects semantically related to the target. The proportion of semantic errors increased with early presentation of the context, but this effect was removed by the application of a guessing correction and did not account for all of the contextual facilitation. Context can improve the perceptual identification of objects, even when it consists of arbitrarily positioned objects that are not organized into a scene.

4:50–5:05 (251)

To See or Not to See: ERP Studies of Visual Awareness. HARTMUT LEUTHOLD, *University of Glasgow*—Behavioral and neurophysiolog-

ical studies have claimed the importance of feedback processing for conscious perception, whereas visuomotor performance has been taken to depend on feedforward processing. The present studies examined the nature of perceptual and motor processing in different masking and priming paradigms by analyzing event-related brain potential (ERP) correlates of visual and motor processing. ERPs up to about 200 msec post prime indicated the feedforward volley of visual processing not to differ as a function of the participants' awareness of the stimuli. Nevertheless, in the priming experiments visible and subjectively invisible primes induced qualitatively different reaction time effects at a late level of motoric processing as suggested by ERP measures of motor activation. Most importantly, ERP analysis supplemented by dipole source analysis revealed visual cortical areas to be reactivated more than 100 msec after their initial stimulus-triggered activation. This finding supports the idea of visual awareness being associated with feedback processing.

5:10–5:25 (252)

Stimulus Duration Does Not Modulate the Benefit of Word Context in Visual Crowding. ELISABETH M. FINE, *SERI, Harvard Medical School*—Visual crowding is modulated by the semantic relationship between the target letter and the flanking letters (Fine, 2000). This study investigates how stimulus duration (SD) affects this relationship. Two groups (10/group) identified single letters and the middle letters of 3-letter words and nonwords presented at 5º eccentricity. SDs (blocked) were 50 and 100 msec or 25 and 50 msec for each group. A 2 (group) × 2 (SD) × 3 (stimulus) ANOVA found better performance with the longer SDs [$F(1,18) = 10.8$, $p < .005$], and better performance for letters (96%) than for words (60%), which were better than nonwords (42%) [$F(2,36) = 226.4$, $p < .001$]. There were no significant interactions. These data suggest that for this task, stimulus duration modulates neither visual crowding nor the benefit of word context. Both of these findings are inconsistent with the conclusions of previous studies.

Spatial Memory
Regency F, Saturday Afternoon, 3:30–5:30

Chaired by Mark G. A. Van Selst, San Jose State University

3:30–3:50 (253)

Spatial Memories and Locomotion. TIMOTHY P. McNAMARA, *Vanderbilt University*—An important function of spatial memories is to guide action in space, including route following and wayfinding. In this presentation, I will summarize the results of several experiments that have examined basic questions about the relations between spatial memories and locomotion: Do spatial memories acquired during static viewing differ from those acquired during locomotion? Do memories of large-scale spaces—spaces that can be experienced in their entirety only via locomotion—differ from memories of small-scale spaces? How do people update their location and orientation as they locomote in a familiar environment? The answers that we have obtained to these questions challenge entrenched views about the relations between spatial memories and locomotion.

3:55–4:10 (254)

Spatial Pattern Learning and Spatial Working Memory. MICHAEL F. BROWN & JILLIAN WINTERSTEEN, *Villanova University*—Rats searched for food pellets in a 5 × 5 matrix of discrete locations, the location of which was cued only by the baited locations' being arranged in a consistent spatial pattern (a checkerboard). During training trials, a visual cue indicated which of the locations had already been investigated. During test trials, these cues either were or were not provided. Although control of choices by the spatial pattern was acquired and the cues were used to avoid revisits to locations already investigated, there was no difference in the degree of control by the spatial pattern as a function of the presence of these cues. This indicates that the use of spatial patterns is independent of spatial working memory in at least some important ways and suggests limits on the mechanisms by which spatial patterns are involved in controlling spatial search.

4:15–4:30 (255)

Orientation Metaphor and Spatial Memory of Emotionally Evocative Stimuli. L. ELIZABET CRAWFORD, *University of Richmond* — The association of positivity and negativity with up and down is a ubiquitous orientation metaphor (Lakoff & Johnson, 1980). The present studies examine how this association between valence and verticality affects spatial learning and memory for emotionally evocative picture stimuli. The results indicate that positive but not negative stimuli are remembered as having appeared higher in space than they actually did. Spatial memory is more accurate for positive stimuli presented above center and negative stimuli presented below center than for the opposite pairing. Recognition judgments are faster in response to positive test stimuli presented above center and negative test stimuli presented below center than to the opposite pairing. Even in the absence of an explicitly evaluative task, evaluations of stimuli appear to facilitate processing in metaphorically consistent spatial regions.

4:35–4:45 (256)

Systems of View-Dependent Representations: Learning and Beyond. RANXIAO FRANCES WANG, *University of Illinois, Urbana-Champaign*—View-dependent representations have been shown in studies of navigation, object and scene representations, and spatial reasoning. To examine the relationship between different view-dependent representations, participants learned five targets in a room from a given perspective (*studied view*), and pointed to them while blindfolded according to various perspectives. When participants turned to face a different orientation (*updated view*) without disorientation, they showed evidence for the updated view but not the studied view. However, when participants were disoriented after updating occurred, they showed evidence of the studied view but not the updated view. These data suggest two distinctive systems of view-dependent representations of scenes. One encodes the studied perspective, which is enduring but may not be accessible for action tasks when people are oriented. The updating system dynamically generates representations according to the viewer movements, which may correspond to any view, but is transient and may be lost when disorientation occurs.

4:50–5:05 (257)

Influence of Incompatible Location Mappings on Subsequent Location-Irrelevant Tasks. ROBERT W. PROCTOR, KIM-PHUONG L. VU, & PETER J. URCUIOLI, *Purdue University*—Two experiments examined the influence of practice with an incompatible location mapping on performance of a subsequent Simon task, for which stimulus location was irrelevant, after a 5-min or 1-week delay. In Experiment 1, the visual Simon effect was eliminated when the practice modality was auditory and reversed to favor noncorresponding responses when it was visual. In Experiment 2, significant auditory Simon effects were obtained that did not vary as a function of practice modality. In both experiments, delay between the practice and Simon tasks had little influence on the Simon effect. The elimination of the visual Simon effect in the transfer session is likely due to associations between noncorresponding stimulus–response locations for the prior task remaining active during the transfer session. Because the auditory Simon effect is stronger than the visual one, more practice with the incompatible mapping may be necessary to produce reliable transfer effects for it.

5:10–5:25 (258)

Learning Geographical Information Using Hypothetical Maps. NOELLE C. CHIANG & NORA S. NEWCOMBE, *Temple University* (read by Nora S. Newcombe)—People often show biases in geographic judgments, although these biases can be eliminated by "seeding" with accurate information (Friedman & Brown, 2000). However, certain questions about geographic learning are difficult to study using the geography of Earth (e.g., What is the effect of altering the physical separation of geographic regions by bodies of water? or What is the effect of prior knowledge on learning?). In a series of three experiments, we replicated key findings from real geography using hypothetical geography, including bias and seeding effects. These data suggest that learning about hypothetical countries is a feasible method for studying geographic learning.

POSTER SESSION V
Fairmont Hotel–Conference Level, Saturday Evening, 6:00–7:30

• MUSIC AND AUDITION •

(5001)
The Perception of *f*0 Contour in Language and in Music by Children. SAOLUIS F. CASTRO & CARLOS M. MARQUES, *University of Porto,* & MIREILLE BESSON, *CNRS*—This study examined pitch perception in music and in language. Two groups of 10-year-old children ($N = 18 \times 2$), one without musical training and another with musical training lasting ca. 4 years, performed an incongruity detection task in the melodic line of melodies and in the intonational contour of sentences. Either the final note/word was left unchanged, or its fundamental frequency, *f*0, was increased (for strongly incongruous melodies and sentences, 1/2 tone and 120%, respectively; for weakly incongruous ones, 1/5 tone and 35%). Accuracy, including d' scores, and latency were analyzed. The results revealed a marked effect of congruity in favor of the strongly incongruous stimuli, both in melodies and in sentences, and an overall superiority of language. Irrespective of musical training, children with better performance in the musical incongruities were also better at detecting the weak incongruities in language. These results are compared with those previously found for adults.

(5002)
The Effect of Familiar Music Varying in Tempo on Cognitive Performance. GREG BOHÉMIER, *Culver-Stockton College*—The effect of familiar background music varying in tempo on cognitive performance was investigated. During each condition of music type—fast, slow, or no music (control)—participants solved either difficult or easy anagrams. Music type was a within-subjects variable, and order of presentation was counterbalanced across participants and timed to coincide with the type of anagram being solved. The dependent variables were the number of words generated and the magnitude of the participant's GSR. The results showed a significant interaction between type of anagram and music type. Participants solved more anagrams and showed a greater GSR response when familiar fast music was played, as compared with when familiar slow familiar music was played or when no background music was present. There were no other interactions. The results suggest that the use of familiar music is an important consideration when the effects of background music on motor performance are tested.

(5003)
Instrument-Specific Action–Effect Associations in Experienced Piano and Guitar Players. ULRICH DROST & MARTINA RIEGER, *Max Planck Institute for Psychological Research,* MARCEL BRASS & THOMAS GUNTER, *Max Planck Institute for Cognitive Neuroscience,* & WOLFGANG PRINZ, *Max Planck Institute for Psychological Research*—The repeated contingent experience of movements and their effects results in bidirectional action–effect associations. Such associations can be observed in experienced musicians. Here, we investigated whether such associations are specific for the own instruments. We employed an interference paradigm in which participants responded to a visual stimulus by playing a chord. Concurrently, a task-irrelevant auditory stimulus was presented, which consisted of the same (congruent condition) or another (incongruent condition) chord. In several experiments, we investigated piano and guitar players and varied (1) the timbre of the irrelevant auditory stimulus (e.g., piano, flute, guitar) and (2) the type of task to be performed (chord playing, tonality discrimination). Results showed (1) a specific interference effect for their own instruments and (2) that the tonality of chords from their own instruments was easier to discriminate than that of chords from other instruments. We conclude that action–effect associations in experienced musicians are instrument specific.

(5004)
Action Identity: How Pianists Recognize Their Own Performances. BRUNO H. REPP, *Haskins Laboratories,* & GÜNTHER KNOBLICH, *Max Planck Institute for Psychological Research*—Action identity refers to a match between an individual's past actions perceived in a video or audio recording and covert action tendencies or explicit action knowledge evoked by such perceptions, which lead to self-recognition. We recorded 12 pianists playing 12 mostly unfamiliar musical excerpts (6 with and 6 without sound from a digital piano) and several months later tested their ability to recognize their own performances. Participants gave their own performances significantly higher ratings ("Is this me playing?") than any other pianist's performances. Two later follow-up tests removed differences in tempo and overall dynamic level, as well as dynamic nuances from the performances. Self-recognition did not deteriorate significantly, which suggests that remaining information about expressive timing and articulation was sufficient for action identity to be established. Absence of sound during recording had no significant effect, which suggests that self-recognition was based largely on implicit action identity.

(5005)
Musical Stem Completion: Humming That Note. ANDREA R HALPERN & JILL A. WARKER, *Bucknell University*—We report a musical equivalent of a stem completion task. Participants listened to novel tunes and were then presented with tune stems (first few notes) from previously heard tunes and new tunes. For the stem completion task, they were asked to sing a note they thought would come next musically. In a parallel cued recall task, they were asked to sing the note they remembered as coming next. Experiment 1 showed that people significantly completed correctly more old stems than new stems and that performance in the two tasks was unrelated. In Experiment 2, we found that neither task was sensitive to timbre change from study to test or to a deep (rate tune pleasantness) versus shallow (rate rhythm regularity) encoding task. However, the cued recall, but not the stem completion task, was sensitive to whether tunes were presented in preferred versus nonpreferred timbres, showing at least a single dissociation.

(5006)
Music and Emotion: The Relative Effects of Lyrics and Melodies on Affective Responses. S. OMAR ALI & ZEHRA F. PEYNIRCIOĞLU, *American University*—We examined the relative effects of melodies and lyrics on eliciting emotion across the dimensions of happy, sad, calm, and angry. In a series of four experiments, we found that lyrics detracted from the intensity of emotional responses to happy and calm music (positive emotions) but enhanced that to sad and angry music (negative emotions). When the lyrics and the melodies were incongruent (e.g., happy melodies were sung with angry lyrics), we found that melodies were more dominant in eliciting the emotional responses than were the lyrics. These findings were replicated, although the intensities were somewhat dampened, when the emotional ratings were made not to the music itself, but to emotionally neutral pictures presented against the music background

(5007)
Memory and Liking for Music as a Function of Exposure Frequency. E. GLENN SCHELLENBERG, *University of Toronto, Mississauga,* KARL K. SZPUNAR, *Washington University,* & PATRICIA PLINER, *University of Toronto*—Musical stimuli were presented a varying number of times in "focused" or "incidental" listening conditions. When the stimuli were short tone sequences, exposure frequency affected recognition, but not liking, for focused listeners and liking, but not recognition, for incidental listeners. When the stimuli were orchestral excerpts, recognition ratings of focused listeners increased monotonically with exposure, but liking ratings initially increased, then decreased. For incidental listeners, increasing exposure led to monotonic increases in liking, accompanied by small increases in recognition. A third group of listeners, tested with stimuli and procedures of intermediate ecological validity, provided ratings that were midway between those for tone sequences and orchestral excerpts. These results indicate that (1) the ecological validity of stimuli has implications for the evaluative consequences of exposure, (2) associations and dissoci-

ations between liking and memory are context dependent, and (3) high levels of recognition are associated with reductions in liking.

(5008)

Different Processes Underlying Dichotic and Spectral TOJs: Evidence With SOAs. ELISHEVA BEN-ARTZI, HARVEY BABKOFF, & LEAH FOSTICK, *Bar Ilan University*—Psychometric curves were generated for dichotic temporal order judgments (TOJs; same frequencies presented asynchronously to two ears and order determined by which ear received the first stimulus) and spectral TOJs (two different frequencies presented to the same ear and order determined by which tone was presented first) at five durations, from 5 to 40 msec. When the dichotic TOJ curves were plotted in terms of stimulus onset asynchrony (SOA), rather than interstimulus intervals (ISI), all the data could be modeled by the same quadratic equation, with $R^2 = .95$. However, when the spectral TOJ curves were plotted in terms of SOA, the R^2 was .49 for data modeled by one quadratic equation. We conclude that SOA adequately explains dichotic TOJs, but not spectral TOJs.

(5009)

Gain Control in the Auditory System: Transmitted Information in Absolute Identification Tasks. SCOTT PARKER, *American University,* BRUCE A. SCHNEIDER, *University of Toronto, Mississauga,* & DANA R. MURPHY, *Nipissing University*—Subjects identified which of four or five 1-kHz tone intensities had been presented in a trial. Accuracy (measured by transmitted information) declined when a fifth tone was added to a four-tone set. We used two four-tone sets, one of loud tones and one of soft tones. Subjects were equally accurate identifying tones in the loud and the soft four-tone sets. However, adding a loud fifth tone to the soft set reduced accuracy more than did adding a soft fifth tone to the loud set. This is consistent with the auditory system's having a gain control mechanism that can expand or contract the function relating loudness to sound intensity.

(5010)

A Dynamic Model of Auditory Stream Segregation. BETTY TULLER, FELIX ALMONTE, VIKTOR K. JIRSA, & EDWARD E. LARGE, *Florida Atlantic University*—When two sequences of tones differing in frequency are presented to listeners, small frequency differences and/or slow presentation rates result in perception of a single stream with accurate report of the ordering of the tones. Large frequency differences and/or fast presentation rates result in perception of two streams, one with higher pitch, with the relative order of events between streams uncertain. Here, we explore this "auditory streaming" using a neurally inspired dynamic model of auditory processing. The model reproduces the perceptual results via two coupled dynamical systems. The first is a spatiotemporal neural field whose dynamics depend on the acoustic input. The second is a pattern-forming system that evolves dynamically to stationary states that are identified with a single perceptual stream or multiple streams. Intriguingly, the methodology may provide a tool for understanding the strong coherence among formants in speech.

• Haptics •

(5011)

Integration of Force and Position Cues in Haptic Curvature Perception. KNUT DREWING & MARC O. ERNST, *Max Planck Institute for Biological Research*—When one slides a finger across a surface with a bump on it, the finger follows the geometry of the bump, providing positional cues for the shape. At the same time, the finger is opposed by forces related to the steepness of the bump. With a specific device, Robles-de-la-Torre and Hayward (2001) dissociated positional and force cues in the haptic perception of small-scale bumps and holes: Participants in this experiment reported feeling the shape indicated by the force cues and not those indicated by the positional cues. We extended this research by systematically disentangling the contributions of these two cues to the perception of curvature. Using the PHANToM haptic device, we presented virtual curves, in which we intermixed force and position cues related to curvatures between 0 and 16/m. Participants compared these with pseudonatural curves. Our results suggest that perceived curvature is a weighted average of both positional and force cues.

(5012)

Vibrotactile Apparent Motion on the Abdomen: Effect of Presentation Mode. ROGER W. CHOLEWIAK, *Naval Aerospace Medical Research Laboratory & Princeton University,* & ANJA SCHWAB & KRISTEN BEEDE, *Naval Aerospace Medical Research Laboratory*—Several laboratories in North America and Europe are developing vibrotactile arrays fitted to the abdomen, intended to provide users with information about their mobility, orientation, or attitude in three-dimensional space. Both efficiency and comfort argue for the smallest number of tactors necessary to present the intended information. Motion is a potentially useful and important quality for encoding such information, but such parameters as tactor density, required to adequately represent smooth movement over the skin, have not been studied on the torso. In paired-comparison paradigms, we demonstrate that apparent motion generated by illusory patterns (in the saltatory mode) is, for the most part, indistinguishable from that generated by activating every tactor on arrays having twice as many active sites (the veridical mode). The ability to distinguish between saltatory and veridical stimuli does improve, however, with longer temporal intervals that result in deterioration of illusory motion. Supported by Office of Naval Research.

(5013)

Limits to Body Schema Remapping in the Fake Hand Illusion. ERIN L. AUSTEN, *University of British Columbia,* SALVADOR SOTO-FARACO, *Universitat de Barcelona,* & ERIC EICH, JAMES T. ENNS, & ALAN F. KINGSTONE, *University of British Columbia*—Speeded tactile elevation judgments with respect to a vibration on an unseen hand (forefinger/top vs. thumb/bottom) are modulated by the spatial congruency of a simultaneously flashed distractor light, presented at either a congruent or an incongruent elevation. This effect is more pronounced when a fake hand is seen to "hold" the distractor lights (e.g., Pavani, Spence, & Driver, 2000), suggesting a remapping of limb position on the basis of the available visual information. The present study examined this fake hand illusion for all combinations of hand orientation (prone vs. supine) and mapping of target elevation foot response (top-toe and bottom-heel vs. top-heel and bottom-toe). The illusion was smallest overall for top-heel and bottom-toe mappings and was qualitatively different when this mapping was paired with a supine hand orientation. These results point both to important default settings and to the limits of remapping in the fake hand illusion.

(5014)

Exploration Mode and the Haptic Müller-Lyer Illusion. MORTON A. HELLER, JENNIFER SCHULTZ, KATHY WILSON, JAYME GREENE, MELISSA SHANLEY, & ERIN SIEVING, *Eastern Illinois University*—An experiment studied the impact of manner of exploration on the haptic Müller-Lyer illusion. Blindfolded sighted subjects felt raised-line Müller-Lyer and control stimuli. The stimuli were felt by tracing with the index finger, free exploration, grasping with the index finger and thumb, or measuring with the use of any two or more fingers. Haptic judgments of extent used a sliding tangible ruler. The illusion was present in all exploration conditions, with overestimation of the wings-out, compared with the wings-in, stimuli. Tracing with the index finger reduced the magnitude of the illusion. However, tracing and grasping induced an overall underestimation of size. The theoretical implications of these results will be discussed.

• Motor Control •

(5015)

Infant Motor Patterns in Multimobile Conjugate Reinforcement Task. HAMA WATANABE & GENTARO TAGA, *Japan Science and*

Technology Corporation SORST & University of Tokyo, KEISUKE KUSHIRO, *University of Tokyo,* & KAYO ASAKAWA, *Japan Science and Technology Corporation SORST*—Three- to five-month-old infants were positioned on their backs with a ribbon connecting one wrist to one of two overhead mobiles. We used 3-D motion analysis system to observe infants' abilities to generate a variety of movement patterns, find solutions for making the mobile move, and then select a specific motor pattern on the basis of memory. Results of motion analysis indicated that the frequency of movements of arms and legs increased after the reinforcement phase and that the high frequency of motion was maintained after a 5-min unrelated interference task. We also observed preferential head and gaze directions to the mobile connected to their wrist during the reinforcement phase. These suggest that infants can recognize the correspondence between the arm movements and the multiple mobiles and memorize it for at least several minutes. In the future, we will study individual difference of motor solutions under a changed conjugate condition.

(5016)

The Role of Effect Anticipation in Action Planning. MICHAEL ZIESSLER, *University of Sunderland,* & DIETER NATTKEMPER, *Humboldt University, Berlin*—Action effects play an important role in action planning. First, effect anticipation is necessary to select the appropriate action producing the desired effect. An action plan can be executed when the anticipated effect corresponds to the desired effect. Later, the actual effect is compared with the anticipated effect to check whether the action was successful. In the learning phase of our experiments, participants learned the effects of their responses. Later, these effects were presented shortly before or after the imperative stimulus. Effects presented before stimulus onset did not affect the response; effects presented after stimulus onset facilitated the response. The facilitation depended on practice. At the beginning of the test phase, only effects presented at 50%–75% of the mean RT facilitated the response. With practice, the earlier effects were more efficient; later effect presentation increased the RTs. The results are discussed in the framework of an activation model of action planning.

(5017)

Age-Related Effects on the Fine Motor Control of the Lower Limb. PHILIP H. MARSHALL, *Texas Tech University,* & ELIZABETH M. WILLIAMSON, *Texas Tech University Health Science Center*—The purpose of this study was to examine age-related effects on continuous fine motor control accomplished by extending and flexing the knee. A second purpose was to determine to what extent potential differences were related to differential involvement of joint receptors and muscle spindles. Young (17–25 years), middle-aged (40–50 years), and elderly (65–75 years) participants performed a tracking task by extending and flexing the leg to follow a computer-generated visual target. Elderly participants performed more poorly than the other age groups, and elderly women more poorly than men. The diminished capabilities appear to be unrelated to specific sensory receptors, since there were no performance differences between extreme and mid-range movements. The results are discussed in terms of decreased motor coordination or visuospatial control.

(5018)

Sequential Effects in Obstacle Avoidance: The Obstacle Perseveration Effect. STEVEN A. JAX & DAVID A. ROSENBAUM, *Pennsylvania State University*—The goal of the present research was to demonstrate the importance of sequential effects when the computationally demanding task of reaching around obstacles is performed. To examine these sequential effects, we had participants perform reaching movements between targets in the presence or absence of an intervening obstacle. Results from three experiments showed significant sequential effects in obstacle avoidance. Specifically, when obstacle-present and nonobstacle trials were intermixed within a block of trials, the hand paths in the nonobstacle trials were more curved than were hand paths generated when no obstacle was ever present. This sequential effect, called the obstacle perseveration (OP) effect, demonstrates that recent experience plays a more important role in obstacle avoidance than previous theories have recognized.

(5019)

Cerebellar Lesions Disrupt Learned and Novel Anticipatory Adjustments Required for Bimanual Coordination. JÖRN DIEDRICHSEN, *University of California, Berkeley, & Johns Hopkins University,* & RICHARD IVRY, TIMOTHY VERSTYNEN, & NEIL ALBERT, *University of California, Berkeley*—When an object is supported by one hand and then lifted by the other hand, neurologically healthy individuals exhibit an anticipatory postural adjustment (APA): There is a reduction in the upward force generated by the support hand prior to unloading. This behavior is preserved in callosotomy patients, suggesting that the integration of the control signals for the two hands occurs subcortically. Patients with cerebellar lesions also produced an APA. However, the response was poorly timed, occurring much earlier than in control participants. In a second experiment, the object was raised following a buttonpress produced by the hand not supporting the object. Unlike control participants and the callosotomy patient, patients with cerebellar lesions failed to learn to produce an APA with extensive training. The results demonstrate a role for the cerebellum in bimanual coordination, with functions present here similar to those observed in other motor control tasks.

(5020)

First Trial "Adaptation" to Prism Exposure: Contribution of Visual Capture. GORDON M. REDDING, *Illinois State University,* & BENJAMIN WALLACE, *Cleveland State University*—Terminal target pointing error on the first prism exposure trial is usually less than would be expected from the optical displacement. Visual capture of the felt head–shoulder relationship was found to account for about 93% of such "adaptation," whereas the remaining 7% can be attributed to ordinary motor undershoot.

(5021)

Interactions Between Concurrently Perceiving and Producing Functionally Unrelated Events. MARC GROSJEAN & WOLFGANG PRINZ, *Max Planck Institute for Psychological Research*—In a task designed to study specific interactions between the concurrent perception and production of events, Schub, Aschersleben, and Prinz (2001) asked participants to perform a previously specified movement trajectory while simultaneously encoding a functionally unrelated stimulus trajectory. The results revealed a form of contrast effect that was characterized by a suppression between perception and action. In the present study, we employed a similar task and showed that this contrast effect is (1) actually preceded within a given action by an assimilation effect and (2) obtained only when participants are aware that they exhibit the latter effect. These findings are consistent with what has typically been reported in the stimulus–response compatibility literature (i.e., an assimilation between perception and action) and suggest that such contrast effects are, at least in part, strategic in origin.

(5022)

Compensation for and Adaptation to Changes in the Environment. MARTINA RIEGER, GÜNTHER KNOBLICH, & WOLFGANG PRINZ, *Max Planck Institute for Psychological Research*—Human motor behavior is remarkably accurate, even though many everyday skills require flexible adjustments between motor activity and its consequences in extracorporal space. The present study addressed two questions: First, how do people compensate for unpredictable changes in the environment, and second, how do they adapt to such changes? Participants repeatedly and continuously drew up and down strokes on a writing pad. After drawing under a base mapping, (1) a change of target position, (2) a change of gain, or (3) both occurred. Compensation for gain changes occurred later than compensation for changes in target position. In addition, there were aftereffects of the previous movement in accuracy and movement time. Adaptation to changes occurred in reference

to extracorporal space. These results support a hierarchical view of movement organization and planning, in which a distal movement representation in extracorporal space is the primary frame of reference.

• Associative Learning •

(5023)

Taste + Odor Interactions in Aversion Compound Conditioning. W. R. BATSELL, JR., & CHRISTINA A. TROST, *Kalamazoo College,* & JOHN D. BATSON, *Furman University*—Recent theoretical work in animal learning has investigated compound conditioning for evidence of configural associations (Pearce, 2002) or the integration of elemental associations and configural associations (Wagner & Brandon, 2001). Taste + odor aversion conditioning appears to be a good model for these investigations because of the perceptual similarity of tastes and odors. A series of three experiments was conducted to detect whether unique combinations of taste + odor facilitated potentiation of odor by taste. Experiment 1 compared the results of taste extinction on single-element odor aversions and potentiated odor aversions. Experiments 2 and 3 investigated the effects of element extinction on responding to the compound. The results confirmed that the identity of the taste and the odor are important determinants of the strength of odor potentiation. These results indicate that an integration of configural and elemental associations may provide a viable account of taste-mediated odor potentiation.

(5024)

Conditional Stimulus Control of Timing Behavior: Feature-Short and Feature-Long Discriminations in the Pigeon. SADAHIKO NAKAJIMA, *Kwansei Gakuin University*—Feature-short (FS) and feature-long (FL) discrimination tasks were devised to explore conditional stimulus control of pigeons' timing behavior. The key remained illuminated until a single peck occurred after a fixed-interval (FI) value, and termination of the key illumination immediately yielded an access to grain. For 8 birds, the FI value employed in featured training trials was 15 sec and that of nonfeatured training trials was 30 sec. Hence, the feature stimulus signaled advancement of reinforcer availability. For the remaining 8 birds, the intervals of featured and nonfeatured training trials were reversed. Thus, the feature stimulus signaled postponement of reinforcer availability. Discrimination performance was assessed by measuring temporal distribution of pecks in featured and nonfeatured probe trials 60 sec long (i.e., a peak procedure). The results clearly indicated that FS discrimination is difficult, as compared with FL discrimination, at least with the parameters employed.

(5025)

Sequence Learning With Visual and Auditory Stimuli. ROLF REBER, *University of Bergen,* & CHRISTA THOMKE, *University of Bern*—We present three experiments on sequence learning with visual and auditory stimuli. Participants had to react to position in the visual task and to tone height in the auditory task. First, participants showed learning for both visual and auditory sequences in a serial reaction time task. They learned a sequence even if they just saw or heard it within the first five blocks. Reaction times were higher for auditory than for visual stimuli. Second, rearrangement of spatial correspondence between stimulus and response hampered learning. In this condition, reaction times were higher for visual than for auditory stimuli. Third, participants represented auditory sequences spatially only when they played a musical instrument, as shown by differences in learning between those who played an instrument and those who did not. These findings suggest that learning visual and auditory sequences may use different cognitive resources but that the underlying learning principles are the same.

(5026)

The Effect of Emotional Focus on Memory for Semantically Related Word Lists. JENNIFER L. TOMES & LORENA RUCI, *Mount Allison University*—This study investigated the effect of emotional focus on memory for semantically related word lists, using recall and recognition of emotional word lists and remember/know judgments. Participants were placed into one of three conditions (happy, sad, or neutral emotional focus) and were presented with Deese/Roediger–McDermott lists that were happy/positive (e.g., beautiful), sad/negative (e.g., anger), and neutral (e.g., chair). Results supported the hypothesis that intrusion errors for the happy, sad, and neutral lures would be higher in emotionally congruent conditions, whereas mood-congruent memory effects for correct recall was found only in the happy emotional focus condition. No relationship was found between scores on the Dissociative Experiences Scale and false memories for the critical lures.

(5027)

Modeling False Recall: The eSAM Model of Associative Semantic Memory. DANIEL R. KIMBALL, *University of Texas, Arlington,* & MICHAEL J. KAHANA, *Brandeis University*—We present the eSAM model, which augments the search of associative memory (SAM) model by adding representations in long-term memory of preexisting semantic associations rather than strictly episodic associations formed during study, and by adding a mechanism for contextual drift. We have previously shown that, with lists of unrelated and categorically related words, eSAM simulates behavioral data for prior-list intrusions, extra-list intrusions, and recall transitions among episodically and semantically related words (Sirotin, Kimball, & Kahana, 2003). We now apply eSAM to the Deese/Roediger–McDermott list-learning paradigm, in which participants often falsely recall an unpresented critical word that is semantically related to each of the words in a study list. Results show that eSAM can easily simulate several benchmark findings from the behavioral literature on false recall, using the DRM paradigm. We discuss the theoretical and empirical implications of eSAM's successes and limitations in simulating false recall.

(5028)

The Role of Working Memory and Context in Forgetting. LILI SAHAKYAN & PETER F. DELANEY, *University of Florida*—Working memory has recently been linked to various inhibitory phenomena. In the present study, we explored the relationship between working memory capacity as assessed with the O-SPAN task and the amount of forgetting that occurred in response to the *forget* cue in the list method directed forgetting task. Because elsewhere we have argued that contextual change is a mechanism underlying directed forgetting, we explore the role of working memory in context change. Using regression analyses, we have found that people with high working memory showed greater forgetting than people with low working memory capacity. The results are discussed in terms of attentional demands of context change and maintenance.

(5029)

Does Synesthesia Influence Name Recall? CAROL BERGFELD MILLS, LAUREN B. OWSIANIECKI, & TARYN R. WESTENDORF, *Goucher College*—A multilingual synesthete professor and nine multilingual nonsynesthete professors participated in a name recall experiment, in which they were presented with 30 names of individuals (first and last). This study explored the role of synesthesia on both qualitative and quantitative aspects of name recall. It was hypothesized that the synesthete would have better recall and give qualitatively different reasons for remembering the names than would the other multilingual professors. The results showed that the synesthete did not have the greatest recall, but her synesthesia did affect the reasons given for remembering the names.

(5030)

A New Test of Music Mood Induction and Mood Congruent Memory. LAUREN F. V. SCHARFF & PHUONG T. NGUYEN, *Stephen F. Austin State University*—The goals of the present study were twofold: to systematically investigate music mood induction (MMI) and its duration and to use MMI to assess mood congruent memory (MCM). In

Experiment 1, participants ($N = 90$) were placed in one of nine groups (all combinations of happy, sad, or no music and lyrics). Unlike previous studies, standardized lyrics and music were combined auditorily, and mood was measured over time, using the MAACL–R state mood measure (given prior to induction and at 0, 5, and 10 min after induction). Overall, lyrics influenced mood to a greater extent than did music, and there were greater increases in negative than in positive affect. In Experiment 2, with the most effective happy and sad inducing conditions and a control condition, 60 participants were tested for MCM, using a recognition test for personality trait words of positive, neutral, or negative valence. No MCM was obtained. Implications are discussed.

• Recognition Memory •

(5031)

The Contribution of Perceptual Mechanisms to the Spacing Effect. JASON D. ARNDT & JULIE DUMAS, *Middlebury College*—Recent explanations of the spacing effect posit a central role for semantic priming mechanisms (e.g., Challis, 1993). Russo and his colleagues (Russo et al., 1998, 2002) have further provided evidence consistent with the contribution of perceptual priming mechanisms to the spacing effect for items not conducive to semantic analysis (e.g., nonwords), but no such contribution for items conducive to semantic analysis (e.g., words). We further test this empirical regularity by presenting repetitions of both spaced and massed words in different fonts. Critically, and deviating from prior studies where only two fonts were utilized to present all items, we utilized many different fonts. The results of two experiments demonstrate that the spacing effect for words was eliminated when the perceptual format changed between item repetitions, which is consistent with the theory that perceptual priming mechanisms contribute to the spacing effect for information that lends itself to semantic analysis.

(5032)

Strong Memories Obscure Weak Memories in Associative Recognition. MICHAEL F. VERDE & CAREN M. ROTELLO, *University of Massachusetts, Amherst*—Does recognition of a test probe depend on the strength of other, related items in memory? Much evidence suggests that there is no list strength effect in item recognition. However, Norman (2002) has suggested that the recollective component of recognition renders weaker items vulnerable to strength-based interference. We find further evidence for this in associative recognition, a task thought to rely heavily on recollection. Both accuracy and response times were adversely affected when word pairs related to the target pair were strengthened during study via repetition. The finding that strengthening related pairs via deep (rather than shallow) encoding produces similar results supports the generality of the list strength effect in associative recognition.

(5033)

Does Presentation Format Mediate the Cross-Race Effect in Face Recognition? PAULA J. WADDILL & STEFAN SCHELS, *Murray State University*—One of the more robust findings in studies of face recognition is the cross-race effect: Recognition memory tends to be better for faces of one's own race than for faces of other races. This effect has traditionally been investigated in the laboratory, using old/new judgments of faces presented one at a time. In forensic settings, however, witnesses are generally required to identify previously seen faces from a lineup. We explored whether differences exist in the cross-race effect as a function of recognition paradigm. African-American and European-American participants viewed a series of male African-American and European-American faces and were then tested using either a traditional (one-at-a-time) recognition paradigm or a lineup paradigm in which sets of six faces were presented. The cross-race effect was present in both paradigms but was strongest for African-American participants viewing lineups. The data suggest that test presentation format may mediate the size of the cross-race effect.

(5034)

Suppressing Gist- and Source-Based False Recognition With a Distinctiveness Heuristic. AMY L. WISEMAN, BENTON H. PIERCE, & DANIEL L. SCHACTER, *Harvard University*—Suppression of gist-based and source-based false memories has individually been shown when participants invoke a distinctiveness heuristic (DH), in which expectations of remembering distinctive information allows them to correctly reject nonstudied items. We asked whether the DH is invoked when false memories have both gist and source components. After participants were presented with related lures in an incidental task (source + gist), they studied categorized lists in either a distinctive (imagery) or a nondistinctive (reading) condition. Whereas recognition memory was similar across groups, only in the distinctive condition were participants able to suppress false recognition of related lures. We suggest that this suppression was due to participants' invoking the DH, whereby their expectation to remember images allowed them to appropriately reject items that were both incidentally presented (source based) and semantically related to studied items (gist based).

(5035)

A Defocused Account of the Revelation Effect in Recognition Memory. WILLIAM E. HOCKLEY & MELISSA WELLS, *Wilfrid Laurier University*—The revelation effect is evidenced by an increase in hit and false alarm rates for recognition decisions that are made immediately after performing an unrelated task. This effect is readily seen for words but is attenuated or absent for pseudowords. An explanation of this effect based on the distinction between generalized strength (or familiarity) and episode specific strength (Humphreys, Bain, & Burt, 1989) is proposed. In this account, the revelation task displaces context-relevant information in working memory. The subsequent recognition decision is based on a reduced set of contextual cues allowing preexperimental familiarity to have a greater influence on the recognition decision. Novel pseudowords have less episode-specific strength, and recognition of these items is normally based more on their generalized strength. Thus, pseudowords are less affected by the revelation task. This defocused context account is able to provide an explanation of the major findings associated with the revelation effect.

(5036)

Neural Correlates of Memory Retrieval During an Opposition Task as Measured by Event-Related fMRI. MOLLY B. DuBRAY & JANINE M. JENNINGS, *Wake Forest University,* & PAUL J. LAURIENTI, *Wake Forest University School of Medicine*—Participants underwent event-related fMRI while performing a continuous recognition task in which they were asked to identify words from a prior study list and new words (unstudied) that were presented twice during the test phase. The second presentation of these new words, which occurred at one of two different lag intervals, was of particular interest, since participants had to recollect the first occurrence of these items in order to distinguish them from the previously studied words that were relatively comparable in familiarity. Accurate responding to repeated items was associated with activation in the bilateral inferior parietal gyrus (BA 40), the right precuneus (BA 7), the left medial frontal gyrus (BA 9), and the bilateral superior frontal gyrus (BA 8, right BA 6). Implications regarding the neural underpinnings of familiarity (automatic memory processing) and recollection (consciously controlled memory) will be discussed.

(5037)

Perceptual fluency Effects on Episodic Familiarity: Recognition Bias Changes With Immediate Repetition Priming. TEDRA FAZENDEIRO, *University of Denver,* DAVID E. HUBER, *University of Maryland, College Park,* TIM CURRAN, *University of Colorado, Boulder,* & PIOTR WINKELIEMAN, *University of California, San Diego*—Jacoby and Whitehouse (1989) found that subliminal prime presentations biased recognition toward *old* responses for immediately repeated test words, whereas supraliminal prime presentations biased recognition toward *new* responses. The authors proposed a top-down conscious discounting strategy to explain the latter result. Using

a nonepisodic perceptual task, Huber and colleagues (e.g., Huber, Shiffrin, Lyle, & Ruys, 2001) likewise observed bias changes from positive to negative with increased prime duration. We relate these results by employing forced-choice testing in an episodic recognition task with immediate repetition priming. Utilizing a new cued-recall measure as an improved method for separating the familiarity and the recollective components of recognition, we find that these bias changes lie in the familiarity component, both for short (positive bias) and long (negative bias) duration primes. We interpret these results in terms of bottom-up perceptual fluency and its influence on episodic familiarity, rather than appealing to a top-down conscious discounting strategy.

• Memory •

(5038)

Cue Identification in Directed Forgetting. ALI I. TEKCAN & AYCAN KAPUCU, *Boğaziçi University*—The purpose of this study was to investigate retrospective cue identification in directed forgetting under both item and list methods. Following up on MacLeod (1999), we looked at the possible contaminating effects of recall and recognition tasks on cue identification. Under both of the directed forgetting methods, participants were given a cue identification test either before or after free recall and recognition. Cue identification was above chance under both methods; however, accuracy was substantially better under the item method. Having performed recall and recognition before cue identification decreased accuracy under the list method, but not under the item method, thereby increasing the accuracy difference between the two methods. The results provide further evidence that cue identification is better under the item than under the list method and is resistant to possible contamination from other tasks.

(5039)

Forgetting and Recovery Without Inhibition. STEVEN M. SMITH, DAVID R. GERKENS, & HYUN CHOI, *Texas A&M University,* & RACHEL G. HULL, *Rice University*—A growing body of evidence demonstrates that memory inhibition can occur under laboratory conditions, and this has been empirically verified with an independent probe technique. In the present study, we asked whether there can be sizeable long-term forgetting and recovery effects without inhibition. Three experiments used an independent probe technique to test for memory inhibition in an interference paradigm that produces large forgetting and recovery effects (Smith et al., 2003). Although forgetting effects in free recall were substantial, there was no evidence on the independent probe tests that forgotten items were inhibited. To see whether the free recall test itself induced inhibition via output interference, the independent probe test was also given after the free recall test; again, no inhibition was observed. The evidence indicates that long-term forgetting can occur without inhibition.

(5040)

Retrieval Practice: Effects of Gender Stereotypes. LISA STREEFLAND, *Argosy University,* & JENILEE HESS, VINCENT VOGT, & LESLIE A. VALDES, *St. Cloud State University*—This study is a system replication of Macrae and MacLeod (1999). Participants were asked to remember personality traits paired with one of two names. The personality traits were consistent with a gender stereotype, conflicted with the stereotype, or were neutral. In Experiment 1, the gender of the names was a within-subjects variable. In Experiment 2, the gender of the names was a between-subjects variable. After the participants had studied the traits, they practiced retrieving half of the traits. Overall, people remembered fewer of the unpracticed traits than the practiced traits. However, the gender of the name and the type of trait (stereotype or neutral) interacted with amount of traits recalled.

(5041)

Depressive Deficits in Forgetting: Help From Something New to Remember. PAULA T. HERTEL & GINA CALCATERRA, *Trinity University*—Using a think/no-think paradigm modified from Anderson and Green (2001), Hertel and Gerstle (in press) found evidence for depression-related deficits in forgetting. Students in dysphoric states recalled more words following suppression trials than did nondysphoric students. Like deficits in remembering, deficits in forgetting appear to result from reduced control of attention. A subsequent experiment has shown that dysphoric participants benefit from assistance in the control of attention. The forgetting aids consisted of new responses to the old cues, practiced a variable number of times (and no doubt, inviting retrieval-induced forgetting of the original responses).

(5042)

The Effect of Mnemonic Encoding on Attention Use at Retrieval. ELIZABETH P. KIRK & COLLEEN M. KELLEY, *Florida State University*—We examined the effects of mnemonic training on the attention demands of memory retrieval, using dual-task methodology. Experimental group participants were trained on the Pegword mnemonic and then were asked to recall lists of unrelated words under full and divided attention. Control group participants solved anagrams and made pleasantness judgments during encoding. Mnemonic training vastly increases recollection, which likely increases demands for attention at retrieval, as compared with control participants. Mnemonic training also enables participants to develop a well-organized retrieval structure similar to those formed by memory experts, which may reduce demand for attention at retrieval. Our studies revealed evidence for both outcomes, depending on the conditions of learning.

(5043)

Remembering and Knowing: Just How Subjective Are Subjective Judgments of Memory? DAVID I. DONALDSON, *University of Stirling,* PATRICK O. DOLAN, *Drew University,* & DAVID A. GALLO, *Harvard University*—Remember/know judgments are believed to reflect dissociable states of consciousness, based on the subjective experience of memory. We present evidence that the subjective distinction is sensitive to simple changes in instructions. Each subject studied words, presented once or thrice, and performed three tests. On the standard test, subjects were given typical two-stage old/new then remember/familiar/guess instructions. The other tests used just one judgment. On the remember test, subjects said "yes" only to items that they "remembered." On the familiarity test, they said "yes" only to "familiar" items. Feedback from the subjects suggested that they were able to follow these instructions. On the standard test, repetition increased "remember," but not "know," judgments. By contrast, identical effects were present on both the remember and familiarity tests, and the subjective distinction between these judgments disappeared. Consistent with other research (Bodner & Lindsay, 2003; Hicks & Marsh, 1999), test context strongly influenced subjective judgments of memory.

(5044)

The Relation Between Context Information and Remember–Know Judgments. SALVADOR ALGARABEL, ALFONSO PITARQUE, & ARCADIO GOTOR, *University of Valencia*—In a series of experiments, we tried to determine the relationship between context information and recognition. In particular, there is an ongoing controversy about the adequacy of the remember–know paradigm for accessing recognition processes and its value for differentiating between one- and two-process accounts. In the first experiment, we presented a series of words over a background serving as context. The context was specific and constant for a series of repetitions of each word and was varied in each presentation. Recognition of words was virtually identical in all conditions, despite large variations in the ability to recognize the context backgrounds. Further experiments showed that despite variations in context and associative information, the levels of responding to words were identical. ROC analysis of the data of the first experiment showed that the quadratic components of ROC and *z*-ROC conformed to a signal detection model with unequal variances.

(5045)

Factors Affecting the Context Effect: Learning Conditions, Divided Attention, and Time Delay. ELI VAKIL & TAL RAZ, *Bar-Ilan University*—The facilitation of target memory due to correspondence of context in learning and test is the "context effect." There are inconsistent reports in the literature regarding this effect, probably due to the wide range of paradigms used. A first experiment tested the impact of different learning conditions on the context effect. The findings showed a more pronounced context effect when target and context were parts of the same stimulus than when presented side by side. The second experiment tested the effects of divided attention and time delay on the context effect. The findings indicated that (1) divided attention and time delay disturb the formation of specific association between target and context and (2) the effect of context on target recognition was greater after a week delay than after brief delay tested under divided or full attention. These results help to resolve some of the conflicting findings in the literature regarding context effect.

(5046)

How Generation Affects Source Memory. KINDIYA D. GEGHMAN & KRISTI S. MULTHAUP, *Davidson College*—Generation effects (better memory for self-produced items than for provided items) typically occur in item memory; the present research explored generation effects in source memory. In Experiment 1, undergraduates answered questions and read statements made by a face on a computer screen, where the key word either was scrambled or needed letters filled in. Generation effects were found for both item recall and source recognition (which person did which task). Experiment 2 replicated and extended the findings to conditions in which the external sources were two different people who were shown either in consistent locations or not. The data suggest that the generation effect may extend to source memory and that item and source memory may have similar underlying mechanisms.

(5047)

Distinguishing Response Bias From Sensitivity in the Revelation Effect. MICHAEL F. VERDE & CAREN M. ROTELLO, *University of Massachusetts, Amherst*—It can be difficult to determine when memory illusions are the product of response bias or reflect actual changes in memory sensitivity. We use signal detection theory to examine this issue in the revelation effect, the increased tendency to claim that an item was previously encountered when recognition is preceded by an incidental task. Changes in d' are assumed to implicate an effect of revelation on sensitivity. However, using ROC curve analysis, we illustrate how sensitivity measures based on a single pair of hit and false alarm rates can be misleading under conditions of changing bias. Our results suggest that response bias alone is responsible for the revelation effect when the incidental task is unrelated to the recognition probe but that sensitivity plays a role when the incidental task is related to the probe. Thus, the revelation effect does not seem to be a unitary phenomenon, as has been previously assumed.

(5048)

How Relational and Item-Specific Cues Unblock Blocked Memories. HAJIME OTANI & KOICHI KATO, *Central Michigan University,* ROBERT L. WIDNER, JR., & PHILLIP GOERNERT, *Minnesota State University, Mankato*—How could blocked memories be unblocked? In this study, we investigated this issue by providing two types of cues: relational and item specific. A processing account of hypermnesia indicates that item-specific processing increases memory recovery across repeated tests, whereas relational processing reduces forgetting across repeated tests. Accordingly, we predicted that item-specific cues would be more effective in unblocking blocked memories than would relational cues. Participants studied a list consisting of 10 words from each of six categories. Participants then completed a free recall test followed by a free or cued recall test. On the cued recall test, participants received either relational (category) or item-specific (associate or first letter) cues. Both the category and the associate cues were equally effective in unblocking blocked memories. However, the associate cues produced greater loss of previously recalled items than did the category cues. The results were similar to the effects of relational and item-specific processing on hypermnesia.

(5049)

Recalling Conjunctions: What Comes Together in Awareness Is Remembered Together. MARK T. REINITZ, *University of Puget Sound,* & SHARON L. HANNIGAN, *St. Lawrence University*—Subjects studied pairs of faces (Experiment 1) or compound words (Experiments 2–4); pair members appeared simultaneously or sequentially. A recognition test followed, containing old and new items as well as within-pair conjunctions (composites of stimuli from the same study pair) and between-pair conjunctions (composites of stimuli from separate pairs). For faces, there were more false alarms to within-pair relative to between-pair conjunctions in the simultaneous, and not in the sequential, condition. However, with compound words (Experiment 2), false alarms in the conjunction conditions were equal for both presentation conditions. In Experiment 3, prevention of controlled rehearsal of compound words produced results similar to those of Experiment 1. In Experiment 4, within-pair, but not between-pair, conjunctions were falsely recalled in the simultaneous condition only. Awareness appears to bind stimulus parts so that they are subsequently remembered together.

• Metacognition •

(5050)

Divided Attention and Metamemory Judgments. MICHAEL R. DOUGHERTY, *University of Maryland, College Park,* & KELLY A. BARNES, *Georgetown University*—This study examined the effect of divided attention on the accuracy of global judgments of learning (JOLs) in a multitrial list-learning paradigm. Participants studied the same list of words for four trials. Attention was divided during one of three phases of the task (study, judgment, or retrieval), using a word-monitoring task. As was expected, divided attention at encoding and retrieval led to decrements in overall recall. As compared with a no-load control condition, participants showed greater overconfidence when attention was divided at encoding (only on Trial 2) or at retrieval (for both Trials 1 and 2). Interestingly, there was no effect of dividing attention during the judgment phase and no effect of divided attention in any of the three conditions in Trials 3 and 4. Results indicate that participants consider both the conditions of encoding and the conditions of retrieval, but do not engage in overt recall, when forming global JOLs.

(5051)

Phenomenological Characteristics of Memory for Events That Never Happened. PETER J. BRUSS & DAVID B. MITCHELL, *Loyola University, Chicago*—When people claim to remember a nonpresented word, what are they actually remembering? We adopted a mixed qualitative/quantitative approach to shed some light on this question. After recalling several lists, 100 participants made remember/know judgments on a subset of the words. For each remember response, participants attempted to explain specifically what they remembered about that word's presentation. Remember responses for critical lures and studied items revealed few phenomenological differences. Although much of their recollective experience involved associative information, 67% of the participants' remember responses included information indicative of an actual reliving of the encoding episode, which did not differ between studied items and lures. Confidence ratings revealed some subtle differences. Ultimately, we argue that false memories elicited in the DRM paradigm are subjectively compelling and can serve as a useful research tool for the investigation of memory distortions that occur in real-life circumstances.

(5052)

Young and Older Adults Overestimate Their Communicative Effectiveness. LORI E. JAMES & PAULA M. ADKINS, *University of Colorado, Colorado Springs*—We tested the effects of aging on com-

munication ability and on metacognitive judgments of communicative effectiveness. Following Keysar and Henley (2002), young (ages 18–30) and older (ages 60–85) participants produced aloud sentences containing structural or lexical ambiguities with the goal of clearly communicating to a listener one of two possible meanings of each sentence. They then rated how effectively they had communicated the intended meaning. Participants failed to appropriately alter their prosody to differentiate the meanings of the structurally ambiguous sentences (i.e., their communication was ineffective), yet confidence ratings were high for young adults and significantly higher for older adults. For lexically ambiguous sentences (impossible to differentiate through prosody), young adults remained confident in their communicative ability, and again, older adults produced higher confidence ratings than did young adults. The results indicate a communication deficit for both age groups and an overestimation of communicative effectiveness that is more pronounced for older than for young adults.

(5053)

Aging, Encoding Fluency, and Judgments of Learning. A. EMANUEL ROBINSON & CHRISTOPHER HERTZOG, *Georgia Institute of Technology,* & JOHN DUNLOSKY, *University of North Carolina, Greensboro*—Fluency of encoding is a cue used by younger adults in making judgments of learning (JOLs) for paired associates, even though it is not a valid cue (Hertzog, Dunlosky, Robinson, & Kidder, 2003). Are older adults similarly influenced by fluency of encoding in making JOLs? The first experiment investigated whether older adults also use fluency of generating image mediators in making JOLs. Older and younger adults produced equivalent gamma correlations of latency to produce images with JOLs. The second experiment investigated whether younger and older adults accurately judged how long it took to form an image mediator and whether this mediated latency–JOL correlations. Both age groups showed an encoding fluency effect on JOLs and also accurately discriminated between fast and slow production latencies. Implications for aging and the monitoring of encoding will be discussed.

(5054)

Underconfidence With Practice: Do Anchoring Effects Play a Role? DOMINIC A. SIMON, *New Mexico State University*—Two experiments were conducted exploring a possible role of anchoring in the underconfidence with practice (UWP) effect (Koriat et al., 2002). In Experiment 1, participants went through two rounds of study and test, making judgments of learning (JOLs) for each item during study. Half the participants studied the same list of paired associates in both rounds; half studied different lists. UWP was demonstrated only for the "same" group, supporting the suggestion that UWP is specific to studied items and does not generalize across lists. In Experiment 2, participants went through four study–test cycles for the same list of paired associates. JOLs were made for each item on all four rounds, on Rounds 1 and 4 only, or on Rounds 3 and 4 only. Delaying the start of JOLs amplified UWP: On the common, fourth round, underconfidence was greatest for those who made JOLs only on Rounds 3 and 4.

(5055)

A Contextual Test of Theories of Racism, Using a High-Dimensional Memory Model. ALEX HATSOPOULOS, CHRISTOPHER CREW, CURT BURGESS, & KEVIN LUND, *University of California, Riverside*—The psychological investigation of racism has traditionally been the domain of social and personality psychology. A limitation of these approaches has been the use of very abstract concepts and measurement devices with such obvious face validity and subjectiveness as to render them scientifically questionable. Using the hyperspace analogue to language (HAL; Burgess, 1998), a contextual model of meaning representation, we were able to examine the portrayal of minorities in an indirect, but completely contextually operationalized, manner without the use of human judgments. We compared CNN and FOX News along two dimensions (positive and negative words associated with minorities), in order to assess potential bias. Our results suggest that overall, the two networks do not differ with respect to the negative contexts in which minorities are presented; however, CNN presents minorities in a more positive manner than does Fox. We argue that these results are consistent with a theory of modern racism.

• Divided Attention •

(5056)

Divided Attention Effects on Recall of Related and Unrelated Words in Young and Old Adults. MYRA A. FERNANDES & CHERYL GRADY, *Rotman Research Institute*—Previous work shows that free recall of a list of unrelated words can be disrupted by dividing attention during retrieval, primarily when the memory and the distracting tasks use the same materials. Here, we compare interference effects, from either a word- or a digit-based distracting task, on recall for a list of related, as compared with unrelated, words in 48 young and 48 older adults. Reduced resource theories of aging suggest that an age-related loss of available processing resources impairs memory performance. As such, aging should amplify memory interference under divided attention conditions, especially when recall performance could benefit from using strategic and organizational processing resources, as in recall of categorized (related) word lists. Results show dividing attention during retrieval, using a word-based distracting task, coupled with the increased resource demands of a strategic test of memory, overextends the limited resources in older adults, leading to amplified memory interference effects, as compared with young adults.

(5057)

Dissociating, Attending, and Remembering. JESSICA E. KIERAS & JENNIFER J. FREYD, *University of Oregon*—Dissociation—the breakdown of normally connected processes of consciousness and memory—has been associated with exposure to abuse and trauma. Previous work (DePrince & Freyd, 1999) suggested that the cognitive capacities of high dissociators are impaired under conditions of focused (selective) attention, but not under conditions of divided attention, as compared with low dissociators. The present study extends these findings with a task order that is unconfounded with attention condition and with a new attention task. Two groups of undergraduates were recruited on the basis of their scores on the Dissociative Experiences Scale. They completed standard and divided attention versions of the Stroop paradigm and a new attention task. The stimuli included color, neutral, and emotional words. Reaction time in the attention tasks, subsequent memory (both recall and recognition), and trauma history were assessed. We consider the role of attention and memory in response to trauma and abuse.

(5058)

Attentional Limitations in Visual Short-Term Memory. BILJANA STEVANOVSKI & PIERRE JOLICŒUR, *Université de Montréal*—We investigated the attentional limitations of visual short-term memory (VSTM), using a dual-task paradigm. In the VSTM task, subjects viewed two visual displays separated by a short blank delay. The task was to decide whether the displays were the same or different. This VSTM task was paired with a concurrent speeded pitch discrimination task. The results suggest that there are attentional limitations on processing in VSTM: There was evidence of mutual interference between the VSTM task and the concurrent speeded choice task. This interference suggests that processing in VSTM requires central attentional resources that are also required for the speeded choice task. The experiments further investigated whether these attentional limitations were due to a cost of preparing for the concurrent task and whether attentional limitations were greater for conjunctions of features (e.g., color and orientation conjunctions) than for single features (color or orientation).

(5059)

Does Attention Modulate Semantic Priming With a Cross-Modal Divided-Attention Task? SACHIO OTSUKA & JUN KAWAGUCHI, *Nagoya University*—This study examined semantic priming following

an auditory divided-attention task with a visually presented prime. It is known that the amount of semantic priming depends on the prime task. When a large amount of processing resources is necessary for the secondary task, no priming occurs. On the other hand, after a prime task requiring fewer processing resources, significant priming is observed. Smith et al. (2001) proposed "attention modulation"—that semantic activation is modulated by the attention required for a prime. However, these experiments may confound competition due to similarity of target and secondary tasks with general attentional resources irrespective of modality. In this experiment, it was investigated whether semantic priming would be modulated by a prime task when an auditory secondary task was used. The results showed a smaller amount of priming in the divided-attention condition than in the control condition, even when the prime and the secondary tasks were cross-modal. This supports the attention modulation idea.

(5060)

Electrophysiological Investigations of Dual-Task Identification Delays. KAREN M. ARNELL, *Brock University*—A robust attentional blink (AB) is typically observed when two visual targets are presented within half a second of each other. However, the AB is often more difficult to observe when one target is presented visually and the other is presented auditorily. It is unclear whether this pattern is the result of greater difficulty in adequately masking auditory targets or the result of modality-specific attentional limitations. In this study, two targets (both visual or one visual and one auditory) were presented at variable temporal separations. The mask for the second target was removed, and the latency of the second target's P3 event-related potential was examined. At short target separations, the P3 component was delayed for both visual and cross-modal conditions. The results provide evidence for amodal processing limitations on stimulus identification and categorization and suggest that backward pattern masking difficulties may underlie the reduced AB in experiments with auditory targets.

(5061)

Search Asymmetry in Singleton Search Tasks. JUN SAIKI, *PRESTO & Kyoto University,* & KOHSKE TAKAHASHI & TAKAHIKO KOIKE, *Kyoto University*—Although an underlying mechanism of search asymmetry is still elusive, most accounts assume that top-down selection of target-defining features plays a crucial role. Subjects use more discriminable perceptual features in search for an A among Bs than vice versa, which implies that subjects know what the target is beforehand. To test the validity of this account, we investigated search asymmetry in singleton search tasks, where the target is unknown until the search display is presented. Using a typical stimulus set showing search asymmetry, O and Q, both target-defined and singleton search tasks showed significant search asymmetry, and the magnitude of asymmetry was not different between the tasks. The same pattern of results was obtained with more complex Chinese characters, "tongue" and its mirror reversal, known to show search asymmetry. These results suggest that top-down selection of the target-defining feature may not be necessary for search asymmetry to occur.

(5062)

System Configuration, Not Resource Limitation, Determines the Efficiency of Visual Search. SHAHAB GHORASHI & DANIEL SMILEK, *University of British Columbia,* JUN-ICHIRO KAWAHARA, *Hiroshima University,* & VINCENT DI LOLLO, *University of British Columbia*—We examined two theories of visual search: resource limitation, grounded in a static, built-in brain architecture, with attention seen as a limited depletable resource, and system reconfiguration, in which the visual system is dynamically reconfigured from moment to moment so as to optimize performance on the task at hand. In a dual-task paradigm, a search display was preceded by a visual discrimination task and was followed—after an ISI governed by a staircase procedure—by a pattern mask. Search efficiency, as indexed by the slope of the function relating critical ISI to number of distractors, was impaired under dual-task conditions for tasks that were performed efficiently (shallow search slope) when done singly, but not for tasks performed inefficiently (steep slope) when done singly. These results are consistent with system reconfiguration, but not with resource limitation, models and point to a dynamic, rather than a static, architecture of the visual system.

(5063)

A Hierarchy of Attentional Systems for Action: Evidence From the PRP Paradigm. HAGIT MAGEN & ASHER COHEN, *Hebrew University of Jerusalem*—Many studies suggest that selective attention can be divided into two hierarchically organized networks. It is often claimed that a higher level system (termed anterior or central attention) deals with action-related processes and that a lower level system (e.g., visual attention) is concerned with input selection. We challenge the latter classification and propose that both networks deal with different aspects of action-related processes. We use the PRP paradigm with the locus-of-slack method to examine our hypothesis. In a series of experiments, we embedded a variety of action-based interference tasks (e.g., spatial Stroop, Simon) as T2 and examined the pattern of interference over different SOAs. We demonstrated that the observed interference in the short-SOA conditions crucially depends on the involvement of visual attention in the resolution of the interference. We outline a model that sketches the division of labor between visual attention and central attention in dealing with action.

(5064)

Attention for Visually Guided Action and Perception. GENIVA LIU, JAMES T. ENNS, JOHN PJ. PINEL, & ROMEO CHUA, *University of British Columbia*—The dual-systems theory (Goodale & Milner, 1992) postulates a ventral system for conscious visual perception of objects and a dorsal system for guiding visual actions. This theory leaves unspecified whether there are common or separate attentional resources for each system. The present study examines dual-task interference when the first task is *ventral* and the second task is *dorsal* or *ventral*. Participants pointed either directly to a target (dorsal) or to a position displaced from the target (ventral). On some trials, the target unexpectedly jumped to a new location during a saccade. Pointing was performed alone or after discriminating the duration of a light (ventral). For dorsal pointing, measures of movement time, accuracy, and on-line correction for jumps were unaffected by the dual-task context. These results point to different attentional resources for ventral and dorsal stream tasks.

(5065)

How to Produce and to Avoid Attentional Blinks: An MEG Study and an Individual-Differences Analysis. BERNHARD HOMMEL, *Leiden University,* FRANK SCHMITZ, *Heinrich-Heine-Universität, Düsseldorf,* KIMRON SHAPIRO, *University of Wales,* & ALFONS SCHNITZLER, *Heinrich-Heine-Universität, Düsseldorf*—When people monitor a visual stream of rapidly presented stimuli for two targets (T1 and T2), they often miss T2 if it falls into a time window of about half a second after T1 onset—the attentional blink (AB). We analyzed the neural correlates underlying the AB and their dynamics by means of whole-head magnetoencephalography. Target-specific neural responses were found to originate mainly from sources in the bilateral temporo-parietal and frontal cortex. Both the temporal dynamics of these sources and interindividual differences in their activation nicely predicted the behavioral results: the more T2-induced activation the smaller, and the more T1-induced activation the bigger the AB. Taken together, our findings support the idea that the AB arises from "biased competition," with the (strategic) bias coming from frontal areas and the competition for identification taking place between codes in the temporo-parietal cortex.

(5066)

Effect of Attention on the Perception of Line Length. LINDA M. RUECKERT, *Northeastern Illinois University*—Patients with unilateral neglect due to right-hemisphere lesions typically underestimate

the lengths of the left sides of lines. However, with very short lines, they exhibit a "crossover" effect and overestimate the left sides. To determine whether this could be due to an exaggeration of the normal tendency to underestimate long lines and overestimate short lines, 18 normal adults were tested. Lines ranging from 1 to 20 cm were briefly presented on a computer screen. Subjects were asked to draw a line of equal length. In one condition, the attention paid to the lines was reduced by having subjects simultaneously rehearse six digits. Subjects showed the expected tendency to underestimate long and overestimate short lines. This effect was significantly greater when attention was reduced, suggesting that the crossover effect observed in neglect may simply reflect an exaggeration of the normal error pattern due to reduced attention to the left side of the line.

• Cognitive Control •

(5067)

Development of Executive Function in the Second Year of Life. SANDRA A. WIEBE, ANGELA F. LUKOWSKI, & PATRICIA J. BAUER, *University of Minnesota*—The first years of life are characterized by tremendous cognitive and neurological development. Although executive function does not reach adult levels until adolescence, there are significant changes early in life. Thirty children were tested longitudinally at 15 and 20 months on an imitation-based task tapping executive function. An experimenter demonstrated sequences of actions with novel props; each sequence led to a desirable goal. Children were then provided with an array of props that permitted imitation of these actions. However, the task was ambiguous such that the children lacked some information about which props and/or actions were needed to reach the goal. Thus, the task required substantial planning and cognitive control. Significant development in executive function was seen, beyond development in general imitation skill. Patterns of correlation between the executive function task and measures of working, short-, and long-term memory and inhibitory control elucidate possible mechanisms for developmental change.

(5068)

Aging and Concurrent Response Selection in Dual-Task Performance: The Effect of Practice. JENNIFER M. GLASS, *University of Michigan*—Although the deleterious effect of aging on dual-task performance has been well established, differences in the magnitude of this effect have been wide ranging. One possible reason for this is the amount of practice given subjects in various experiments. Older adults may require more practice to develop efficient task performance strategies, and erroneous conclusions may be drawn about the true dual-task abilities of older adults. The present experiments used the psychological refractory period procedure to examine the effects of aging on dual-task performance. The task parameters used in these experiments have previously yielded evidence for concurrent response selection in both young and older adults. For each experiment, there were three sessions. After the first session, few of the older adults demonstrated concurrent response selection, but after the third session, the majority showed concurrent response selection. These results highlight the importance of practice for studies of cognitive aging and dual-task performance.

(5069)

Cognitive Aging and Interferences From Lures on the Same Screen. ETSUKO T. HARADA, *Hosei University,* & SATORU SUTO, *Chuo University*—Although inhibitory processes are well known to be reduced with aging, little is known about effects of lures (attractive distractors) on the same screen for old people, which are frequently encountered in everyday lives. Three experiments were conducted to investigate these effects and their aging, using a Kanji selection task with four candidates presented after a context sentence: the correct Kanji, a homophone (the lure), and two distractors. In Experiment 1, both old and young participants showed declines of the correct rates from left to right target positions only when the lure was to the left of the target, whereas only old participants showed similar asymmetrical results on reaction time data. In Experiments 2–3, with sequential presentation of candidates, both groups showed the asymmetrical effects both on the correction rates and reaction time. The serial, but quasi-parallel, mechanism in young adults with simultaneous presentation will be discussed.

(5070)

Two Kinds of Inhibition Over the Lifespan. MICHELLE M. MARTIN & ELLEN BIALYSTOK, *York University*—A distinction is made between conflict tasks based on a single distracting element (univalent tasks) and those that contain two misleading cues (bivalent tasks). This distinction makes a different aspect of inhibitory control more relevant for each—specifically, inhibition of attention to perceptual cues for the former and inhibition of motor response for the latter. Participants in four age groups (5, 19–24, 40–45, 60–65) were compared on two tasks that manipulated the univalent/bivalent variable. The first was a combination of go/no-go (univalent) and flanker (bivalent) tasks, and the second was a Simon task that used central (univalent) or side (bivalent) presentation of the stimuli. The relative difficulty of the tasks for each group was examined. The bivalent tasks were disproportionately difficult for children and older adults, because the relevant form of inhibitory control is in the process of either developing (children) or declining (older adults).

(5071)

Executive Functions in Episodic Memory. TIMO MÄNTYLÄ, *University of Umeå*—Both prospective memory and source recall are assumed to reflect individual differences in executive functions. Yet the empirical support for the involvement of executive functions in these task domains is rather inconsistent and weak. One reason for these inconsistencies is that executive functions have been assessed by using poorly validated and unreliable "frontal" tests. The present study involved an individual-difference approach with three latent executive functions: mental shifting, information updating and monitoring, and inhibition of prepotent responses. Undergraduates completed a series of experimental tasks that were assumed to tap each target executive function, as well as separate tasks of prospective memory and source recall. The results suggested that the three target functions contribute differentially to performance on tasks of prospective memory and source recall. The findings are discussed in relation to the unity and diversity of executive functions and their contribution to episodic memory performance.

(5072)

Modeling Response Competition Using Task-Specific and Task-Invariant Executive Processes. TRAVIS L. SEYMOUR, *University of California, Santa Cruz*—The exclude recognition task is often used to explore the interaction between familiarity and recollective processes in recognition memory. Rejecting familiar but excluded items is slower and less accurate than rejecting unfamiliar new items. This work focuses on explanations involving conflict between familiarity-based and recollective memory processes. The present work recasts the exclude recognition task as a response competition task, rather than a memory task, and models the data as an interaction between executive control processes, memory processes, and peripheral motor processes. A general framework is developed where interactions between task-specific and task-invariant executive processes interact and constrain one another to produce response competition data. This framework is also used to model data from three variations on the Stroop task, rather than the typical approach using attention or response inhibition processes. This approach is supported by a series of quantitative computational models specified within the EPIC architecture.

(5073)

Systematic Errors in the Execution of Routine Procedures. MICHAEL D. BYRNE, *Rice University*—Even in the execution of relatively simple procedures, people make nonrandom errors; anyone

who has either sent or received an e-mail missing its promised attachment has experienced this. This research reports on the results of a series of experiments designed to investigate how cognitive control structures operate to yield such errors in computer-based procedural tasks. Participants performed two tasks that were isomorphs in terms of task structure but differed in terms of the visual layout of the task elements (e.g., buttons). Systematic differences in terms of error frequency and step completion time for the two tasks suggest that models of cognitive control for routine procedures that simply chain together control units (e.g., productions, schemas) based on such structures as step numbers or linked lists cannot, without additional machinery, explain the task performance. Alternative control schemes will be discussed.

(5074)

Temporal Dynamics of Deliberate Control. DANIEL N. CASSENTI & RICHARD A. CARLSON, *Pennsylvania State University*—Deliberate control occurs as goal representations evolve in stages: plans, intentions, procedures, and finally outcome representations. Coordination, placekeeping, and monitoring processes link evolving goal representations with perceptual and memorial objects on which they operate. We describe a model of the time course of deliberate control in multiple-step cognitive activities, such as counting and running arithmetic, and apply that model to placekeeping and monitoring. Several experiments tested its predictions. Participants counted events or performed running arithmetic in paradigms that varied the difficulty and availability of strategies for placekeeping. College student participants found these tasks challenging, despite the well-learned nature of component skills, exhibiting many failures of placekeeping and monitoring. Strategies and conditions that support fine-grained temporal coordination of cognitive events reduce the likelihood and change the nature of these failures. The results suggest that the objects of goals are often specified deictically and that monitoring of fluent performance is often implicit.

(5075)

Additive Factor Logic Used to Reveal Monkey Preparation Strategy in Task-Switching Paradigm. GIJSBERT STOET & LAWRENCE H. SNYDER, *Washington University School of Medicine*—Humans can rapidly switch between applying different stimulus–response (S–R) mappings. Task-switching studies have revealed that switching between S–R mappings requires preparation time: With increasing delay intervals between task cue and imperative stimulus, reaction time and error rate decrease. Yet it is unclear whether it is the preparation for the S–R mapping or the sensory encoding of the task cue that benefits from a longer delay. Whereas research on adult humans might use introspective reports to reveal the nature of processing during the cue–stimulus interval, this is impossible in nonverbal subject populations, including animals. We trained two rhesus monkeys on a task-switching paradigm and manipulated cue–stimulus interval and sensory features of the task-cues. Using additive factor logic, we found that monkeys do use the cue–stimulus interval for active preparation of the upcoming S–R mapping.

(5076)

Item-Specific Control in Global/Local and Attention Capture Tasks. BRUCE MILLIKEN, *McMaster University,* & JASON P. LEBOE & LAUNA C. LEBOE, *University of Manitoba*—Tasks that require a response to the less salient of two conflicting stimulus dimensions have been used widely to study attentional control. For example, Stroop interference provides a measure of control exerted over processing of the irrelevant word dimension. By varying the proportion of congruent items in a Stroop task at an item-specific level, Jacoby, McElree, and Trainham (1999) demonstrated control over processing of the word dimension that could not be attributed to strategic, preparatory processing prior to stimulus onset. We extended this method to global/local and attention capture tasks. There also, we observed item-specific control over processing of the irrelevant global letter and item-specific control over processing of irrelevant color singletons. These results contradict the notion that control over global processing stems only from controlled preparation of an appropriately sized attention focus and that control over attention capture stems only from a preparatory control set.

(5077)

Skill Execution and the Self: What Can Stereotype Threat Teach Us About Real-Time Task Performance? SIAN L. BEILOCK, ROBERT J. RYDELL, & ALLEN R. McCONNELL, *Miami University,* & THOMAS H. CARR, *Michigan State University*—Stereotype threat occurs when activation of a negative stereotype about one's own social group induces performance decrements. We explored the cognitive substrate governing these failures in modular arithmetic (MA). In Experiment 1, women performed unpracticed MA problems with varying working memory demands. Difficult, demanding problems were impaired by introducing a negative stereotype (men are better at math than women). In Experiment 2, women practiced MA problems 48 times each (high practice) or only once (low practice) before the negative stereotype introduction. Easy problems did not fail under threat, regardless of practice, nor did difficult high-practice problems (which had become automated with practice). However, difficult low-practice problems suffered (replicating Experiment 1). In working-memory-intensive cognitive tasks such as MA, negative stereotype activation hurts performance via working memory limitations. This contrasts with sensorimotor skills such as golf putting, where stereotype threat operates by prompting too much attention to well-practiced execution, rather than too little attention to novel execution.

• Speech Perception •

(5078)

The Effect on Lexical Access of Arbitrary Versus Phonologically Regular Variation. MEGHAN SUMNER & ARTHUR G. SAMUEL, *SUNY, Stony Brook*—Spoken words exhibit considerable variation from their hypothesized canonical forms. Some variation is arbitrary and unpredictable, whereas some is governed by phonotactic principles. This project examines whether rule-governed variation has different consequences for lexical access than does arbitrary variation, using an auditory–auditory priming paradigm. Monosyllabic words with final /t/ were used as primes. Four versions of each prime (e.g., prime = *jet*, target = *plane*) were recorded: (1) the canonical form (je[t]), (2) a coarticulated, nonreleased form (je[?t], with ? = glottal stop), (3) a legally changed form with no coarticulation (je[?]), and (4) an arbitrarily changed form (je[p]). These conditions test whether facilitation occurs when primes are legally changed forms, but not when they are arbitrarily changed, and whether there are no differences in target word activation between the variants of /t/ and its canonical pronunciation, as would be predicted by the view that legal variation should not hinder lexical access.

(5079)

Dichotic Target Detection With Attention Control. DANIEL VOYER, FRANK SZELIGO, & NANCY L. RUSSELL, *University of New Brunswick*—The present study investigated the magnitude and reliability of laterality effects in a dichotic task using a simple attention control procedure. Twenty-five participants completed a dichotic task requiring them to identify the ear to which a target word was presented by circling *left*, *right*, or *neither* on a response sheet for each trial. A large and reliable right-ear advantage was obtained on correct responses. In addition, there were more left-ear stimuli misattributed to the right than right-ear stimuli misattributed to the left. The equal number of left and right false alarms excluded the possibility of a general tendency to circle *right* more often than *left*. The discussion emphasizes the usefulness of requiring ear identification in target detection to ensure an equal division of attention in dichotic listening. It also proposes a measure of laterality that minimizes attentional effects.

(5080)

How General Is Lexically Driven Perceptual Learning of Phonetic Identity? TANYA KRALJIC & ARTHUR G. SAMUEL, *SUNY, Stony*

Brook—Lexical context strongly influences listeners' identification of an ambiguous sound—for example, one midway between /f/ and /s/. Such a sound is reported as /f/ in "sheri_," but as /s/ in "Pari_." Norris, McQueen, and Cutler (2003) demonstrated that hearing such lexically determined phonemes subsequently expanded listeners' phonetic categories to include more of these ambiguous tokens than before. We tested whether listeners adjust their phonetic categories for a specific speaker: Are listeners learning a particular speaker's "accent"? Similarly, we examined whether the perceptual learning is specific to the particular phonemes that listeners are exposed to, or whether the adjustments generalize to related sounds. Participants heard ambiguous /d/ or /t/ phonemes during a lexical decision task. They then categorized sounds on /d/–/t/ and /b/–/p/ continua, either in the same voice they had heard for lexical decision or in a different voice. The results clarify the properties and function of perceptual learning.

(5081)

Generalization in Japanese /r/–/l/ Perception: Shining a Light on the Right Cue. ERIN M. INGVALSON, LORI L. HOLT, & JAMES L. MCCLELLAND, *Carnegie Mellon University*—Native American English speakers predominantly rely on *F*3 to discriminate /r/ and /l/, but native Japanese speakers fail to use this cue when attempting to identify the sounds (Yamada & Tohkura, 1991). Other research (e.g., Logan et al., 1991) demonstrates some success in teaching native Japanese to hear the contrast in natural speech sounds, but it is unclear what cues the listeners are using. Synthetic /r/ and /l/ stimuli were created, differing only on *F*3, and were presented to native Japanese in a protocol that promotes learning with natural /r/–/l/ stimuli (McCandliss et al., 2002). No effects of learning were found, and there was nearly total insensitivity to the *F*3 cue after 4,000 trials of training with feedback. Further research is needed to determine whether sensitivity to this cue can be trained using other methods.

(5082)

Word Segmentation Benefits from Diminutives: Cross-Linguistic Evidence. VERA KEMPE, *University of Stirling,* PATRICIA J. BROOKS, *City University of New York,* & STEVEN GILLIS, *University of Antwerp*—Diminutives, a pervasive feature of many child-directed speech registers, are characterized by a high degree of invariance in their endings. A previous study using pseudo-Dutch materials (Kempe, Gillis, & Brooks, 2002) showed that word-ending invariance aids word segmentation. In this study, we attempt to broaden the cross-linguistic evidence for this claim and to increase its ecological validity. Adult native English speakers listened to Russian pseudo-nouns embedded in a 20-min stream of natural Russian sentences whilst drawing a picture. The pseudo-nouns were modeled after Russian masculine diminutives and varied systematically in the invariance of final syllable onsets and rhymes. A subsequent forced-choice test showed that recognition performance improved with increasing ending invariance. The findings confirm that ending invariance is a valid segmentation cue in artificial, as well as naturalistic, speech and that segmentation benefits from diminutives may exist in a number of languages.

(5083)

Eye Movements Reveal the Time Course of Multiple Context Effects in the Perception of Assimilated Speech. DAVID W. GOW, *Massachusetts General Hospital,* & BOB MCMURRAY & MICHAEL K. TANENHAUS, *University of Rochester*—In production, spoken segments with alveolar place of articulation often assimilate the place of subsequent consonants ("eight babies" sounds like "ape babies"). Recent research shows that listeners use postassimilation context to interpret modified segments and that assimilated segments affect interpretation of postassimilation context. Competing theoretical accounts explain these effects either as statistical inference processes or as perceptual grouping of phonetic cues. We tested differing predictions of these accounts concerning the time course of processing. Eye movements were monitored as participants heard spoken instructions to select one of four images described by a two-word phrase (e.g., "eight babies"). Item names manipulated assimilation status, place of articulation, and assimilation context. Distractor images reflected possible interpretations of the assimilated and context segments. Experiment 1 examined progressive facilitation effects, using anticipatory eye movements to the context item. Experiment 2 explored the relative time course of progressive and regressive effects in the interpretation of assimilated speech.

(5084)

On the Perception of Similarity Among Talkers. ROBERT E. REMEZ & JENNIFER L. VAN DYK, *Barnard College,* JENNIFER M. FELLOWES, *New York Presbyterian Hospital,* & DALIA SHORETZ NAGEL, *Harvard University School of Medicine*—A listener who recognizes a talker notices attributes of the talker's voice that persist despite the novelty of each utterance. Accounts of identification have presumed that consistency in an individual's speech is determined by a talker's unique anatomy, independent of the acoustic attributes that convey a linguistic message. Alternatively, some studies suggest that attention to attributes of a talker includes the indexical linguistic attributes of dialect and idiolect conveyed in the articulation of consonants and vowels. This investigation sought direct evidence of attention to phonetic attributes of speech in the identification of talkers. Natural samples and sinewave replicas were used in tests of perceptual similarity. Three experiments revealed that the subjective similarity of individual talkers is preserved in the absence of natural vocal quality and that global acoustic properties of speech, as well as local phonetic segmental attributes, are exploited when listeners assay the characteristics of individual talkers.

(5085)

Individual Differences in Audiovisual Speech Processing and Working Memory Capacity. SONYA SHEFFERT, JESSICA EDWARDS, MICHELLE WILSON, EMILY SHAFFER, & ASHLEY RADAWSKI, *Central Michigan University*—In two studies we demonstrate that the operation span task (a complex working memory measure) predicts listeners' ability to transcribe spoken sentences presented multimodally (voice + face). Subjects were presented with multimodal or unimodal (voice alone) sentences for immediate written recall. The data showed that subjects with high working memory capacity performed better with the multimodal sentences, as compared with the unimodal sentences. The opposite pattern was found among the low working memory span subjects, who tended to remember the unimodal sentences better than the multimodal sentences. Additional measures of verbal and nonverbal executive control suggest that low-span individuals may be less able to inhibit attention to linguistically irrelevant facial information. The results will be discussed in terms of how resources are allocated between multimodal language and memory processing.

• PSYCHOLINGUISTICS •

(5086)

Context Effects on Gender Retrieval in Italian Epicenes. CRISTINA CACCIARI & ROBERTO PADOVANI, *University of Modena,* MANUEL CARREIRAS, *University of Tenerife, La Laguna,* & ALBERTO VERZELLESI, *University of Modena*—Syntactically, epicene words (e.g., "la vittima," "the victim") are either feminine or masculine but can be used to refer to both male and female individuals, since they can have both a linguistic and a conceptual gender (Cacciari et al., 1997, 2001). We explored the time course of linguistic and conceptual information retrieval in assigning an antecedent to a pronoun when it coreferred with an epicene. We used a noncumulative self-paced moving window technique. In Experiment 1, neutral, gender-congruent and gender-incongruent contexts were used that ended with a sentence whose referent in the subject position was an epicene. The final sentence started with a pronoun matching its syntactic gender. In Experiment 2, the same contexts were used, but the final sentence was varied in that a pronoun mismatching the syntactic gender of the epicene and matching the conceptual gender biased by the context was used.

(5087)

Literal and Idiomatic Meaning Activation in Italian Idioms. CRISTINA CACCIARI & PAOLA CORRADINI, *University of Modena*—In Experiment 1, participants read sentences containing an Italian familiar ambiguous idiom (e.g., "break the ice") followed by a sentence with a literal or a figurative bias. For predictable idioms, reading a literally oriented critical segment took longer, and the reverse was true for unpredictable idioms. In Experiment 2, a cross-modal lexical decision paradigm was used. Predictable and unpredictable idioms were preceded by a literal or a figurative context. An idiomatically associated target was presented before the idiom (control condition) or at its offset. Idiomatic targets were facilitated with respect to controls, irrespective of the contextual bias. An effect of idiom predictability was found with faster decision times for predictable idioms. In both experiments, a significant difference emerged between fast and slow readers, suggesting a role for cognitive individual differences.

(5088)

Metaphors More Apt Than Similes! Conventionality Plays Minor Role? JOHN M. KENNEDY, *University of Toronto, Scarborough,* DAN CHIAPPE, *California State University, Long Beach,* & MEGAN COWLEY, *University of Toronto, Scarborough*—Subjects got pairs of words such as *crime*/*disease*. They made sentences and judged their fabrications as metaphors, similes, or "other." They also rated the sentences on "aptness" and on how "conventional" they deemed their use of the vehicle (*disease*) to comment on the topic (*crime*). Metaphors (*life is but a dream*) are styled after literal category claims (*Vancouver is a super city!*) requiring the subordinate (*Vancouver*) to have defining features of the superordinate (*city*). Similes have the form of literal comparisons (*But Vancouver is a bit like a wet Toronto . . .*) that require some relevant features, but not the essential ones. Category claims are more demanding than similarities, so their stepchild metaphor should demand more key features than does a simile. Indeed, subjects rated their own metaphor productions as more apt than their own similes, with just a minor effect of vehicle conventionality "barely peeking through Vancouver's clouds."

(5089)

Understanding Metaphors: Is the Right Hemisphere Uniquely Involved? NATALIE A. KACINIK & CHRISTINE CHIARELLO, *University of California, Riverside*—Research with brain-injured individuals suggests that the right hemisphere (RH) is preferentially involved in understanding figurative language, whereas evidence from noninjured participants has been mixed (Anaki et al., 1998; Coulson, 2000). We conducted several divided visual field priming experiments examining each hemisphere's involvement in comprehending metaphors of increasing linguistic complexity. Experiments 1 and 2 investigated ambiguous words with literal and metaphoric meanings in single-word and sentence contexts, whereas Experiment 3 involved standard metaphors (e.g., *His girlfriend's face was a storm*). Although some RH metaphor priming was obtained in both sentence and single-word priming conditions, the results did not strongly support the RH figurative language hypothesis. Metaphor priming also occurred in the left hemisphere at early time courses (100-msec SOA) or when supported by a sentence context. Results are discussed in terms of current theories of cerebral asymmetries for processing language and theories of metaphor comprehension.

(5090)

Metaphoric Meaning Activation: Is There an Effect of Language Status? FRANCISCO MARTÍNEZ & JYOTSNA VAID, *Texas A&M University,* & ROBERTO R. HEREDIA, *Texas A&M International University*—Previous research using a true/false judgment task concluded that metaphoric meaning is activated nonoptionally in fluent users of a language (Glucksberg, Gildea, & Bookin, 1982). The present research examined whether this extends to nonnative language users. Spanish–English and English–Spanish adult bilinguals and monolingual controls were to decide on the literal truth or falsity of statements whose salient meaning was literal (e.g., *Some animals are dogs* or *Some weapons are pelicans*) versus statements that allow for a metaphoric interpretation (e.g., *Some jobs are jails* or *Some cats are detectives*). In the latter case, the statements are figuratively true, even though literally false. If figurative meaning activation is nonoptional, metaphoric statements should show a slower "false" decision, relative to nonmetaphoric false statements. Moreover, if a metaphor interference effect is found across first and second languages, it would demonstrate that automatic activation of figurative meaning is not limited to the most fluent language.

(5091)

The Role of Semantic Anomaly in Moses-Like Illusions. DONALD G. MACKAY, *UCLA,* & MEREDITH A. SHAFTO, *University of Oxford*—This study examines the role of semantic novelty detection in the Armstrong illusion, a Moses illusion-like effect caused by phonological similarity. For example, participants miscomprehend Louis Armstrong as Neil Armstrong in the question, "What was the famous line uttered by Louis Armstrong when he first set foot on the moon?" (see Shafto & MacKay, 2000). To manipulate novelty detection, we created two new conditions by replacing the valid name in Armstrong questions (e.g., Neil Armstrong) with phonologically similar names that the participants did not know, either Rick Armstrong (no semantic conflict with the target name) or Mary Armstrong (gender conflict with the target name). The Armstrong illusion occurred more frequently in the no-conflict condition than in the original Armstrong condition and as frequently in the gender conflict condition as in the Armstrong condition. These results suggest that semantic novelty detection plays an important role in comprehension failures, such as the Moses and Armstrong illusions.

(5092)

Forward Versus Backward Processing of Subject–Verb Agreement in Comprehension. ERIC S. SOLOMON & NEAL J. PEARLMUTTER, *Northeastern University*—Two comprehension experiments examined whether syntactic features in subject–verb agreement are processed during the parser's forward movement through a sentence or through a backtracking process instead. We focused on predictions with respect to nonovertly marked modal verbs, which could be biased in favor of one number alternative over another. Counts of subject noun phrase number revealed five singular-biased modals and two equibiased modals. In Experiment 1, singular versus plural local noun conditions were compared for pure singular verbs ("was"), singular-biased modals, and equibiased modals in a grammaticality judgment task. The largest mismatch effect appeared for "was," an intermediate effect occurred for singular-biased modals, and there was no effect for equibiased modals. Experiment 2 compared reading times for singular-biased and equibiased modals within singular or plural subject noun phrases and revealed a larger number effect for singular-biased modals. The results suggest that agreement features are processed by a forward-checking mechanism.

(5093)

Production Constraints and Comprehension Difficulty: The Case of Object Relatives. SILVIA GENNARI & MARYELLEN C. MACDONALD, *University of Wisconsin, Madison*—We use object relative clauses (ORs; *the man that Mary saw . . .*) to investigate how word and structure choices during language production create distributional patterns that, in turn, affect language comprehension. Speakers tend to use ORs more often to modify inanimate nouns than animate ones and use passive constructions with some verbs more than with others. These tendencies create distributional patterns in the language, with the result that comprehenders gain more experience with certain thematic role assignments than with others. We report production, corpus, and self-paced reading studies identifying patterns of verb and noun use in OR production and show that less practiced patterns cause processing difficulty. The rate of verb-based passive usage in production predicted reading times for ORs, and reading times also varied with

noun animacy. Thus, the ease of OR comprehension varies with previous experience with distributional patterns, which are themselves driven by production factors, such as lexical accessibility.

(5094)

Effects of Referential Processing and Noun Phrase Type on Comprehension of Cleft Sentences. FRANTISEK KUMINIAK & RANDI C. MARTIN, *Rice University*—Although object-extracted clefts are more difficult to comprehend than subject-extracted clefts, their difficulty is modulated by the types of NPs used. To find out whether the differences relate to referential processing (Gibson, 1998) or confusability in memory resulting from matching NP types (Gordon et al., 2001), we compared comprehension of clefts with different types of NPs (semantically related vs. unrelated descriptions, pronouns and proper names) for young and old subjects and for a patient with a semantic STM deficit. The detrimental effects of matching NP types were mediated by semantic confusability of the NPs, supporting the memory confusability position. However, sentences with two pronouns were processed as easily as sentences with one pronoun and one description, consistent with the referential processing position. The patient showed no improvement for mismatched, relative to matched, NP types, which could be due to the sparse semantic information in pronouns and proper names.

(5095)

Comprehending Reflexive Pronoun Anaphors: Discourse Prominence and Co-Reference Resolution. SHELIA M. KENNISON, *Oklahoma State University*—The research investigated Badecker and Straub's (2002) claim that during co-reference resolution, the initial set of candidate antecedents excludes discourse entities that lack prominence in the local discourse, such as genitive NPs in sentences containing reflexive pronoun anaphors. In Experiment 1, reading time was measured on sentences containing a reflexive pronoun anaphor preceded by an antecedent modified by a genitive NP. The gender of the antecedent and the genitive NP either matched or mismatched (e.g., *The executive's father cut himself* and *The secretary's father cut himself*.). Co-reference resolution took longer when the genders mismatched than when the genders matched. In Experiment 2, reading time was measured on sentences in which the antecedent for the anaphor preceded, rather than follow, the gender matching or mismatching noun (e.g., *The father of the executive/secretary*). Co-reference resolution again took longer when the genders mismatched than when they matched. Implications for theories of referential processing will be discussed.

(5096)

Implicit Causality and Pronominal Reference. OREN SCHWARTZ & WILLIAM BADECKER, *Johns Hopkins University*—Implicit causality, a property of some verbs, favors the verbs subject (for NP1 verbs such as *bore*) or object (for NP2 verbs such as *appreciate*) for subsequent reference. Studies conflict over whether implicit causality alters the relative prominence of subject and object referents in the focus of attention or whether this aspect of verb semantics only influences processes that later select among antecedent candidates. We look for implicit causality effects on focusing by measuring repeated name effects in self-paced reading. The type of anaphor (pronoun vs. repeated name) was crossed with verb type (NP1 vs. NP2) for anaphors with subject or object antecedents (e.g., *Nick bored*/*appreciated Alice. He*/*Nick talked to her*/*Alice every day*). The absence of effects for verb type, in combination with strong repeated name penalties for subjects for both verb types, suggests that verb causality may, at best, play a subordinate role in ranking entities in the focus of attention.

(5097)

Eye Gaze Has Immediate Effects on Reference Resolution in Conversation. JOY E. HANNA & SUSAN E. BRENNAN, *SUNY, Stony Brook*—Studies of conversation typically prevent visual contact between interlocutors. Since eye gaze is an important source of information in face-to-face conversation, we monitored interlocutors' eye movements in a referential communication task, to determine how they would coordinate and use eye gaze during reference resolution. Speakers and addressees could see each other over a barrier, which hid their horizontal displays. The speaker's display was informative (a mirror image of the addressee's), a reversed mirror image, or noninformative (a circular rather than horizontal arrangement). Speakers' object descriptions were accompanied by eye movements to the target, which was next to or far away from a competitor. Addressees' first fixation was most often to the side of the display that the speakers were fixating. Target identification was speeded in informative displays and when the competitor was far away. Analyses also explore the degree to which addressees can use object-oriented gaze as a strategic visual cue.

• Reasoning and Problem Solving •

(5098)

Reasoning About Familiar and Blank Properties. SERGEY BLOK & DOUGLAS L. MEDIN, *Northwestern University*—An important goal of models of category-based induction is to be able to account for reasoning with both blank and familiar properties. ProbSim is a model of conditional probability that integrates prior probability and similarity information, exhibiting a good fit to judgments about familiar properties. Assuming that blank properties can be characterized as having uniform priors across categories in a domain, ProbSim predicts the use of similarity for single-premise arguments and weak diversity effects for multiple-premise arguments. Nonetheless, it appears that standard argument evaluation tasks elicit substantial use of diversity, which may lead ProbSim to underpredict the use of diversity. We used a probability estimation task to probe for diversity effects. Contrary to standard finding and consistent with ProbSim, we observed only weak use of diversity, with participants relying on premise–conclusion similarity as the dominant strategy. Findings are discussed in terms of differences between probability estimate and argument choice paradigms.

(5099)

Strategies in Resolving Anomalous Data in Diagnostic Reasoning. ANDREAS KEINATH & JOSEF F. KREMS, *Chemnitz University of Technology*—The resolution of anomalous data is an important factor for successful scientific discovery, medical diagnosis, or everyday problem solving. Although there exist some studies on psychological responses to anomalous data in general, little attention has been paid to the role of the initial hypothesis later contradicted by anomalous evidence. In two experiments, we investigated the influence of unspecific (e.g., representing a class of explanations), as opposed to specific (e.g., a single explanation), initial hypotheses on anomaly resolution. Our results suggest that, in contrast to specific hypotheses, unspecific hypotheses facilitate successful anomaly resolution and, therefore, hypothesis change. Furthermore, analysis of verbal protocols indicated that the advantage of unspecific hypotheses may be due to increased hypothesis space search, whereas specific hypotheses are more likely to trigger instance space search.

(5100)

Discovering Deep Structure Through Comparison: Does Property Depth Matter? JEREMIAH J. TRUDEAU & JAMES A. DIXON, *University of Connecticut*—Comparison of surface features has been shown to facilitate use of deep structure in later cognition. This has been taken as evidence that the comparison process itself drives discovery of deep structure. The present study examined whether this effect is moderated by the depth of the properties being compared. Participants were asked to discover common properties between two sets of gear systems and to determine which of another pair shared this common trait. The common properties for the initial blocks were either deep or shallow. The common property for the test block was the turning direction of the last gear in the system, an inherently deep property. Consistent with a strong view of structure's arising from comparison, no differences were found between deep and shallow initial

conditions. However, time spent studying the initial systems before correct (but not incorrect) answers strongly predicted performance on the test block, even when accuracy was statistically controlled.

(5101)

Do Students Judge Mathematical Proofs to Be Valid Reasoning? PATRICIA BAGGETT, *New Mexico State University,* & ANDRZEJ EHRENFEUCHT, *University of Colorado*—Mathematical proofs use two-valued logic. This means that in any mathematical structure, every syntactically correct sentence is either true or false. The meaning of logical connectives (*and*, *or*, *not*, . . .) is well defined and does not depend on the context in which a connective is used. Students with different mathematical backgrounds were asked to evaluate mathematical sentences. Most students (1) also used other logical values (e.g., "neither true nor false") when given the opportunity, (2) assigned the values true and false differently than is done in mathematics, and (3) interpreted logical connectives differently depending on the context. It is possible that students' difficulty with proofs is due to the fact that they do not see some mathematical proofs as being valid reasoning. The finding also calls into question NTCM's (2000, p. 56) statement, "A mathematical proof is a formal way of expressing particular kinds of reasoning and justification."

(5102)

The Role of Mapping and Comparison in Relational Predication. LEONIDAS A. DOUMAS & JOHN E. HUMMEL, *UCLA*—Relations play a central role in human perception and cognition, but little is known about how relational concepts are acquired. We report an experiment testing the hypothesis that structure mapping (a.k.a. analogical mapping) plays a key role in this process. The results suggest that mapping does indeed facilitate the predication of novel higher order relations among familiar first-order relations, but only when the learner has first explicitly predicated the relevant first-order relations.

(5103)

Barbie Doll, Spatial Intelligence, Threat, and Physiological Arousal. CRISTINA M. CARRASQUILLO, MARNIE G. KAGAN, CHAD FORBES, SETH L. DUNCAN, MARK W. GEISLER, & TALIA BEN-ZEEV, *San Francisco State University*—Barbie doll (1994) said, "Math is hard!" Females who are reminded of stereotypes experience situational underperformance (Steele, 1997). The present study examined the role of physiological arousal in producing this stereotype threat. Physiological arousal was measured by heart rate, skin conductance response (SCR), and electroencephalographic activity in the alpha (8–13 Hz) and beta (13–30 Hz) bands from right and left frontal lobes. In the threat condition, females were told to complete a spatial intelligence test (Trail Making Test) and that their performance would be compared with a male confederate's. In the no-threat condition, there was no mention of intelligence, and the comparison confederate was a female. Preliminary results suggest that females under threat performed worse on the TMT than did those under no threat, as was expected. Importantly, females under threat had a higher mean heart rate, greater SCR, and decreased beta band activity, as compared with females under no threat.

(5104)

Assessing the Unobservable: Inferring the Impact of Hidden Causes. YORK HAGMAYER, MATTHIAS RAPPE, & MICHAEL R. WALDMANN, *University of Göttingen*—Normatively the causal impact of a single observed cause upon a single effect can be correctly estimated from data only if certain assumptions about other hidden causes of the effect hold. Power PC theory (Cheng, 1997) assumes that the target cause occurs independently of all other unobserved causes. Bayesian theories often use the notion of a noisy-or gate to model hidden causes, which also ensures independence (Jensen, 1997). These assumptions allow it to estimate the impact of both the observed and the unobserved causes. In two experiments, participants either only observed the target cause or actively manipulated it. The results show that participants do not generally make independence assumptions. Proportional to the probability of the effect in the absence of the target cause, an increasing negative dependency of the target and the hidden cause was assumed. The theoretical consequences of these findings will be discussed.

(5105)

Talk-Aloud Data Supporting the Relative Importance of Example Quality Over Learner Quality. RICHARD CATRAMBONE, *Georgia Institute of Technology*—Learners studied example mechanics problems (e.g., blocks on inclined planes) that either did or did not highlight relevant subgoals. They then solved isomorphs and far transfer problems. Transfer performance was affected by whether or not subgoals were highlighted in the examples. Talk-aloud results provided converging evidence, during both the study and the problem-solving phases, for greater subgoal learning by the "subgoal" group. Interestingly, individual differences (e.g., GPA, SAT) did not play a role in performance. This might suggest that, in some cases, the quality of the examples might play a larger role in initial learning and problem solving than does the quality of the learner.

(5106)

Effects of Individual Differences in Spatial Working Memory on Cognitive Planning. ERIC G. FREEDMAN & RAE E. CORNING, *University of Michigan,* & CHRISTOPHER J. HERZOG, *Kansas State University*—The effects of spatial working memory (WM), problem difficulty level (i.e., 1–8 moves), type of indirect problem (i.e., control, move ball from goal, inhibit prepotent response), and problem order (i.e., random, increasing or decreasing difficulty) were investigated in the Tower of London (TOL) task. In the TOL, participants planned a sequence of moves to get a start configuration of balls into a goal configuration. Planning times increased with increasing difficulty level, although no individual differences in spatial WM were obtained. Move times also increased as a function of greater problem difficulty, but, individuals with low spatial WM showed a relatively greater increase in move times as difficulty increased. Additionally, the type of indirect problem and problem order produced significant effects on planning. Implications of these findings for neuroscientific and computational models of the role of the prefrontal cortex in complex cognition and executive control will be discussed.

(5107)

Conceptual and Perceptual Recoding in the Reproduction of Solutions to Candidate Insight Problems. EDWARD P. CHRONICLE & THOMAS C. ORMEROD, *Lancaster University,* & JAMES N. MACGREGOR, *University of Victoria*—We have recently argued that knowledge of how solutions are recoded may be important for understanding insight. In two experiments, we manipulated the likelihood that solutions would be recoded in terms of either conceptual or perceptual attributes of the sequence of moves leading to solution. Both experiments used variants of our novel six-coin problem. In Experiment 1, the initial proportions of successful solutions to the conceptual variant and standard problems were similar. After solutions had been demonstrated, accurate solution reproduction was significantly more frequent with the conceptual variant. In Experiment 2, a perceptual variant was created by using two different colors of coin. The perceptual variant did not lead to significant improvements either in the initial proportion of successful solutions or in accurate reproduction. Taken together, the results of the two experiments support our view that post-solution conceptual recoding is a crucial component of insight.

(5108)

The Role of Mental Representation in Problem Solving. ZHENG LI & ZYGMUNT PIZLO, *Purdue University*—Our previous work on the traveling salesman problem and on the 15-puzzle suggested that humans use pyramid representations involving hierarchical clustering to solve problems. We tested this suggestion by manipulating mental representation of the M + M puzzle, a sliding tile puzzle. The M + M puzzle can be presented to a subject in two quite different ways. The re-

sults indicate that these two presentations of the same problem were indeed treated as different problems by the subjects. One presentation allowed the subjects to solve the problem quickly, whereas the other made it very difficult, if at all possible, to solve the problem. Simulation experiments showed that the two presentations of the M + M puzzle lead to different pyramid representations, which in turn lead to different solutions. The presentation that was easy for the subjects was also "easy" for the pyramid algorithm. These results provide direct evidence for the role of mental representation in problem solving.

(5109)

Solving More Difficult Math Problems: Psychology Versus Math Students. MARK H. ASHCRAFT, THOMAS J. LESKOVEC & KELLY S. RIDLEY, *Cleveland State University*—We present some initial results on college students' problem solving when they deal with more advanced mathematics—that is, mixed operation problems with exponents, algebraic notation, and functions [e.g.; $x = 16$ or $x = 7$, $f(x) = (x - 5)^2 + 4$]. Upper-level math students show strong proficiency on these difficult problems, with a much shallower problem size effect than for introductory psychology students, who show serious difficulties (very slow RTs, high error rates) with those same problems. We relate problem-solving performance to measures of math competence and working memory and present preliminary results with a task (delayed verification) that may be of use in future studies.

• Judgment & Decision Making •

(5110)

Heuristic Decision Making in Threat Assessment. DAVID J. BRYANT, *Defence R&D Canada*—Research investigated the applicability of the fast and frugal heuristic framework (Gigerenzer, Todd, & The ABC Group, 2000) to the "threat assessment" task, which is the classification of sensor contacts according to their threat level, performed by naval operations officers. In a simulated naval warfare environment, participants learned to classify sensor contacts as friend or foe on the basis of probabilistic cues. Participants then performed a test session in which they chose which cues to inspect before classifying a contact. The take-the-best-for-classification (TTB-C) heuristic is proposed as a potential fast and frugal heuristic for threat classification. The patterns of participants' cue selections and their threat classification judgments provided evidence of use of TTB-C by some participants under some conditions. People's understanding of the information structure underlying threat classification and the conditions promoting the use of fast and frugal heuristics are explored.

(5111)

Incentive Relativity and Sampling Behavior in Least Chipmunks. LYNN DEVENPORT, JENNIFER PENNER, & JENNIFER BROSTEK, *University of Oklahoma,* & JILL DEVENPORT, *University of Central Oklahoma*—Choosing between a pair of patches, one of known quality and one of unknown quality, is a risk-sensitive problem. We suspected that the such choices would be influenced by variation in the quality of patches experienced in the foraging context prior to the choice test. We gave groups of chipmunks several days' experience with two patches of either the same or differing quality. Then we removed one of the known patches and left the other in place. At the same time, we introduced a new patch in a different position into the foraging room and recorded first choices. Chipmunks that had previously experienced patches of the same quality were risk prone. Most sampled the new patch first. However, if they had previously experienced patches of differing quality, choices were predictably related to (1) the missing patch, and (2) the degree to which it differed from the remaining known patch.

(5112)

Correlates of Decision-Making Style With Performance Measures on Laboratory Versus Real-Life Decision Tasks. KATHLEEN M. GALOTTI, *Carleton College*—Participants in two studies filled out an inventory of their general decision-making style (General Decision-Making Style or GDMS survey; adapted from Scott & Bruce, 1995). Undergraduates completing a laboratory decision-making task modeled after Payne's (1976) choosing-an-apartment task showed few differences in performance as a function of their decision-making style. In contrast, parents choosing a first-grade placement for their kindergarten children did show several significant correlations with performance measures and decision-making style. Implications of these differences will be discussed.

(5113)

Probability Learning in Language and Judgment. J. ISAIAH HARBISON & STEPHEN E. EDGELL, *University of Louisville*—Recent research has discovered that humans are highly sensitive to the transitive probabilities between syllables (e.g., Saffran, Aslin, & Newport, 1996). Follow up studies have replicated this finding with nonlinguistic stimuli, such as visual shapes (e.g., Fiser & Aslin, 2002), suggesting that this sensitivity is not particular to language. The present work investigates whether there could be an overlap between the probability learning studied with respect to word segmentation in language acquisition and the probability learning studied within the area of judgment and decision making. This possibility is supported by the success of models from the judgment literature in predicting the language findings.

(5114)

Comparison-Induced Sequence Effects. JESSICA M. CHOPLIN, *Vanderbilt University*—Evaluations of magnitude often depend upon the sequence in which items are presented. The author proposes a quantitative model of sequence effects on magnitude evaluation in which each item in a sequence is compared with the most similar recent item observed. These comparisons, in turn, create bias in evaluations of magnitude (Choplin & Hummel, 2002). Unique predictions of this model were tested and verified using a paradigm in which sequences either periodically ascended (i.e., ascended for *n* trials, dropped back down, and ascended again) or periodically descended by small or large amounts. Consistent with previous models, of those participants who observed small differences between successive magnitudes, those who observed ascending sequences judged values to be larger than did those who observed descending sequences. However, contrary to previous models, of those participants who observed large differences between successive magnitudes, those who observed ascending sequences judged values to be smaller than did those who observed descending sequences.

(5115)

Evaluating the Small-Sample Advantage in Inferences About Population Correlations. RICHARD B. ANDERSON, MICHAEL E. DOHERTY, JEFF C. FRIEDRICH, & NEIL D. BERG, *Bowling Green State University*—A set of simulations employed signal detection theory to examine the counterintuitive hypothesis that small samples provide better grounds for inferring the existence or nonexistence of a population correlation than do larger samples. A simulated decision-maker observed random samples of XY pairs (X and Y were continuous variables) and inferred whether each sample was drawn from a population in which the correlation (rho) was zero or from a population in which rho was nonzero. The results indicated that the presence of a small-sample advantage depended on the response criterion. The findings are partially consistent with some previous nonsignal-detection analyses of the small-sample advantage. But the findings contrast with those obtained from signal detection simulations in which X and Y were dichotomous variables and in which the response criterion was defined as a "usefulness" criterion, rather than as a standard signal detection criterion.

(5116)

Economic Psychophysics: Range Frequency Effects in Wage Satisfaction. GORDON D. BROWN, *University of Warwick,* JONATHAN GARDNER, *Watson Wyatt LLP,* & ANDREW OSWALD & JING

QIAN, *University of Warwick*—What factors determine an individual's wage satisfaction? Traditional economic accounts focus on absolute level of earnings as the factor underpinning utility and, hence, satisfaction, but such models have been supplanted by reference-dependent theories, according to which satisfaction is determined, at least in part, by the relation of a wage to a mean or reference wage of some kind. We show that models developed independently within psychology, such as Parducci's range frequency theory, motivate a different account, according to which utility and, hence, satisfaction is gained, at least in part, by the ranked position of a wage within a comparison set. We report two experimental studies and an analysis of a survey of over 16,000 employees' wage satisfaction ratings, to test the predictions of the rank-dependent model. The studies provide evidence for the rank dependence of wage satisfaction.

(5117)

Effects of Mood on Implicit Judgments of Semantic Coherence. ANNETTE BÖLTE, *Technical University Braunschweig,* & THOMAS GOSCHKE, *Max Planck Institute for Psychological Research*—We investigated effects of emotional states on the ability to make intuitive judgment about the semantic coherence of word triads. Participants were presented word triads, consisting of three clue words that either were weakly associated with a common fourth concept (coherent triads) or had no common associate (incoherent triads). In Experiment 1, participants in a neutral mood discriminated coherent and incoherent triads reliably better than chance level even if they did not consciously retrieve the solution word. In Experiment 2, the induction of a positive mood reliably improved intuitive coherence judgments, whereas participants in a negative mood performed at chance level. We conclude that positive mood potentiates spread of activation to weak or remote associates in memory, thereby improving intuitive coherence judgments. By contrast, negative mood appears to restrict spread of activation to close associates and dominant word meanings, thus impairing intuitive coherence judgments.

(5118)

Test Sample Selection by Preschool Children: Honoring Diversity. ELIZABETH F. SHIPLEY, *University of Pennsylvania*—To draw conclusions about a nonapparent property of individuals of a set, one must test individual members. Three- and four-year-olds were asked to select, one by one, a sample of objects from a set of toys to be tested for defects (e.g., cars that do not roll). Each set consisted of two subsets contrasting on a surface property (e.g., color). In one set, one half of a subset was defective. Overwhelmingly, 4-year-olds selected objects from different subsets for their first two tests. Three-year-olds did so to a lesser extent. However, when a defective toy was found, both 3- and 4-year-olds selected a similar object for their next test. Apparently, they were attempting to establish the status of the defect: anomaly or subset characteristic. Thus, like both American (Lopez, 1995) and traditional Mayan (Lopez, Atran, Coley, & Medin, 1997) adults, preschool children appreciate the importance of diversity.

(5119)

Working Memory Load Eliminates Age Differences in Hindsight Bias. UTE J. BAYEN, *University of North Carolina, Chapel Hill,* & EDGAR ERDFELDER & TINA S. AUER, *University of Mannheim*—Hindsight is the phenomenon in which, after people get to know the correct answer to a question, their judgment regarding their own past answer is biased toward the correct answer. In this research, young and older adults gave numerical responses to general knowledge questions and later attempted to recall their own responses. For some questions, the correct answer was provided at recall. In this paradigm, both lack-of-inhibition theory of cognitive aging (Hasher & Zacks, 1988) and accessibility bias theory (Jacoby, 1999) predict larger hindsight bias in older than in younger adults. To distinguish between the two theories, we had participants recall their original judgments under dual-task conditions. Data were analyzed with a multinomial model for the hindsight effect (Erdfelder & Buchner, 1998). Results show age differences in hindsight bias that disappear if participants recall their judgments under conditions of high working memory load induced by a distractor task. These results support lack-of-inhibition theory.

(5120)

Good After Bad Is Better. DEBRA ZELLNER, PAUL LOCHER, MELISSA DOLESE, & MARSHA VASSERMAN, *Montclair State University,* & SCOTT PARKER, *American University*—In positive hedonic contrast, stimuli are judged better when presented after very bad context stimuli than when presented alone. We demonstrated positive hedonic contrast for paintings, using two different sets of instructions. One group of subjects rated how much they liked five paintings from "Goya's dark period" (hedonically negative), followed by two "tapestry paintings." These subjects rated the tapestry paintings as more hedonically positive than did controls who were shown only the two "tapestry paintings." Another group of subjects was shown the same sets of paintings and made the same ratings but was told only that the paintings were "works by Goya," with no distinction made between the dark and the tapestry paintings. They too rated the two tapestry paintings as more hedonically positive than did controls who were shown only the tapestry paintings and were told that they were "works by Goya."

Visual Selective Attention II
Regency CD, Sunday Morning, 8:00–9:55

Chaired by Marisa Carrasco, New York University

8:00–8:15 (259)

Allocation of Attention Over Space-Time. ALICIA MACKAY, DEVIN LAND, MING-CHOU HO, & JAMES F. JUOLA, *University of Kansas* (read by James F. Juola)—Visual attention is distributed over space and time in response to external events and internal goals. The parameters of this distribution were studied in a search task using an RSVP sequence of 17 different 4-letter displays. On control trials, participants searched for an R or an L that could appear in any of the frames numbered 2 through 16 and in any of four positions around the fixation (upper left, upper right, lower left, lower right). On other trials, cues indicated either where the target would be or when it would occur, or both spatial and temporal information was given. The results indicated that both spatial and temporal cues facilitated target detection, and we will describe how their effects interact.

8:20–8:40 (260)

Keeping Track of Object Identities During Multiple-Object Tracking. ZENON W. PYLYSHYN, *Rutgers Center for Cognitive Science*—In multiple-object tracking, observers keep track of a small set of targets that move randomly and independently among a set of identical distractors. Earlier we reported that observers were poor at keeping track of previously assigned target labels, in comparison with keeping track of which objects were targets. We suggested (and have now confirmed) that this is because targets are more frequently confused (swapped) with other targets than with nontargets. A possible reason for this confusion bias is that nontargets might be actively inhibited. We investigated this hypothesis using the dot-probe method introduced by (Watson & Humphreys, 1997). We found that accuracy for detecting a probe was significantly worse when the probe was on a nontarget that when it was at any other location. In addition, we found that tracking performance was not affected by the probe task, confirming other results we have showing that tracking itself may be nonattentive.

8:45–9:05 (261)

Inhibition of Return From Stimulus to Response. DAVID A. PRIME & LAWRENCE M. WARD, *University of British Columbia* (read by Lawrence M. Ward)—*Inhibition-of-return* (IOR) refers to an inhibitory effect on performance that occurs at long cue–target intervals for targets at previously cued locations relative to other locations. IOR may improve visual search efficiency by inhibiting attention from returning to previously inspected locations. We examined the effect of IOR in the visual modality both on early sensory event-related brain potential (ERP) components and on the motor-related lateralized-readiness potential (LRP). IOR was associated with a delay of premotor processes (target-locked LRP latency) and reduced sensory ERP activity. No effect of IOR was found on motor processes (response-locked LRP latency). Thus, IOR arises at least in part from changes in perceptual processes and, at least when measured with manual keypresses, IOR does not arise from inhibition of motor processes. These results provide support for an inhibition-of-attention explanation for IOR.

9:10–9:25 (262)

Neural Basis of Attention-Induced Prior Entry. JOHN J. MCDONALD & JENNIFER C. WHITMAN, *Simon Fraser University*—When participants judge the temporal order of nearly simultaneous attended and unattended visual stimuli, they often report seeing the attended stimulus first, even if the unattended event is presented first. Such results suggest that the visual system processes attended information before unattended information. Here, we investigated the effects of attention on visual temporal perception by recording event-related potentials (ERPs) in temporal-order-judgment experiments. Various types of cues were used to orient attention prior to the appearance of two visual targets. As in previous studies, participants often reported seeing a target at the cued location before a simultaneously presented target at the uncued location. However, at least in some cases, the cue influenced the amplitudes of the early ERP components but had no influence on their latencies. This indicates that the changes in visual temporal perception were not mediated by changes in the speed of information transmission at early stages of vision.

9:30–9:50 (263)

Attention and the Representation of Visual Stimuli in Psychophysical Decisions. PHILIP L. SMITH, *University of Melbourne,* ROGER RATCLIFF, *Ohio State University,* & BRADLEY J. WOLFGANG, *University of Melbourne*—Mask-dependent cuing effects, like those previously found in yes/no detection by P. L. Smith (2000), were found in a task in which observers discriminated the orientations of orthogonally oriented Gabor patches presented at cued or uncued locations. Cues enhanced detection sensitivity for masked, but not unmasked, stimuli. Also, responses were faster to cued than to uncued stimuli, irrespective of masking. The distributions of response times and accuracy were well described by a sequential-sampling model of decision making, the diffusion process model of Ratcliff (1978). The changes in performance across cue and mask conditions were explained by an attention window model that assumed the following: (1) decisions are based on stable stimulus representations in visual short-term memory (VSTM) that determine the drift of the diffusion process; (2) inattention delays the entry of stimuli into VSTM; and (3) masks limit the visual persistence of stimuli.

Lexical Processing
Regency AB, Sunday Morning, 8:00–9:55

Chaired by Kenneth I. Forster, University of Arizona

8:00–8:20 (264)

The Processing of Complex English Words During Reading: Eye Movement Research. ELIZABETH NISWANDER & ALEXANDER POLLATSEK, *University of Massachusetts, Amherst* (read by Alexander Pollatsek)—The present research follows up prior work in English (Niswander, Pollatsek, & Rayner, 2000) indicating that both the frequency of the root morpheme and the frequency of the whole word affect the fixation time on a polymorphemic word during the reading of text. Our findings confirm the effects of both root and our whole-word frequencies for prefixed and suffixed words in English. In addition, our latest research indicates that word length plays an important mediating role: For prefixed words, there is clear evidence that for long words the effect of root frequency is dominant, whereas for short words, the effect of word frequency is dominant. This effect mirrors a finding for Finnish compound words (Bertram & Hyönä, 2003). The implications of these results for lexical access will be discussed.

8:25–8:40 (265)

The Effect of Case-Mixing on Morphological Processing. JAY G. RUECKL, *University of Connecticut & Haskins Laboratories*—At last year's meeting we reported that cAsE MiXiNg reduces the effect of word-body consistency on word naming (Rueckl & Wright, 2002). More recent experiments have focused on the effect of case mixing on morphological processing. Words with many morphological relatives tend to be processed faster than words with few relatives. The "family size" effect is reduced when words are presented in mixed case. Together, the interactions of case mixing with word-body consistency and morphological family size suggest that letter case, phonological regularities, and morphological structure jointly determine the organization of the (so called) orthographic representations that act as the input to phonological and morpho/semantic processing pathways.

8:45–9:05 (266)

The Orthographic Representation of Consonant/Vowel Status. ADAM B. BUCHWALD & BRENDA C. RAPP, *Johns Hopkins Uni-*

versity, (read by Brenda C. Rapp)—Orthographic representations must minimally contain information regarding the identity of a word's constituent letters and their order. It has been proposed that the orthographic consonant/vowel (C/V) status of letters is also represented. Strong evidence for this claim is the high rate (85%–99%) of C/V preservation in the substitution errors of a number of individuals with acquired dysgraphia. In errors such as NEPHEW → NEGHEW, the C/V status of target letters is preserved, despite the apparent loss of letter identity information. One explanation is that C/V information in the representation remains available to constrain the output. We use data from dysgraphic individuals to examine two alternative accounts of this phenomenon. We consider the possibility that C/V preservation may be based on phonological C/V information or that it may be derived from the orthotactics of English. We reject both alternatives, and conclude that orthographic C/V information forms an independent component of orthographic representations.

9:10–9:25 (267)

Morphological Facilitation Interacts With Concreteness and Family Size. LAURIE B. FELDMAN, MATTHEW J. PASTIZZO, & TRACY JANACK, *SUNY, Albany, and Haskins Laboratories*—Semantic aspects of morphological processing including concreteness and family size (number of words formed from the base morpheme) were examined in a series of lexical decision experiments for targets in isolation and with primes at varying SOAs. Targets (large/small × abstract/concrete) were matched for surface frequency and prime–target LSA. In isolation, latencies revealed an effect of concreteness only for targets from small families (RISK was slower than FOAM). In priming at SOA 250 msec, morphological facilitation varied with family size but only for concrete targets. In masked priming at SOA 48 msec, morphological facilitation varied only with family size. Inflected and derived morphological relatives (FOAMING–FOAM vs. FOAMY–FOAM) produced similar patterns of facilitation across experiments. Morphological facilitation is sensitive to semantic variables.

9:30–9:50 (268)

Phonological Typicality Affects Lexical Processing. MORTEN H. CHRISTIANSEN, *Cornell University,* & PADRAIC MONAGHAN & NICK CHATER, *University of Warwick*—Some words have a phonological form that is more typical of its lexical category than others, and we hypothesize that such phonological typicality influences lexical access. Focusing on nouns and verbs, we measured the phonological typicality of a word by comparing the extent to which it matched that of its category for 15 phonological cues. We analyzed response times for naming (Spieler & Balota, 1997) and lexical decision (Balota, Cortese, & Pilotti, 1999). Controlling for phoneme onset, frequency, neighborhood size, familiarity and imageability, we found that phonological typicality was a significant predictor of response time for nouns and verbs. In a lexical decision experiment, subjects responded to matched sets of nouns and verbs with either high or low phonological typicality. The results showed that high-typicality nouns were responded to more quickly than low-typicality nouns, and the same effect was found for verbs, suggesting that phonological typicality affects lexical processing.

Risky Decisions
Georgia, Sunday Morning, 8:00–10:00

Chaired by Jerome R. Busemeyer, Indiana University

8:00–8:20 (269)

How Memory and Reasoning Processes Explain Risk. VALERIE F. REYNA, MARY B. ADAM, & KRISTIN MULLER-POIRIER, *University of Arizona*—Many health and safety problems, including war and terrorism, are by-products of how people reason about risk. A new approach to this area is described that implements a modern dual-process model of memory: fuzzy-trace theory. This approach posits: encoding of verbatim and gist representations, with reliance on the latter whenever possible; dependence of reasoning on retrieval cues that access stored values and principles; and vulnerability of reasoning to processing interference from overlapping classes, which causes denominator neglect in risk or probability judgments. These simple principles explain classic and new findings (e.g., small risks are overestimated but very small risks are ignored as "nil"). Fuzzy-trace theory differs from other dual-prospect approaches to reasoning in that intuition is seen as more advanced than computation (trading off risks and rewards). The theory supplies a conception of rationality that permits superficially different risk judgments to be treated similarly when they share an underlying gist.

8:25–8:45 (270)

The Case Against Prospect Theory. MICHAEL H. BIRNBAUM, *California State University, Fullerton*—A series of studies shows that neither prospect theory nor cumulative prospect theory provides an adequate description of choices that people make between risky gambles. Seven empirical findings are inconsistent with or opposite to the predictions of cumulative prospect theory. All seven results are consistent with a configural weight TAX model, in which each probability–consequence branch of a gamble has a weight that depends on the probability of the branch and the rank of the branch's consequence in comparison with those of other discrete branches in the gamble.

8:50–9:10 (271)

Sampling and the Evaluation of Risky Options. YAAKOV KAREEV, *Hebrew University of Jerusalem,* & MASSIMO WARGLIEN, *University of Venice, Ca'Foscari*—Along with expected value, risk (i.e., the variance of potential outcomes) is a major determiner of option value: Risk-seeking people would value an option more, and risk-averse people would value it less, the greater the variance. Earlier work (Kareev et al., 2002, and pilot studies) has shown that when the number of possible outcomes exceeds working memory capacity, the inevitable use of a sample results in the attenuation of perceived variance for analogically presented data, but in its amplification for numerically presented data. Consequently, the effect of available sample size on the evaluation of a risky option would differ for risk-seeking and risk-averse people, and, further, would interact with mode of presentation. An experiment with real monetary outcomes bore out the predictions, suggesting that differences in available sample size, mode of presentation, and risk propensity can help explain differences in the evaluation of risky options.

9:15–9:30 (272)

Emotions Within Reason: Dualism of Risky Decisions. X. T. WANG, *University of South Dakota*—The role of emotions in decision making has long been postulated, if not well understood, in experimental psychology. In this study, participants were asked to make their choices between alternative options of hypothetical problems according to their emotional reactions and to their rational analysis separately. Each of the options was also rated by the participants in terms of their overall preference. This method allowed us to identify emotionality–rationality (E–R) conflict and to examine how the two modes of decision making interacted. It was found that emotional decisions were more likely to involve risk seeking. The magnitude of the overall choice preference was significantly higher when the emotional choice and rational choice were in tandem. In addition, the E–R conflict in risk preference was more likely to occur under negative frames than under positive frames. Hypothetical strategies for resolving the E–R conflict were examined against real data across different problem arenas.

9:35–9:55 (273)

Evidence That Transient Nicotine Lowers the Body-Weight Set-Point. MICHEL CABANAC & PATRICK FRANKHAM, *Université Laval*—Smokers usually gain weight when they quit smoking. The present work explores the hypothesis according to which such an increase is a behavioral response to a raised body weight set-point taking place when nicotine is eliminated from the body. We explored the in-

fluence of nicotine on rats' and human subjects' body weight set-points. Body weight set-point was assessed with classical behavioral and psychophysical methods: in rats, from their threshold to hoard food, and in humans, from the delay to experience negative alliesthesia when repeatedly ingesting sweet stimuli. Intraperitoneal injection of nicotine 0.02 and 0.05 mg lowered the rats' body weight set-point by 8.5±2.7 and 19.2±2.6 g. In humans, oral and transdermal administration of nicotine did not decrease the initial pleasure of eating sweet stimuli but significantly accelerated the following onset of self-reported displeasure (negative alliesthesia) aroused by the ingested repeated stimuli, a sign of lower body weight set-point.

Producing Words
Plaza, Sunday Morning, 8:00–10:20

Chaired by Deborah Burke, Pomona College

8:00–8:15 (274)

Perseveratory Inhibition in Language Production. JOSEPH P. STEMBERGER, *University of British Columbia*—During language production, when speakers produce successive words involving the accidental repetition of phonemes (e.g., /b/ in BIG BASKET), there is an increase in error rates. I explore the statistical characteristics of such errors in the natural speech of normal adults. This repetition effect is generally (1) only perseveratory (with an increased error rate only on the second occurrence of the phone), and (2) based on segments, with no effect of larger units (consonant clusters) or smaller units (features/gestures). Errors on word-initial consonants are an exception, also showing anticipatory effects and effects of repeated (low-frequency) features/gestures. I argue that the inhibitory effect is an aspect of the system designed to prevent errors (especially perseveratory errors), and that elements that are active early in the phonological processing of a word induce and are subject to the inhibitory effect. Implications for models of language production are discussed.

8:20–8:35 (275)

The Minimum Scope of Phonological Planning in Single-Word Speech Production. MARKUS F. DAMIAN, *University of Bristol*—When speakers produce single words, it is possible that under increased task demand, speech sounds are assembled not for the entire response word, but only for its initial portion before articulation begins. To test this claim, speakers named objects while attempting to ignore visual distractors that were form-related to either the initial or the final portion of the response, or unrelated. Task demand was manipulated by applying a response deadline to half of the participants. Experiments 1, 2, and 3 tested mono-, bi-, and trisyllabic response words. In all cases, the deadline procedure accelerated responses substantially. Crucially, however, the pattern of phonological facilitation induced by the distractors remained unchanged. These results suggest that a single word is the lower boundary of phonological encoding.

8:40–8:55 (276)

Influence of Consonantal Context on the Pronunciation of Vowels: Evidence From Children. REBECCA TREIMAN & BRETT KESSLER, *Washington University,* SUZANNE BICK, *Wayne State University,* & MELISSA DAVIS, *Oakland University*—In previous work (Treiman, Kessler, & Bick, 2003, *Cognition*, **88**, 49–78), we found that college students' pronunciations of vowels in monosyllabic nonwords can be influenced not only by the following consonant (coda) but also by the preceding consonant (onset). In the present study, we presented the same nonwords to a total of 94 first graders, third graders, fifth graders, and high school students, to determine when these contextual influences emerge. According to some theories of reading development, beginners rely on context-free grapheme-to-phoneme links. However, we found that even children reading at a first-grade level were to some extent influenced by context. These contextual effects increased in strength up to about the fifth-grade reading level. Theories of reading and reading development have stressed the importance of rime units. However, we found no evidence for earlier sensitivity to coda-to-vowel associations than to onset-to-vowel associations.

9:00–9:15 (277)

Integrated Representation of Novel Spoken Compounds. PADRAIG G. O'SEAGHDHA & KRISTINE SCHUSTER, *Lehigh University,* & JENN-YEU CHEN, *National Chung Cheng University*—Is control of compound word production delegated to component morphemes or exercised at the compound level? We assessed these possibilities using a low-level continuous word-pair repetition task in which production of similarly structured, begin-related, noncompound words (e.g., *margin–marble*) is known to create difficulty (O'Seaghdha & Marin, 2000). According to phonological competition theory, the difficulty is that facilitation among shared word beginnings leads to competition among later discrepant segments during phonological assembly. In Experiment 1, we isolated facilitation: Speakers repeated an ABAD monosyllable morpheme sequence (*man web man fate*) more easily than did no-repeat (ABCD) controls. In Experiment 2, we induced competition by configuring the same ingredients as compounds (*manweb manfate*). Thus, the speaker's lexical conception of the speech plan is the primary regulator of production. We also present a strong test of this principle in Mandarin Chinese, where compounding is not accompanied by prosodic modifications and so is entirely mental.

9:20–9:35 (278)

Conceptual and Semantic Effects in the Production of Verbs. PATRIZIA TABOSSI, *University of Trieste,* & SIMONA COLLINA, *Istituto Universitario Suor Orsola Benincasa, Naples*—The study explores the process of verb production in a series of picture–word interference experiments. Experiment 1 showed that a semantically related verb interferes with the production of a target, only if the two verbs are intransitive. Experiments 2, 3, and 4 established the conditions under which interference effects can be detected with transitive verbs too. It is argued that conceptual factors intervene in the naming of a picture. These factors must be taken into account in the study of semantic effects by means of the picture–word interference paradigm.

9:40–9:55 (279)

Past Tense Verb Generation in Semantic Dementia: Evaluating Theoretical Perspectives. MICHAEL J. CORTESE, *College of Charleston,* DAVID A. BALOTA, SUSAN D. SERGENT-MARSHALL, BRIAN GOLD, & RANDY L. BUCKNER, *Washington University*—Healthy older adults (n = 65) and individuals with semantic dementia (SD, n = 6) produced the past tense of verbs on the basis of present tense carrier sentences (e.g., *Everyday I ding the bell. Yesterday, I _____ the bell.*). The verbs that were examined included regular verbs (i.e., verbs that follow the add *-ed* rule; e.g., *trimmed*) and irregular verbs (i.e., verbs that violate the add *-ed* rule; e.g., *flew*). Within regular and irregular categories, consistent verbs (i.e., verbs associated with more "friends" than "enemies"; e.g., *trimmed*, *crept*) and inconsistent verbs (i.e., verbs associated with more "enemies" than "friends"; e.g., *beeped*, *flew*) were examined. In comparison with healthy older adults, individuals with SD show equal disruption for irregular verbs and regular verbs associated with many enemies, whereas performance for regular consistent verbs is less affected. These results challenge theoretical models of past tense verb generation.

10:00–10:15 (280)

Do Squid Make a Visual Language on Their Skin? JENNIFER A. MATHER, *University of Lethbridge*—In the 1980s, Moynihan noted a rich multicomponent visual display on the skin of Caribbean reef squid. He suggested that these components could be the equivalent of nouns, verbs, and adverbs in human language and that squid might thus make a visual language on their skin. Moynihan did not follow up on this, and so I have observed the squid in their groups in the field in order to evaluate his suggestion. The system appears to show the Hockett (1960) design features of specialization, arbitrariness, discreteness, productivity, and duality. No information is available on feedback, semanticity, or tra-

dition. Squid do not appear to reference external events, which Hauser (1996) stressed as important, although they do use deception and can produce double signals. Thus, although it is a complex system, the skin display does not appear to be a visual equivalent of language.

Sentence and Text Comprehension
Regency E, Sunday Morning, 8:00–9:50

Chaired by Beverly Roskos-Ewoldsen, University of Alabama

8:00–8:15 (281)

Moving Words: Language Comprehension Produces Representational Motion. ROLF A. ZWAAN, CAROL J. MADDEN, RICHARD H. YAXLEY, & MARK E. AVEYARD, *Florida State University*—Forty-four subjects listened to sentences and then judged whether two sequentially presented visual objects were the same. On critical trials, sentences described the motion of a ball toward or away from the observer (e.g., *The pitcher hurled the softball to you*). Two hundred fifty milliseconds after the offset of the sentence, a picture of an object (e.g., a softball) was presented for 250 msec, followed by a 250-msec mask, followed by a 250-msec presentation of a second picture. On critical trials, the same object was presented twice, but it was slightly larger or smaller in the second presentation relative to the first, suggesting movement toward or away from the observer. Responses were faster when the direction of the implied movement of the objects matched the direction described in the sentence. This demonstrates—for the first time, to our knowledge—that language comprehension involves dynamic perceptual simulations.

8:20–8:40 (282)

Timing Is Everything: The Effect of Verb Biases in Dutch Sentence Comprehension. JOHN C. TRUESWELL & ELSI KAISER, *University of Pennsylvania*—When resolving ambiguous phrases, verbs play a crucial role: compare *Now tap/choose the doll with the feather*. Listeners' interpretations are strongly influenced by verb information even in referentially biased contexts (Snedeker, Thorpe, & Trueswell, 2001). Is verb potency general, or does it depend on when verb information is encountered? We investigated this with a similar eyegaze–listening study in Dutch, in which a natural construction requires the verb at the end of the sentence. In contrast to findings for English, Dutch listeners uniformly committed to a modifier interpretation, and they were reluctant to revise this interpretation even after encountering countervailing verb information. This occurred despite strong, independently established verb biases. Our findings suggest that information availability at the point of ambiguity plays an important role: Postambiguity information, even when it is verb information, has reduced effects. We discuss implications for constraint-based theories and the issue of revision in adults (Christianson et al., 2001) and children (Trueswell et al., 1999).

8:45–9:00 (283)

The Representation of Surface Structure in Long-Term Memory for Sentences. CHARLES R. FLETCHER, *University of Minnesota, Twin Cities,* & JASON D. NEMETH, *Carnegie Mellon University*—Some researchers have argued that the surface forms of sentences are reconstructed from separate representations of lexical items, syntactic structure, and meaning. To test this hypothesis, we presented readers with texts containing sentences with reciprocal verbs (e.g., *With a sigh of relief, John and Mary kissed*.). In such sentences, two arguments simultaneously serve as agent and object (e.g., *John* and *Mary* are both kissers and recipients of the kiss). On a subsequent forced-choice recognition test, readers were able to discriminate between the sentences that they had actually read and paraphrases in which the order of the two arguments was reversed (e.g., *With a sign of relief, Mary and John kissed*.). Because the recognition targets and distractors use the same lexical items, have the same syntactic structure, and mean the same thing, these results suggest that long-term memory for sentences includes an integrated representation of surface form.

9:05–9:25 (284)

Aging and Social Inferences. GABRIEL A. RADVANSKY & DAVID E. COPELAND, *University of Notre Dame,* WILLIAM VON HIPPEL, *University of New South Wales,* & DARCIA NARVAEZ, *University of Notre Dame*—In a series of experiments, we explored the effects of normal aging on the likelihood of drawing and remembering social inferences. These were either stereotypic inferences about ethnic group members that needed to be inhibited, or desirable inferences about the morality of story characters' behavior. Memory data were analyzed to separate out surface form, textbase, and situation model levels of representation. Lexical decision probe words during reading yielded similar results. Overall, the experiments showed differences in how older adults process these types of information, with older adults being more likely to draw prejudicial inferences. They were also more likely to remember moral statements from a text, although there was no age difference in the likelihood of integrating moral inferences into the situation model memory.

9:30–9:45 (285)

The Processing of Warrants in Written Arguments. CHRISTOPHER R. WOLFE, *Miami University,* & ANNE M. BRITT, *Northern Illinois University*—Arguments are claims supported by reasons. Claims and reasons are logically connected by warrants. Five experiments investigated how warrants are processed. Explicitly stating the warrant affected agreement but not quality ratings for both short (Experiment 1) and long (Experiment 2) arguments. However, the generality of the warrant statement affected agreement (Experiment 3): Reasonable warrant statements produced the highest agreement levels, followed by implicit warrants, weak warrants, and strong warrants. Two experiments investigated whether warrants are inferred during reading. The same sentence was not read faster when it was a warrant than when it was a new claim (Experiment 4) and explicitly stating the warrant led to more attacks on the claim–reason connection (Experiment 5). These findings suggest that readers do not immediately infer missing warrants. Explicitly stating the warrant often negatively affected the persuasiveness of arguments, perhaps explaining why warrants are generally unstated and implicit.

Processing Disfluencies/Bilingualism
Regency F, Sunday Morning, 8:00–9:40

Chaired by Niels O. Schiller, University of Maastricht

8:00–8:20 (286)

Disfluency Effects in Comprehension: The Discourse-New Bias. JENNIFER E. ARNOLD, REBECCA J. ALTMANN, MARIA FAGNANO, & MICHAEL K. TANENHAUS, *University of Rochester*—Spontaneous speech is rarely fluent, resulting in words such as *um*, *uh*, repeats or repairs (Fox Tree & Clark, 1997), and other manifestations of disfluency, including prosodic ones (e.g., Gregory et al., 1997). Yet disfluency is generally considered not to affect the core processes of language comprehension. In two experiments, disfluency caused a bias toward new (unmentioned) objects, unlike the given bias frequently observed with fluent stimuli. Participants were eyetracked as they viewed displays including two cohort competitors (e.g., *candle*, *camel*). They followed instructions like *Now put* (*the*/*thiy uh*) *candle* in the context of a sentence that established either the target or the competitor as given. At the onset of temporarily ambiguous *can*, there were more early fixations on the given cohort for fluent instructions, but on the new cohort for disfluent ones. This new bias was strongest when a large pitch excursion on *Now put* supported the impression of disfluency.

8:25–8:40 (287)

A Model of Disfluency Processing During Parsing. FERNANDA FERREIRA, ELLEN F. LAU, & KARL G. D. BAILEY, *Michigan State University*—Disfluencies include editing terms such as *uh* and *um* as well as repeats and revisions. Our work focuses on the way in which disfluencies affect structure-building operations during comprehen-

sion. We describe experiments showing that information associated with misarticulated verbs lingers, and we present a model of disfluency processing. The parser uses a tree adjoining grammar to build phrase structure. Filled and unfilled pauses affect the timing of substitution operations, and repairs and corrections are handled by a mechanism that we term *overlay*, which allows the parser to cover up an undesired tree with the appropriate, correct tree. This approach to disfluency processing suggests that the parser must sometimes coordinate the mechanisms that perform garden path reanalysis with those that do disfluency repair. The research program as a whole demonstrates that it is possible to study disfluencies systematically and to learn how the parser handles filler material and mistakes.

8:45–8:55 (288)

Some Characteristics of Interjections Used in a German Interview. DANIEL C. O'CONNELL, *Georgetown University,* & SABINE KOWAL, *Technical University Berlin*—Occurrence and temporal properties of interjections in a television interview of Katarina Witt by Günter Gaus are analyzed. The hypotheses that (1) *äh* belongs to the word class interjection (on the basis of its distribution; Ehlich, 1986), (2) interjections are isolated by preceding and following pauses (Ameka, 1992, 1994), and (3) *ja* and *nein* serve as interjections (Tesniere, 1936) are all rejected.

9:00–9:15 (289)

Psychophysiological Studies of Emotional Arousal to Bilingual Speakers' First and Second Languages. CATHERINE L. HARRIS, *Boston University*—Second language users frequently report that concepts expressed in their first language have greater emotional resonance than concepts expressed in their second language. Electrodermal recording was used to verify this psychophysiologically in three populations (English speakers who also spoke Turkish, Spanish, or Mandarin). Stimuli included taboo words, childhood reprimands (e.g., *Shame on you!*), and various emotional expressions (insults, endearments). Late learners of English showed higher skin conductance response (SCRs) to emotion words in their first language than to emotion words in their second language. Skin conductance amplitudes were greater in the second language (L2) than in the first language (L1). However, age of acquisition and proficiency traded off against each other, with similar SCRs in the two languages when the second language was learned later but to a greater level of proficiency than the native language.

9:20–9:35 (290)

Grammaticality Judgment Performance by Stressed Monolinguals and Bilinguals. JANET L. McDONALD, *Louisiana State University*—Monolingual English speakers performed a grammaticality judgment task under a variety of stress conditions: No stress, listening through noise, responding within a time limit, and having a concurrent memory load. Relative to subjects in the no-stress condition, those in the noise condition showed impaired performance on items involving unstressed morphemes, but had no trouble with word-order changes. Those in the time stress condition showed few difficulties with morphemes, but were impaired on the more gross structural changes. Those in the memory load condition were only mildly impaired. Bilinguals with English as a second language showed parallels to both monolinguals under memory load stress and monolinguals listening through noise.

Task Switching
Regency CD, Sunday Morning, 10:05–12:00

Chaired by Ines Jentzsch, University of Glasgow

10:05–10:25 (291)

Executive Control in the Task Span Procedure. GORDON D. LOGAN, *Vanderbilt University*—How many tasks can you perform correctly in order before you forget what you're doing? About three. Subjects received lists of 1–10 task names to remember and then lists of 1–10 stimuli on which to perform the tasks. Task span is the number of tasks performed in order perfectly. Experiment 1 compared the task span with the traditional memory span in 6 practiced subjects and found little difference. Experiment 2 compared the task span and the memory span in 64 unpracticed subjects and also found little difference. Experiment 3 manipulated the number of task switches and found that it had little effect on task spans. These results suggest there is no tradeoff between storage and task switching, which supports some theories of executive control and challenges others.

10:30–10:50 (292)

Switch Cost: Much Ado About (Almost) Nothing. ERIK M. ALTMANN, *Michigan State University*—Switch cost remains the focus of most task switching research, perhaps because a switching homunculus, charged for example with "reconnecting and reconfiguring the various modules in our brains" (Monsell & Driver, 2000), still plays at least a tacit role in many theoretical perspectives. This presentation will identify several phenomena other than switch cost that implicate comparatively primitive processes as building blocks of cognitive control. The phenomena include within-run slowing and error increase; an unconventional full-run switch cost affecting errors but not latencies; and a task-neutral first-trial cost that is much larger than conventional switch cost. Any viable model of task switching will have to accommodate these diverse phenomena, ideally in some functionally integrated way. One such model will be sketched that implicates encoding, priming, and proactive interference, with switch cost reflecting not the switching homunculus rearranging boxes in our heads, but rather these ordinary memory processes interacting with one another.

10:55–11:10 (293)

Task Switching in the Cuing Task-Switching Paradigm. NACHSHON MEIRAN, *Ben-Gurion University of the Negev*—In the cuing task switching paradigm, a task cue instructs which task is currently relevant. This version of the paradigm makes it possible to study the time course of task-preparation effects. However, it is conceivable that participants react to the cue–target compound rather than switch tasks. I will report a series of experiments that tested the validity of this alternative account.

11:15–11:35 (294)

Does the Preparation Effect in Cued Task Switching Measure Task Set Reconfiguration? STEPHEN MONSELL & GUY MIZON, *University of Exeter*—The reduction in task switch cost observed as the interval between a task cue and the stimulus increases (the *preparation effect*) has widely been assumed to index an endogenous task-set reconfiguration process performed before the stimulus if time allows, and during the latent interval if not. However, Logan and Bundesen (in press, *JEP:HPP*) used two cues per task so that effects of cue change and task change could be unconfounded. Their results suggested that the switch cost and preparation effect reflect an advantage in interpreting a repeated cue, not task set reconfiguration. Using different tasks and cues, we have replicated Logan and Bundesen's result. But we have also identified other tasks and cues for which the preparation effect does reveal an endogenous task set reconfiguration process. Interpreting the cue can contribute to switch costs, and may even become a task sufficient to require reconfiguration.

11:40–11:55 (295)

The PRP Effect in the Dual-Tempo Task. CHRISTOPHER T. KELLO, *George Mason University*—Much of what is known about dual tasking comes from the PRP paradigm, in which two stimuli are presented in succession and each stimulus requires a speeded response. The latency of each response is mostly free to vary, and latencies have often revealed an increasing cost as the two stimuli are presented more closely together in time. Because latencies are free to vary (among other reasons), it has been difficult to determine whether the cost reflects a competition for some kind of limited resource, or a strategic choice in how to per-

form the task. Two experiments are reported in which two audiovisual metronomes were used to fix response latencies in a PRP-like task. Results of these experiments were generally consistent with the existence of some kind of limited resource. However, some aspects of the results are difficult to explain within current theories of dual tasking.

Working Memory and Language
Regency AB, Sunday Morning, 10:10–11:55

Chaired by Robert H. Logie, University of Aberdeen

10:10–10:25 (296)

When Does Phonological Similarity Facilitate Immediate Serial Recall? Testing Alternative Accounts. PRAHLAD GUPTA & JOHN LIPINSKI, *University of Iowa*—The phonological similarity effect is a hallmark phenomenon of immediate serial recall (ISR). Although it has been replicated numerous times, there is also evidence that phonological similarity may have no detrimental effect on ISR and may even facilitate item recall. Alternative accounts have sought to explain these results in terms of feature overlap, linguistic structure, or serial order. Four experiments were conducted to distinguish among these accounts. In each experiment, participants' ISR was assessed for rhyming, alliterative, and similar lists. Experiments 1 and 2 showed that item recall was better for rhyming than for alliterative lists, in agreement with the predictions of the linguistic structure and serial order accounts. Experiments 3 and 4 showed that item recall was better for alliterative than for similar lists, in agreement with the predictions of the serial order and feature overlap accounts. Overall, the results support the serial order account over the other two theoretical proposals.

10:30–10:50 (297)

Repetition of Single Phonemes Affects Recall of Pseudoword Lists. ELISABET SERVICE, *University of Helsinki & Dalhousie University,* SINI MAURY & EMILIA LUOTONIEMI, *University of Helsinki*—In a pseudoword span task, Finnish participants recalled lists consisting of /C(consonant)V(vowel)CVCV/ pseudowords, made up from pools of 12 items. Nonredundant lists consisted of items with unpredictable combinations of consonants and vowels. In consonant-redundant lists, all items had the consonant frame /t/_/s/_/l/. In vowel-redundant lists, all items had the vowel frame _/u/_/e/_/o/. A harmful phonological similarity effect was apparent in the vowel-redundant case but not the consonant-redundant case. Unlike the result for redundant last syllables in a previous experiment, neither consonant nor vowel redundancy helped list recall. A phoneme-level analysis of partially recalled items showed a recall advantage for both redundant consonants and vowels. Vowels seemed more important for discrimination between items, redundancy resulting in confusions. In a second experiment, phoneme redundancy was limited to only one phoneme position per condition. Vowel redundancy in the second and third syllables, and consonant redundancy in the third syllable, helped recall. Single repeated phonemes affect the recall of pseudowords.

10:55–11:10 (298)

Use of a Word's Sound Code After Its Identification During Reading. ALBRECHT W. INHOFF, MICHAEL SKELLY, & CYNTHIA M. CONNINE, *SUNY, Binghamton,* & RALPH RADACH, *Technical University at Aachen*—Articulation of a word that is similar in sound to a concurrently read visual target word increased the time spent reading posttarget words in our prior work, as the sound code of the target remained active after it was identified. The present work examined whether this sound code is reactivated when a subsequent pronoun refers to the target. Sentences with an anaphoric reference were constructed so that the pronoun was either in the same sentence as the target or in a different sentence. A spoken word that was identical, phonologically similar, or dissimilar to the previously read target was presented when the eyes moved at the pronoun. The results revealed shorter pronoun viewing durations in the identical condition than in the similar and dissimilar conditions, which did not differ. These results suggest that the phonological form of the target was not reactivated when the pronoun was read.

11:15–11:25 (299)

Measuring Long-Term Working Memory Under Concurrent Load. FRANCIS T. DURSO, JOHN D. NORRIS, M. KATHRYN BLECKLEY, & ANDREW R. DATTEL, *Texas Tech University*—Long-term working memory (LTWM) has been used as an explanatory construct underlying many expertise effects in basic and applied research. We have been exploring various means of measuring LTWM. In our thinking, working memory measurement requires that the memory task be performed with some concurrent processing. Evidence for a distinguishable LTWM would be a superadditive relationship between expertise and organization under such concurrent conditions. For example, in a version of the reading span task using organized or scrambled paragraphs from an introductory psychology text, recall of nontechnical terminal words from organized text was superior to that for unorganized text, experts outperformed novices, and the expertise effect was especially pronounced with organized paragraphs.

11:30–11:50 (300)

Working Memory and Semantics in Relative Clause Processing. MATTHEW J. TRAXLER, *University of California, Davis*, & ROBIN K. MORRIS & RIHANA S. WILLIAMS, *University of South Carolina*—In two eye-movement monitoring experiments, readers processed sentences containing subject- or object-relative clauses. Participants were classified as having high or low working memory capacity. When critical nouns were interchangeable, low-capacity comprehenders had greater difficulty processing object-relative clauses than subject-relative clauses, but high-capacity comprehenders processed both types of relative clause with equal ease. When animacy of the sentential subject and the noun in the relative clause were manipulated, high-span readers were somewhat less disrupted by object-relative clauses than were low-capacity comprehenders, but animacy interacted with clause type in both groups. When the sentential subject was inanimate, both high- and low-capacity readers had no more difficulty processing object-relative clauses than subject-relative clauses. When the sentential subject was animate, both groups had greater difficulty processing object-relative clauses than subject-relative clauses. We propose that the pattern of processing is best explained by difficulty in making and revising binding decisions.

Context and Feedback Effects on Decision Making
Georgia, Sunday Morning, 10:15–11:50

Chaired by Yaakov Kareev, Hebrew University of Jerusalem

10:15–10:35 (301)

What's in a Frame? Cues to Social Context. SANDRA L. SCHNEIDER & NICEY MARTIN, *University of South Florida*—The framing effect is considered an anomaly in which people are fooled into changing their risky decision behavior as a function of irrelevant changes in problem phrasing. Our study explored the possibility that positive and negative frames provide different information about what can be assumed about the social context surrounding the decision. We asked participants about their assumptions and reactions to the Asian disease problem. Participants in both frames were equally likely to assume that those afflicted would die and that the decision maker should not be held accountable for their deaths. However, those exposed to the positive frame were more likely to assume that the sure thing was a newly developed solution, that the decision maker should be given responsibility for survivors, and that the decision maker should be evaluated favorably. The positive frame also led to a more favorable evaluation of the sure thing but not the risk.

10:40–11:00 (302)

Reducing Contextual Bias in Performance Appraisal. DOUGLAS H. WEDELL, *University of South Carolina*—Performance appraisals

can be contextually biased in that the same performance record is rated more favorably when preceded by records of lower performing rather than higher performing employees. Such contextual contrast lowers the reliability and validity of assessment. Several experiments investigated methods for reducing contrast effects in performance appraisals, with stimuli consisting of records of hypothetical computer programmers that contained both numerical and verbal indices of performance. Both skewing and range of the records were manipulated, with range frequency theory used to model effects on performance ratings and recommended salary increases. The procedural manipulation of using comparative judgments of performance given the context of extreme and middle-valued performance records was largely unsuccessful in reducing contextual bias. Rating of components of the record rather than the record as a whole gave rise to additional contextual effects. Training judges on a set of records was only partially successful in eliminating contextual bias.

11:05–11:25 (303)

Information Flow and Decision Barriers in Giving and Receiving Social Feedback. ILAN YANIV, *Hebrew University of Jerusalem*—Efficient decision making requires that social feedback is given and received. We document a preference asymmetry in giving and receiving social feedback. Providers of feedback tend to deliver ambiguous social feedback, whereas receivers prefer more informative feedback. Direct, informative feedback (which is potentially useful to the receiver) is often perceived also as being offensive. I suggest that the costs and benefits of informativeness and constructive yet direct and intrusive feedback are not weighted symmetrically for providers and receivers of feedback. Such findings suggest that the learning process through social interactions may not be as efficient as it could be.

11:30–11:45 (304)

Graphical Displays and Risk Avoidance. HANNAH F. CHUA, J. FRANK YATES, & PRITI SHAH, *University of Michigan* (read by J. Frank Yates)—Many real-life adverse events have low rates of occurrence that vary, depending on a person's actions. For instance, fatal accident rates differ according to whether drivers are intoxicated. For some time, there have been speculations that displaying such rates graphically rather than numerically should affect people's avoidance of the risky alternatives in such situations. Only recently, though, has there been empirical evidence bearing on these speculations. Stone et al. (1997, 2003) showed that graphs that focus attention on the number of people actually experiencing adverse outcomes (foreground statistics) rather than the total number exposed to a hazard (background statistics) do indeed reliably increase professions of risk avoidance. The research reported in this talk revealed effects of presenting risk information graphically per se, even when foreground statistics are not differentially highlighted by the graph. The results also implicated reasons why such effects occur, including induced impressions of risk magnitude.

Spoken Word Recognition
Plaza, Sunday Morning, 10:35–11:55

Chaired by Michael E. R. Nicholls, University of Melbourne

10:35–10:55 (305)

The Time Course of Indexical Specificity Effects in the Perception of Spoken Words. CONOR T. McLENNAN & PAUL A. LUCE, *SUNY, Buffalo* (read by Paul A. Luce)—This research investigates the time course of indexical specificity effects in spoken word recognition by examining the circumstances under which variability in speaking rate affects participants' perception of spoken words. Previous research has demonstrated that variability has both representational and processing consequences. The present research examines one of the conditions expected to influence the extent to which indexical variability plays a role in spoken word recognition, namely time course of processing. On the basis of our past work, we hypothesized that indexical specificity effects associated with speaking rate would only affect later stages of processing in spoken word recognition. The results confirm our hypothesis: Specificity effects are only in evidence when processing is relatively slow.

11:00–11:15 (306)

The Syllable Onset Segmentation Hypothesis: New Evidence. ULRICH H. FRAUENFELDER & ODILE BAGOU, *University of Geneva,* & ALAIN CONTENT, *Université Libre de Bruxelles*—According to the syllable onset segmentation hypothesis (SOSH; Content, Kearns, & Frauenfelder, 2001), syllable onsets in continuous speech serve as privileged alignment points for lexical search. We tested this hypothesis in two experiments, using word spotting and cross-modal priming. In the first experiment, participants had to spot either monosyllabic or bisyllabic words embedded in nonword sequences. The targets could be aligned with syllable boundaries at both ends, or misaligned either at onset or at offset. The results confirmed SOSH by showing higher omission rates for onset misalignment only. In the second experiment, the same nonwords were used as auditory primes to visual targets in a lexical decision task. The results showed significant facilitation for bisyllabic targets only. More importantly, the facilitation was reduced and nonsignificant with the onset-misaligned primes. Taken together, the results provide clear support for SOSH.

11:20–11:35 (307)

An Effect of Pronunciation Consistency on Auditory Word Identification. JENNIFER S. BURT, *University of Queensland*—Evidence for the activation of the orthography of phonological neighbors has been found in lexical decision and spelling tasks with auditorily presented words. In the present studies with university students, factorial variation of feed-forward (pronunciation) and feed-back (spelling) consistency in short words produced the expected feedback consistency effects in an oral spelling task, and unexpectedly, both feed-forward and feedback effects in auditory lexical decision. A variety of lexical tasks were performed by students on multisyllabic words that were typical or atypical in both spelling and pronunciation or typical in pronunciation and atypical in spelling. The typicality of the pronunciation had effects in visual word identification tasks but not reliably in the auditory lexical decision task. It appears that the predictability of phonology from orthography may exert an effect on lexical decisions about spoken words when the discriminability of words from other words and nonwords is not high.

11:40–11:50 (308)

False Memory Effects on Spoken Word Recognition Among Bilingual Speakers. BRENDAN S. WEEKES, *University of Sussex,* ROBYN E. HOLLIDAY, *University of Kent,* KERRY LEE & SEAN KANG, *National Institute of Education Singapore,* & ELIZABETH HAYWARD, *University of Sussex*—Two experiments were conducted to test whether proficient bilingual speakers display false memory effects in their second language (English). We modified the Deese/Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger & McDermott, 1995) and presented spoken words in English as a second language (L2) or native language (L1). In Experiment 1, 36 bilingual and 36 monolingual English speakers residing in Sussex showed reliable false memory effects in English (L2 and L1). The effect was smaller for bilingual than for monolingual speakers, and there was a positive relationship between proficiency in L2 and false memory for bilingual speakers. In Experiment 2, 36 Chinese–English bilingual speakers from Singapore were tested; the results showed larger false memory effects in L2 than in L1, in agreement with the effects from Experiment 1. We interpret these data in terms of Kroll and Stewart's (1994) revised hierarchical model, and we argue that bilingual memory processing requires a two-lexicon model.

Automatic Processes
Regency E, Sunday Morning, 10:00–11:55

Chaired by Veronica J. Dark, Iowa State University

10:00–10:20 (309)

Priming Arithmetic Knowledge With Semantic Relations. SAMUEL PEDIGO, *University of Washington,* AN T. OSKARSSON, *University*

of Colorado, & MIRIAM BASSOK, *University of Washington* (read by Miriam Bassok)—People use mathematics to model real-life situations. Such modeling involves analogical alignment of semantic and mathematical relations (Bassok, Chase, & Martin, 1998). For example, college students asked to construct addition word problems for various object pairs readily added taxonomically related objects (tulips, daffodils) but refrained from adding thematically related objects (tulips, vases). We examined whether such alignments facilitate priming of relevant arithmetic knowledge. We adapted LeFevre and Kulak's (1994) number-matching task, in which digit pairs activate their sum (3 + 5 activates 8). We preceded each digit pair with a brief presentation of a word pair that consisted of taxonomically related (*tulips*, *daffodils*), thematically related (*tulips*, *vases*), or unrelated (*tulips*, *cars*) objects. Activation of digit sums was higher when they were primed by taxonomically related objects than by either thematically or unrelated objects. These results show that semantic relations selectively prime mathematical knowledge associated with analogous arithmetic relations.

10:25–10:45 (310)

"Unconscious" Semantic Congruency Effects Depend on Prime Discriminability. DANIEL HOLENDER & KATIA DUSCHERER, *Université Libre de Bruxelles*—We report several experiments based on the task of Dehaene et al. (1998), in which the same set of four digits presented in either the Arabic or the verbal notation were used both as visible targets and as masked primes. Participants alternated between blocks in which they classified the primes or the targets as larger or smaller than five. They had to make speeded responses to the targets and unspeeded forced-choice responses to the primes. We manipulated the physical similarity of the Arabic digits (1, 4, 6, 9 vs. 2, 3, 8, 9) and prime duration (29 and 43 msec). We found (1) no congruency effect with d' close to 0, even when the congruent primes and targets shared both their identity and format, and (2) increasing congruency effects with increasing discriminability of the primes. We discuss the implications of these results for current interpretations of "unconscious" semantic congruency effects.

10:50–11:05 (311)

Implicit Association Test (IAT): Support for the Salience Asymmetry Account. SACHIKO KINOSHITA & MARIE PEEK-O'LEARY, *Macquarie University*—The Implicit Association Test (IAT, Greenwald, McGhee, & Schwartz, 1998) is used widely to index implicit preference for one target category over another (e.g., flowers vs. insects; white vs. black Americans). The IAT compatibility effect refers to the faster responding when the same response key is assigned to one of the target categories (e.g., "flowers') and the "pleasant" category (and "insect" and "unpleasant") rather than when the opposite assignment is used (e.g., "flowers" and "unpleasant," and "insect" and "pleasant"). An assumption underlying the use of the IAT is that the dimension of compatibility underlying the IAT effect is affective valence. Our data suggest instead that the major source of the IAT effect is salience asymmetry, as has been proposed by Rothermund and Wentura (2001).

11:10–11:25 (312)

Mirror Neurons, Imitation, and Motor Priming. BENNETT I. BERTENTHAL, MATTHEW R. LONGO, & ADAM D. KOSOBUD, *University of Chicago*—Recent neuroimaging and chronometric experiments reveal that imitating a movement is faster than responding to a spatial or symbolic cue. Presumably, this processing advantage is attributable to automatic activation of responses by the perception of congruent actions or gestures. Alternatively, these findings could be attributable to a Simon effect, because spatial congruency between stimulus and response and imitation were consistently confounded. In order to disambiguate these findings, we conducted a series of experiments in which participants were shown right or left hands with fingers spread apart and were instructed to respond with the index or middle finger of the right hand to the spatially congruent (right or left finger moving down) or figurally congruent (index or middle finger moving down) stimulus. The results revealed separate effects for figural and spatial congruence, thus confirming that movement observation primes movement execution beyond the priming contributed by the spatial congruency of stimulus and response.

11:30–11:50 (313)

CAP3: A Model of Automatic/Controlled Processing in the Brain. WALTER SCHNEIDER, JASON CHEIN, & MAUREEN McHUGO, *University of Pittsburgh*—We describe tests applied to a model of automatic/controlled processing, CAP3. Predictions based on simulations within the CAP3 connectionist control architecture were tested through simulation and fMRI experiments designed to illustrate transitions that occur with practice. The model interprets the functions of a network of specialized subsystems including an attention controller (PPC), goal processor (DLPFC), activity monitor (ACC), gating and report relay (thalamus), and episodic store (medial temporal lobe). We explain why controlled processing is serial, how automatic processing becomes parallel, and how language and conscious metacognition mediate control. Predictions for performance in search, attention selection, and problem solving tasks are detailed. In search tasks, we examine how a manipulation of the number of positions to search, the difficulty of comparisons, and the complexity of the response can identify the computational role of unique subsystems. The results were analyzed to identify dissociations across regions detected with fMRI.