

**Selective Attention I**

Nicollet A, Friday Morning, 8:00–9:40

Chaired by Shlomo Bentin, Hebrew University of Jerusalem

8:00–8:15 (1)

**Priming in the Stroop Task: What Causes Facilitation Versus Interference?** COLIN M. MACLEOD, *University of Waterloo*—Warren (1972, *JEP*) reported that repetition priming of a noncolor word in the Stroop task slowed color naming of that primed word, relative to an unprimed word. Thus, if the target word was TABLE in red, the response *red* was slower if the preceding prime word was TABLE rather than HORSE. This enhanced interference is still widely regarded as prototypical, despite research showing that identity priming often actually facilitates color naming (MacLeod & Hodder, 1998, *Psychonomic Society*; Burt, 2002, *JEP:HPP*). Burt (2002) has argued that facilitation is the norm and that interference occurs only when phonological activation of the target word increases response competition. I will present evidence consistent with the argument that there is a routine target-to-prime matching operation. Facilitation occurs when this check determines that the target and the prime match, permitting truncated processing of the word dimension. Interference occurs when a mismatch forces further processing of the word dimension.

8:20–8:35 (2)

**The Time Course of the Attentional Blink and Efficiency of Target 1 Processing.** JUAN BOTELLA, *Universidad Autónoma de Madrid*, ISABEL C. AREND, *University of Wales*, & MANUEL SUERO, *Universidad Autónoma de Madrid*—When observers try to bind stimulus features presented in RSVP conditions, illusory conjunctions are produced. Botella et al. devised a model (based on two sequential attempts to make a response) to explain how those errors are distributed over features occurring in the temporal vicinity of the target. In the present experiment, participants had to report the single letter in an RSVP stream of letters that was presented in a previously specified color (T1) and then report whether or not it was followed after some lag by an X (T2). Performance on T2 (conditionalized on a hit on T1) showed the expected U-shaped function across T1–T2 lag (the attentional blink). However, the time course of the interference was longer for trials with an illusory conjunction response on T1 than for trials with a correct response. Furthermore, the time courses of the interference associated with illusory conjunctions were indistinguishable for pretarget and posttarget intrusions.

8:40–8:55 (3)

**Picture Duration Does Not Affect Magnitude of the Involuntary Attentional Blink.** VERONICA J. DARK & AMY L. RAMOS, *Iowa State University*—Participants alternated between an imagery task (form an image of the object named by a word) and a digit identification task (identify the digit presented in the middle of an RSVP stream of eight pictures). Digits were masked, and duration was set to maintain accuracy around 70%. Picture duration varied between participants (47, 71, 94, 118, and 141 msec). A picture of the imaged object occurred before or after the digit (third/fifth picture). Digit identification was lower in the *before* condition, indicating that the critical picture produced an attentional blink for the digit. Blink magnitude did not vary with picture duration, suggesting that the effect was involuntary rather than due to intentional search. Although participants were not informed of the relationship between the two tasks, most noticed (2/3) and indicated that the picture usually occurred before the digit, as would be expected if *before* pictures involuntarily captured attention.

9:00–9:15 (4)

**Graphical and Other Methods for Representing the Speed and Accuracy of Performance.** RAYMOND M. KLEIN, *Dalhousie University*, JASON IVANOFF, *Vanderbilt University*, & JOHN CHRISTIE, *Dalhousie University*—Following a tradition encouraged by Donders and Cattell, reaction time has become a lynchpin-dependent variable

for drawing theoretical and practical conclusions from carefully designed studies of human performance. Whether the focus is comparing the speed of responding or the overall efficiency of performance in different conditions, a variety of strategies have been adopted for dealing with the well-known trading relation between speed and accuracy. These include minimizing errors and ignoring any accuracy differences that are often nonsignificant under these conditions, using a single measure that combines speed and accuracy (e.g., inverse efficiency), examining accuracy as a function of speed of responding (speed–accuracy tradeoff functions), and a graphical method we have developed for this purpose. We will compare these methods and illustrate the last one with graphic meta-analyses of the effects of spatial attention, IOR, and other manipulations upon performance.

9:20–9:35 (5)

**The Impact of the Stimulus-Content Significance on Orienting Attention: ERP Evidence.** SHLOMO BENTIN & RONI GRANOT, *Hebrew University of Jerusalem*, & DONNA ABECASIS, *Université de Paris V*—Previous studies reported a positive electrophysiological voice-sensitive response (VSR), peaking at 320 msec, which distinguished between matched harmonic sounds emitted by humans and by musical instruments. The VSR was insensitive to relative frequency, was modulated by attention, and was absent if attention was allocated away from the auditory input. We suggested that this component is a manifestation of orienting attention toward stimuli of particular significance. Here, we explored this hypothesis, comparing the VSRs elicited by voices and musical instruments in professional musicians and musically naive participants. Replicating previous data, the VSR distinguished between voices and instruments in naives. This VSR effect was augmented in professional singers. In contrast, instrumentalists elicited the same positive component to instruments and voices. This pattern may suggest that the VSR is, indeed, a manifestation of the orienting response based on stimulus significance. Alternatively, it might reflect lifelong expertise in listening to a particular category of stimuli.

**Recognition Memory I**

Nicollet BC, Friday Morning, 8:00–10:00

Chaired by Andrew J. Heathcote, University of Newcastle

8:00–8:15 (6)

**On the Flexibility of Remember–Know Decision Bounds.** CAREN M. ROTELLO, NEIL A. MACMILLAN, MUNGCHEN WONG, & RUTH-ANNA GORDON, *University of Massachusetts*—In the remember–know paradigm for studying recognition memory, subjects report the subjective basis for their *old* response to a test probe to be either recollection of specific details (remembering) or just familiarity (knowing). Remember–know judgments are most often requested after an *old* response but are sometimes collected in a trinary remember–know–new paradigm. Distinct response patterns in these two task variants can be understood within a two-dimensional signal detection model that combines global and specific information about test items. The standard two-part judgment is based on the sum and difference of these variables (STREAK; Rotello et al., 2004), whereas the trinary decision uses process-pure decision bounds (SAC; Reder et al., 2000).

8:20–8:35 (7)

**Clear Evidence for Recollection on Conjunction Error Rates in a Continuous Recognition Memory Task.** TODD C. JONES, *Victoria University of Wellington*, & PAUL ATCHLEY, *University of Kansas*—We report experiments on recollection-based rejections in a continuous recognition memory paradigm with conjunction lures (e.g., *blackbird* after the presentation of parent words *blackmail* and *jailbird*). The experiments reproduced Jones and Atchley's (2002) findings where conjunction error rates initially increased from a 0-word to a 1-word parent-to-conjunction lure lag, then decreased from a 1-word lag onward. In the present experiments, though, we solicited recollect

judgments, as well as actual (cued) recall, to gain evidence for the role of recollection-based rejection on conjunction error rates. The rates of recollect judgments and recall started relatively high but dropped sharply from a 0-word to a 1-word lag. Very little, if any, forgetting occurred by these measures from a lag of 1 word to a lag of 20 words. The results are consistent with a dual-process theory of recognition memory.

8:40–8:55 (8)

**On the Stability and Accuracy of Recollection.** MICHAEL S. HUMPHREYS & ANGELA M. MAGUIRE, *University of Queensland*—In the first experiment, high levels of false alarms occur after subjects study a pair of related words and are given a word related to both words in the pair. A condition in which subjects recall to the same cues implicates recall in the recognition process. In the second experiment, old words are tested in an intact, a rearranged, or a novel context, and new words are tested in an old or a novel context. Subjects are also questioned about their subjective experience. Both intact and rearranged contexts increase reports of recollection. Subjects also report quite high levels of recollection to new words if the recollection question is not preceded by a recognition question. It is suggested that the recall process identified by the first experiment is a likely candidate for at least some of the errors in the DRM paradigm. Together, the two experiments raise issues about the importance of recollection.

9:00–9:15 (9)

**The Natural Shape of the Source Memory ROC Supports a Continuous (Single-Process) Model of Memory.** SCOTT D. SLOTNICK, *Harvard University*, & CHAD S. DODSON, *University of Virginia* (sponsored by Scott D. Slotnick)—The shape of the receiver operating characteristic (ROC) has been used to determine whether memory retrieval occurs in a continuous or all-or-none manner, where curvilinear and linear memory ROCs support continuous and all-or-none memory retrieval processes, respectively. Continuous retrieval processes have been represented using signal detection models (e.g., with unequal variance Gaussian distributions), whereas all-or-none retrieval processes have been represented using threshold models (including the multinomial model and the recollection component of the dual-process model). We (and others) have observed curvilinear source memory ROCs (supporting the unequal variance signal detection model); however, linear source memory ROCs have also been reported (supporting the dual-process model). We resolve these seemingly inconsistent results by showing that source memory ROCs are naturally curvilinear but can appear linear when nondiagnostic source information is included in the analysis. The present findings indicate that memory retrieval can be construed as a single process that is continuous in nature.

9:20–9:35 (10)

**Testing Processing Tree Models of the Recall–Recognition Paradigm.** FRANCIS S. BELLEZZA, *Ohio University*—In the recall–recognition paradigm, participants complete word stems, including stems from previously presented words, and are then given a recognition test on the words they generated. This paradigm has been used to estimate the role of conscious and unconscious memory processes in remembering tasks and, specifically, to demonstrate unconscious memory priming. Bellezza (2003) tested six processing tree models and found two models, the generate–recognize model of Jacoby (1998) and the source evaluation model of McBride and Doshier (1999), able to account for data from a variety of experiments. Presented here are two additional processing tree models, the task dissociation model and the two-cue model, that also can account for the same data. The inclusion of additional memory tasks in the recall–recognition paradigm is described. The goal of this extension is to falsify one or more of the four models.

9:40–9:55 (11)

**An Approximate Binomial Likelihood Theory of Mirror Effects in Episodic Item Recognition Memory.** ANDREW J. HEATHCOTE, *University of Newcastle*—In this paper, I propose and test ABL–ER

(approximate binomial likelihood: episodic recognition), a theory of long-term episodic recognition memory. I show that the ABL–ER provides an accurate quantitative account of both false alarm and hit rate data and ROC data from over 30 published item recognition memory experiments comprising over 300 experimental conditions. The experiments were selected to comprehensively examine item mirror effects (mainly, but not exclusively, due to word frequency), both when they occur and when they fail. ABL–ER is also shown to give an accurate and parametrically coherent account of the list strength mirror effect, test time and capacity manipulations, forgetting and similarity effects, list length and strength effects, category length effects, and the effects of brain damage, aging, dementia, and Midazolam on item recognition memory, as well as the interaction of these effects with the item mirror effect.

#### Combining Information in Decision Making

Nicollet D, Friday Morning, 8:00–9:40

Chaired by Wayne D. Gray, *Rensselaer Polytechnic Institute*

8:00–8:15 (12)

**Confidence in Aggregation of Correlated Opinions.** DAVID V. BUDESCU & HSIU-TING YU, *University of Illinois, Urbana-Champaign*—We study the process by which a single decision maker (DM) aggregates probabilistic opinions from multiple correlated sources, with a special emphasis on the determinants of the DM's confidence in the final estimate. Budescu, Rantilla, Yu, and Karelitz (2003) have proposed and successfully tested a model that assumes that (1) the DM combine the advisors' opinions by weighting them according to the amount of information underlying them and (2) the DM's confidence increases as a function of a variety of factors that reduce its variance. We report results of a new study testing the model's predictions. We employ a new and more realistic experimental paradigm that allows us to control the diagnosticity of the various cues and their intercorrelations. Most of the model's predictions are supported. The best predictor of the DM's confidence is the level of agreement among the advisors.

8:20–8:35 (13)

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

8:40–8:55 (14)

**Assessing the Development of Decision-Making Expertise in Teams.** JAMES SHANTEAU & JOHN RAACKE, *Kansas State University*—Many technological tasks—for example, air traffic control (ATC)—are beyond the capabilities of single individuals and, so, must be performed by teams. How should a team's performance be assessed? Our approach is to analyze the team as a single unit—that is, an integrated entity. The purpose is to assess development of team skills, using a measure of expertise we originally developed to assess individuals. We applied this approach using a microworld (computer) simulation of ATC, with teams of four operators trained for 3 months. Major findings were the following: (1) Our measure of individual expertise

can be applied to team performance; (2) team skills developed more slowly than individual skills; (3) although most teams improved, some declined in performance; (4) similarity of mental models was more predictive of team performance than were personality variables; and (5) colocated teams outperformed distributed teams. These results have implications for team cognition and training.

#### 9:00–9:15 (15)

**Signal Detection Model of Advice Acquisition.** SHENGHUA LUAN, ROBERT D. SORKIN, & JESSE ITZKOWITZ, *University of Florida* (read by Robert D. Sorkin)—We used signal detection theory to describe how people acquire and use advice. Our normative model specifies whether and whom to consult when performing a detection task. The model shows how consulting decisions should depend on the decision maker's own estimate, as well as the cost, expertise, and bias of the potential advisors. Suppose a decision maker has two potential advisors with equal expertise and cost but different biases: One advisor has a liberal bias (favors signal), and one is conservative (favors noise). If the decision maker's own estimate favors a signal response, he or she should consult the liberal advisor. If the estimate favors noise, he or she should consult the conservative advisor. This strategy would result in advice that usually agrees with the decision maker's opinion. Thus, in these situations, seeking confirmatory advice (confirmation bias) is a rational strategy. In our experiments, the behavior of paid human subjects matched the prediction of the model.

#### 9:20–9:35 (16)

**Interaction-Intensive Versus Memory-Intensive Adaptations to Information Access in Decision Making.** WAYNE D. GRAY, MICHAEL J. SCHOELLES, CHRISTOPHER W. MYERS, & HANSJÖRG NETH, *Rensselaer Polytechnic Institute*—Over the last 2 decades, attempts to quantify decision making have established that, under a wide range of conditions, people trade off effectiveness for efficiency in the strategies they adopt. However, as interesting, significant, and influential as this research has been, its scope is limited by three factors: the coarseness of how effort was measured, the confounding of the costs of steps in the decision-making algorithm with the costs of steps in a given task environment, and the static nature of the decision tasks studied. In the present study, we embedded a decision-making task in a dynamic task environment and varied the cost required for the information access step. Across three conditions, small changes in the cost of interactive behavior led to changes in the strategy adopted for decision making, as well as to differences in how a step in the same strategy was implemented.

### Language Production I

#### Greenway BCD, Friday Morning, 8:00–10:00

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

#### 8:00–8:15 (17)

**The Implicit Priming of the Tonal Syllable: Phonological or Phonetic?** JENN-YEU CHEN, *National Cheng Kung University*, & TRAIN-MIN CHEN & YOU-YU DAI, *National Chung-Cheng University*—We investigated whether the implicit priming effect of the tonal syllable in Chinese was phonological or phonetic, by making use of tone sandhi. Experiments 1 and 2 showed a similar size of the effect when the shared first syllables of the target words were homogeneous with respect to the tones before, as well as after, tone sandhi. In Experiments 3 and 4, where tone sandhi was irrelevant, target words sharing the first syllables with similar tones (T2 and T3) produced the usual effect, whereas those with distinct tones (T1 and T3) produced a smaller effect. These results suggested both a phonological and a phonetic source of the implicit priming effect of the tonal syllable, consistent with Cholin, Schiller, and Levitt (2004). In addition, the results argued for a decomposed phonetic syllable, which consists of two sequentially organized articulatory gestures. The suspension–resumption mechanism of word production works down to this level.

#### 8:20–8:35 (18)

**Number Meaning and Number Agreement: A Cross-Language Comparison.** KATHRYN BOCK, *University of Illinois, Urbana-Champaign*, MANUEL CARREIRAS & ENRIQUE MESEGUER, *Universidad de La Laguna*, & ELIZABETH OCTIGAN, *University of Illinois, Urbana-Champaign*—Grammatical agreement puts different demands on speakers of different languages. One influential and intuitively compelling hypothesis is that these demands influence how speakers deal with the meanings behind agreement. We tested claims that richer morphology and greater word order freedom increase sensitivity to number. Native English and Spanish speakers were compared in their use of semantically and grammatically motivated number agreement. With translation-equivalent materials, speakers of both languages displayed significant sensitivity to nuances of number meaning, but the effects were the same in magnitude for both groups. In this respect, speakers of English and Spanish appear to respond to number in similar ways, despite the substantial morphological and syntactic differences in their languages.

#### 8:40–8:55 (19)

**Syntactic Class Influences Phonological Priming of Tip-of-the-Tongue Resolution.** LISE ABRAMS & EMILY L. RODRIGUEZ, *University of Florida*—When tip-of-the-tongue (TOT) experiences are had, phonologically related words have been shown to both facilitate and inhibit word retrieval. This experiment examined whether phonologically related words' syntactic class (i.e., part of speech) is responsible for these differential effects. Sixty college students saw general knowledge questions whose answers were designated target words, and participants responded know, don't know, or TOT. Following TOT and don't know responses, participants saw five words, one of which was a prime. Primes contained the target's first syllable and either shared or did not share the target's part of speech. Following presentation of the primes, retrieval of the target was attempted again. Different part-of-speech primes facilitated resolution of TOTs, whereas same part-of-speech primes had no effect, relative to phonologically unrelated words. These results support node structure theory's most-primed-wins principle and the transmission deficit model account of TOTs, where TOTs are caused by weak connections among phonological representations.

#### 9:00–9:15 (20)

**What Do Speakers Prepare When They Prepare Words in Advance?** ZENZI M. GRIFFIN, *Georgia Institute of Technology*—Researchers have argued that when speakers prepare an utterance, they structure a clause and decide which words (lemmas) to use before speaking. Only the processes of organizing the phonological forms of words and motor programming are performed after speech begins (e.g., Butterworth, 1989; Meyer, 1996). Two experiments explored the degree to which speakers chose to prepare object names prior to versus while speaking when they described displays of multiple objects under different conditions. The objects varied in naming difficulty at different levels of production. Speakers' eye movements were monitored. The results suggest that speakers are able to buffer visual or semantic representations of objects and phonological forms of object names but offer no support for buffered lemmas in the absence of phonological forms.

#### 9:20–9:35 (21)

**Verbal, Visual, and Spatial Working Memory in Written Sentence Production.** RONALD T. KELLOGG, MARK T. MORGAN, MELISSA M. ARMSTRONG, & MICHAEL J. CAHILL, *Saint Louis University*—The dependence of language production on specific components of working memory was investigated by having participants write definitions of either abstract or concrete nouns in longhand. A continuous, concurrent working task required the detection of a verbal (phoneme), a visual (shape), or a spatial (location) stimulus and a speeded decision regarding whether it matched the last one presented several seconds earlier. In Experiment 1, writing both concrete and ab-

stract definitions reliably elevated the time to respond to verbal targets (relative to single-task baseline data). This interference was observed for visual targets only when concrete definitions were written. In Experiment 2, the selective interference effect was replicated for visual targets and was eliminated for both concrete and abstract nouns with spatial targets. We conclude that only verbal working memory is necessary for sentence production; visual, but not spatial, working memory is selectively engaged when the referents of concrete nouns are imaged in the writing of definitions.

#### 9:40–9:55 (22)

**How Do Speakers Avoid Ambiguous Linguistic Expressions?** VICTOR S. FERREIRA & L. ROBERT SLEVC, *University of California, San Diego*, & ERIN S. ROGERS, *Stanford University*—Ambiguous expressions disrupt communication, and so speakers should avoid producing them. In three experiments, speakers described target objects (a flying mammal, “bat”) in contexts including foil objects that caused nonlinguistic (a larger flying mammal) and linguistic (a baseball bat) ambiguity. Whereas speakers nearly always avoided nonlinguistic ambiguity before producing an expression, they avoided linguistic ambiguity before producing it only sometimes. However, once it was produced, speakers avoided using linguistically ambiguous expressions again, showing that they can at least detect linguistic ambiguity after the fact. This shows that nonlinguistic and linguistic ambiguity must be distinguished; speakers naturally avoid the former, but they only avoid the latter once production processes have accessed and articulated the ambiguous expression itself.

#### Learning in Nonhuman Species Greenway FGH, Friday Morning, 8:00–9:40

*Chaired by James S. Macdonall, Fordham University*

#### 8:00–8:15 (23)

**Latent Inhibition in Honeybees.** PATRICIA A. COUVILLON & M. E. BITTERMAN, *University of Hawaii*—Latent inhibition was studied in three experiments on classical proboscis extension conditioning in honeybees. In Experiment 1, nonreinforced exposure in the first stage to Odor A, to Odor B, or the context alone was followed in the second stage by B+ training, which showed a stimulus-specific retardation effect; in the third stage, testing with AB− failed to show a summation effect. These results, like those for vertebrates, support an attentional, rather than an inhibitory, interpretation of nonreinforced preexposure. In Experiment 2, performance in AB+ training was no different after nonreinforced exposure to B, as compared with the context alone. In Experiment 3, inhibition was evidenced by better performance in discrimination training with A+ and AB− after nonreinforced exposure to B, as compared with the context alone.

#### 8:20–8:35 (24)

**Resistance to Interference in Complex Negative Patterning.** DOUGLAS A. WILLIAMS, DALLAS REIMER, & JENNIFER GAWEL, *University of Winnipeg*, & RICK MEHTA, *Acadia University*—Resistance to interference was examined in rats that had partially mastered a complex negative patterning discrimination (XA+, XB+, and XAB−, where the letters indicate distinctive conditioned stimuli and “+” and “−” stand for the food pellet unconditioned stimulus and no food pellet, respectively). Retention of the discrimination, as measured by anticipatory food magazine entry, was poor after AB+ and XAB+ interference treatments but was similar to control levels after an A+ and B+ interference treatment. Results are consistent with the notion that complex negative patterning discriminations are learned through a configural process.

#### 8:40–8:55 (25)

**Conditions Favoring Rule-Based Generalization of Configural Learning.** RICK MEHTA, *Acadia University*, & DOUGLAS A. WILLIAMS, *University of Winnipeg*—A categorization experiment

investigated the extent to which rule-based instructions facilitate generalization of configural processing. Participants were instructed to apply an “opposites rule” prior to acquiring a discrimination in which elements and compounds predicted opposite outcomes (Stage 1: A+, B+, AB−, C−, D−, CD+; “+” and “−” stand for outcome and no outcome). In this stage, elements were introduced prior to compounds (ec1), or compounds were introduced prior to elements (ce1). In Stage 2, participants experienced W+, X+, Y−, and Z− elements and were tested with WX and YZ compounds (ec2) or experienced WX+, YZ− compounds and were tested with their W, X, Y, and Z elements (ce2). Transfer of configural learning was higher when stimulus presentation was consistent (ec1/ec2, ce1/ce2), rather than inconsistent (ec1/ce2, ce1/ec2), across stages. This result suggests that the interaction of instructions and consistency of stimulus presentation mediates rule-based generalization of configural learning.

#### 9:00–9:15 (26)

**Role of the Opioid System in Consummatory Successive Negative Contrast.** MICHAEL D. WOOD, ALAN M. DANIEL, & MAURICIO R. PAPINI, *Texas Christian University* (read by Mauricio R. Papini)—Two experiments explored the role of the opioid system in a situation involving a surprising reduction in reward magnitude: consummatory successive negative contrast. Rats received access to 32% sucrose solution (Trials 1–10), followed by 4% solution (Trials 11–15). Independent groups received an injection of either saline solution or the d-receptor agonist DPDPE (24 mg/kg). DPDPE attenuated the contrast effect when injected before Trial 11, but not when injected before Trial 12. An additional experiment showed that the attenuating effect of partial reinforcement on the recovery from contrast was reduced by DPDPE injections administered before nonreinforced trials. These results are consistent with Gray’s (1987) fear = frustration hypothesis.

#### 9:20–9:35 (27)

**Does the Concatenated Generalized Matching Law Identify the Necessary and Sufficient Conditions?** JAMES S. MACDONALL, *Fordham University*—The concatenated generalized matching law (CGML), which says that preference (response or time) is a function of the allocation of reinforcer rates, magnitudes, and immediacies, is among the most reliable quantitative findings in conditioning and learning. Does the CGML identify the necessary and sufficient conditions that influence preference? Using a procedure in which two pairs of variable-interval schedules arrange reinforcers for staying at and switching from each alternative (MacDonall, 2000), overall rates of earning reinforcers differed at each alternative; otherwise, conditions were identical. Rats were exposed to these concurrent choice procedures. We found that (1) these procedures can produce data consistent with the CGML, (2) conditions produced preferences but no difference in reinforcer allocation—that is, reinforcer allocation was not a necessary condition for preference—and (3) conditions produced differences in reinforcer allocation but no preference—that is, reinforcer allocation was not a sufficient condition for preference.

#### Movement Perception Regency, Friday Morning, 8:00–10:20

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

#### 8:00–8:15 (28)

**See the Ball, Hit the Ball: Apparent Ball Size Is Correlated With Batting Average.** JESSICA K. WITT & DENNIS R. PROFFITT, *University of Virginia* (read by Dennis R. Proffitt)—Baseball players frequently say that the ball appears bigger when they are hitting well. In describing a mammoth 565-ft home run, Mickey Mantle said, “I never really could explain it. I just saw the ball as big as a grapefruit.” We ran an experiment that confirmed that this phenomenon is a psychological reality. After they had competed in one or two games, we presented softball players with several circles of various sizes, and they picked the one that they thought best corresponded to the size of a

softball. We found that players picked sizes that were correlated with their batting average for the just completed games. Players with higher batting averages selected larger circles. This finding is consistent with recent research, by us and others, that shows that perception relates the spatial dimensions of the environment to the action potential of the perceiver.

#### 8:20–8:35 (29)

**Spatial Updating Depends on Set Size.** RANXIAO FRANCES WANG, JAMES A. CROWELL, DANIEL J. SIMONS, MICHAEL S. AMBINDER, LAURA E. THOMAS, & JESSICA L. GOSNEY, *University of Illinois, Urbana-Champaign*—Spatial updating refers to the cognitive process that maintains a representation of one's spatial relationship to the environment as one moves. Allocentric models suggest that object locations are encoded in an external reference frame and only the viewer's position and orientation need to be updated as he or she moves. Thus, spatial updating should be independent of the number of objects in the environment. The egocentric updating model suggests that object locations are encoded relative to the viewer and all their egocentric positions and orientations need to be updated as the viewer moves. Thus, egocentric models predict that spatial updating efficiency depends on the number of objects being updated (set size). We examined which model better accounts for spatial updating, using a virtual environment. Object localization after observer movements was affected by the number of objects being updated, supporting egocentric models of spatial updating.

#### 8:40–8:55 (30)

**Balancing Competing Visual Demands in Perceiving Moving Images.** DUJE TADIN & JOSEPH S. LAPPIN, *Vanderbilt University* (read by Joseph S. Lappin)—Detecting the invariant structure of moving images demands spatial integration of local signals. Segregating and discriminating moving forms, however, demands spatial differentiation of motion fields. Both functions are well described in the literature on visual motion perception, but the resolution of these competing demands has been poorly understood. Tadin et al. (2003) recently described psychophysical correlates of the center-surround antagonism found in many neurons in cortical area MT. Motion directions of large high-contrast patterns are surprisingly less visible than those of smaller patterns. Spatial suppression occurs at high contrast, but summation occurs at low contrast. The present study examined the role of this mechanism in visually segregating moving forms from backgrounds. A within-subjects experiment found a tradeoff over varying contrasts in discriminating motion directions and motion-defined forms ( $r = -.98$ ). A between-subjects experiment found that persons with greater spatial suppression tended to be better in discriminating motion-defined forms.

#### 9:00–9:15 (31)

**Visual Control of Heading and Speed to Intercept a Moving Target on Foot.** WILLIAM H. WARREN & ALEXANDRA CHARDENON, *Brown University*—People intercept a moving target by changing their direction of travel to achieve a constant target-heading angle (Fajen & Warren, in press). But they can also do so by changing their walking speed (Chardenon et al., 2004). To examine the integration of heading and speed control, we tested interception of fast-moving targets on foot in a  $12 \times 12$  m virtual environment. The data can be modeled if heading and speed are controlled independently, so that heading direction is regulated by the target-heading angle (Fajen & Warren, 2004) and speed is regulated by the first-order time-to-contact with the target (Lees, 1976, tau variable). In a second experiment, we tested this hypothesis by making the target shrink or expand as it moved. The results imply that humans intercept moving targets by adjusting both heading and speed but that they are regulated independently.

#### 9:20–9:35 (32)

**Similarities in Bipedal, Bimanual, Quadripedal Locomotion: Evidence for a Unified Locomotor Action System.** JOHN J. RIESER, KAYSI HOLMAN, & PEG CUMMINS, *Vanderbilt University*, FELIX

WEINGARTEN, *Max Planck Institute for Evolutionary Anthropology*, & CAMI RIDLEY, *Vanderbilt University*—Viewing a target and locomoting to its remembered location without environmental feedback depends on perceiving locomotor actions in the scale of the surrounding environment. In four experiments, adults were asked to view a target located 6–24 m (even out to 190 m) away and to locomote to its remembered location without vision or other environment cues. Form of locomotion was varied—highly practiced (bipedal walking), practiced (quadripedal swimming), and novel (pushing along while prone on a roller board). Targets were viewed from upright or prone postures. Systematic errors were used to compare bias in the calibration of the three forms of locomotor action and visual perception, and variable errors were assessed to compare precision of the calibrations. People performed with little or no bias and with remarkably little variability. Even without access to environmental information, practiced and novel forms of locomotion alike are calibrated in terms of the environment as a frame of reference. They constitute an action system.

#### 9:40–9:55 (33)

**Interpreting Human Movement: Using Virtual Reality Characters in Multiple Contexts.** RUTH S. DAY & DANIEL C. HOWARD, *Duke University*, & ROBERT HUBAL, *Research Triangle Institute*—How do we evaluate the overall emotional state of others on the basis of their whole body movement? The answer depends on what body parts move, how they move, when they move, and other key movement features. This research uses virtual reality characters to examine movement features in a systematic way. Our recent experiments show that specific features (such as arm or torso movements) are generally perceived as expressing positive or negative emotion. However, they can change substantially when combined with other features. The basic results are highly robust across a wide range of stimulus conditions and types of participants. The present experiments examine the generality of these results for different types of virtual characters (fierce vs. friendly) and environmental contexts (negative vs. positive). Implications for cognitive theories and applications to everyday situations (how dancers remember movement sequences, how police officers interpret movements of alleged perpetrators, how physicians interact with patients) are discussed.

#### 10:00–10:15 (34)

**Evaluating and Modeling Auditory Event Perception: Postural Contrasts in Human Gait.** RICHARD E. PASTORE, JEREMY R. GASTON, MATTHEW J. SOLOMON, & JESSE D. FLINT, *SUNY, Binghamton*—In the visual domain, point-of-light research demonstrates that viewers can identify many characteristics of individual walkers, indicating that humans possess considerable knowledge about the biomechanics of human gait. The present research addresses the question of whether equivalent knowledge is available to listeners, allowing them to identify characteristics of auditory source events—specifically, the ability to identify upright versus stooped posture. Our three-stage approach evaluates (1) anthropometric and biomechanical properties of the source event, (2) the acoustic consequences of those events and their specific properties, and (3) the ability of listeners to identify specific event properties. Evaluating the properties of these stages and the relationships among these stages has allowed us to develop models of actual and ideal listener abilities to differentiate specific auditory events.

#### SYMPOSIUM: What Does It Mean to Model Cognition? Nicollet A, Friday Morning, 9:50–12:00

Chaired by Mark A. Pitt & Jay I. Myung, *Ohio State University*

As cognitive modeling continues to grow in popularity, it is important that cognitive psychologists in general, and future modelers in particular, entertain this question. Answers are difficult to come by in the literature. Equally scarce are discussions of why one style of modeling might be chosen over another (mathematical vs. connectionist).

The purpose of this symposium is to stimulate public discourse on the topic by having researchers familiar with both modeling and experimentation present their views. Three researchers will provide answers to a common set of questions in the context of their style of modeling (e.g., Why use a particular style of cognitive modeling? What are its rewards and hazards? How should such models be evaluated?). Two others will then comment on the talks and provide a broader perspective on the enterprise of cognitive modeling.

9:55–10:20 (35)

**The Art and Science of Modeling.** RICHARD M. SHIFFRIN, *Indiana University*—Psychology's unique place in the sciences, with noisy data describing almost infinitely complex systems and with ambiguous explanatory validation, requires modeling but makes it as much an art as a science. I will discuss levels of explanation, from heuristic descriptions to quantitative fits of data to prescriptive normative theory, the range in precision of data to be explained, the importance and imprecision of the qualitative/quantitative distinction and its implementation in modeling, the uses of computational and analytic methods, methods of model validation and testing, a priori prediction versus descriptive fitting, factors affecting model assessment including simplicity, elegance, fit, and predictive power, model evolution and rejection, and uses and misuses of modeling. If time permits, I will illustrate with examples from (mostly) my own research.

10:25–10:50 (36)

**Models Are Not Answers: Connectionist Modeling as Theoretical Exploration.** DAVID C. PLAUT, *Carnegie Mellon University*—Computational models are often viewed as monolithic theoretical proposals that stand or fall as a whole, typically based on the quantitative match between the model's performance and empirical data. An alternative, incremental perspective views modeling as more akin to hypothesis testing. Here, the goal is broader—to explore the implications of core aspects of a theory by examining how, when instantiated in specific implementations, they give rise to key empirical phenomena. A given model is not intended to account for all aspects of the data and may not include all relevant principles if some are not critical to the phenomena at hand. Theoretical consistency across models is encouraged by drawing on a common, coherent set of computational principles and by gradually expanding the breadth of empirical coverage of individual models as the implications of the underlying principles become better understood. The advantages and pitfalls of this approach will be illustrated by examining connectionist modeling of reading and language.

10:55–11:20 (37)

**Processing Tree Modeling as a Method of Measurement.** WILLIAM BATCHELDER, *University of California, Irvine*—Multinomial processing tree (MPT) models are for paradigms involving categorical data. Parameters are interpreted as probabilities of hypothesized latent cognitive acts during response production—for example, storing an item in memory, detecting the source of a fact, or making a particular logical inference. MPT models are paradigm specific, intentionally simple, and validated for specific experimental conditions. The goal is to measure (estimate) the latent parameters and compare them between experimental groups. MPT models are surely wrong in detail, but their simplicity permits a deep understanding of their statistical properties: issues in Bayesian and classical inference, modeling individual differences, and in model selection. The approach makes no claim to represent deep cognitive theory; however, when applicable, an MPT model may be more useful than off-the-shelf statistical packages in understanding data. Thus, MPT models comprise a cognitive psychometrics rather than a cognitive theory.

11:25–11:45 (38)

**The Role of Models in Understanding.** GORDON D. LOGAN, *Vanderbilt University*—Skinner said that science progressed from prediction to understanding to control. Models play a central role in all three steps.

Models expose the causal forces that underlie phenomena and allow us to measure aspects of phenomena that cannot be seen directly. This understanding of the causal forces affords prediction in two senses: It allows quantitative accounts of existing data, and it suggests hypotheses about undiscovered aspects of the phenomena, providing a principled way to extend our knowledge. Understanding and prediction allow us to control phenomena in laboratory experiments and applied settings and fosters the development of new theory and the development of technology. I will illustrate these ideas with examples from models of attention, skill acquisition, and executive control.

11:45–12:00 (39)

**Ask Not Whether a Model is Right or Wrong; Ask Whether It Is Useful.** THOMAS S. WALLSTEN, *University of Maryland, College Park*—Under the assumption that models are at best under-dimensionalized representations of reality, the proper question to ask is not whether they are right or wrong (they are always wrong in detail), but whether they are useful. For example, models are useful when they reexpress the data in terms of theoretically meaningful constructs, when they offer insight as to how measurement may take place, or when they systematically misfit the data in ways that lead to new understanding. I will discuss the other presentations from this perspective.

**Priming Effects on Word Processing**  
Nicollet BC, Friday Morning, 10:15–11:55

Chaired by Catherine L. Harris, Boston University

10:15–10:30 (40)

**Using Repetition Blindness to Investigate Lexical Retrieval and Comprehension.** SALLY ANDREWS, *University of Sydney*—Repetition blindness is the tendency to omit the second occurrence of a repeated item when recalling lists or sentences exposed in rapid serial visual presentation (RSVP) procedures. The present experiments compared recall for sentences containing repeated words, neighbor pairs, or control pairs (e.g., *Most people are happy/poor in poor suburbs; You won't see a fight/pool in poor suburbs*) across variants of the RSVP procedure and in untimed whole-sentence presentation conditions in which eye movements were recorded. Other paradigms required plausibility judgments rather than recall. The RSVP data replicated the previously reported findings of repetition blindness and showed equivalently reduced recall for the second word of a neighbor pair. However, only the neighbor pairs affected eye movements during reading and plausibility judgments. Discussion will consider the implications of the results for specifying the locus of repetition deficits and for understanding the relationship between lexical retrieval and sentence comprehension.

10:35–10:50 (41)

**A Nonmagical Account of the Prime Validity Effect.** SACHIKO KINOSHITA, *Macquarie University*, KENNETH I. FORSTER, *University of Arizona*, & MICHAEL C. MOZER, *University of Colorado*—Bodner and Masson (2001, *Journal of Memory & Language*; 2004, *Memory & Cognition*) reported that the masked repetition priming effect is magnified in a block containing a high proportion of repetition prime trials. They took this finding, termed the *prime validity effect*, to suggest that subjects strategically modify reliance on the prime even when the prime is not available to consciousness. We believe instead that the prime validity effect is an instance of a list composition (context) effect, reflecting a shift in the estimated optimal time to initiate a response as a function of difficulty of recent trials. We present an account and supporting data cast in terms of the model of list composition effects proposed by Mozer, Kinoshita, and Davis (2003, *Psychonomic Society Meeting*).

10:55–11:10 (42)

**Can Unconsciously Perceived Words Guide Behavior?** KENNETH I. FORSTER, *University of Arizona*—It has been proposed that heavily

masked words can act as cues for decision making, despite the fact that they are not perceived consciously. Kunde, Kiesel, and Hoffman (2003) explain this in terms of an “action trigger,” which is intentionally created during training with consciously perceived stimuli but which is, nevertheless, triggered by unconscious stimuli. This hypothesis was tested by explicitly providing a visible but briefly presented “prime,” which simply acted as a cue indicating which key to press in a lexical decision experiment. After training with visible cues, a forward mask was introduced to test whether the cues were still effective when they were masked. A weak effect was observed with an SOA of 60 msec, but this disappeared entirely with a 50-msec SOA. This could mean that action triggers have a latency longer than 50 msec or that partial awareness of the prime is required for the cuing effect.

#### 11:15–11:30 (43)

**Eye Movements and Lexical Ambiguity Resolution: Investigating the Subordinate Bias Effect.** SARA C. SERENO & PATRICK J. O'DONNELL, *University of Glasgow*, & KEITH RAYNER, *University of Massachusetts*—Recent debates in lexical ambiguity resolution have centered around the “subordinate bias effect”—that is, reading time is longer on a biased ambiguous word in a subordinate-biasing context, as compared with a control word matched to the overall word form frequency of the ambiguous word. The nature of the control word—namely, whether it matches the frequency of the ambiguous word's overall word form or its contextually instantiated word meaning (a higher or lower frequency word, respectively) was examined. Eye movements were recorded as participants read contextually biasing passages that contained an ambiguous word target or a word form or word meaning control. Significant effects of word frequency (comparing the two control words), as well as ambiguity (with fixation time between and different from both controls) were obtained. Results are discussed in terms of the reordered access model, in which both meaning frequency and prior context affect access procedures.

#### 11:35–11:50 (44)

**Does Emotion Speed Binding of Word Fragments Into Words?** CATHERINE L. HARRIS, *Boston University*, DONALD G. MACKAY, *UCLA*, RENDI BOLTON, *Boston University*, & CHRISTOPHER ROBLES, *Emmanuel College, Boston*—Perception of “illusory words” in RSVP sequences of words and word fragments is increased if the stream contains orthographically similar words (due to orthographic repetition blindness) and if potential illusory items have taboo status. According to MacKay's binding theory, emotion facilitates binding, meaning that taboo words will be detected earlier than neutral words. Observers attempted to detect taboo or animal targets in sequences such as @%\$#@&\* FRIGHT @%\$#@&\* slight ut filler @%\$#@&\* (possible illusory word, *slut*). Skin conductance was monitored in order to detect subthreshold activation of taboo words. More taboo than animal targets were detected, and detection was faster, supporting the predictions of binding theory. Skin conductance responses (SCRs) were strongly influenced by whether a target was detected but were less influenced by taboo versus animal target. This implies that target detection was itself highly arousing, meaning that tasks (such as report) would make better use of the typically greater SCRs elicited by taboo words.

#### Working Memory in Rats and Humans Nicollet D, Friday Morning, 10:00–12:00

Chaired by Elisabet Service, *Dalhousie University*

#### 10:00–10:15 (45)

**Factors Affecting Rats' Object Recognition Working Memory in a Foraging Task.** JEROME COHEN, PARAMESWARAN VARAKINI, & ROBERT ZUNIGA, *University of Windsor*—Rats were trained to push aside three, five, or seven objects to obtain sunflower seeds beneath them during the foraging *study* phase of a trial. To test their memory of these objects, we replaced one of the objects with a *new*, baited

object for the foraging *test* phase of the trial. Rats were allowed to search for the remaining baited object following a retention interval that varied from 0.5 to 15 min. We assessed rats' working memory by noting the number of nonbaited *old* objects they chose before finding the *new* baited object. We present data showing how their working memory is a function of list length, retention interval, and the serial position of the new object.

#### 10:20–10:35 (46)

**Configural Determinants of Visuospatial Serial Memory Performance.** FABRICE B. R. PARMENTIER & GREG ELFORD, *University of Plymouth*, & DYLAN M. JONES, *Cardiff University* (sponsored by Dylan M. Jones)—The study of serial memory has been dominated by the use of verbal stimuli, whereas visuospatial stimuli have been relatively neglected. As a result, no formal account is available to account for patterns of performance in visuospatial serial recall tasks. We suggest that one important reason for this theoretical gap may be lack of understanding of the role that stimuli characteristics play in serial memory. We report the results of a series of experiments using the dots task, demonstrating for the first time that path length and path crossings negatively affect serial memory performance, and argue that such characteristics have implications for experimental, as well as clinical, assessments. We interpret our data within a proceduralist framework in which verbal and nonverbal events are seen as different points on a continuum relating to the availability to long-term knowledge or strategies, rather than within a modular framework.

#### 10:40–10:55 (47)

**Rethinking Output Interference in Immediate Serial Recall.** JAMES S. NAIRNE, *Purdue University*—Two experiments investigated how recall of one item affects recall of a second item in immediate serial recall. In Experiment 1, subjects received six-item memory lists followed immediately by a recall probe (recall the third item) or an easy distractor task. After an equivalent delay, recall of a target item was required. Recalling an initial item, as opposed to distraction, substantially improved recall of the target item, and perhaps more important, position-based gradients were obtained—for example, initial recall of the third item helped subsequent recall of the second or fourth item more than the first or fifth. In Experiment 2, the distraction condition was replaced by a condition in which a list item was merely read, rather than recalled. Although no recall advantage was found over reading, strong position gradients were again obtained. Implications of these data for current theories of immediate serial recall will be discussed.

#### 11:00–11:15 (48)

**Serial Position Effects in Nonword Repetition.** PRAHLAD GUPTA & BRANDON ABBS, *University of Iowa*—A growing body of research has emphasized the linkage between performance in immediate serial recall of lists, nonword repetition, and word learning. Recently, it has been reported that primacy and recency effects are obtained in repetition of individual syllables within nonwords (Gupta, 2004). Five experiments examined whether such within-nonword primacy and recency effects are attributable to common sequencing mechanisms that are shared with immediate list recall. Experiments 1 and 2 indicated that the primacy and recency effects are not due simply to greater morphological salience at the beginnings/endings of nonwords. Experiments 3, 4, and 5 examined alternative hypotheses for the observed serial position effects, concluding that the alternative hypotheses fail to account for the obtained pattern of results. These results provide support for the common sequencing mechanisms hypothesis. The implications of these results are discussed in terms of the relationship between list recall and nonword repetition and in terms of broader issues in word learning.

#### 11:20–11:35 (49)

**Response Durations in Spoken Recall Exhibit a Serial Position Effect.** KARL F. HABERLANDT & HOLLY LAWRENCE, *Trinity College, Hartford*—Response durations in spoken serial recall exhibit a bow-

shaped function, relative to serial position. In forward and backward recall, response output was faster in the primacy and recency region than at center positions. We recorded the durations, as well as inter-response pauses, in spoken recall, using ungrouped lists of four through six words and postcuing of recall direction. We discuss the pause pattern in terms of recent models of serial order memory, including the ACT-R, distinctiveness, and SOB models. The duration pattern suggests that response articulation in serial recall depends on concurrent cognitive processes. The pattern is inconsistent with a modular view of recall output—namely, that articulation is independent of retrieval processes.

11:40–11:55 (50)

**Simple and Complex Span for Morphologically Complex Forms.** ELISABET SERVICE, *Dalhousie University*, & SINI MAURY, *University of Helsinki*—In previous studies, the morphological complexity of Finnish words interacted with memory task (simple vs. complex span). We studied immediate recall of visually presented morphologically complex words, recall of last words in read sentences, and recall of independent words presented after read sentences. An analysis of errors showed that immediate recall was characterized by incorrect or missing words and within-list form confusions, whereas order recall was good. Last-word recall suffered from order errors but showed good retention of items and their forms. Independent-word recall showed signs of forgetting of both items and their forms but better order memory than last-word recall. We infer that when many morphologically complex forms are simultaneously activated in working memory for immediate recall, both inflectional and derivational suffixes are available to create confusions in recall. When recall of morphologically complex forms relies on an episodic record, interference is based on morphological neighbors in long-term memory.

**Problem Solving and Decision Making**  
**Greenway BCD, Friday Morning, 10:20–11:40**

*Chaired by Douglas H. Wedell, University of South Carolina*

10:20–10:35 (51)

**Visual Cognition: Recognition and Reasoning With Microscope Slides.** JULIA H. CHARIKER, JOHN R. PANI, & RONALD D. FELL, *University of Louisville* (read by John R. Pani)—Interpretation of microscope slides in histology, a complex visuocognitive domain, involves highly integrated cognitive processes. In an interview study, successful graduates of the college course found this task to be extremely challenging, and individual differences in performance were large. Successful performance was supported by a close mapping between visual and anatomical knowledge. Visual knowledge took the form of holistic recognition of patterns and the analytical understanding of the structure of tissue on slides. Anatomical knowledge took the form of an analytical understanding of the composition and the taxonomic organization of tissues. Histological slide interpretation was remarkable for the degree to which it forced integration between the use of visual knowledge, anatomical knowledge, and reasoning. Recognition processes went forward when possible. With partial recognition, a variety of forms of reasoning took place. Effective skill in reasoning, with no confirmation bias, was observed to be a primary tool of these developing histologists.

10:40–10:55 (52)

**Subgoal Learning Reduces Cognitive Load During Training and Problem Solving.** 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. During training and transfer, participants provided cognitive load ratings. Transfer performance was superior for participants who studied examples that highlighted subgoals. Cognitive load ratings were lower for the subgoal condition during both the training and the problem solv-

ing phases. This suggests that examples designed to convey subgoals might free up working memory so that learners can more effectively acquire useful problem-solving knowledge.

11:00–11:15 (53)

**Is Time a Cost? The Sunk Cost Effect for Investments of Time and Money.** FRANCA AGNOLI & TOMMASO TESSARI, *University of Padua*—The expression “time is money” is well understood in the industrialized world. This equivalence suggests that the sunk cost effect should result from investments of either time or money. We compared the effects of investments of money or time on the sunk cost effect in four experiments. In the first two experiments, we found that investments of either time or money influenced current decisions in much the same way, consistently exhibiting a sunk cost effect. Participants chose to continue a project instead of canceling it after investments of either time or money. In the last two experiments, we offered participants an alternative choice of action. Instead of canceling the project, they could change it. This alternative reduced the frequency of sunk cost effects following an investment of money. Many participants opted to change the project. But the alternative had little effect on sunk cost effects after an investment of time.

11:20–11:35 (54)

**The Role of Categorical Context in Dominance and Ideal-Point-Based Judgment.** DOUGLAS H. WEDELL, *University of South Carolina*, JONATHAN C. PETTIBONE, *University of Southern Illinois, Edwardsville*, & SUSANNE M. KARPICK, *University of South Carolina*—Dominance-based judgments describe attribute magnitudes, whereas ideal-point judgments describe proximities of stimulus attributes to ideal values. Wedell and Pettibone (1999) demonstrated how manipulating the recent contextual set of schematic faces experienced produced contrastive shifts on dominance judgments of feature widths and assimilative shifts of ideal points for ideal-point-based judgments of pleasantness. The present research describes results from a series of experiments assessing whether parallel effects occur for manipulations of category-based contexts. Categorical context was manipulated by designating schematic faces as belonging to different groups: gnomes and leprechauns. When face cues were presented for judgments of facial configuration, categorical context effects were minimal. When faces were associated with names in a learning phase and names later served as judgment cues, large effects of categorical context emerged. These effects were moderated by how the learning task was structured and which cues were primary to the learning task.

**Motor Control**

**Greenway FGH, Friday Morning, 10:00–12:00**

*Chaired by Charles E. Wright, University of California, Irvine*

10:00–10:15 (55)

**Noise in Fitts's Law: White Time and Pink Space.** ANDREW B. SLIFKIN, JEFFREY R. EDER, & RHIANNON L. HAMILTON, *Cleveland State University*—The spatial and temporal dynamics of long sequences of movement (1,000) were investigated when participants performed under conditions of Fitts's cyclical aiming paradigm. The index of difficulty (ID) ranged from 1 to 5 bits. For variations in space (movement amplitude), power function exponents describing declines in spectral power with increases in frequency were close to  $-1.0$ . In contrast, the average power function exponent describing temporal (movement time) variations was  $-0.2$ . For both variables, exponents were constant across increases in ID. Consistent with prior research (e.g., Gilden, 2001), spatial variations had a  $1/f$ , or pink, noise structure. However, spectral analysis of time revealed a much whiter structure. When viewed according to one framework (Gilden, 1995), the  $1/f$  spatial structure might reflect higher intentional control of movement amplitude, whereas the more noisy temporal structure might reflect lower intentional control of movement time. Additional analyses will examine levels of space-time coherence.

## 10:20–10:35 (56)

**The Underlying Mechanism for Spatial Symmetry in Bimanual Tapping.** TIN-CHEUNG CHAN & LING-PO SHIU, *Chinese University of Hong Kong* (sponsored by Ling-Po Shiu)—Mechsner, Kerzel, Knoblich, and Prinz (2001) showed that the phase bias in bimanual coordination (Kelso, 1981) conforms to perceptual spatial symmetry in bimanual tapping. When the consecutive tapping of the index and middle fingers of the left hand is simultaneous with that of the middle and ring fingers of the right hand, the right middle finger will synchronize with the left index finger, and not with the homologous left middle finger, resulting in spatial symmetry. Two experiments were conducted to explore the mechanism that underlies such spatial symmetry in tapping. Results showed that fingers have different strength in tapping, with index, middle, and ring fingers in descending order. When two fingers of each hand were tapped consecutively, a difference in velocity could be detected. Since it is easier for fingers of similar velocities to go together, velocity difference may be considered as one of the factors responsible for coordination in spatial symmetry.

## 10:40–10:55 (57)

**Effector-Dependent Sequence Learning in the Serial RT Task.** WILLEM B. VERWEY, *University of Twente*—At least five earlier studies could not find effector-dependent learning in the keying version of the serial reaction time (RT) task. Experiment 1 examined whether effector-dependent learning occurs when participants practice the serial RT task with three fingers of one hand for about 1,300 sequence repetitions, instead of the more common 50 or 100 repetitions. The results confirm that, following extended practice, sequence learning produces an effector-dependent component. Specifically, an unpracticed hand executed a practiced sequence more slowly than a practiced hand. However, Experiment 2 showed that effector-dependent sequence learning develops only when fingers of one hand are used, suggesting that effector-dependent sequence learning involves adjustment to the mechanical interactions between fingers of one hand. Generally, the same results were found in more and less aware participants, congruent with the idea that the effector-dependent representation and the representation allowing transfer to mirror sequences are implicit.

## 11:00–11:15 (58)

**Task Switching in Music Performance.** CAROLINE PALMER, *McGill University*, & GRANT C. BALDWIN, *University of Texas, Austin*—Three experiments assessed musicians' ability to switch tasks from performing one melody to another at points of hypothesized high stability (stressed metrical beats) or low stability (unstressed beats). Moderately skilled pianists performed melodies at different tempi. At the sound of a cue, participants switched from performing the initial melody to performing one of two melodies specified by the cue timbre. Despite instructions to switch as quickly as possible, switching times from cue to onset of final melody were biased toward underlying beat durations, as well as toward 900 msec. Both the total switching time and the number of events produced after the cue and before the switch were related to the number of beats required to complete a metrical cycle. These findings suggest that events are prepared for production in metrical units and that the flexibility of task-switching depends on the number and rate of prepared events.

## 11:20–11:35 (59)

**Deceiving Oneself About Being in Control: Conscious Detection of Changes in Visuomotor Coupling.** GÜNTHER KNOBLICH, *Max Planck Institute for Cognitive and Brain Sciences*, & TILO KIRCHER, *University of Tübingen*—Previous research has demonstrated that compensatory movements for changes in visuomotor coupling often are not consciously detected. But what factors affect the conscious detection of such changes? This issue was addressed in four experiments. Participants carried out a drawing task in which the relative velocity between the actual movement and its visual consequences was perturbed. Unconscious compensatory movements and conscious de-

tection rates were simultaneously recorded. There was an invariant relationship between the extent of the change and its conscious detection that was proportional to the initial drawing velocity. This suggests that conscious change detection relies on a system that integrates visual and motor information, as, for instance, is suggested by the internal model theory of motor control. Figural discrepancies increased the detection rates, indicating that additional cues for the system facilitate conscious change detection.

## 11:40–11:55 (60)

**Visually Guided, Aimed Movements Are Unaffected by Stimulus-Response Uncertainty.** SHANE A. BELOVSKY, CHARLES E. WRIGHT, VALERIE F. MARINO, & CHARLES CHUBB, *University of California, Irvine* (read by Charles E. Wright)—Response times are generally found to increase linearly with the logarithm of the number of potential stimulus-response (S-R) alternatives (e.g., Hick's law). Kveraga, Boucher, and Hughes (2002) demonstrated that saccade latencies were unaffected by S-R uncertainty. They suggested that visually guided saccades are unusual because they can be automatically selected using topographically organized pathways in the superior colliculus that convert spatially coded visual activity into spatially coded motor commands. We report that visually guided, aimed hand movements also are largely unaffected by both S-R uncertainty and S-R repetition. Taken together, these results have important implications for theories of S-R selection processes.

**Face Recognition and Eyewitness Testimony  
Regency, Friday Morning, 10:40–12:00**

*Chaired by Ronald P. Fisher, Florida International University*

## 10:40–10:55 (61)

**Parallel Retrievals Given Facial Cues.** MICHAEL J. WENGER, *Pennsylvania State University*—The possibility of parallel retrievals given a single retrieval cue has been explored using the psychological refractory period (PRP) paradigm; these explorations have produced a series of contradictory conclusions. In order to explore the source of these apparent contradictions, stochastic linear systems models of a set of alternative hypotheses were constructed. Simulations of these alternative systems indicate that it may not be possible to unambiguously distinguish among different processing architectures (e.g., serial, parallel, or coactive) in the standard PRP paradigm. However, it may be possible to identify process architecture in a modification of the PRP paradigm that includes factorial manipulations. Results from a series of three experiments investigating semantic retrieval given highly meaningful visual forms (faces) (1) suggest that the modifications to the paradigm do not lead to outcomes that are qualitatively different from those obtained with the standard paradigm, and (2) provide strong evidence for parallel retrieval processing.

## 11:00–11:15 (62)

**Facial Expression as a Distinctive Feature in Memory.** STEPHEN R. SCHMIDT & KATRINA D. McMULLEN, *Middle Tennessee State University*—Processing facial emotions may require cognitive resources and influence memory performance. To test these hypotheses, participants viewed a series of pictures of smiling people engaged in everyday activities. In a target picture embedded in the middle of the series, a woman had either a smiling or a mad expression. Recall of the mad face exceeded recall of the smiling face, demonstrating that a distinctive expression enhances memory. This effect was found when the expression of the target fit the picture context (e.g., frowning while hitting a tennis ball), as well as when the expression was incongruent with the context (e.g., frowning while receiving a trophy). Good memory for the distinctive expression did not lead to poor memory for the picture following the target. We concluded that facial expressions are extracted automatically, providing a feature supporting good recall, but not robbing memory-coding resources from other stimuli.

**11:20–11:35 (63)**

**Components of False Recognition of Faces.** JAMES C. BARTLETT, KALYAN SHASTRI, HERVÉ ABDI, & MARSHA NEVILLE-SMITH, *University of Texas, Dallas*—A novel application of principal components analysis has produced consistent evidence that two distinct factors support face recognition. The first factor shows a near-zero loading for correct recognitions of study-list faces but strong loadings for false recognitions of (1) new faces, (2) conjunctions that recombine the parts of study-list faces, and (3) familiarized foils (FFs) that were previously viewed outside the study list. The second factor showed a strong loading for correct recognitions, a weaker loading for conjunction false alarms, and reversed-sign loadings for both new-face false alarms and FF false alarms. We believe that Factor 1 reflects executive and source-monitoring processes that work with memory to reduce false recognitions, whereas Factor 2 reflects processes that signal degree of resemblance between test faces and faces viewed previously in a designated context. To test this view, we present a new experiment that more rigorously examines whether both factors are context specific.

**11:40–11:55 (64)**

**The Relationship Between Consistency and Accuracy of Eyewitness Memory.** RONALD P. FISHER, *Florida International University*, & TERRI D. PATTERSON, *Federal Bureau of Investigation*—Jurors and other decision makers often infer the accuracy of an eyewitness's memory of an event on the basis of the consistency of the witness's recollection over repeated interviews. How good is consistency of recollection as a predictor of accuracy? Are the two measures influenced in the same fashion by other experimental variables, or are they experimentally dissociable? In our study, experimental witnesses observed a simulated bank robbery and were tested under three conditions: immediately or after a delay, for typical or atypical actions, and under three questioning formats (free narrative, cued recall, recognition). We examined different measures of metacognition (remember/know judgments and output threshold) as possible explanations of why some manipulations experimentally dissociated between measures of consistency and accuracy, whereas other manipulations had similar effects on consistency and accuracy.

**SYMPOSIUM: Cognitive Time Travel in People and Animals**  
**Nicollet A, Friday Afternoon, 1:30–3:35**

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

Some years ago, Tulving (1972, 1983) made the seminal distinction between episodic memory for past experiences containing both time and place information and semantic memory for general information. He also argued that episodic memory was a uniquely human experience. An expansion of this idea suggests that people, but not animals, can cognitively time travel; animals are stuck in a permanent present, without the ability either to remember events as past or to anticipate events in the future. Recently, this position has been challenged by evidence that scrub jays show both episodic-like memory and anticipation of future events in their food storing and recovery behavior (Clayton & Dickinson, 1998; Emery & Clayton, 2001). The exciting possibility that some capacity for cognitive time travel might be found in animals has led recently to new experiments with pigeons, rats, and several species of nonhuman primates, as well as an interest in the development of episodic memory and future thinking in children (Atance & O'Neill, 2001). This symposium draws together a number of investigators currently studying episodic memory and future thinking in animals and people to evaluate the current status of comparative and developmental research.

**1:35–1:50 (65)**

**Mental Time Travel by Food-Caching Western Scrub Jays (*Apelto-coma californica*).** NICOLA S. CLAYTON, *University of Cambridge*—The mental time travel hypothesis claims that only humans can travel backward in time to reexperience and recollect specific past events (episodic memory) and travel forward in time to anticipate future needs, independent of current needs (future planning). The behavior of food-caching western scrub jays challenges this assumption on two counts. First, jays demonstrated integrated, flexible, trial-unique memories of what they hid, where, and when (episodic-like memory). Second, jays that were observed by a conspecific at the time of caching subsequently moved their caches to new places when they came to recover them in private. But they did so only if they have been observed during caching and if they had stolen another bird's caches in the past. These results suggest that jays can take action now for future eventualities on the basis of past experience (future planning). Thus, several features of retrospective and prospective cognition may not be uniquely human.

**1:55–2:10 (66)**

**The Emergence of Episodic Future Thinking in Humans.** CHRISTINA M. ATANCE, *University of Ottawa*—Memory has been conceptualized as involving two distinct systems: episodic and semantic (Tulving, 1983). The former allows us to travel back in time to reexperience an event, whereas the latter allows us to retrieve general knowledge about the world. Only recently have researchers begun to apply this distinction to future thinking (e.g., Atance & O'Neill, 2001). Atance and O'Neill define episodic future thinking as the ability to project oneself into the future to preexperience an event. In this talk, I expand upon the concept of episodic future thinking and discuss tasks that my colleagues and I have developed to examine this ability in children. On the basis of our findings, I conclude that episodic future thinking emerges sometime during the 4th year of life and undergoes important transitions during the preschool years in both the linguistic and the behavioral domains.

**2:15–2:30 (67)**

**Discrimination of What, When, and Where: Implications for Episodic-Like Memory in Rats.** STEPHANIE J. BABB & JONATHAN D. CRYSTAL, *University of Georgia*—We investigated discrimination of what, when, and where in rats, 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 lithium chloride, and subsequent testing used the long RI. Following the taste aversion manipulation, the rats visited the chocolate location less often than in previous training. These data demonstrate knowledge of what, when, and where. Implications for episodic-like memory are discussed.

**2:35–2:50 (68)**

**Rhesus Monkeys Demonstrate Memory for What and Where, But Not When, in an Open-Field Test.** R. R. HAMPTON, B. M. HAMPSTEAD, & E. A. MURRAY, *NIMH-NIH*—To test for episodic-like memory in monkeys, we required them to simultaneously remember what foods they had seen, where they had seen them, and when they had seen them, in a large room (Clayton & Dickinson, 1998). In the study phase of each trial, monkeys found a preferred and a less preferred food reward in an array of three trial-unique locations. After 1 h, monkeys returned to the test room, where foods were placed as during study. The monkeys again visited the room 24 h later, but now the preferred food was replaced with a distasteful food remnant, while the less preferred food was still present. In tests at both delays, monkeys searched first in the location that had contained the preferred food during study. Thus, the monkeys demonstrated memory for the type and location of food but failed to demonstrate sensitivity to when they acquired that knowledge.

**2:55–3:10 (69)**

**Evidence for Anticipation of a Future Event in Squirrel Monkeys.** WILLIAM A. ROBERTS, *University of Western Ontario*—In an initial experiment, 2 squirrel monkeys showed significant preferences for a transparent cup containing 20 peanuts over one containing 10 peanuts. During a test phase, the experimenter pilfered all the uneaten peanuts 15 min after choice of 20 peanuts, but not after choice of 10 peanuts. In a second experiment, both monkeys showed a significant preference for 4 peanuts over 2 peanuts. In a test phase, the experimenter replenished the monkey with 8 more peanuts 15 min after choice of 2 peanuts, but not after choice of 4 peanuts. Both the pilfering and replenishment manipulations led to significant drops in preference for the larger number of peanuts. These findings suggest that squirrel monkeys anticipated the consequence of their choice 15 min into the future.

**3:15–3:30 (70)**

**Episodic Memory in Pigeons: The Answer to the Unexpected Question “What Did You Just Do?”** THOMAS R. ZENTALL, *University of Kentucky*, & TRICIA S. CLEMENT, *Stanford University*—Episodic memory is the ability to retrieve personal memories. Such an ability is difficult enough to assess in verbal humans who are able to describe sometimes verifiable events in great detail. The absence of verbal ability in animals makes the study of episodic memory particularly difficult. However, episodic memory is not, as some have suggested, the ability to learn to identify three particular characteristics of stimuli: their physical properties (what), their location (where), and how long ago they were presented (when). Instead, we argue that a better analogy would be to supply the correct answer to an unexpected question about a personal experience (as in, What did you have for dinner last night?). In the case of pigeons, we can design an experiment to ask them, What did you just do? We believe that the results of such an experiment provide a better approach to the question of episodic memory.

**Mechanisms of Attention**

**Nicollet BC, Friday Afternoon, 1:30–2:50**

*Chaired by Walter Schneider, University of Pittsburgh*

**1:30–1:45 (71)**

**Voluntary and Involuntary Attention.** WILLIAM PRINZMETAL, MICHAEL ESTERMAN, & JOSEPH DEGUTIS, *University of California, Berkeley*, & ELIOT HAZELTINE, *University of Iowa*—We have

proposed that voluntary and involuntary attention involve different mechanisms and serve different functions in vision. In the experiments described here, we used the spatial cuing paradigm to test differences in voluntary and involuntary attention. We manipulated voluntary attention by having a spatial cue (box brightening) that was correlated with the subsequent target location precede the target face. For involuntary attention, the spatial cues were not correlated with target location. With voluntary attention, consistent with previous reports, conjunction search leads to larger attention effects than does feature search, but the opposite was found with involuntary attention. Thus, voluntary and involuntary attention serve different functions. In an fMRI study, using the same spatial-cuing paradigm, we found dissociations in brain activation between voluntary and involuntary attention.

1:50–2:05 (72)

**Distinct and Shared Mechanisms in Space- and Object-Based Attention.** JAMES E. HOFFMAN & COURTNEY TODD, *University of Delaware*—Space-based attention has been likened to a spotlight of enhanced processing centered on a target area. This selection mechanism faces difficulties in cluttered environments in which several objects might fall within a single spotlight, suggesting that a separate system for attending to objects may be required. According to the grouped array hypothesis, however, both space- and object-based attention might be explained in terms of a spotlight that can be flexibly allocated to object surfaces and/or contours. We report a test of this hypothesis, based on the finding that attention to location uniquely enhances the P1–N1 components of the ERP, suggesting that this pattern might serve as a signature of spatial attention. The grouped array hypothesis predicts that attention to one of two overlapping objects should result in larger P1–N1 components for that object, as compared with the unattended object. Our results disconfirm that prediction.

2:10–2:25 (73)

**Interactions Between Central and Spatial Attention: Evidence From Human Electrophysiology.** PIERRE JOLICŒUR, BENOIT BRISON, NICOLAS ROBITAILLE, CATHERINE OUMET, & ÉMILIE LEBLANC-LANGLOIS, *Université de Montréal*—Conflicting behavioral evidence both supports and fails to support a functional independence between central attentional mechanisms—those responsible for response selection and/or short-term memory encoding—and the control of visual spatial attention. We used the N2pc ERP component to track the locus of visual attention in dual-task situations that required the simultaneous execution of central processes and the deployment of visual spatial attention. Results from several experiments suggest that the deployment of visual spatial attention is not independent of central processing.

2:30–2:45 (74)

**Differentiating the Control Network of the Human Brain: Modules Supporting Attention, Decision Making, Learning, and Skilled Performance.** WALTER SCHNEIDER & NICOLE HILL, *University of Pittsburgh*, JASON CHEIN, *Princeton University*, & MAUREEN MCHUGO & MICHAEL COLE, *University of Pittsburgh*—Brain imaging is used to identify and differentiate a cortical control network for human control processing. This single network is involved in attention, decision making, and learning. The network drops out as automatic processing develops. The network is domain general, dealing with verbal, spatial, visual, and acoustic information. The control network involves differentiable modules performing specialized functions. These include the dorsolateral prefrontal cortex (DLPFC; goal processing and production system execution), the posterior parietal cortex (PPC; attention shifting), and the anterior cingulate (ACC; activity monitoring and comparison). fMRI brain imaging shows activation of the ACC, which increases with comparison difficulty, the PPC, which increases with switching attention across locations, and the DLPFC, which increases with task switching, variable binding, or the performance of strategic/difficult processing operations. A hybrid connectionist control architecture (CAP2) predicts the behavioral,

computational and biological activation changes in learning and attention tasks. It suggests that human processing is a result of a specialized cortical control network exhibiting complementary strengths and weakness paralleling the behavioral tradeoff of controlled and automatic processing theory.

**Metacognition and Metamemory**  
Nicollet D, Friday Afternoon, 1:30–3:30

Chaired by Chizuko Izawa, Tulane University

1:30–1:45 (75)

**Does Momentary Accessibility Influence Metacomprehension Judgments?** JULIE M. BAKER & JOHN DUNLOSKY, *Kent State University* (read by John Dunlosky)—Metacomprehension involves judging how well one understands text materials. Major bases of these judgments presumably include how quickly and how much of a text an individual accesses in the moment prior to judging the text. Although such momentary access (MA) is often cited as influential, only one investigation has established its contribution to metacomprehension judgments. In two experiments, we further examine this issue, most notably by evaluating the relation between MA and judgments when the latter are made either immediately after reading or after a 1-day delay (as in the original investigation of MA). A major conclusion is that MA has a minimal influence on immediate judgments, which have been nearly the sole focus of metacomprehension theory.

1:50–2:05 (76)

**Metacognitive Monitoring and Self-Regulation in Cognitive Skill Acquisition.** ANIQUE B. H. DE BRUIN, HENK G. SCHMIDT, & REMY M. J. P. RIKERS, *Erasmus University Rotterdam* (read by Henk G. Schmidt)—Previous research has shown that accuracy of metacognitive monitoring and self-regulation when paired associates are learned improves test performance. The present study examined the effect of reselection and providing judgments of learning (JOLs) on learning to play chess. In four learning trials, participants were asked how confident they were that they would recall the moves of a chess computer. Afterward, they had the opportunity to select moves for restudy. The results indicate that participants who were forced to select at least two of the six moves per trial for restudy outperformed participants who were free as to the number of selections, even when we controlled for number of selections actually made. Moreover, correlations between JOLs, test performance, and selections were significant for the forced selection group but were nonsignificant for the free selection group. Thus, it seems that forced selection, as compared with free selection, positively affects self-regulation in cognitive skill acquisition.

2:10–2:25 (77)

**False Memory Can Be Reduced by Operant Learning Procedure.** JERWEN JOU, DAWN M. ROGERS, RYAN L. ZIMMERMAN, & JOSEPH FOREMAN, *University of Texas, Pan American*—Explicit warnings are typically found ineffective in reducing false recall and recognition of lure words in the DRM paradigm. In this study, an operant conditioning procedure was used to reduce false memory in the DRM paradigm. Subjects were rewarded with credit points for correct recall and recognition for each list of words. However, when they falsely recalled or recognized the lure words, the computer issued an instant feedback warning and penalized them heavily by taking away all the points accumulated for the particular list of words. As the operant procedure continued, the false recall and recognition rates for the lure words continued to decrease to a substantially lower level than was found with the traditional warning procedure. This study showed that the identification of the lure words can be taught with an inductive learning method.

2:30–2:45 (78)

**Monitoring and Regulating the Accuracy of Source Memories.** CHAD S. DODSON & SAMEER BAWA, *University of Virginia*—From

time to time, we all must make decisions about the accuracy of our memories and, therefore, which of them to report and which to keep private. As we age, it appears that our ability to monitor and judge the accuracy of recently acquired memories diminishes greatly. The question is why, exactly? Is it due to changes in the veracity of our memories, or is it due to changes in our ability to evaluate their veracity? We show that older adults' diminished ability to judge the likely accuracy of their memories is caused by false recollections.

### 2:50–3:05 (79)

**Very Long Term Judgments of Learning: Evidence From Flashbulb Memories.** CHARLES A. WEAVER III, *Baylor University*, & KEVIN D. KRUG, *Southeastern Oklahoma State University*—One of the most robust findings in metamemory is the delayed judgment of learning (d-JOL) effect: Judgments made after a delay are remarkably accurate predictors of performance. The cause of this effect, however, remains a subject of debate. The memory hypothesis proposes that d-JOLs are accurate because they function as spaced practice trials. The metamemory hypothesis proposes that memory monitoring improves under delayed conditions. Using standard flashbulb memory questionnaires, we collected memories, confidence judgments, and JOLs from approximately 200 subjects for the Columbia Shuttle tragedy in February, 2003, either 1 day, 1 week, or 1 month after the disaster; subjects were tested again 3 months after the explosion. Despite near-ceiling recall initially, JOLs were relatively accurate (mean  $G = .40$ ). Judgments were more accurate with longer delays between event and judgments, and JOLs were generally better predictors than were confidence ratings. These data pose difficulties for a strict memory explanation of d-JOLs.

### 3:10–3:25 (80)

**Generation Failure: Context and Cued Recall.** PHILIP A. HIGHAM & HELEN TAM, *University of Southampton*—The lesson we learned from the 1970s was that generate–recognize models of cued recall are not viable because failure to reinstate the same cues at test, which were encoded specifically with information during study, results in recognition failure. In other words, context in cued recall exerts its effect solely by moderating the extent to which generated candidates are monitored as having a recent episodic source. We demonstrate that this lesson is incomplete. By using the Type 2 signal detection analysis advocated by Higham (2002) and a new multiple-response methodology, context reinstatement in the classic encoding specificity paradigm is shown to have its effect not just at the recognition stage, but also at the generation stage of cued recall. That is, failing to reinstate context causes generation failure in cued recall, even to strong associate test cues. The results are discussed in terms of generate–recognize theory, metacognition, and dual-route models of cued recall.

### Text Comprehension

#### Greenway BCD, Friday Afternoon, 1:30–3:30

Chaired by Arthur C. Graesser, *University of Memphis*

### 1:30–1:45 (81)

**When Are the Unskilled Unaware?** RUTH H. MAKI, AMANDA EASTON WHEELER, & TAMMY LOWERY ZACCHILLI, *Texas Tech University*—Kruger and Dunning (1999) showed that individuals having low skill in a domain are highly overconfident about their performance, whereas individuals with high skill tend to be underconfident. We investigated this unskilled and unaware effect, using methodology from metacomprehension research. Students read difficult or easier texts and predicted their likely percentage correct. After answering multiple-choice questions on each text, they again judged their percentage correct. We divided students into low, medium, and high ability on the basis of standardized verbal test scores. We observed overconfidence among the low-ability students, especially with harder texts. In a second experiment, students predicted and judged number of questions correct, and they estimated their percentile. For both re-

vised and hard texts, we found fairly small overconfidence effects for number of questions, but large overconfidence effects with percentiles. We conclude that being unskilled and unaware depends on the difficulty of materials and the specific type of judgment required.

### 1:50–2:05 (82)

**Practice and Self-Evaluation Influence Metacomprehension Accuracy.** GARY E. RANEY, *University of Illinois, Chicago*, JOHN D. MURRAY, *Georgia Southern University*, & SHARON R. OBEIDALLAH & FRANCES DANIEL, *University of Illinois, Chicago*—We evaluated whether students' ability to accurately predict performance on a test over material just read would improve if they were given practice making predictions and evaluated their reasons for their predictions. Students read 32 expository texts (approximately 550 words in length) distributed across four sessions. After reading each text, they predicted their performance on a six-question quiz. During Sessions 2–4, students were asked to explain how they made their predictions. Half the students were given quiz answers to facilitate their performance evaluation. Metacomprehension judgment accuracy improved from Session 1 to 2, but the improvement was not maintained across Sessions 3 and 4 for all subjects. The self-evaluations indicate that students considered text familiarity, text difficulty, interest in text topic, and past performance when making a prediction. Our results demonstrate that practice and feedback can improve judgment accuracy but that maintaining the improvement is difficult.

### 2:10–2:25 (83)

**Reported Attitudes About Euthanasia Reflect Comprehension of Terms in Survey Questions.** MAILE O'HARA & MICHAEL F. SCHOBBER, *New School for Social Research* (read by Michael F. Schober)—When people answer survey questions about attitudes and opinions, their idiosyncratic interpretations of the terms in the questions are reflected in their reported opinions. One hundred eighteen respondents on the streets of New York City first used a 4-point scale to report the extent to which they supported euthanasia under one of five wordings (“euthanasia,” “physician assisted suicide,” “voluntary assisted suicide,” “mercy killing,” or “the right to die”), as well as how firmly they held their opinion. Then, in an open-ended response, they were asked to define how they understood the euthanasia term in the question they had answered. Attitudes indeed reflected alternate definitions, as evidenced by lexical analysis (using LIWC) of self-reported definitions, and alternate wordings of the question led to significantly different interpretations. Leaving the interpretation of words in attitude questions up to respondents to avoid bias may lead to a different kind of unintended bias from idiosyncratic question interpretation.

### 2:30–2:45 (84)

**Measuring Comprehension of Planning Knowledge.** CONNIE A. SHEARS, *Chapman University*, & MARY GAUVAIN, *University of California, Riverside*—Assessment of executive functions, such as planning skills, has relied on execution tasks, such as the Wisconsin card sort or the tower of Hanoi. A major criticism of these tools involves their limitations in predicting cognitive skills related to comprehension of planning. That is, a survivor of brain injury may perform within normal ranges on one of these planning tasks and yet have profound deficits in daily life skills requiring ordering or sequencing of actions or events (Goel & Grafman, 1995). This study reports an errand-planning task that relates to comprehension of planning. We employed a paper-and-pencil task (Hayes-Roth et al., 1979) as a pre-screening measure of planning ability. We hypothesized that this measure would differentiate between a noninjured population ( $n = 28$ ) and a population of survivors of brain injury ( $n = 28$ ) for comprehension of planning knowledge in two-sentence text that required an inference. We report data from a diverse group of survivors of brain injury whose scores on the errand-planning measure (Shears & Gauvain, 2004) were predictive of their ability to utilize planning knowledge to support explanatory inference processes and significantly identified their comprehension abilities both between and within groups. The errand-planning

measure as adapted here may provide a unique measure of planning skills that relate to comprehension, rather than to task performance.

### 2:50–3:05 (85)

**Reading Time and Comprehension as a Function of Text Format.** CHARLES R. FLETCHER, ALDWIN Q. DOMINGO, & YUNG-CHI SUNG, *University of Minnesota*—In spoken language, prosodic cues help listeners identify constituent boundaries and relationships between constituents. Such cues are normally lost in written language. LiveInk is a computer program that uses a cascaded text format to reintroduce these cues. Line breaks are used to signal constituent boundaries, and indentation is used to signal relationships between constituents. We present two experiments in which we evaluated the impact of LiveInk on college student readers. In the first experiment, we found that LiveInk has no effect on the performance of native speakers of English but results in significant improvements in the comprehension scores of nonnative speakers. In the second experiment, we attempted to minimize the impact of top-down processing by presenting sentences out of context. Under these conditions, native speakers showed slower reading times and lower comprehension scores when they read with LiveInk, but nonnative speakers showed significant improvements in both.

### 3:10–3:25 (86)

**Older Adults Stop Smoking More Often When Interventions Incorporate Principles of Cognitive and Discourse Psychology.** ARTHUR C. GRAESSER, *University of Memphis*, ROBERT KLEGGES, *Mayo Clinic*, & MARGARET DeBON & KAREN JOHNSON, *University of Tennessee, Memphis*—Available research has reported modest smoking cessation rates in the elderly when normal clinical interventions are combined with transdermal nicotine patches (TNPs). Will cessation rates increase when the interventions are tailored to elderly smokers by principles of cognitive and discourse psychology? We conducted a large-scale program in which 450 elderly smokers were randomly assigned to one of three conditions: TNP, behavioral intervention with TNP, and tailored intervention with TNP. The 1-year cessation rate was approximately two times higher in the tailored condition than in the other treatment conditions. The intervention scripts in the tailored condition were modified to optimize the following theoretical components that decline with age: (1) perceptual-processing speed, (2) working memory capacity and management, (3) sentence and discourse comprehension, (4) retrieval from episodic memory, and (5) reasoning and problem solving. Our results open up some promising new avenues of collaboration between the cognitive sciences and the health sciences.

### Multisensory Integration

#### Greenway FGH, Friday Afternoon, 1:30–3:50

Chaired by Catherine L. Reed, *University of Denver*

### 1:30–1:45 (87)

**Illusory Self-Motion Perception (vection) and Cybersickness.** FREDERICK BONATO & ANDREA BUBKA, *Saint Peter's College, Jersey City*—Illusory self-motion perception (vection) often results when a large portion of a stationary observer's visual field moves. Vection often occurs in vehicle simulators and/or other virtual environments and can enhance the perceived realism of the virtual environment. Several reports indicate that vection is correlated with cybersickness, a form of motion sickness. However, what is the nature of the correlation? It is well known that the vestibular system responds to changes in gravitational and inertial forces. We propose a model based on the results of several experiments using optokinetic drums. The two-fold model asserts that cybersickness is provoked in vection environments only during (1) acceleration/deceleration phases and (2) direction changes of the optical flow pattern. The model fits squarely with the sensory conflict theory of motion sickness, but not with the subjective vertical mismatch theory that asserts only conflicts regarding visual and vestibular vertical (gravitational vertical) are responsible for symptom onset.

### 1:50–2:05 (88)

**Perceptual Recalibration Versus Visual–Motor Skill Acquisition: The Effects of Error-Corrective Prism Exposure.** ROBERT B. WELCH, *NASA Ames Research Center*, & ANTHONY C. SAMPANES, *University of California, Santa Cruz*—It has been argued (e.g., Clower & Boussaoud, 2000) that adaptation to sensory and sensory–motor rearrangements can take two qualitatively different forms: perceptual recalibration and visual–motor skill acquisition. The first of these can be observed in the recalibration of proprioception in visual terms from viewing the actively moving hand through a light-displacing prism. The second is the outcome of learning a novel relationship between motor actions and visual consequences, as when manipulating a robotic arm for the first time. We hypothesized that exposure to prismatic displacement that includes error-corrective feedback will lead to both kinds of adaptation and that the relative proportion of each will change during the course of exposure. The present data supported this hypothesis by finding that intermanual transfer of adaptation (a distinguishing feature of visual–motor skill acquisition) was substantial at the outset of exposure but subsequently declined, whereas proprioceptive recalibration gradually increased over exposure.

### 2:10–2:25 (89)

**Access to Dimensional Values Is Nonselective in Early Perceptual Processing.** STEPHEN C. DOPKINS, *George Washington University*—The early holistic hypothesis holds that, when a stimulus has values on two dimensions, access to these values is often completely nonselective during the early stages of perceptual processing. The dimensional similarity hypothesis holds that access to dimensional values is always at least somewhat selective. A new method was used for testing between these two ideas. Participants classified pairs of points on the basis of the horizontal distance between them. The classification could be performed on the basis of (1) the horizontal or (2) the two-dimensional distance between the points. The classification could be performed more easily on the basis of horizontal than of two-dimensional distance. When the classification was performed under speed stress, horizontal and vertical distance had equivalent effects on classification performance. When the classification was performed under more relaxed conditions, horizontal distance had a greater effect than did vertical distance. These results support the early holistic hypothesis.

### 2:30–2:45 (90)

**Blind Patients See Their Moving Hand in Darkness (Synesthesia).** V. S. RAMACHANDRAN & SHAI D. AZOULAI, *University of California, San Diego*—A patient who was blind because of damage to the visual pathways was asked to move his hand in front of his eyes in complete darkness. Amazingly, he not only felt, but literally saw his hand moving—the converse of experienced movement of phantom limbs induced by visual feedback in mirrors. Normals do not see this because the top-down signals to the visual centers from polymodal cells in parietal and frontal lobes are vetoed by bottom-up nulling signals from the intact visual pathway.

### 2:50–3:05 (91)

**Visuotactile Integration: Automatic and Obligatory.** DAVID I. SHORE & NEVENA SIMIC, *McMaster University*—Observers asked to indicate which of two tactile vibrators (top or bottom of a hand-held cube) are slower when distracting visual stimuli are presented from the same cube (held in one hand) at a different elevation. That is, a visual stimulus from the top will slow responding to the tactile stimulus from the bottom (or visa versa), but only if the stimuli come from the same cube (hand). If the two stimuli are presented to different hands, the compatibility effect is drastically reduced. In order to examine the relative contribution of sensory and response factors, the probability of a congruent or an incongruent trial was varied both across blocks (Experiment 2) and within blocks (Experiment 3). In both cases, the size of the congruency effect was unaffected by the probability manipulation. These data support an automatic and obligatory form of integration with these visuotactile stimuli.

**3:10–3:25 (92)**

**Haptic Identification of Common Objects: Constraining the Manual Exploration Process.** SUSAN J. LEDERMAN, *Queen's University*, & ROBERTA L. KLATZKY, *Carnegie Mellon University*—In this paper, we consider the effects of constraining manual exploration on the haptic recognition of common objects. Two kinds of rigid links, fingertip sheaths and pencil-like probes, were used. The overall consequences of introducing five types of constraint are considered. These include reducing the number of end effectors, wearing a compliant finger cover, splinting the finger, wearing a rigid finger sheath, and using a rigid probe. We interpret the resulting recognition impairments in terms of loss of somatosensory information. In addition, we relate our results to the design of haptic interfaces for teleoperation and virtual environment applications that share some of the same diminished sensory cues that we produced experimentally (e.g., virtual medical-training systems, space repair). The present results may be used to plan interface design in a more principled manner by basing design choices on the general consequences of constraining manual exploration in one or more ways.

**3:30–3:45 (93)**

**Grasping Attention: Attentional Consequences of Bimodal Neurons.** CATHERINE L. REED, JEFFERSON D. GRUBB, RYAN BETZ, & JOSHUA BAKER, *University of Denver*—Monkey and patient studies have identified bimodal neurons in the parietal cortex that respond to tactile and visual stimuli presented near the hand. Few studies have explored the functional consequences of bimodal neurons. Five experiments using covert orienting paradigms explored how the proximity of visual stimuli to participants' hands affected the orientation and attention to targets. Compared with no-hand conditions, participants responded more quickly to validly and invalidly cued targets appearing near the hand. Subsequent experiments replicated this facilitation and documented that similar effects were not found with an arbitrary visual anchor, that they occurred when proprioceptive, but not visual, information of hand location was available, that they were weaker when a fake hand position was visually available but proprioceptive information was not, and that effects disappeared for targets outside of the hand's grasp. Thus, manipulations that affect the response of bimodal neurons also affect spatial attention.

**Risk Behavior**

**Regency, Friday Afternoon, 1:30–2:50**

*Chaired by Robert M. Hamm,  
University of Oklahoma Health Science Center*

**1:30–1:45 (94)**

**Risky Choice in Cultural Contexts.** X. T. WANG, *University of South Dakota*, & ELENA A. SAVINA, *Orel State Technical University*—We took an interdisciplinary approach to both universal features and cultural variations in risk taking. The present paper focuses on a Russian study. Consistent with social domain-specific hypotheses derived from kin selection theory, sexual selection theory and the bounded risk distribution model (Wang, 2002), Russian participants were more risk taking when making life-saving choices in kith-and-kin contexts than in large group contexts. The risk-taking preference was significantly reduced in the monetary domain. Russian men were more risk seeking than Russian women. This sex difference was likely to be a function of a steeper future discount by Russian men, as indicated by a significant negative correlation between the proneness to risk-taking and their subjective life expectancy. In addition, Russian women were more susceptible than men to verbal framing of choice outcomes. This indecisiveness (the framing effect) in risk preference was most evident when the lives at stake were Americans rather than Russians.

**1:50–2:05 (95)**

**Controlling Risks: A New Paradigm for Understanding Risk Behavior.** SANDRA L. SCHNEIDER & CHRISTOPHER HUDSPETH,

*University of South Florida*—Most studies of risky decision making seem to start from the assumption that people must simply react to the risks they encounter. Sometimes, however, people may have the opportunity to control the amount of risk to which they are exposed. We describe a new paradigm for studying how people change their risk exposure when given the opportunity. This paradigm, exemplified by the ticket transfer task, starts with lotteries of 2–20 tickets. Instead of selecting which lottery to play from among a given set, participants can systematically change the distribution of tickets in a lottery before playing it. Results from this paradigm demonstrate strong and systematic heuristics for dealing with risk, and they also reveal how situations that offer some control differ from situations limited to making choices among risks. The results suggest the importance of different motivations in guiding behavior as a function of decision context.

**2:10–2:25 (96)**

**Dual Processes in Decision Making: Risk, Reward, and Rationality.** VALERIE F. REYNA, *University of Texas, Arlington*, MARY B. ADAM, KRISTIN M. POIRIER, KIRSTEN METZ, & JENNIFER ROBERTS, *University of Arizona*, & CRAIG LECROY, *Arizona State University*—We investigated dual gist and verbatim processes in risky decision making with respect to decision representations, retrieval of principles, and integration of risk information. Two hundred fifty-five adolescents received scenarios in which objective risk factors were varied (e.g., unprotected vs. protected prior sex; none vs. many prior sexual partners). Subjects characterized risks and benefits, using qualitative response categories (e.g., none, low, medium, or high risk), as well as numerical rating scales (e.g., 0%–100% chance of exposure to a sexually transmitted disease). For identical scenarios, gist representations differed predictably by gender, ethnicity, and risk-taking experience. Although younger subjects distinguished objectively different levels of risk, older subjects perceived risks as categorically greater. Age differences emerged for small categorical differences in risk, consistent with predictions of fuzzy-trace theory. Endorsement of retrieved principles indicated that many adolescents view sexual decision making as a calculated gamble. Implications for dual-process approaches to rationality are discussed.

**2:30–2:45 (97)**

**Numeracy, Risk Assessment, and Consideration of Future Consequences.** ROBERT M. HAMM, *University of Oklahoma Health Sciences Center*—The consideration of future consequences (CFC) scale (Strathman, 1994, modified) was filled out by 122 women, along with numeracy (TOFHLA, arithmetic, number comfort) and literacy measures and risk judgments concerning effects of protective measures against the progression of human papilloma virus (HPV) toward cervical cancer. Factor analysis yielded an interpretable three-factor solution for the eight CFC items: (F1) For good results now or in the future, (F2) against sacrifice for the future, and (F3) for such sacrifice. Factor 2 was significantly negatively correlated with literacy, arithmetic, and TOFHLA, and Factor 3 positively with arithmetic. The more a woman dislikes sacrificing now for future good (F2), the less likely she thinks HPV transmission with one sex act, the less efficacy she thinks condoms have, and the more likely she thinks an infected woman could get HPV free with or without treatment. The more she favors sacrifice (F3), the lower  $p$ (HPV free|treated).

**Cognitive Control**

**Nicollet A, Friday Afternoon, 3:50–5:30**

*Chaired by John Jonides, University of Michigan*

**3:50–4:05 (98)**

**Consciousness and Control: Dissecting the Prepared Reflex Through Masked Priming Effects.** ULRICH MAYR, EDWARD AWH, & RICHARD L. BRYCK, *University of Oregon*—Are masked priming effects dependent on experience or on intentionally established task

sets? In past research, priming seemed completely contingent on flexibly changing, compatible versus incompatible S–R rules (Neuman & Klotz, 1994). We used a 4:2 mapping between arrow stimuli and responses to separate stimulus-dependent from response-dependent priming. Only 20% of the priming effect proved to be dependent on response categories, and this component was *not* sensitive to flexibly changing S–R rules. Furthermore, specific selection experiences were a necessary condition for priming: Stimuli that did not occur as targets had no effects. In contrast to response-dependent priming, stimulus-dependent priming could be modulated in a trial-by-trial manner through task sets specifying potentially relevant stimuli. Apparently, specific selection experiences are necessary for priming, but task sets can gate stimulus-driven retrieval of selection episodes. Once triggered, automatically retrieved response tendencies can be counteracted only through conscious contact between task rules and stimuli.

#### 4:10–4:25 (99)

**When Does Haste Make Waste? Speed–Accuracy Instructions, Expertise, and the Tools of the Trade.** SIAN L. BEILOCK, *Miami University*, MICHAEL HOERGER, *Michigan State University*, BENNETT I. BERTENTHAL, *University of Chicago*, & THOMAS H. CARR, *Michigan State University* (read by Thomas H. Carr)—Speed–accuracy tradeoff is ubiquitous in cognitive and sensorimotor skills; the faster the attempted performance, the less accurate the outcome. However, most studies have focused on relatively unpracticed performances. We compared novice and expert golfers putting with standard putters or distorted “funny putters.” We measured planning time, execution time, and accuracy for each putt. Novices produced standard speed–accuracy tradeoffs with both putters. Going slower, which translated into taking more time to plan, improved their performance. Experts improved by going slower only with a “funny putter,” and only when it was unfamiliar. After funny putter practice, and from the beginning with the already-familiar standard putter, experts were more accurate when urged to hurry than when told to take as much time as needed. Thus the speed–accuracy tradeoff reverses when experts wield highly practiced tools, reappears with new tools, and reverses again as the new tool becomes familiar. Planning time absorbs these changes.

#### 4:30–4:45 (100)

**The Role of Planning in the Speed–Accuracy Tradeoff.** BENNETT I. BERTENTHAL, *University of Chicago*, & JOHN VAN DER KAMP & GEERT SAVELSBERGH, *Vrije Universiteit Brussels*—Beilock et al. (2004) report evidence showing that the speed–accuracy tradeoff is mediated by expertise. Novice and expert golfers putted under two instruction conditions emphasizing either speed or accuracy: Performance by novices conformed to the speed–accuracy tradeoff, but experts putted more accurately under speed instructions than under accuracy instructions. In order to test the generalizability of this finding, we conducted a similar study involving novice, intermediate, and expert dart throwers. In contrast to putting, dart throwing involves little preparation time, and thus, the effects of the instruction are confined primarily to movement time. The results revealed that novices did show the expected speed–accuracy tradeoff, but experts failed to show a reversal of this pattern. Kinematic analyses showed consistent improvements as a function of expertise. We interpret these findings to suggest that expertise is most likely to lead to a violation of the speed–accuracy tradeoff when the task involves explicit knowledge and a significant preparation phase.

#### 4:50–5:05 (101)

**Seeing What to Do: Operator Preview in Cognitive Tasks.** LISA M. STEVENSON & RICHARD A. CARLSON, *Pennsylvania State University* (read by Richard A. Carlson)—Preview, the opportunity to see information about an upcoming task while still completing the current task, is often available in everyday life. We examine benefits preview may confer, particularly with respect to the possibility of overlapping mental processes, as well as the boundary conditions of those bene-

fits. Following Jersild (1927) and Spector and Biederman (1976), we examined how preview may reduce switch costs in a task switch paradigm in which each step is a discrete task. We also examined preview in a cascaded task, running arithmetic. Practice in this task produces temporal tuning (Carlson & Stevenson, 2002), in which participants learn to anticipate the time course of their own mental processes when preview of upcoming operators is available. We argue that preview of upcoming operators allows overlapping of goal instantiation with task completion under some conditions, reducing task switch times and providing a temporal reference frame that supports temporal tuning.

#### 5:10–5:25 (102)

**Dissociating Information Suppression During Encoding Versus Working Memory.** DEREK E. NEE & JOHN JONIDES, *University of Michigan* (read by John Jonides)—A series of experiments were performed to investigate whether interference resolution is a unitary phenomenon, or whether there are separable mechanisms underlying interference resolution at different stages of processing. We examined differences between resolving conflict at the level of encoding and resolving conflict at the level of working memory representations. Using a novel paradigm that encompassed both conflict during encoding and conflict in working memory, we investigated variables that affected these processes in different ways. We discovered that when the task was performed while under high working memory load, the ability to resolve conflict during encoding was reduced, whereas the ability to resolve conflict at the level of working memory was spared. We also found that saliency affected the two types of conflict in opposite ways: increasing encoding-level conflict, but decreasing conflict at the level of working memory. These results point to dissociable mechanisms of interference resolution by level of processing.

#### SYMPOSIUM:

#### Visual Short-Term Memory for Features and Objects Nicollet BC, Friday Afternoon, 3:25–5:30

*Chaired by Steven J. Luck & Andrew Hollingworth, University of Iowa*

Visual short-term memory (VSTM) has played a key role in theories of visual cognition for the past 20 years, but the fundamental properties of this memory system were not intensively studied until recently. Over the past few years, however, the use of change-detection paradigms has led to an explosion of research and rapid growth in our understanding of VSTM. This symposium will explore several key issues in this area, including the storage capacity of VSTM, the representational format used in VSTM, the relationship between spatial and nonspatial features, the binding of features into integrated object representations, and the integration of object information across discrete perceptual events. The new findings that will be presented have important implications for theories across a broad spectrum of research domains, including object recognition, attention, memory, and categorization.

#### 3:30–3:45 (103)

**Memory Capacity and the Efficiency of Attentional Control Over Access to Visual Short-Term Memory.** EDWARD K. VOGEL & MARO G. MACHIZAWA, *University of Oregon*—The storage capacity of VSTM for simple objects is known to be quite small and to vary considerably across individuals. These individual differences in capacity have been proposed to be due to variability in memory storage space. However, it is also possible that much of the variability stems from the efficiency of attentional control mechanisms that restrict access to VSTM. Here, we presented subjects with arrays of objects and asked them to remember only a subset of the objects in the display so that we could measure how efficient each subject was at keeping distractors from being stored in VSTM. Using a neurophysiological index of the current number of objects in memory, we found that the efficiency of excluding distractors from VSTM is strongly predicted by an individual’s memory capacity, with low memory capacity individ-

uals maintaining more irrelevant items in VSTM than do high-capacity individuals.

### 3:50–4:05 (104)

**The Structure of Visual Short-Term Memory: Evidence for a Flexible Storage Mechanism.** GEORGE A. ALVAREZ & PATRICK CAVANAGH, *Harvard University* (read by Patrick Cavanagh)—A change detection task was used to estimate storage capacity for the color and complex shape of objects. We investigated the extent to which performance in this task can be accounted for by three alternative models for the structure of memory storage: a fixed-resolution slot model, an independent feature store model, and a flexible resource model. The results are inconsistent with the fixed-resolution slot model and the independent feature store model and are consistent with the hypothesis that visual short-term memory is a flexible resource. According to this model, there is a tradeoff between the level of detail stored per object and the maximum number of objects that can be stored in visual short-term memory. Thus, the number of objects that can be stored is not fixed (although it has an upper limit of about four) and depends on the level of detail required for the memory task.

### 4:10–4:25 (105)

**Representing Objects in Visual Short-Term Memory: Features, Parts, and Locations.** YAODA XU, *Yale University*—Previous studies have documented that VSTM has a limited capacity and can hold about four simple objects at a time. To better understand the nature of VSTM information representation, I examined other factors that limit the capacity of VSTM and how object features might be stored together in VSTM. By asking observers to remember multiple object features in a display and then to perform change detection of a feature after a brief delay (Luck & Vogel, 1997), I found that the similarity between object features, the grouping of object parts, and the spatial layout of objects can all modify VSTM capacity. Together, these observations show that details of object representation beyond the total number of features and objects can modify the capacity of VSTM.

### 4:30–4:45 (106)

**Visual Short-Term Memory for Sequential Arrays.** YUHONG JIANG & ARJUN KUMAR, *Harvard University*—Past research has investigated VSTM for a single visual display but has only recently begun to explore VSTM for multiple, sequentially presented arrays. In this study, we ask how two sequential arrays, separated by a variable stimulus onset asynchrony (SOA), are represented in VSTM. Specifically, are two sequential arrays represented as an integrated image or as separate images? Experiment 1 shows that at short SOAs (0–200 msec), the two arrays are held as an integrated image in iconic memory but that, at longer SOAs, the two arrays are held as separate images in VSTM. Experiment 2 tests whether subjects can effectively integrate images in VSTM in a task that entails integration. Experiment 3 compares the overall capacity of VSTM for simultaneously and sequentially presented arrays. We suggest that humans hold separate VSTM representation for sequentially presented arrays. These arrays compete for limited VSTM capacity, with the trailing arrays gaining an advantage in the competition.

### 4:50–5:05 (107)

**The Role of Visual Short-Term Memory in the Representation of Natural Scenes.** ANDREW HOLLINGWORTH, *University of Iowa*—Scene perception is a dynamic process in which local objects are serially selected via movements of the eyes and attention. Visual memory plays a central role in the construction of scene representations by accumulating information as the eyes and attention are oriented from object to object. Prominent theories hold that visual accumulation during scene viewing is limited to the contents of VSTM. In a change detection study, participants' eye movement scan paths on scenes were controlled, and the serial position of a target object in the scan path was manipulated. Memory for the visual form of the target was most

accurate when that object was one of the last two objects fixated in the scene, a recency effect suggesting a two-object VSTM component to on-line scene representation. Changes to objects fixated earlier in viewing were detected at rates well above chance, however, demonstrating a significant LTM component to on-line scene representation.

### 5:10–5:25 (108)

**Visual Short-Term Memory for Features and Objects: A Synthesis of Recent Research.** STEVEN J. LUCK, *University of Iowa*—There has been an explosion of VSTM research over the past decade, and this talk will consider the major questions that have been asked and some preliminary answers. The questions can be broken down according to the main processes involved in accurately performing change detection: (1) forming a perceptual representation, (2) transforming the perceptual representation into a durable VSTM representation, (3) maintaining the VSTM representation over time, and (4) comparing the VSTM representation with incoming perceptual inputs. Recent work indicates that (1) the perceptual representations are sets of features that are bound together in a manner influenced by grouping factors, (2) the process of creating durable representations is resource intensive but relatively fast, (3) representations become noisy over time and may completely terminate, and (4) there is a fast, unlimited-capacity comparison process. It is also important to ask what role VSTM plays outside the laboratory, and several possibilities will be discussed.

### Decision Making

Nicollet D, Friday Afternoon, 3:50–5:30

Chaired by Jay I. Myung, Ohio State University

### 3:50–4:05 (109)

**Human Heuristics for Two Versions of a Combinatorial Optimization Problem.** EDWARD P. CHRONICLE, *University of Hawaii*, JAMES N. MACGREGOR, *University of Victoria*, & THOMAS C. ORMEROD, *Lancaster University*—The traveling salesperson problem (TSP) is a combinatorial optimization problem, in which the task is to find the shortest possible tour around a set of points in the plane. In the standard version of the TSP, the tour must return to the starting point. Human performance with TSPs is surprisingly good. We have previously shown that a boundary-following heuristic can account for this finding. Here, a single experiment examined the effect of removing the requirement to return to the starting point. The resultant problems (termed open TSPs) are easier from a combinatorial standpoint; however, human performance was significantly worse with open than with standard TSPs. We argue that this is because the boundary-following heuristic is no longer applicable. Nevertheless, the absolute level of performance with open TSPs suggested that other cognitive heuristics were operating. We present empirical and modeling data that explore possible heuristics for open TSPs.

### 4:10–4:25 (110)

**Preference for a Compromise Increases as Choice Alternatives Become More Extreme.** MARIUS USHER, *University of London*, & JAMES L. MCCLELLAND, *Carnegie Mellon University*—In choices among three alternatives differing on two attributes (e.g., three cars differing on economy and roominess), people tend to prefer a compromise rather than an extreme alternative. This compromise effect, which violates the normative theory of choice, is explained in different ways by the decision field theory (DFT) and the leaky competing accumulator model (LCAM). In DFT, it is due to an inhibition mechanism that decreases with dissimilarity between the alternatives, whereas in LCAM, the effect is due to an asymmetry between relative gains and losses that reflects loss aversion and that increases as a function of the dissimilarity between the alternatives (on each attribute). Thus, the DFT predicts that the compromise effect diminishes with the dissimilarity between the noncompromise alternatives, whereas LCAM predicts that the effect increases. We report an experiment

showing that the compromise effect increases with dissimilarity (i.e., as noncompromise alternatives become more extreme).

4:30–4:45 (111)

**Thinking About Uncertain Data: How Scientists Represent Uncertainty in Their Data.** CHRISTIAN D. SCHUNN & LELYN D. SANER, *University of Pittsburgh*—The data analysis process can be construed as an uncertainty reduction process. Scientists begin data analyses uncertain of many elements: their theories, their operationalized predictions, the existence of patterns in the data, and the validity of their analytic techniques. Through problem solving, they must reduce their uncertainty about each of those elements. At the same time, many scientists are wrestling with visual and spatial representations of their data. As a lens that brings uncertainty and visuospatial processing together, we use a computational theory of spatial problem solving based on neuropsychology data on how the brain represents visuospatial information in different tasks, called ACT–R/S. ACT–R/S makes predictions about how problem solvers will represent visuospatial information as a function of the demands of the data analysis task and the uncertainty levels. We present data from expert and novice scientists analyzing fMRI and planetary science data that test these predictions.

4:50–5:05 (112)

**Consequences of the Likelihood Principle for the Statistical Analysis of Psychological Experiments.** ERIC-JAN WAGENMAKERS, *University of Amsterdam*—According to the likelihood principle, all statistical information from an experiment is contained in the likelihood function. The likelihood principle implies that inference should be based on observed data and that inference should not be based on hypothetical data that have not been observed. Also, according to the likelihood principle, statistical inference should not be affected by the (possibly unknown) intentions of the researcher performing the experiment. Classical hypothesis-testing procedures violate the likelihood principle: Classical inference is based on unobserved data and also depends on the experimental sampling plan. In scientific practice, these undesirable properties can have rather grave consequences, as will be illustrated by example. I will discuss several practical alternatives to classical hypothesis testing that do follow the likelihood principle.

5:10–5:25 (113)

**A Bayesian Approach to Testing Decision-Making Axioms.** JAY I. MYUNG, *Ohio State University*, GEORGE KARABATSOS, *University of Illinois*, & GEOFFREY J. IVERSON, *University of California, Irvine*—Theories of decision making are often formulated in terms of deterministic axioms, which, however, cannot easily account for stochastic variation that confounds empirical data. Overcoming this incompatibility between axioms and data, we present a Bayesian inference framework for dealing with fallible data. The framework provides a readily applicable statistical procedure that addresses many types of inference questions that arise in axiom testing. Specifically, the Bayesian framework assumes a set of parameters, where each parameter represents a choice probability of interest and is viewed as a random variable on which a probability distribution is defined. The framework considers the posterior distribution of these parameters as arising from a prior distribution representing the order constraints implied by these axioms. We illustrate the Bayesian framework by testing a well-known axiom of decision making, monotonicity of joint receipt, with Cho and Fisher's (2000) data.

#### Discourse Processing

Greenway BCD, Friday Afternoon, 3:50–5:30

Chaired by Sam Glucksberg, Princeton University

3:50–4:05 (114)

**Perspective Taking Among Friends and Strangers in Communication: Who Is More Egocentric?** BOAZ KEYSAR, TRAVIS J. CARTER, & ASHLEY T. SWANSON, *University of Chicago*—When

we interpret others' actions, we need to use what we know about their beliefs, desires and goals; we attempt to take their perspective, not ours. Common sense suggests that people more easily and naturally take their friend's perspective than a stranger's. We argue the opposite: Because friends tend to have more strongly convergent perspectives than do strangers, accounting for perspective tends to be less diagnostic among friends. We therefore predicted that people are more egocentric when interpreting the actions of friends than when interpreting those of strangers. To test this, pairs of friends and strangers played a communication game where a director instructed an addressee to move objects around. Eyegaze pattern and behavioral data show that addressees interpret instructions from their egocentric perspective, rather than from the other's perspective, and that this tendency is stronger for friends than for strangers. This shows that our interpretive system adapts to the informational value of perspective.

4:10–4:25 (115)

**Addressing the My-Side Bias in Argumentation.** CHRISTOPHER R. WOLFE, *Miami University*, & M. ANNE BRITT, *Northern Illinois University*—When developing arguments, less skilled writers do not include positions on the other side of an issue: the "my-side" bias. This may impede informal reasoning and effective writing. We assessed the causes of, and interventions to reduce, my-side biases in argumentation. Participants conducted research, took notes, and wrote argumentative essays. Half were instructed to visit as many or few of the 16 available Web sites as they liked and the other half to visit a balance of both pro and con sites. Balanced search instructions produced significantly more essays with other-side information (73% vs. 48%) and significantly more full arguments including claim, reason, and warrant. This significant improvement due to balanced search instructions appears to result from more balanced note taking, rather than from modified search behavior. These results suggest that the my-side bias is rooted in misconceptions about both the nature of argumentation and the nature of research.

4:30–4:45 (116)

**The Processing of Metaphorical Anaphors in Reading.** AMIT ALMOR, *University of South Carolina*, SUDHA ARUNACHALAM, *University of Pennsylvania*, & KRISTEN A. SETZLER SIMENSEN & MELISSA L. JANTZ, *University of South Carolina*—Although previous research showed that processing metaphorical references is harder than processing literal references, it may be that when sufficient information is available about the metaphor and its relation to the referent, processing metaphorical references can become as easy as processing literal ones. We describe two self-paced reading experiments that tested this hypothesis by providing the relation expressed by the metaphor prior to its use as a reference. In both experiments, sentences with metaphorical references took longer to read than comparable sentences with literal references. This metaphor disadvantage was not affected by the amount of information provided about the metaphor prior to its use as a reference or by whether this information was reinstated before the metaphorical reference. Our results are compatible with the view that the processing of a metaphorical reference is harder than the processing of a literal one even when the relation underlying the metaphor is readily available.

4:50–5:05 (117)

**Metaphor Comprehension as Attributive Categorization.** LARA L. JONES & ZACHARY ESTES, *University of Georgia* (read by Zachary Estes)—The class inclusion model (Glucksberg & Keysar, 1990) claims that metaphors (e.g., *That exam is a filter*) are comprehended by inclusion of the topic (or subject) as a member of an attributive category named after and exemplified by the vehicle (or predicate). Alternatively, the career-of-metaphor hypothesis (Gentner & Wolff, 1997) claims that only conventional metaphors, and not novel metaphors, are processed categorically. In two experiments, participants rated the extent to which a topic concept (e.g., EXAM) was a member of a vehicle category (e.g., FILTER). To test the scope of the class inclusion model,

both conventional and novel metaphors were included. The likelihood of class inclusion was higher following metaphorical primes than following either literal primes (Experiment 1) or no primes (Experiment 2). Moreover, this metaphor-induced categorization occurred equally for both conventional and novel metaphors. Thus, results supported the class inclusion model but failed to support the career-of-metaphor hypothesis.

#### 5:10–5:25 (118)

**When Old Sharks Are Not Old Pros: Metaphors Are Not Similes.** CATRINEL HAUGHT & SAM GLUCKSBERG, *Princeton University* (read by Sam Glucksberg)—Some theories of metaphor comprehension claim that metaphors are understood via a comparison process. Other theories view metaphors as categorization assertions and reject comparison as the comprehension mechanism. The two types of theories, however, share the assumption that a metaphor and its corresponding simile have the same “meaning.” We argue that this assumption is mistaken. Although many metaphors can be paraphrased as similes with little or no change in meaning, we show that this is not an invariant property of metaphors but, instead, depends on the specific content of a metaphor and its corresponding simile. Some expressions can be used only as similes, others as metaphors. Yet others change in their interpretations when converted from metaphor to simile. The implication of these phenomena is clear: Theories of metaphor that rely on the equivalence of metaphors and similes are fundamentally flawed. Metaphors are not similes.

#### Judgment and Decision Making Greenway FGH, Friday Afternoon, 4:10–5:30

*Chaired by Stanley Coren, University of British Columbia*

#### 4:10–4:25 (119)

**Risk to Innocent Persons From Lineup Identification Errors.** RALPH N. HABER & LYN HABER, *Human Factors Consultants, University of California, Santa Cruz*—Jurors believe eyewitnesses and vote to convict when eyewitness identifications have been made. However, roughly 90% of the people exonerated since 1989 by new DNA evidence were convicted on the basis of an erroneous eyewitness identification. Furthermore, experimental evidence implies real-life erroneous identification rates of 50% or higher. These data suggest very high risks to innocent persons who find themselves in police lineups. Using experimental, empirical, and criminal justice system data, combined with a variety of assumptions about the efficiency and operations of the criminal justice system, we estimate the risk rates of erroneous identification for an innocent suspect in a perpetrator-present and a perpetrator-absent lineup and for an innocent foil in either kind of lineup. We then estimate the risk of indictment and conviction to those innocents. Depending on the assumptions about the criminal justice system used, the risks of erroneous identification in a lineup range from zero to 100% but, regardless of assumption, approach 100% for indictment, conviction, and long incarceration.

#### 4:30–4:45 (120)

**Mindset: Contamination in the Fingerprint Comparison Process.** LYN HABER & RALPH N. HABER, *Human Factors Consultants, University of California, Santa Cruz*—ACE-V (analysis, comparison, evaluation, and verification) is the most widely accepted method of fingerprint comparison in current use. During the analysis stage, the crime scene latent print is fully examined. During comparison, the characteristics identified in the latent print are compared with the features in the suspect’s print. During evaluation, the examiner reaches a conclusion (match/no-match) and tests it by further comparison. During verification, a second examiner evaluates the conclusion. We consider the effects of prior knowledge, experience, and expectancies at each stage of the fingerprint comparison process, within the real-life parameters of police departments and crime laboratories. For example, the examiner may begin with knowledge that this is a major case,

have a suspect in hand, and be pressured to solve quickly; the FBI’s computer output may identify this suspect. During analysis, the examiner may start with the suspect’s print instead of with the latent print. During comparison, discrepancies between the prints may be ignored. During evaluation, further comparison may be foregone. The verifying examiner is normally zero-blind.

#### 4:50–5:05 (121)

**Transfer of Hindsight Bias.** NORMAN R. BROWN, *University of Alberta*—A two-phase experiment was conducted to determine whether hindsight bias transfers. During the first phase, participants estimated answers to 50 general knowledge questions. Included in this set were 16 question pairs; paired questions queried the same quantitative feature of two similar targets (e.g., seating in Fenway Park/Wrigley Field). During the second phase, participants were presented with one member of each pair and attempted to recall their prior response to it. This question occurred alone (control) or was preceded by a statement indicating its actual value (direct feedback) or the actual value of the paired question (transfer). Consistent with prior research, recall was worse in the direct-feedback condition than in the control condition, and direct-feedback responses assimilated to the presented value. Importantly, recall and assimilation were comparable in the two experimental conditions, although transfer condition responses were 30% slower than direct-feedback responses. Implications for the memory impairment and reconstruction theories will be considered.

#### 5:10–5:25 (122)

**The Relationship Between Habitual Sleep Durations and Scientific Productivity and Impact.** STANLEY COREN, *University of British Columbia*—Evidence suggests that individuals with a large sleep debt do poorly in tasks that require sustained attention and creative problem solving. Yet a widely believed folklore is that many of the greatest and most productive scientists slept very little. To test the relationship between sleep and scientific productivity, 223 university professors (engaged in behavioral and biological research) were asked to record their sleep times for a 2-week period. Annual reports submitted to the university for the prior 2 years were obtained. Individuals who averaged less than 7 h of sleep had lower publication rates. The quality of the work may have also been lower, based the impact value of the journals. The typical sleep pattern of the most productive individuals involved sleeping around 7–7.5 h per night from Monday to Friday and then making up any sleep deficits by sleeping longer on weekends.

#### Speech Perception Regency, Friday Afternoon, 3:15–5:15

*Chaired by Elizabeth K. Johnson,  
Max Planck Institute for Psycholinguistics*

#### 3:15–3:30 (123)

**How the Spread of the Neighborhood Influences Spoken Word Recognition.** MICHAEL S. VITEVITCH, JONNA L. ARMBRUSTER, & JULIA FITZER, *University of Kansas*—Phonological spread (or phonological  $P$ ) of a neighborhood refers to the number of phonemes that produce a phonological neighbor via the substitution of a single phoneme in a word. For example, *king* has a  $P$  of 2, because two phoneme positions produce neighbors (*ring* and *kin*, but not *k\*ng*), and *cat* has a  $P$  of 3, because all three positions produce neighbors (*hat*, *cut*, *cap*). Words that had the same overall number of neighbors but varied in the spread of the neighborhood were presented in an auditory lexical decision task and an auditory naming task. In both tasks, words with a  $P$  of 2 were responded to more quickly than words with a  $P$  of 3. It is hypothesized that lexical representations of words with a  $P$  of 2 form deeper attractor basins, whereas lexical representations of words with a  $P$  of 3 form shallower attractor basins.

#### 3:35–3:50 (124)

**Lexically Driven Perceptual Learning in Speech Perception: Evi-**

**dence From Noise-Vocoded Speech.** MATTHEW H. DAVIS & KAREN TAYLOR, *MRC Cognition and Brain Sciences Unit*, CAROLYN McGETTIGAN, *Cambridge University*, & INGRID S. JOHNSRUDE, *MRC Cognition and Brain Sciences Unit*—We are studying the processes by which listeners adjust to unusual-sounding speech, using noise-vocoded sentences (Shannon, 1995). Comprehension of vocoded sentences improves rapidly, with word report improving from near zero to >70% over 30 sentences. Learning changes low-level perceptual processing, since participants can report untrained words, and is enhanced by written or spoken feedback (Davis et al., 2004). Here, we investigate whether perceptual learning depends on sentence content by assessing word report for normal vocoded sentences after training with vocoded sentences in which linguistic content has been manipulated. Results indicated that (1) training with nonword sentences does not improve comprehension, as compared with naive listeners; (2) training with “jabberwocky” sentences in which function words are preserved produces some benefit; and (3) training with syntactically normal but semantically empty sentences was equivalent to training with normal prose. Thus, lexical information (but not sentence-level meaning) is needed to tune lower level perceptual processes consistent with top-down learning processes.

#### 3:55–4:10 (125)

**Perceptual Learning: Evidence for Dynamic Phonemic Representations.** ARTHUR G. SAMUEL & TANYA KRALJIC, *SUNY, Stony Brook*—Hearing an ambiguous phoneme in a disambiguating lexical context expands listeners’ phonetic categories in the direction of the ambiguous phoneme (Norris, McQueen, & Cutler, 2003). We investigate how the perceptual system makes such adjustments and whether they reflect long-term learning. Our data suggest that the perceptual system is able to use the information best afforded by particular phonemes: for stop consonants (/d/ and /t/), learning is feature based and generalizes to new speakers and consonants (e.g., /b/ and /p/). In contrast, learning for fricatives (/s/ and /ʃ/) is acoustically based and speaker specific. We also show that perceptual learning does not simply diminish over time. Instead, input that corrects the adjusted phoneme is necessary to return to prelearning representations; at least for fricatives, correcting input must come from the same speaker that the ambiguous input did. These results support a view of phonemic representations as dynamic and flexible.

#### 4:15–4:30 (126)

**Recalibration and Selective Adaptation of Ambiguous Speech Sounds Co-Occur.** JEAN VROOMEN & SABINE VAN LINDEN, *Tilburg University*, & PAUL BERTELSON, *Tilburg University and Université Libre de Bruxelles*—Listeners use lipread speech to recalibrate speech sounds; when an ambiguous sound intermediate between /aba/ and /ada/ is dubbed onto a face articulating /aba/ (or /ada/), speech categories are expanded such that the ambiguous sound falls

within the phoneme class specified by the lipread stimulus (Bertelson, Vroomen, & de Gelder, *Psych. Sci.*, 2003). The study reported here shows that recalibration occurs remarkably quickly, whereas prolonged exposure to the recalibrated sound causes an opposite effect, revealing selective adaptation. Exactly the same stimulus thus causes two opposing effects, recalibration and selective adaptation, with different build-up rates. These results inform theories of speech perception and explain apparent contradictions in the literature.

#### 4:35–4:50 (127)

**Effects of Syntactic Expectations on Speech Segmentation.** SVEN L. MATTYS, *University of Bristol*—Although the effects of acoustic cues on speech segmentation have been extensively investigated, the role of higher order information—for example, syntax—has received less attention. In this study, we tested whether syntactic expectations based on subject–verb agreement can affect segmentation and whether they can do so despite conflicting acoustic cues. Although participants detected target words more quickly in phrases containing proper allophonic cues (“sports” in “like sports” and “ports” in “likes ports”), this acoustic effect was suppressed when the phrases were appended to a plural context (“the children like sports/\*likes ports”). Here, the syntactically congruent target (“sports”) was detected more quickly regardless of the acoustics. However, a singular context (“the child \*like sports/likes ports”) had no effect on segmentation, and the results resembled those of the neutral phrases. These and additional data suggest that syntactic knowledge can facilitate segmentation, provided that syntactic realization (verb inflection) occurs before conflicting acoustic cues are encountered.

#### 4:55–5:10 (128)

**Voice and Language Discrimination by Dutch-Learning Infants.** ELIZABETH K. JOHNSON, *Max Planck Institute for Psycholinguistics*, ELLEN WESTREK, *Vrije Universiteit Amsterdam*, & THIERRY NAZZI, *CNRS, Paris*—Two experiments using the visual fixation paradigm were carried out to investigate the effect of language familiarity on voice and language discrimination in Dutch-learning 7-month-olds. Infants were habituated to three voices in one language and then were tested on a new voice in the habituated language (voice change) and a new voice in a new language (language change). In Experiment 1 (Dutch vs. Japanese) and Experiment 2 (Japanese vs. Italian), infants dishabituated to language change trials. But only Dutch-habituated infants in Experiment 1 dishabituated to voice change trials. These findings constitute the first evidence that voice discrimination in infants is affected by language familiarity, a finding with important implications for the study of voice identification and encoding. Our results also indicate that language familiarity does not affect Dutch-learners’ ability to discriminate rhythmically distinct languages. These effects are being further tested in rhythmically similar languages: German versus English and English versus Dutch.

**Letter and Word Processing**  
**Nicollet A, Saturday Morning, 8:00–10:00**

*Chaired by Jukka Hyönä, University of Turku*

**8:00–8:15 (129)**

**The Effect of Transposed Letter Stimuli in Visual Word Recognition.** MANUEL PEREA, *Universitat de València*, & STEPHEN J. LUPKER, *University of Western Ontario*—Nonwords created by transposing two letters (e.g., JUGDE) are very effective at activating the lexical representation of their base words, a result that is quite problematic for slot-based models of letter coding. Recently, Perea and Lupker (in press) reported that this result occurs across nonadjacent letter positions (e.g., AMINAL) and is modulated by the consonant/vowel status of the transposed letters (occurring if the letters are two consonants, but not if they are two vowels), causing further problems for slot-based models. The present research extends our investigation of the impact of transposed letters in visual word recognition. To summarize, we found that (1) Perea and Lupker’s results arise in English as well as in Spanish, (2) transposed-letter effects are as strong when the transposed letters are a consonant and a vowel (e.g., HOSUE) as when they are two consonants (e.g., JUGDE), and (3) transposed-letter effects do not occur when the transpositions involve initial letters (OHUSE).

**8:20–8:35 (130)**

**On Coding the Position of Letters in Words: Some Key Data and a Model.** JONATHAN GRAINGER, JEAN-PIERRE GRANIER, & FERNAND FARIOLI, *LPC–CNRS and Université de Provence*—Recent research has highlighted two key phenomena obtained with the masked priming paradigm, using nonword primes that share letters with word targets without containing letters that are not present in the target. Facilitation is obtained relative to unrelated prime stimuli when primes contain a subset of the targets’ letters, as long as the relative order of letters is respected (relative-position priming). When primes contain all of the targets’ letters, priming is obtained with minor modifications of letter order (transposition priming). These two phenomena severely limit the possible mechanisms that are used by the human brain to code letter position information. We describe a model that can account for these two phenomena and report new data on contiguity effects in relative-position priming (the extent to which priming depends on how contiguous the prime letters are in the target stimulus) that provide a critical test of the model.

**8:40–8:55 (131)**

**Morpho-Orthographic Segmentation in Early Visual Word Recognition.** KATHLEEN RASTLE, *University of London*, MATTHEW H. DAVIS, *MRC Cognition and Brain Sciences Unit*, & SAMANTHA MCCORMICK & BORIS NEW, *University of London*—In this paper, we challenge the dominant view of morphological representation in visual word recognition—namely, that the decomposition of morphologically complex words is governed by semantic transparency. Participants made lexical decisions to targets preceded by masked primes sharing a semantically transparent morphological relationship with the target (e.g., *cleaner*–CLEAN), a pseudomorphological relationship with the target (e.g., *corner*–CORN), and a nonmorphological form relationship with the target (e.g., *brothel*–BROTH). Priming effects were based on the appearance of a morphological relationship: Significant and equivalent priming effects emerged for the semantically transparent stimulus pairs (*cleaner*–CLEAN) and the pseudomorphological pairs (*corner*–CORN), but no priming was observed for the nonmorphological form pairs (*brothel*–BROTH). These findings implicate a level of representation in the visual word recognition system at which morphological decomposition is defined on an orthographic—not semantic—basis. Further data concerning the nature of the morpho-orthographic segmentation algorithm are discussed.

**9:00–9:15 (132)**

**Frequency Measures as Indices of Morphological Processing.**

LAURIE B. FELDMAN, *SUNY, Albany, and Haskins Laboratories*, & MATTHEW J. PASTIZZO, *SUNY, Geneseo*—By traditional accounts, effects of surface frequency reflect whole-word processing, and base morpheme frequency effects reflect analytic morphological processing. Ambiguity with respect to word class plays no role. We compared 30 noun-dominant words ending in ING (e.g., PAINTING) and 30 verb-dominant words ending in ING (e.g., FINDING). All could be nouns as well as verbs. Decision latencies were slower and accuracies lower for noun- than for verb-dominant forms. Affixation of an *s* (legal by the noun reading only) affected both sets comparably. Priming by a function word (150-msec SOA) differentially benefited verb-dominant forms. The contributions of surface and base frequency to decision latencies for *ing* words in three experimental contexts will be described. The role of surface and base frequency as measures of morphological processing will be discussed.

**9:20–9:35 (133)**

**Parafoveal Processing and “Optimal” Behavior in Reading.** RALPH R. RADACH, *University of Aachen*, RONAN G. REILLY, *National University of Ireland, Maynooth*, & CHRISTIAN VORSTIUS, *University of Aachen* (sponsored by Albrecht Inhoff)—We examined relations between three key phenomena of reading behavior: parafoveal linguistic processing, distribution of saccade landing positions, and optimality of fixation positions for word recognition. In a reading experiment, preview was manipulated by parafoveally presenting orthographically illegal strings in a saccade-contingent paradigm. The same participants performed a single-word recognition task at variable presentation positions. The average optimal viewing position estimated on the basis of word recognition performance was very similar to the generally preferred fixation position in the reading experiment, but, critically, the individual means were uncorrelated. Apparently, optimality for word recognition is not an immediate driving force of dynamic reading behavior. In contrast, there was a significant relationship between parafoveal processing and mean saccade landing position; large target fixation durations found for illegal previews tended to be associated with mean landing positions near word beginnings. Theoretical consequences of these results will be discussed.

**9:40–9:55 (134)**

**The Use of Segmentation Cues in Reading Long Compound Words: An Eye Movement Study.** JUKKA HYÖNÄ & RAYMOND BERTRAM, *University of Turku*, & ALEXANDER POLLATSEK, *University of Massachusetts*—This eye movement study investigated the use of segmentation cues in the reading of long Finnish compounds. The cues were related to the vowel quality properties of the constituents and to properties of the consonant starting the second constituent. In Finnish, “front vowels” never appear with “back vowels” in a lexeme, but in compounds, vowels of different quality can appear in different constituents. Experiments 1 and 2 showed that compounds with different vowel quality constituents are processed faster than those with same vowel quality constituents, but only if the first constituent is long. Experiment 3 established that the effect does not depend on the crucial vowels being adjacent and that processing was affected by the type of consonant beginning the second constituent (whether or not it could end a first constituent). It is concluded that the use of segmentation cues in processing long compounds depends on the ease of encoding the first constituent.

**Reasoning**

**Nicollet BC, Saturday Morning, 8:00–9:40**

*Chaired by Morton Ann Gernsbacher,  
University of Wisconsin, Madison*

**8:00–8:15 (135)**

**Causality and Prior Knowledge in Rational Models of Inductive Reasoning.** JOSHUA B. TENENBAUM & CHARLES KEMP, *MIT*—In everyday learning and reasoning, people regularly draw successful generalizations from just one or a few examples. We propose a rational-

modeling framework for explaining these inductive leaps, based on domain-general Bayesian inference operating over hypotheses generated by people's implicit domain theories. Domain theories may incorporate significant prior knowledge about the relevant features of objects and the causal relations that hold between objects and between features in a given domain. We present applications of this theory-based Bayesian framework to the modeling of several kinds of category-based induction tasks with biological categories, including reasoning with generic properties, meaningful and familiar properties, and causally transmitted properties. This approach compares favorably to leading models based on similarity or feature matching and also provides a unifying framework for understanding inductive inference over a wide range of task contexts and knowledge structures.

**8:20–8:35 (136)**

**Taxonomic and Ecological Relations in Open-Ended Induction.** JOHN D. COLEY, ALLISON BAKER, & CARISSA KEMP, *North-eastern University*—Medin et al. (2003) argue that inductive inferences may be based on salient relations among premise categories deemed relevant to the immediate context of the inference. If so, manipulation of relations among premise categories should influence the basis of inductive inference. Participants saw 12 pairs of animal names. Each pair was either far or near taxonomically, and related or unrelated ecologically (varied orthogonally). Participants were told that the pair shared a property and were asked to list other species that might have the property and to explain their responses. Responses were coded as taxonomic or ecological. Overall, ecological responses were twice as frequent as taxonomic responses. Taxonomic responses were more frequent for taxonomically near pairs and for ecologically unrelated pairs. Ecological responses were more frequent for ecologically related pairs but were unaffected by taxonomic distance. Together, these results suggest that open-ended inductive inferences are sensitive to relevant relations among premise categories.

**8:40–8:55 (137)**

**Tests of Blocking in a Social-Reasoning Paradigm.** JESSE W. WHITLOW, JR., *Rutgers University*—The domain in which people might be expected to be most expert at causal reasoning is that of social reasoning, in which people are viewed as agents causing outcomes. This report describes laboratory studies with a social-reasoning paradigm in which participants decide how one person is likely to act toward another (helps, hinders, or is neutral). Results from studies designed to test associative theories and rule-based theories of causal reasoning will be described.

**9:00–9:15 (138)**

**True Causal Discounting Exists Despite Controlling for Alternative Causes: A Disconfirmation of Spellman (1996).** KELLY M. GOEDERT, *Pacific Lutheran University*, & BARBARA A. SPELLMAN, *University of Virginia* (read by Barbara A. Spellman)—Several experiments on human causal reasoning have demonstrated “discounting”—that the presence of a strong alternative cause may decrease the perceived efficacy of a target cause. We and others have shown that these effects may be attributable to subjects' use of conditional, rather than unconditional, contingencies (i.e., subjects control for alternative causes). However, contrary to our predictions (Spellman, 1996), and to others' support of our predictions (Tangen & Allen, 2003), we now believe that there is “true discounting” above what is accounted for by conditionalization. Four experiments demonstrate that “true discounting” exists, discounting may depend on the nature of the question put to the subjects, and discounting can be affected by motivation. We conclude that because true discounting occurs for both summary and trial-by-trial presentations of information, and because true discounting depends on motivation, discounting is not a necessary result of cue competition during the contingency acquisition process.

**9:20–9:35 (139)**

**Three Reasons Not to Believe in an Autism Epidemic.** MORTON ANN GERNSBACHER, *University of Wisconsin, Madison*—According

to the popular press, there is a mysterious upsurge in the prevalence of autism (*New York Times*), we are witnessing a baffling outbreak of autism (*CBS News*), and the number of new cases is exploding (*Time*). Several U.S. Congress members decree on their .gov Web sites that the nation is facing an autism epidemic; the world's largest parent support group mistakenly claims that a set of data from California confirms the autism epidemic; and some officials are misguidedly panicking over astronomical percentage increases in the number of autistic children served by public schools since 1992. However, no sound scientific evidence indicates that the increase in the number of diagnosed cases of autism arises from anything beyond intentionally broadened diagnostic criteria, coupled with deliberately greater public awareness and conscientiously improved case findings. How did public perception become so misaligned from scientific evidence? I shall review three bases of misunderstanding.

**Working Memory**

**Nicollet D, Saturday Morning, 8:00–10:00**

*Chaired by Randall W. Engle, Georgia Institute of Technology*

**8:00–8:15 (140)**

**Effects of Social and Physical Presence in Virtual Reality Learning Environments: A Cognitive Load Perspective.** ROXANA MORENO, *University of New Mexico*—According to cognitive load theory (Sweller, 1999), it is important to design learning environments that minimize extraneous load (i.e., working memory load resulting from activities unrelated to the learning process) and maximize germane load (i.e., working memory load that results from mental activities relevant to learning). This is particularly important when students lack substantial prior knowledge (i.e., when there is already high intrinsic load due to the difficulty of the material). On the basis of an empirical study that used a virtual reality learning environment (Moreno & Mayer, 2004), I report the effects of personalization and immersion methods on students' understanding of a science lesson. The overall results show that each method affects learning in different ways. Whereas personalization helps students' understanding, immersion affects only their sense of physical presence in the learning environment. Students' learning and subjective measures suggest that personalization increases germane load, whereas immersion may increase only extraneous load.

**8:20–8:35 (141)**

**Working Memory and Strategies in Arithmetic.** PATRICK G. LEMAIRE & MIREILLE LECACHEUR, *CNRS & Université de Provence*—Seventy-two adults, 72 fourth graders, and 72 sixth graders had to solve one-digit addition problems under single-task and dual-task conditions. In the dual-task condition, participants held series of three or five letters in working memory while solving simple addition problems (e.g.,  $7 + 9$ ). On each problem, participants could choose either direct retrieval or repeated addition in a choice condition. In no-choice conditions, they had to use either retrieval or repeated addition on all problems. Results showed (1) age-related differences in strategy preferences, in strategy execution, and in strategy selection and (2) how effects of working memory resources on these strategic aspects change as a function of age. These data have implications for further understanding the role of working memory in strategic aspects of arithmetic performance, as well as in strategic changes.

**8:40–8:55 (142)**

**Presentation Format Effects in Working Memory: The Role of Attention.** PAULA GOOLKASIAN & PAUL W. FOOS, *University of North Carolina, Charlotte*—In a series of studies, participants attempted to remember three or six concrete nouns presented as pictures, spoken words, or printed words while also verifying the accuracy of sentences. Hypotheses meant to explain the higher recall of pictures and spoken words over printed words were tested. Increasing the difficulty and changing the type of processing task from arithmetic to a visual/spatial

reasoning task did not influence recall. An examination of long-term modality effects showed that those effects were not sufficient to explain the superior performance with spoken words and pictures. Only when we manipulated the allocation of attention to the items in the storage task by requiring participants to articulate the items and by presenting the stimulus items under a degraded condition were we able to reduce or remove the effect of presentation format. The findings suggest that the better recall of pictures and spoken words over printed words results from the fact that under normal presentation conditions, printed words receive less processing attention than do pictures and spoken words.

#### 9:00–9:15 (143)

**Where Does the Predictive Power of the Reading Span Test Come From?** AKIRA MIYAKE, *University of Toronto*, & NAOMI P. FRIEDMAN, *University of Colorado*—We examined why the reading span test (RST) 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 other variables were statistically controlled for. However, partialling out a measure of cued retrieval (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 is an attention-mediated ability to use retrieval cues to reactivate/reconstruct target memory items from long-term memory.

#### 9:20–9:35 (144)

**Convergent and Discriminant Characteristics of Working Memory and Intelligence.** PHILLIP L. ACKERMAN, *Georgia Institute of Technology*, & MARGARET E. BEIER, *Rice University*—Cloze and completion tests are highly associated with intelligence, especially general and verbal aspects (Ebbinghaus, 1896–97; Taylor, 1953; Terman, 1906). However, from a process perspective, these tests differ only in immediate-memory demands and, therefore, should have differential correlations with measures of working memory (WM). If WM and fluid intelligence represent similar underlying constructs, the process changes of the tests should result in similar changes in correlations with these respective abilities. We administered multiple measures of intelligence, WM, Cloze, and completion tests across three test sessions. The results suggest that correlations between WM and Cloze/completion test performance track more closely with perceptual speed abilities and do not track with fluid intelligence. Implications for the construct validation of WM, vis-à-vis fluid intelligence and perceptual speed, are discussed.

#### 9:40–9:55 (145)

**Individual Differences in WM Capacity: Size of Focus or Retrieval?** NASH UNSWORTH & RANDALL W. ENGLE, *Georgia Institute of Technology* (read by Randall W. Engle)—What is the essence of complex span tasks that predicts performance on higher order cognitive tasks? Two possibilities are considered here. One is that high-WMC individuals keep more information in the focus of attention. The second is that high-WMC individuals are better able to rapidly retrieve recently active but currently inactive information under conditions of interference. Results from a sample of 235 subjects show that complex span tasks, even at very short list lengths, predict measures of fluid abilities. Performance on simple span tasks at list lengths that should correspond to the size of the focus (Cowan, 2001) does not predict fluid abilities, but performance on lists larger than focus does. Our interpretation is that high-WMC individuals are better able to resist the effects of proactive interference, possibly through enhanced list discrimination and/or suppression.

### Image, Scene, and Picture Processing Greenway BCD, Saturday Morning, 8:00–10:00

*Chaired by Geoffrey R. Loftus, University of Washington*

#### 8:00–8:15 (146)

**Crowding in the Mental Imagery Domain.** PATRICIA A. COSTELLO, KIRSTEN ASLAKSEN, TRACY CLEVELAND, KHOA NGO, & COLLEEN WITTENBERG, *Bradley University*, & SHENG HE, *University of Minnesota*—Crowding occurs when a target is embedded in an array of distractors, rendering its recognition difficult or even impossible. The crowding effect is less pronounced in the lower visual field. In the present study, we examined whether the crowding effect also takes place for stimuli generated using mental imagery. Observers were shown templates denoting spatial placeholders in which they were to place five random letters, using mental imagery. The mental images of the letters were formed either in crowded (radial) or less/noncrowded (tangential) configurations and in either the upper or the lower visual fields. They were then cued to report the letter identity at each position. Subjects were slower and less accurate in reporting letters in the crowded mental configurations than in the less/noncrowded mental configurations. Performance was better overall for lower visual field mental images. Apparently, mental imagery suffers from the same attentional resolution limitation as visual perception.

#### 8:20–8:35 (147)

**Cognitive Strategies in Mental Imagery: Why Older Adults Rotate Holistically.** INA C. SCHMITZ-WILLIAMS & ITIEL E. DROR, *University of Southampton*, & WENDY SMITH, *St. Mary’s College* (read by Itiel E. Dror)—Many studies have investigated whether the underlying representations and processes of mental imagery are piecemeal or holistic. They focused mainly on within-group factors, such as meaning and familiarity of the objects. The present study examines cross-group differences in mental rotations. Thirty-two participants (16 young and 16 older adults) rotated objects of different complexities. The results revealed an interaction between the two age groups, object complexity, and angle of rotation. The interaction reflected that the older adults used holistic representation and processing. This format is less dependent on or affected by the complexity of the image. In contrast, the younger adults used piecemeal representations and processing. This is a more volatile approach, because it entails that the demands on the cognitive system vary with the complexity of the image.

#### 8:40–8:55 (148)

**Remembering Complex Scenes Is Simple.** AUDE OLIVA, *MIT*—Memory of real-world images is known to be very good, but little is known about the mechanisms that observers use to encode and represent complex visual information. A characteristic of natural scenes is their variability in quantity of objects, spatial arrangements, and scale. This variability presents the question of whether perceptual and mnemonic mechanisms depend on the degree of visual complexity of an image. In three experiments, we manipulated the visual complexity of scenes to test the hypothesis that the processing and encoding of visual complexity is a nonlinear function of the quantity of information (variety of objects, colors, textures). Overall, the results show that performance of discrimination is best for medium complexity scenes and then decreases progressively for images of a lower and higher complexity rank. Further analyses suggest that scenes of high and low complexity have a lower degree of discriminability than do scenes of a medium level of complexity.

#### 9:00–9:15 (149)

**Representations of Scene Layout Become Functional Over a Rapid Time Course.** THOMAS SANOCKI, *University of South Florida*—Exposure to a known scene activates a representation of its layout that is functional—it contributes to (facilitates/speeds) subsequent processing of spatial relations across the scene (Sanocki & Epstein, 1997, *Psychological Science*; Sanocki, 2003, *Cognitive Psychology*). A lead time

method is introduced here in which scene primes precede scene targets for time intervals from 0 to 800 msec. The time course functions for scene primes are compared with those for a baseline prime (an empty background control). Results indicate that after minutes of practice, the scene primes become fully functional within 200 msec lead time. Scene processing load (set size) varied, from low (one simple object, 3 surfaces) to high (four complex, multipart, obliquely oriented objects, 24 surfaces). Time courses were similarly fast across load, suggesting that layout processing was independent of traditional capacity. Thus, layout representations become functional rapidly and in parallel across familiar scenes.

#### 9:20–9:35 (150)

**Detecting and Remembering Simultaneous Pictures in RSVP.** MARY C. POTTER & LAURA F. FOX, *MIT*—Can viewers process more than one pictured scene at a time? We report experiments in which subjects viewed one to four pictures per frame in a multiframe RSVP sequence. The SOA between frames varied from 160 to 720 msec, and the frame duration either was the same as the SOA or was 160 msec plus a blank ISI. Subjects either took a yes–no recognition test immediately after each sequence (Experiments 1–3) or tried to detect a verbally specified target (e.g., man with violin) in each sequence (Experiments 4–5). Memory accuracy declined as more pictures were presented on a given frame. Detection was more accurate than memory, overall, and showed a smaller effect of the number of pictures on a frame. The results suggest that parallel search across multiple pictures is possible but that memory consolidation is serial.

#### 9:40–9:55 (151)

**On the Perceptual Representation of Stimulus Contrast and Duration in Picture Memory.** DANIEL M. BERNSTEIN, JANICE CHEN, & GEOFFREY R. LOFTUS, *University of Washington* (read by Geoffrey R. Loftus)—During any instant, our sensory systems are bombarded with information. Accordingly, a primary task of the sensory–perceptual–cognitive system is to acquire and maintain information needed for the task at hand, while ignoring or discarding information that is not. We report experiments in which pictures seen at varying durations and contrasts were followed by unexpected tests wherein original contrast and duration values were estimated. These tests were designed to determine whether seemingly irrelevant information about a picture’s contrast and duration is stored and maintained in memory. We tested the hypothesis that it is not but, instead, that eventual duration and contrast estimates are based on a single strength value that also determines recognition performance. We rejected this hypothesis, concluding that some accurate information about both duration and objective contrast is maintained in memory. However, duration and contrast interact: Longer objective durations produce higher estimated contrasts, and higher objective contrasts produce longer estimated durations.

### Language Production II

Greenway FGH, Saturday Morning, 8:00–10:00

Chaired by Daniel C. O’Connell, *Georgetown University*

#### 8:00–8:15 (152)

**Language Learning Without Feedback: How Children Avoid the Logical Problem of Language Acquisition.** MICHAEL J. RAMSCAR & DANIEL G. YARLETT, *Stanford University*—Children learning language must generalize beyond what they hear. If their grammatical generalizations take the form of “superset hypotheses,” going beyond the grammar to be acquired, negative feedback will be required to enable them to learn the correct generalization (positive evidence will support the erroneous generalization). Because children neither receive nor respond to negative feedback and do make superset hypotheses (i.e., produce “mouses” and “mice” as the plural of “mouse”), innate language-specific mechanisms have been deemed necessary to explain language acquisition. We present a model of plural learning in which superset hypotheses arise out of the relative frequencies of regu-

lar and irregular forms in the input and resolve as representations derived from this input asymptote. Four experiments support the model’s main prediction: that children can converge on the correct grammatical generalization simply by being forced to repeat the incorrect hypothesis, irrespective of any feedback (misleading or otherwise) that they receive.

#### 8:20–8:35 (153)

**Past Tense Forms: A Question of Semantics?** MICHELE MIOZZO & PETER GORDON, *Columbia University*—Kim et al. (1991) found that semantically similar verbs tend not to share regular or irregular past tense forms (e.g., *hit, slapped, struck*). However, if a verb is derived from a noun (denominal), the regular past tense form is preferred, even if the verb normally would take an irregular form (e.g., *Bonds flied out to center field*). However, Ramscar (2002) found that if a nonce verb rhymes with an established verb, its inflectional form can be determined by semantic similarity, but not by derivational history. He then provides evidence that effects attributed to grammatical derivation are explained by semantic distance of the derivational form and the standard verb meaning. The present experiments replicate Ramscar’s original findings but show that minor changes in verb learning contexts and unconfounding semantic distance with derivational history show significant and strong effects of denominalization in determining choice of regular or irregular past tense forms.

#### 8:40–8:55 (154)

**Output-Oriented Similarity Effects in the Production of English Past Tense.** JOSEPH P. STEMBERGER, *University of British Columbia*—Most models for the production of morphologically inflected forms are oriented toward a mapping from the phonological form of a (base) input form to the (past tense) output form. Such models naturally capture statistical regularities between the input and the output forms, but not generalizations over just output forms. Two sentence-production experiments explored mapping-oriented versus output-oriented effects on error rates on regular past tense and perfect aspect forms in English, examining the effect of similarity to known regular and irregular forms. Similarity to output forms has a large impact on error rates, but mapping-oriented similarity also has an effect. Similarity to irregular forms is obvious. Similarity to regular forms has no effect when only rhyming forms are examined but has a large effect when lesser degrees of similarity are included. Regular forms are largely stored in the lexicon. Implications for models of production will be discussed, as well as interactions with error-driven learning.

#### 9:00–9:15 (155)

**Lexical Bias Is Context Dependent, But the Standard Editing Account Doesn’t Fly.** ROBERT J. HARTSUIKER, *Ghent University*, MARTIN CORLEY, *University of Edinburgh*, & HEIKE MARTENSEN, *University of Antwerp*—The lexical bias effect is the tendency for phonological speech errors to result in existing words. Baars, Motley, and MacKay (1975) found lexical bias in a mixed context of words and nonwords, but not in a pure nonword context. They attributed this bias, therefore, to covert editing based on lexicality (interception of nonwords). However, Humphreys (2002) did not find contextual modulation and concluded that the bias results from phoneme-to-word feedback. We report two speech error elicitation experiments, which were better controlled than the original study, and a control experiment (to exclude any influence from reading processes). Context indeed modulated lexical bias, but in a different way than Baars et al. suggested: Nonword errors were not intercepted in the mixed context. Rather, word errors were intercepted in the nonword context (where a word is a sure sign of error). We conclude there is both feedback and (adaptive) editing in the production system.

#### 9:20–9:35 (156)

**Implicit Cues of Misunderstanding in Spoken Conversation.** FREDERICK G. CONRAD, *University of Michigan*, MICHAEL F. SCHÖBER, *New School University*, & WIL DIJKSTRA, *Vrije Universiteit Amsterdam*—When speakers misunderstand speakers in dialogue,

they often do not explicitly say that they need clarification. But they can give paralinguistic and visual cues that clarification might be warranted. How sensitive are speakers to the potential uptake of such cues as disfluencies and looks of confusion? Do they produce them differentially when the cues can and cannot be exploited? We explore this in survey interviews conducted face to face and on the telephone when interviewers were and were not licensed to clarify concepts in the survey questions. Respondents were sensitive to whether visual information was available to the interviewer, producing ums and uhs at a higher rate on the telephone than face to face. In face-to-face interviews, respondents signaled potential uncertainty by looking away from interviewers for more time when giving answers they later changed. Yet interviewers seemed relatively insensitive to such visual cues, as compared with respondents' disfluencies on the telephone.

9:40–9:55 (157)

**Do the Fillers *Uh* and *Um* Signal Delay in Spoken Discourse?** DANIEL C. O'CONNELL, *Georgetown University*, & SABINE KOWAL, *Technical University of Berlin*—Clark and Fox Tree (2002) presented empirical evidence, based primarily on the London–Lund corpus (Svartvik & Quirk, 1980), that the fillers *uh* and *um* are conventional English words that signal a speaker's intention to initiate a minor and a major delay, respectively. We present empirical analyses of *uh* and *um* and of silent pauses (delays) immediately following them. Our evidence indicates that *uh* and *um* cannot serve as signals of upcoming delay, let alone signal it differentially: In most cases, both *uh* and *um* were not followed by a silent pause—that is, there was no delay at all. The silent pauses that did occur after *um* were too short to be counted as major delays. Finally, the distributions of durations of silent pauses after *uh* and *um* were almost entirely overlapping and could, therefore, not have served as reliable predictors for a listener.

#### Making Predictions

Regency, Saturday Morning, 8:00–9:40

Chaired by Nigel Harvey, *University College London*

8:00–8:15 (158)

**The Three-Door Problem: Who Trusts Monty Hall?** W. TRAMMELL NEILL, PETER B. WALKER, JACQUELYN BERRY, & MICHAEL A. CAMARGO, *SUNY, Albany*—In the three-door problem, subjects guess which one of three doors hides a prize. Another door is then shown to not hide the prize, and subjects are offered the option to switch their choice to the remaining door. Although the probability that the remaining door hides the prize is 2/3, and the optimum strategy is to switch, most subjects decline to switch and estimate the probability of winning as 1/2. We presented scenarios varying in who opened the second door—the subject, a partner, an opponent, or the game show host—and whether that door was selected randomly or with foreknowledge. Subjects were relatively unaffected by who opened the door, and they were insensitive to the information provided by a deliberate choice, relative to a random choice. Surprisingly, subjects who demonstrated greater competence for unconditional probabilities, and/or better comprehension of the scenarios were most susceptible to the cognitive illusion.

8:20–8:35 (159)

**Sensitivity to Differentially Diagnostic Test Outcomes Using Familiar Materials: Implications for Confirmation Bias.** CRAIG R. MCKENZIE, *University of California, San Diego*—Researchers have recently pointed out that “confirmation bias”—systematic overconfidence in a focal hypothesis—cannot result from either biased testing or biased evaluation of hypotheses alone, but it can result from a combination of the two. One such testing/evaluation combination is (1) a tendency to ask about features that are either very likely or very unlikely under the focal hypothesis (“extremity”) and (2) a tendency to treat confirming and disconfirming outcomes of tests as more similar in terms of their diagnosticity (or informativeness) than they really are. However, previous research showing (2) has used materials that are

highly abstract and unfamiliar. Two experiments demonstrated that using familiar materials led participants to distinguish much better between the differential diagnosticity of confirming and disconfirming test outcomes. The conditions under which confirmation bias is a serious concern are becoming increasingly small.

8:40–8:55 (160)

**Removing the “Over-” From Overconfidence: Reducing Irrational Expectations About Performance.** SUSAN T. DAVIS, *University of Dayton*—There appears to be an epidemic of overconfidence! People are inaccurate in estimating their performance in academic and perceptual domains, their ability to make lifestyle changes, and their susceptibility to major and minor health risks. Two potential explanations were contrasted in the present research: People are overconfident either because they are ignorant of or are ignoring base-rate information in the relevant domain, or because they are attempting to reduce incongruence between their actual ability and their belief of others' expectations of their performance. Dissonance-reducing instructions produced more realistic assessment of ability in a laboratory word puzzle task; however, encouragement to use base-rate information failed to produce similar results. Furthermore, although overconfidence in performing the laboratory task was highly correlated with that in other domains (e.g., making lifestyle changes, performing physical activities), there was no transfer of reduction in overconfidence even to tasks similar to the laboratory task.

9:00–9:15 (161)

**Likelihood Judgments About Competitions: When You Know More About One Competitor Than About Another.** PAUL D. WINDSCHITL & JOHN R. CHAMBERS, *University of Iowa*—When anticipating the outcome of a competition, people often have more information about one competitor than about another. We investigated how this difference in the amount of information about two competitors influences likelihood judgments regarding the outcome of the competition, as well as judgments about the strengths of the competitors. When the competition involves a generally easy task domain, people expect a familiar competitor (the competitor about which they have more information) to win, whereas when the competition involves a difficult domain, people expect the familiar competitor to lose. Two explanations for this effect were tested: a regression-to-the-mean explanation and a differential-confidence explanation. The amount of information participants had about a competitor had little effect on their ratings of how strong (in absolute terms) the competitor would be in a domain. However, the amount of information did influence the confidence participants had about those ratings, favoring the differential-confidence explanation.

9:20–9:35 (162)

**Self–Other Discrepancies in Preferences for Nonmonetary Risks.** NIGEL HARVEY, MATT TWYMAN, & CLARE HARRIES, *University College London*—Hsee and Weber (1997) found that people predict that others will be more risk seeking than themselves when selecting between risky and certain monetary options. Does their finding hold for nonmonetary risks? We asked people first to estimate the level of risk associated with 16 different activities on the basis of real but unreliable advice. (The activities were concerned with transport, employment, recreation, and drug taking.) Then we asked them to estimate the likelihoods that they and another person would partake in these activities. Like Hsee and Weber, we found self–other discrepancies in risk preference. We discuss these differences in the context of their view that risk taking for others can be modeled as a weighted average of risk taking for self and risk neutrality.

#### SYMPOSIUM:

Representing and Using Words Referring to Events  
Nicollet A, Saturday Morning, 10:15–12:00

Chaired by Gabriella Vigliocco, *University College London*

How the meaning of words is represented and used is a central ques-

tion in cognitive psychology, cognitive neuroscience, and linguistics. Until recently, research on semantic memory organization has focused primarily (if not exclusively) on the representation of words referring to objects. Arguably, however, events (from concrete ones such as running to more abstract ones such as buying) are an equally fundamentally important domain of knowledge, and advances in our understanding of the semantic representation for such words ought to constrain our theorizing concerning semantic memory. The symposium brings together scholars who are contributing to the study of the representation and processing of events. The first two talks (Vigliocco & Tranel) address the issue of neural representation of words referring to events. The second two talks (McKoon & McRae) discuss theoretical perspectives on how words referring to events are represented. The last talk (Tversky) discusses how perceived events are described.

#### 10:20–10:35 (163)

**The Neural System Engaged in Understanding Nouns and Verbs Referring to Events.** GABRIELLA VIGLIOCCO, JANE WARREN, & JOANNE ARCIULI, *University College London*, SIMONA SIRI, *Università Vita-Salute, San Raffaele*, & RICHARD WISE, *Imperial College London*—In a PET study, we tested the prediction, derived from our previous work, that the same neural system underlines the representation for nouns and verbs when both refer to events. We manipulated grammatical class (nouns, e.g., *atterraggi* [landings], *solletico* [tickling], or verbs, e.g., *rincorre* [he or she chases], *annusano* [they sniff]) and semantic type (referring to motion, e.g., *atterraggi*, *ricorre*, or sensation, e.g., *solletico*, *annusano*). The use of words all referring to events allowed us to assess grammatical class effects unconfounded with the correlated semantic distinction between objects and events/actions. We used Italian words to assess the role of cross-linguistic differences as an account of previous conflicting imaging results. Participants in the experiments were asked to listen attentively to blocks of acoustically presented words and blocks of spectrally rotated words (baseline). We found clear semantic effects (motor vs. sensory words) but, crucially, no verb–noun differences.

#### 10:40–10:55 (164)

**Neural Correlates of Nouns and Verbs: Evidence From Neuropsychology.** DANIEL TRANEL, *University of Iowa*—There has been burgeoning interest in the question of whether the processing of nouns and verbs depends on different neural systems. The short answer to this question is yes; however, recent work has revealed important wrinkles in this story. On the basis of a program of research that combines large-scale lesion method studies with functional imaging, we have uncovered several key subplots. (1) “Knowing” and “naming” can be neurally separated, but the separation is stronger for some categories of concrete entities than for actions. (2) For concepts and names, manipulable entities are neurally “closer” to actions, whereas nonmanipulable entities are more “distant.” (3) Noun–verb homonymy has an important influence on the neural systems used to operate names for objects versus names for actions; even when the phonological forms are identical, the neural processors are different according to task demands. Our work has led to new insights into how nouns and verbs are operated in the brain.

#### 11:00–11:15 (165)

**Psycholinguistic and Corpus Investigations of Verbal Event Structures.** GAIL A. MCKOON & ROGER RATCLIFF, *Ohio State University*—Lexical semantic, decompositional representations for verbs of three classes are investigated: manner of motion verbs (e.g., *run*), inherently directed motion verbs (e.g., *arrive*), and appearance verbs. The hypothesized representations are more complex for inherently directed motion verbs and appearance verbs than for manner of motion verbs, in that the former include a location and a change to that location by the entity engaging in the verbal event, whereas the representation of manner of motion verbs includes only an entity engaged in an activity. This differential complexity is demonstrated empirically in four ways: Lexical decisions are significantly faster, STM and LTM

are significantly better, and sentence comprehension is significantly faster for manner of motion verbs than for inherently directed motion verbs and appearance verbs. These data converge in their theoretical interpretation with statistics of naturally produced sentence structures from a large corpus.

#### 11:20–11:35 (166)

**Schema-Based Event Representations and Verb-Specific Conceptually Based Thematic Role Knowledge.** KEN MCRAE, *University of Western Ontario*—Events cannot be conceptualized or represented without taking into account the participants (e.g., an agent and a patient), the objects that are central to the event (e.g., an instrument), and possibly the location at which the event occurs. These elements of events are referred to linguistically as thematic roles of the verb denoting the event (although locations are viewed as adjuncts). I present experiments demonstrating that verb-specific conceptually based thematic role knowledge is computed and used quickly when people understand language. First, short-SOA priming experiments show that people quickly compute event-specific knowledge of agents, patients, and instruments, although possibly not locations. Second, aspectual information modulates the computation of this knowledge. Third, grammatical cues also modulate its computation. Fourth, this knowledge is used to quickly resolve syntactic ambiguities. These studies also suggest that something like schema-based event representations are required to account for these data, rather than existing spreading activation networks.

#### 11:40–11:55 (167)

**Describing Events: Their Nature and Effects.** BARBARA TVERSKY, *Stanford University*, JEFF ZACKS, *Washington University*, & BRIDGETTE MARTIN & SANDRA LOZANO, *Stanford University*—Everyday routine events, such as making a bed, are segmented and described hierarchically, as actions on objects. At a high level, event descriptions are characterized by specific nouns and general verbs, whereas at a fine level, descriptions contain general nouns and specific verbs, supporting the idea that objects underlie high-level segments and actions underlie low-level segments. Describing and segmenting events, in contrast to simply segmenting, can increase hierarchical organization and shift perspective from viewer to actor.

#### Memory Retrieval Processes

Nicollet BC, Saturday Morning, 10:00–12:00

Chaired by Moshe Naveh-Benjamin,  
*University of Missouri, Columbia, and Ben Gurion University*

#### 10:00–10:15 (168)

**Memory Retrieval Involves Differential Processing of Study Items.** ELIZABETH E. JOHNS & DOUGLAS J. K. MEWHORT, *Queen's University* (read by Douglas J. K. Mewhort)—Global models of recognition memory assume that a test item is compared with all studied items equally. By contrast, the iterative resonance model posits that, over iterations, the comparison process homes in on the study item most similar to the test item. We tested for differential processing, using two-dimensional stimuli with Sternberg's (1969) fixed-set procedure, by examining the effects of the test sequence. A response was faster whenever the test item was similar to the same study item as the preceding test item. The advantage was obtained even when the two test items were not similar to each other—that is, the first shared one dimension with the study item, and the second shared a different dimension. Such priming implies differential processing of the most similar study item. We also found memory for preceding responses. The effects are not easily accommodated in models that base decision on a familiarity measure.

#### 10:20–10:35 (169)

**Prospective Memory Performance Depends on Cue–Action Contingencies.** MARTIN L. BINK, *Western Kentucky University*, MICHAEL CLARK, *University of North Texas*, SARAH DAILEY, *University of*

*Oklahoma*, & DARRELL WORTHY, *University of North Texas*—The memory processes involved in executing delayed intentions (i.e., prospective memory; PM) likely depends on the ability to associate the PM cue (when) to the prospective action (what). The contingency between cues and actions in memory has received recent attention in the PM literature insofar as contingency manipulations were used to isolate the processes of PM. The present study directly compared PM performance for different cue–action contingencies. More specifically, PM was compared in two experiments when semantic relatedness of the cues, actions, or cues–actions was manipulated and when the total number of cues and actions was manipulated. Participants were required to perform subject-performed tasks (e.g., ring the bell) in response to PM cues that appeared in a fact verification task. The results showed that PM differentiated in conditions that involved the ability to distinguish actions from one another, and not in conditions that manipulated cue retrieval alone.

#### 10:40–10:55 (170)

**Prospective Memory Retrieval With Primed and Unprimed Cues.** PETER GRAF & JIE GAO, *University of British Columbia*—Prospective memory (ProM) requires recollecting postponed plans or intentions (e.g., to convey a message to a colleague) in the presence of cues that may occur as a natural part of an unrelated activity (e.g., on a visit to a bookstore). We tested the hypothesis that making a plan augments the cognitive system's ability to process task-appropriate retrieval cues, thereby increasing the likelihood that their test phase processing will be perceived as discrepant. In a series of experiments where the ongoing activity required making lexical decisions or yes/no recognition decisions, we presented either primed or unprimed retrieval cues, either to university student subjects or to community-living participants between 20 and 80 years of age. Consistent with our general hypothesis, the results showed facilitated ProM task performance due to a variety of prime manipulations.

#### 11:00–11:15 (171)

**Directed Forgetting in Recognition and Incidental Learning.** LILI SAHAKYAN, *University of South Florida*, & PETER F. DELANEY, *University of Florida*—Instructing people to forget a list of items leads to better recall of subsequently studied items (the benefits of directed forgetting). We have proposed that the forget instruction leads participants to adopt better study strategies (Sahakyan & Delaney, 2003). This paper presents two experiments addressing potential criticisms derived from work by Geiselman, Bjork, and Fishman (1983) against the strategy change account. First, obtaining benefits in incidental learning would suggest that benefits occur even without an intention to study and, hence, without study strategy changes. Experiment 1 addressed this criticism by manipulating intentionality of learning. Second, strategy change would be expected to improve recognition as well as recall, but prior studies found benefits only in recall. Experiment 2 tested recognition at varying list lengths. Multinomial-modeling analyses exploring source memory in directed forgetting are also reported. Results are discussed in terms of two-factor accounts of directed forgetting.

#### 11:20–11:35 (172)

**Forgetting Lists of \*\$%#! Words.** STEVEN M. SMITH, *Texas A&M University*, & SARAH C. MOYNAN, *Washington University*—Although memory retrieval has been implicated as a possible cause of repression (e.g., Levy & Anderson, 2002), objections to this claim include the arguments that (1) inhibition results from conscious attempts to suppress memories rather than from an unconscious mechanism, (2) recall following inhibition is still very good, (3) nothing is known about the recoverability of inhibited memories, and (4) the materials used in inhibition studies are not related to primitive aggressive and sexual instincts (Kihlström, 2002). Output interference effects can be another cause of substantial forgetting effects (e.g., Roediger, 1978; Smith, Gleaves, Pierce, Williams, Gilliland, & Gerken, 2003), such effects can reduce recall to very low levels, no

conscious suppression is involved in output interference, blocked memories are recoverable, and the effects are independent of inhibition effects (Smith, Gerken, Choi, & Hull, 2003). We now show that expletives and words with explicit sexual content are also susceptible to very large memory blocking and recovery effects.

#### 11:40–11:55 (173)

**Divided Attention in Younger and Older Adults: Effects of Strategy and Relatedness on Memory Performance and Secondary Task Costs.** MOSHE NAVEH-BENJAMIN, *University of Missouri, Columbia, and Ben Gurion University*, FERGUS I. M. CRAIK, *Rotman Research Institute*, JONATHAN GUEZ, *Ben Gurion University*, & SHARYN KREUGER, *Rotman Research Institute*—Divided attention at encoding leads to a significant decline in memory performance, whereas divided attention during retrieval has relatively little effect; nevertheless, retrieval carries significant secondary task costs, especially for older adults. We further investigated the effects of divided attention in younger and older adults by employing a cued-recall task and by measuring retrieval accuracy, retrieval latency, and the temporal distribution of attentional costs at encoding and retrieval. An age-related memory deficit was reduced by pair relatedness, whereas strategy instructions benefited both age groups equally. Attentional costs were greater for retrieval than for encoding, especially for older adults. These findings will be discussed in light of notions of an age-related associative deficit (Naveh-Benjamin, 2000) and age-related differences in the use of self-initiated activities and environmental support ( Craik, 1983, 1986).

#### Categorization

Nicollet D, Saturday Morning, 10:20–12:00

Chaired by Lera Boroditsky, Stanford University

#### 10:20–10:35 (174)

**Creator's Intention: Category Essence or Discourse Essential?** BARBARA C. MALT, *Lehigh University*—When people name artifacts, their intuitions about what the creator meant the object to be influence the name they choose. But why does a creator's intention matter? A prominent view is that a creator's intention constitutes an essence and that people name artifacts according to their beliefs about the object's essence. We propose, instead, that intention matters because it is relevant to communication goals. People select names to achieve reference and to direct attention to properties of the artifact relevant to the discourse. A creator's intention is often, but not always, important to achieving these goals. We report several experiments that manipulated discourse goals and asked participants to judge the suitability of artifacts' names that either respected the creator's intention or did not. Results showed that name preference varied with the relevance of the name to the speaker's communication goals.

#### 10:40–10:55 (175)

**When Parameters Collide: A Warning About the Use of Choice Rules in Cognitive Models.** J. DAVID SMITH, *SUNY, Buffalo*—Similarity choice models of categorization contain two principal mathematical transformations: Shepard's exponential decay function of similarity and Luce's choice rule. But there is a delicate balance in modeling between the psychological processes we try to emulate and the mathematics we use to do so. I will show that in these models, an unappreciated interaction occurs between these mathematical transformations, so that they operate antagonistically and mutually cancel as the model operates. The result is that the inputs to the model are reflected linearly and tautologically in its outputs. In such a case, using a complex model with successive mathematical transformations seems unparsimonious and misleading. This phenomenon raises questions about the simplification and psychological grounding of categorization models. Modelers more broadly could benefit from an internal analysis of their models like that described here. They may also glean insights about the psychological story their models really tell.

**11:00–11:15 (176)**

**Stimulus- and Category-Based Knowledge Partitioning in a Rule and Exception Category Structure.** MICHAEL A. ERICKSON, *University of California, Riverside*—An experiment is presented that demonstrates that people can partition their knowledge in rule-and-exception category-learning experiments. Two variables are manipulated factorially: The first is whether a cue is presented, as part of the stimulus, early in training, that identifies whether the item follows a one-dimensional rule but does not predict category membership directly. The second is whether training items that are exceptions to the rule have their own category labels or are reversals of the rule category labels. Both the rule/exception cue and the presence of exception-only categories improve performance. Consistent with previous findings, Atrium, a rule-and-exemplar theory of category learning, accounts well for the effect of the rule/exception cue by learning to use it to choose different classification representations. The ability of feedforward and recurrent models of category learning to account for the improvement in performance due to the presence of exception-only categories is discussed.

**11:20–11:35 (177)**

**Combined ERP and Behavioral Evidence for a Basic-Level Category Representation in 6-Month-Old Infants.** PAUL C. QUINN, *University of Delaware*, & ALISSA WESTERLUND & CHARLES A. NELSON, *University of Minnesota*—Category-learning processes in infants were investigated with both event-related potential (ERP) and looking time indices of performance. With a familiarization/novelty-preference procedure, ERPs were recorded while 6-month-olds were presented with 36 visual cat images during training, followed by 20 novel cat images interspersed with 20 novel dog images during test. Infant looking times were measured during a behavioral paired-preference test (novel cat vs. novel dog) conducted at the conclusion of ERP recording. Consistent with the increased behavioral responsiveness to a novel category observed in infant looking times studies, enhanced positive and negative deflections (P400 and Nc) were observed at posterior and central recording sites for novel dogs, relative to familiar and novel cats. In addition, a significant novel category preference for novel dogs was observed in infant looking time during the paired-preference test. The findings point to a neural correlate of the basic-level representations observed in behavioral categorization tasks conducted with infants.

**11:40–11:55 (178)**

**Effects of Language on Color Discriminability.** LERA BORODITSKY, *Stanford University*, & JONATHAN WINAWER & NATHAN WITTHOFT, *MIT*—Different languages divide the color spectrum in different ways. Can such linguistic codes affect color discrimination? Results of several experiments suggest that color language can influence people's color judgments even in conditions when all color stimuli are present at the same time and need not be stored in memory. Language appears to be involved on line during simple color-discrimination tasks, and effects of language can be selectively disrupted by verbal interference (but not by spatial interference). Furthermore, color-discrimination performance across a boundary that exists in one language, but not in another, can be altered by linguistic interference only for the language group that codes that linguistic distinction. Finally, as the color discrimination tasks become simpler and faster, effects of linguistic interference disappear. These results suggest that language is involved on line in a large number of low-level perceptual discriminations but, also, that not all color discrimination is affected by language.

**Inferences and Situation Models  
Greenway BCD, Saturday Morning, 10:20–12:00**

*Chaired by Isabelle Tapiero, Université de Lyon 2*

**10:20–10:35 (179)**

**Tacit Verification in Text Comprehension: Memory-Based and Pragmatic Influences.** MURRAY SINGER, *University of Manitoba*—The research explored the processes contributing to the reader's continu-

ous tacit verification of text ideas. A reading time task was created that functioned as analogue to familiar sentence verification tasks. The reader encountered target sentences that, with reference to prior text, were either true or false and affirmative or negative. For example, "The policeman implied that the vehicle with the flat was not a truck" was a false negative in the context of the antecedent "He passed a truck with a flat." Target reading time varied systematically as a function of truth and negation. However, readers are sensitive to pragmatic factors, such as the infelicity of such statements as "He knew that the world was flat." The reading times were best fit by a model that incorporated both proposition-matching processes and pragmatic considerations. The present assumptions about pragmatic constraints were corroborated by a norming study.

**10:40–10:55 (180)**

**The Influence of Readers' Preferences on Predictive Inferences.** DAVID N. RAPP, *University of Minnesota*, & RICHARD J. GERRIG, *SUNY, Stony Brook*—In many narrative situations, readers can make reasonable predictions about the likely course of events. What happens, however, when readers prefer outcomes counter to those reasonable predictions? In four experiments, we investigated the extent to which readers' preferences for particular narrative outcomes interacted with the prior likelihood of those outcomes. In Experiments 1 and 2, participants' judgments and reading times for story outcomes were dependent upon whether the prior context supported the likelihood of particular outcomes. In Experiments 3 and 4, we rewrote the stories to include material that instantiated preferences for narrative outcomes independently of the likelihood of those outcomes. Judgments and reading times were influenced by both preferences and prior likelihood. These results demonstrate that readers' predilections for constructing and applying predictive inferences are not simply a function of text elements and prior knowledge but also result from the wishes and desires that readers develop as narratives unfold.

**11:00–11:15 (181)**

**Walking Through Doors Causes Forgetting.** GABRIEL A. RADVAN-SKY, *University of Notre Dame*, & DAVID E. COPELAND, *University of Southern Mississippi*—Subjects traversed through a desktop virtual reality environment. We borrowed techniques and methods from language comprehension and memory research that have been used to test situation model theory. In these experiments, memory was probed for items that were either associated or dissociated from the subject and were in the same or different rooms as the subject as they were moving about. The results revealed that people were faster and more accurate when objects were currently being carried (associated) and when they were in the same room (no spatial shift). Essentially, walking through doors and putting objects down made this information less available. This is consistent with predictions of situation model theory, but here it is applied to first-person experience with a situation, rather than reading or hearing about one.

**11:20–11:35 (182)**

**How Does the Brain Reflect the Processing of Verbatim, Propositional, and Situational Representations? An fMRI Experiment.** FRANZ SCHMALHOFER, UWE FRIESE, MARKUS RAABE, & KARIN PIETRUSKA, *University of Osnabrück*, & ROLAND RUTSCHMANN, *University of Regensburg*—In sentence recognition and verification tasks that are administered after the reading of a text, the contrast in the answers between paraphrases and inference statements have often been used to assess the memory strength of propositional text representations (e.g., Kintsch et al., 1990). More recently, critics have qualified propositions as amodal. We were, therefore, interested in differences of neural correlates that correspond to the observed behavioral contrasts. We first replicated the behavioral results. In an event-related fMRI experiment with 13 participants, reading during a supposed predictive inference generation period was then compared with explicit reading. In a subsequent verification task, the verification of control statements, predictive inferences, paraphrases, and ex-

PLICIT statements were compared. The results show systematic but minimal inference processing during encoding and supplementary activities that can be interpreted as text-related processes, additional inferencing, and situational elaborations when verifying inferences, as compared with paraphrases and explicit statements.

#### 11:40–11:55 (183)

**Effects of Contextual Information on the Strength of Predictive Inferences Generation.** SONIA GALLETI & ISABELLE TAPIERO, *Université de Lyon 2* (read by Isabelle Tapiero)—We investigated the influence of contextual information (causal and emotional) on the generation of inferences. Participants had to read stories that described events either high or low in causal sufficiency. Each text had two versions, one in which the contextual information was causal and another in which the contextual information was emotional. Each subject was assigned to only one contextual version. To measure the activation of inferences, half of the subjects had to answer a critical question at the end of the reading. The other half had to perform this task both during and after the reading of each story. Integration of inferences was tested by measuring reading times of two critical sentences that ended each story. Our main results indicated that emotional contextual information had an effect on the sufficiency of causal information and, consequently, on the activation strength and the degree of integration of predictive inferences.

#### Navigation and Spatial Learning in Humans and Rats Greenway FGH, Saturday Morning, 10:20–11:40

Chaired by William D. Timberlake, *Indiana University*

#### 10:20–10:35 (184)

**Navigation Depends on Enduring Allocentric Representations.** WEI-MIN MOU, *Chinese Academy of Sciences*, & TIMOTHY P. McNAMARA, *Vanderbilt University*—Two experiments investigated whether human navigation depends on allocentric or egocentric representations by testing whether the coherence of spatial memories was disrupted by disorientation. Participants learned the layout of nine objects from a viewing position on the periphery of the array, walked to the middle of the array without changing heading, and then pointed to objects while blindfolded under three conditions: before turning (baseline), after turning to a heading misaligned with salient intrinsic axes of the array of objects (updating), and after disorientation (disorientation). The internal consistency of pointing was relatively high and equivalent across all three conditions. It was also observed that people likely accessed an allocentric spatial representation from the original learning heading after disorientation if they were not forced to adopt a new heading. These results suggest that people navigate primarily by updating their position with respect to an allocentric representation.

#### 10:40–10:55 (185)

**In What Direction Are You Heading?** M. JEANNE SHOLL, *Boston College*—What kind of direction information can be accessed from local views of a familiar environment? Neuropsychological case studies of a rare heading disorientation syndrome describe patients whose landmark recognition is intact, but whose knowledge of the direction of one landmark, relative to another, is disrupted (Aguirre & D'Esposito, 1999). Although the empirical evidence is indirect, the syndrome has been attributed to disrupted connections between local views of familiar landmarks and the body's allocentric heading when observing each view. Using a heading recall task and testing normal adults, behavioral evidence is reported that is consistent with stored associations in spatial memory between allocentric body-heading codes and the representations of local views. However, there were large individual differences in heading recall performance, which were correlated with self-reported sense of direction. The implications of these findings for a human sense-of-direction system are discussed.

#### 11:00–11:15 (186)

**Multiple Systems for Spatial Learning: Dead Reckoning and Beacon**

**Homing in Rats.** SARA J. SHETTLEWORTH, *University of Toronto*, & JENNIFER E. SUTTON, *University of Western Ontario*—Some spatial information acquisition systems compete for an analogue of associative strength. We tested for competition between dead reckoning (path integration) and beacon learning. Rats collected food and carried it home. Without visual cues, they homed by dead reckoning. When a black panel surrounded the home door, beacon homing was also available. Rats trained with the beacon oriented no more accurately than rats without the beacon; tests of beacon-trained rats without the beacon gave no evidence that beacon learning overshadowed dead reckoning. When relative predictive values of the beacon and idiothetic cues were varied by training with the beacon at the home for one group and in random locations for another group, there was again no evidence of cue competition, nor was acquisition of beacon homing blocked in rats with prior experience homing by dead reckoning. Dead reckoning and beacon learning do not compete but interact in other ways.

#### 11:20–11:35 (187)

**Beacon Training Can Facilitate Rather Than Interfere With Landmark Learning.** SUSAN A. SINNING & WILLIAM D. TIMBERLAKE, *Indiana University* (read by William D. Timberlake)—Four experiments explored the relative importance of associative interference (blocking) versus map-like integration of cues for rats in an associative blocking procedure in the Morris water maze. In Phase 1 of training, the experimental group located the platform by using a beacon. In Phase 2 of training, the experimental and control groups located the platform by using both the beacon and room landmarks. A subsequent test of landmarks alone revealed that the experimental group located and sustained interest in the platform location more effectively than did the control group. A preference test pitting the beacon, landmark, and absolute location cues against each other showed a general preference for the beacon. Finally, decreasing beacon salience by displacing it from the hidden platform further facilitated learning the room cues, whereas increasing beacon salience by attaching it to a rod fixed to the platform eliminated facilitation but did not produce blocking.

#### Task Switching

Regency, Saturday Morning, 10:00–12:00

Chaired by Barbara J. Knowlton, *UCLA*

#### 10:00–10:15 (188)

**Task Set Preparation Between Task Cue and Stimulus.** STEPHEN MONSELL, GUY A. MIZON, & AURELIU LAVRIC, *University of Exeter*—In recent work, we have established conditions under which a reliable reduction in the RT cost of switching tasks, unconfounded with the effect of a change of cue, can be observed as the interval between cue and stimulus increases. It is especially important to keep the probability of a task switch low enough that the participant does not prepare for a task change until the cue indicates that one is imminent. We will report a dense-electrode ERP experiment in which the task was to identify the shape or color of the stimulus;  $p(\text{task switch}) = .33$ , with the cue changing on every trial between a verbal and a pictorial cue. Differential activity on trials where the cue signals a task switch, observed during the 800-msec cue-to-stimulus interval, localized using LORETA, suggests components of endogenous task set reconfiguration.

#### 10:20–10:35 (189)

**Conflict Monitoring in Task Switching.** MYEONG-HO SOHN, *George Washington University*—The conflict-monitoring model suggests that registration of response conflicts triggers executive control mechanisms that reduce the harmful effect of conflicting information on task performance. As evidence, the congruency effect decreases after processing an incongruent target–distractor ensemble, as opposed to a congruent target–distractor ensemble, a phenomenon known as the conflict adaptation effect. An alternative hypothesis argues that the

conflict adaptation merely reflects stimulus priming. The present study examined conflict adaptation in the task-switching paradigm while avoiding stimulus repetition. The congruency effect on the current trial was significantly reduced following an incongruent trial. This modulation was observed regardless of whether the two successive tasks involved task repetition or task switch, and regardless of whether the two successive two responses were the same or not. In contrast, the interaction between task transition and response transition was significant. These results suggest that conflict monitoring constitutes an independent processing stage from task set selection or response selection.

#### 10:40–10:55 (190)

**On the Limits of Advance Preparation for a Task Switch.** MEI-CHING LIEN, *Oregon State University*, & ERIC RUTHRUFF, ROGER W. REMINGTON, & JAMES C. JOHNSTON, *NASA Ames Research Center*—Switching between tasks can result in substantial time costs. De Jong (2000) hypothesized that switch costs reflect all-or-none advance task preparation. We tested this hypothesis in three experiments. Each task mapped three stimuli to three response keys, arrayed from left to right. In Experiment 1, switch costs were absent for the left key but present for the others. These findings, along with RT distribution analyses, suggest that participants prepared fully for the left response, but not for the others. Experiments 2 and 3, using a time deadline procedure that strongly promoted advance preparation, replicated these results. These results also showed that switch costs cannot be avoided by extra effort, suggesting that the underlying limitation is structural, not strategic. Contrary to De Jong, we conclude that when switching to a new task, people do not prepare all the task some of the time but, rather, prepare some of the task all of the time.

#### 11:00–11:15 (191)

**Modulation of Word Reading Following Resolution of Stroop Interference.** MICHAEL E. J. MASSON & DANIEL N. BUB, *University of Victoria*—In a task-switching paradigm, we show that resolution of the conflict created by involuntary engagement of word-reading processes when an attempt is made to name the color of a printed word has an adverse effect on subsequent efforts to read words. This modulation can be dissociated from sources of task switch costs, such as backward inhibition and item-specific negative priming. Modulation

appears to involve a learned cohort of items and transfers to phonological, but not semantic, neighbors.

#### 11:20–11:35 (192)

**Goal Maintenance, Switching, and Neglect in the Face of Distraction.** ERIC G. FREEDMAN, MELISSA GREY, & RORY SCHWAN, *University of Michigan*—A modified Stroop task was used to examine how goals are maintained and switched in the presence of interference. On each trial, a cue indicated whether color naming or word reading should be performed on the next target. This cue specified whether the previous goal should be repeated or the prior goal should be switched. The number of distracting stimuli (i.e., pictures) between the cue and target (zero, three, or six) and between trials (zero, three, or six) was manipulated. Goal neglect increased with goal switching, increasing the number of distractors, and when an incongruous color was present. As interfering stimuli increased, goal neglect persisted for longer delays with switch trials, as well as when the goal was switched and the target had an incongruous dimension. The less dominant task (i.e., color naming) was more sensitive to increasing the number of distractors. Goal neglect appears to be produced both by sustained and transient cognitive control mechanisms.

#### 11:40–11:55 (193)

**The Influence of Response Competition on Alternating Switch Costs in Aging.** CHRISTINA L. FALES & BARBARA J. KNOWLTON, *UCLA* (read by Barbara J. Knowlton)—Backward inhibition (BI) is the suppression of an old task set during task switching. It is measured as the difference in switch costs for alternating versus nonalternating situations. For three tasks (A, B, and C), BI is measured as the difference in latency to perform second Task A in sequence ABA, as compared with sequence CBA. BI may be applied to the extent that task switching encounters response competition. We compared BI in younger and older subjects, using three judgment tasks (shape, color, pattern) sharing the same two response keys. On each trial, one of the three judgment tasks was signaled, followed by the stimulus object. The currently irrelevant dimensions afforded either a consistent or an inconsistent response with respect to the target dimension. For younger adults, the presence of incongruent irrelevant information had little effect on BI costs, whereas for older subjects, BI sharply increased when incongruent information was present.

**SYMPOSIUM: Contributions of Research on Bilingualism to Cognitive Psychology**

Nicollet A, Saturday Afternoon, 1:30–3:40

Chaired by Judith F. Kroll, Pennsylvania State University, and Annette de Groot, University of Amsterdam

Although bilingualism is of interest in its own right, it has increasingly been used as an effective tool to investigate fundamental issues in cognitive psychology. These include the way in which competition across the two language systems is manifest during acquisition, comprehension, and production, the implications of cross-language interactions for constraining models of language and memory, the development of theories of the allocation of attentional resources to allow cognitive control, and the relations between language and thought. The papers to be presented in this symposium illustrate the contributions of bilingualism as a research approach to inform the development of theory and data in cognitive psychology.

1:40–1:55 (194)

**Speech Perception in Early Bilinguals: When Is an L2 Contrast Acquired?** NÚRIA SEBASTIÁN-GALLÉS & LAURA BOSCH, *University of Barcelona*—When has a foreign contrast been acquired? Whereas native speakers, in general, carry out different tasks with optimal scores, nonnative speakers are usually highly sensitive to contextual effects or task properties, even in optimal perceptual circumstances. In a series of experiments, two groups of Catalan–Spanish and Spanish–Catalan bilinguals were tested in the perception of a Catalan-specific vowel contrast across three tasks: (1) categorization, (2) gating, and (3) lexical decision. Catalan natives performed optimally in all tasks. However, Spanish–Catalan bilinguals showed difficulties in all of them. In fact, the three tasks were increasingly difficult for Spanish-dominant participants. The results also showed that participants' success in each task varied greatly. In almost all of the cases, successful performance in the lexical decision task also implied a successful performance in the other two tasks. The results suggest a hierarchy of perceptual and lexical analyses of increasing difficulty for L2 learners.

2:00–2:15 (195)

**Parsing Effects in Bilingual Sentence Processing.** PAOLA DUSSIAS & CHIP GERFEN, *Pennsylvania State University*—The study of sentence parsing in bilinguals provides a rich tool for investigating the basic properties of the human sentence-processing mechanism. To illustrate this, we present the findings from two sets of experiments that examine how syntactic and lexical properties specific to one of the bilinguals' languages affect sentence parsing in the other language. The first set of experiments investigates how word order differences in English and Spanish impact sentence interpretation when English–Spanish bilinguals read constructions that are temporarily ambiguous between a verbal complement and a relative clause. The second set examines the contribution of frequency-based verb biases to the comprehension of temporarily ambiguous sentences by Spanish–English bilinguals. The results for both sets of experiments show that bilinguals sometimes parse sentences unlike monolingual speakers of the target language. These findings are informative in understanding the underlying mechanisms governing the interpretation of sentences.

2:20–2:35 (196)

**Subject–Verb Agreement in Beginning L2 Learners and Fluent Bilinguals.** JANET G. VAN HELL & MARIJKE MENSIES, *University of Nijmegen*—We studied the role of conceptual number in computing subject–verb agreement in writing and speaking in the first and in the second language (L2) in bilinguals. Past research with English–Spanish bilinguals suggests that bilinguals with different levels of proficiency differ in their sensitivity to the conceptual number of the subject of the sentence. Two groups of native Dutch speakers with different levels of fluency in L2, English, participated: children who, for 1 year, had learned English as a second language, and fluent adult

bilinguals. Subject–verb agreement errors were elicited in a sentence fragment completion paradigm, in which single-referent preambles (such as *the baby on the blankets*) were contrasted with distributive-referent preambles (such as *the cap on the bottles*). Analyses showed that both beginning L2 learners and fluent bilinguals made more subject–verb agreement errors in the case of distributive-referent preambles, in their first and in their second language, in writing and in speaking.

2:40–2:55 (197)

**Speech–Sign Bilingualism: How Language Modality Affects Bilingual Language Processing.** KAREN EMMOREY, *Salk Institute*—Speech–sign bilingualism is unique because distinct sensory–motoric modalities allow for the simultaneous production and perception of two languages. Whereas unimodal (speech–speech) bilinguals may code switch between their two languages, bimodal (speech–sign) bilinguals produce code blends (simultaneous sign and speech). Unlike code switching, such code blending shares certain properties with co-speech gesture (the spontaneous gestures that accompany spoken language). I discuss the possible consequences of the sensory–motoric differences in language modality for the psycholinguistics of bilingualism, for the features of co-speech gesture, and for the nature of the bilingual brain.

3:00–3:15 (198)

**What Bilinguals Tell Us About Language Production.** TAMAR H. GOLLAN, *University of California, San Diego*—Bilingual speakers know about twice as many words as monolingual speakers. If translation equivalents are like synonyms, bilinguals also have a lexicon full of close competitors. Treating bilingualism as a test of the cognitive system, we compare bilinguals with monolinguals on a number of tasks asking how knowing two sets of possibly competing names changes production. Bilinguals report more TOTs and name pictures more slowly than do monolinguals, but only in some conditions. Bilinguals actually have fewer TOTs than do monolinguals for rare words and the same rate of TOTs as monolinguals for proper names and cognates. Bilinguals name pictures as quickly as monolinguals after four repetitions, and bilingualism slows low-frequency names more than it does high-frequency names. Finally, dual-language activation sometimes affects picture-naming times and TOT rates differently. These results constrain accounts of bilingual and monolingual spoken word production and of what goes wrong when people fall into TOTs.

3:20–3:35 (199)

**Bilingualism and the Revival of Linguistic Relativity.** LERA BORODITSKY, *Stanford University*—How do the languages we speak shape the way we think? There has been a recent revival in research on this question (and linguistic relativity more generally). Research on bilinguals has been very instrumental in bringing new research tools, new clarity, as well as new questions and new complications to this thorny issue. If people who speak different languages think differently, what happens to people who speak more than one language? How do the influences of two or more languages mix in a single mind? I will discuss several empirical studies of linguistic relativity in bilinguals, showing how research on bilinguals has advanced our understanding of linguistic relativity, as well as what has been learned about the nature of the bilingual mind in the process.

**Categories**

Nicollet BC, Saturday Afternoon, 1:30–3:10

Chaired by James A. Hampton, City University, London

1:30–1:45 (200)

**Examining Categorization Dissociations.** SAFA R. ZAKI, *Williams College*, & ROBERT M. NOSOFKY & ROGER D. STANTON, *Indiana University*—Single-system exemplar models of categorization have been challenged by reports of intact categorization performance in amnesia and by reports that suggest separate systems for rule-based and in-

formation integration category learning. Many of the published studies with amnesics, however, show a numerical advantage for controls and have low statistical power. A meta-analysis indicates that amnesics do, in fact, show deficits in categorization tasks, which is consistent with single-system exemplar–model predictions. Ashby et al. (2003) reported that speeded button switching interferes with processing of an information integration category structure, but not a rule-based category structure. They interpret these results as support for the existence of two categorization systems. We report results that demonstrate that button switching causes interference even with rule-based category structures. The degree of interference seems to be related more closely to some form of task complexity, rather than to separate categorization systems.

1:50–2:05 (201)

**Expert Versus Novice Category-Based Judgments About Food Items.** SHARON LEE ARMSTRONG, *La Salle University*—This study investigated the category domain of food. Food is of special interest to research on categorization because it exhibits more than one mental organization—taxonomic, which refers to kinds of foods (e.g., vegetables, meats), and scripts, which refers to food situations (e.g., breakfast foods, snacks) (Ross & Murphy, 1999). Researchers (Medin, Lynch, Coley, & Atran, 1997) investigating sorting and reasoning about another domain, trees, found that expertise (taxonomists, landscape workers, park maintenance personnel) affects category access and inferential processes. Drawing from these research lines, this study investigated whether type of food expertise would affect the judgments subjects would make. Two types of experts—nutrition majors and culinary arts students (chefs)—were compared with naive subjects. It was found that specific training leads to varying perceptions of food and varying inferences about food that were moderated by organizational framework. In particular, chefs appear to be more script oriented.

2:10–2:25 (202)

**The Influence of Category Coherence on Generalization and Explanation.** BRIAN H. ROSS, *University of Illinois, Urbana-Champaign*, ANDREA L. PATALANO, *Wesleyan University*, & SETH CHIN-PARKER, *Denison University*—A critical question in category-based reasoning is how people use knowledge about instances of a category to make generalizations about new instances of that category. We propose that these generalizations are a function of the coherence of the category. Category coherence refers to the extent to which theoretical, causal, and explanatory world knowledge interrelates category features within a representation. Across several experiments, more coherent categories promoted stronger generalizations to a new instance of the category. One possible reason for this difference is that people made generalizations by evaluating how well these categories allowed the category features to be interrelated with the knowledge about the instances. To test this idea, people were asked to provide explanations for why members of a category might share a particular preference. As was predicted, more coherent categories led to more plausible explanations for these preferences.

2:30–2:45 (203)

**Category-Based Induction and Memory: When More Is Less and Less Is More.** VLADIMIR M. SLOUTSKY & ANNA V. FISHER, *Ohio State University*—Induction is crucial for learning: Upon learning that a cat has a particular biological property, one could expand this knowledge to other cats. Recently, Sloutsky and Fisher (2004) demonstrated that whereas adults induce on the basis of category information, 5-year-olds induce on the basis of similarity. However the developmental course of this category-based induction remains unclear, and the goal of the reported research is to elucidate this course. In Experiment 1, following induction, 5-year-olds, 7-year-olds, 12-year-olds, and adults were presented with a recognition task. Decrease in memory accuracy exhibited a developmental trend, with 5-year-olds being most accurate and adults being least accurate. Experiment 2 indicated that after being trained to perform induction in an adult-like manner, memory accuracy of 5-year-olds and 7-year-olds dropped to the level

of adults. These results indicate that children do not spontaneously perform category-based induction but that, rather, it is a product of learning and development.

2:50–3:05 (204)

**Reasons for Vagueness.** JAMES A. HAMPTON, *City University, London*—The extent and causes of vagueness in category terms was examined. Participants first decided whether items were clearly in a category, clearly not in a category, or of intermediate membership. They were then asked to check which of eight possible reasons might explain each intermediate case. Reasons chosen varied across category, with uncertainty being more commonly given for biological kinds, and polysemy more common for artifacts. A second analysis showed that levels of disagreement between participants were just as great for clear category members as for another group who simply judged items as being in or out of the category. The region of vague membership may itself, therefore, be equally vague.

Spatial Attention

Nicollet D, Saturday Afternoon, 1:30–3:30

Chaired by Barbara Bucur, Duke University Medical Center

1:30–1:45 (205)

**Muscarinic Cholinergic Control of Visual Feature Binding: Evidence for a Role of Neural Synchronization in Attention.** LORENZA S. COLZATO & BERNHARD HOMMEL, *Leiden University* (read by Bernhard Hommel)—The distributed organization of the human visual cortex calls for a mechanism that integrates and binds the features of a perceived event, and neural synchronization is a prime candidate to serve that purpose. Animal studies suggest that synchronization in the visual cortex is driven by the muscarinic cholinergic system. Indeed, we were able to demonstrate in healthy humans that the binding of shape and color and of shape and location of visual objects is increased by muscarinic cholinergic agonists (caffeine), decreased by cholinergic antagonists (alcohol), and unaffected by nicotinic cholinergic agonists (nicotine). Interestingly, feature binding across perception and action was unaffected by either manipulation, suggesting a specific link between the visual system and the muscarinic cholinergic system. Taken altogether, these findings support the idea that attentional binding of visual features is mediated by neural synchronization.

1:50–2:05 (206)

**Attention Is Not Selection: Dimensional Gating in Object- and Space-Based Attention Tasks.** CHARLES L. FOLK, *Villanova University*, & ROGER W. REMINGTON, *NASA Ames Research Center*—Conventional wisdom suggests that attending to a multidimensional object results in the “selection” of that object, such that all dimensions of the object are processed, whether relevant or not. Evidence for this assumption comes primarily from response compatibility effects of irrelevant dimensions of attended stimuli (e.g., the Stroop effect). However, Remington and Folk (2002), using a spatial cuing task with peripheral, noninformative cues, found that the processing of attended (i.e., cued) nontarget objects is limited to the task-relevant dimension. In the present experiments, we show that when peripheral, noninformative cues are replaced with central, informative cues, even the processing of the relevant dimension of attended (i.e., cued) nontarget objects is severely attenuated. The results provide further evidence for a dissociation between attention and selection and suggest that the degree to which the dimensions of an attended object are processed may depend on whether attention allocation is object- or space-based.

2:10–2:25 (207)

**A Noncontingent, Automatic Capture of Spatial Attention by a Static Discontinuity.** JAMES H. NEELY & BRYAN R. BURNHAM, *SUNY, Albany*—In a spatial-cuing paradigm, our cuing array was a horizontal continuous single line of red Xs contiguously followed by green Os, with the X-to-O “break point” occurring at one of four lo-

cations. At a 200-msec SOA, a target appeared equally often (and independently of the “break point”) directly below the cuing line at one of the four potential “break point” locations. RTs were faster when the target appeared at the cued break point location rather than at one of the other three locations, whether the target was an abrupt-onset singleton or was simultaneously accompanied by three unique abrupt-onset distractors. To our knowledge, these are the first spatial-cuing data to show that a static visual discontinuity can capture spatial attention automatically (i.e., when the discontinuity does not validly predict the target’s location) and noncontingently (i.e., when the discontinuity is not task relevant and people are not in a singleton search mode).

2:30–2:45 (208)

**Uncertainty of Distractors’ Locations Reduces Interference: The Attentional White Bear Hypothesis.** YEHOShUA TSAL & TAL MAKOVSKI, *Tel Aviv University*—We use the flanker paradigm and show that incompatible distractors produce substantially less interference when they appear at unpredictable locations (either horizontally or vertically flanking the target), relative to when they occupy fixed locations. This finding is surprising, since it should be easier to inhibit distractors appearing at known locations. We propose the “attentional white bear” hypothesis, according to which subjects cannot avoid attending to distractors despite instructions to ignore them. Consequently, preknowledge of distractors’ locations facilitates their processing, thereby causing more interference, whereas uncertainty regarding distractors’ locations interferes with their processing, thereby producing less interference. We discuss the implications of these results for late-selection views of attention and for the notion that incompatible response codes are automatically activated.

2:50–3:05 (209)

**Object-Based Control Over Distractor Suppression During Covert Spatial Orienting.** EDWARD AWH, *University of Oregon*—A variety of paradigms have demonstrated object-based control over the spatial distribution of attention by showing enhanced processing for targets that fall within the contours of a salient background object. The present research suggests that background objects can also influence the degree of distractor suppression at attended locations, in the absence of changes in the spatial distribution of attention. We manipulated the prior probability of distractor interference at potential target locations and observed selective increases in distractor suppression after stimulus-driven shifts of attention toward probable distractor locations. Moreover, by measuring performance over multiple fixation points, we ensured that only an object-based coordinate system could provide a veridical representation of the distractor-probable and distractor-improbable locations. We suggest that object representations provide a context for the retrieval of long-term maps of distractor probability, eliciting increased levels of distractor suppression when and where it is most needed.

3:10–3:25 (210)

**Age-Related Changes in the Processing of Redundant Visual Dimensions.** BARBARA BUCUR & DAVID J. MADDEN, *Duke University Medical Center*, & PHILIP A. ALLEN, *University of Akron*—As a result of age-related cognitive slowing, the coactivation of redundant visual features may be less efficient for older adults than for younger adults. We tested 20 younger and 20 older adults, using a go/no-go single-target detection task, in which the redundant dimensions were either contained within a single object or separated spatially between two objects. The targets were the letter K and the color purple. Using violations of Miller’s (1982) race model inequality as evidence for coactivation, we obtained coactivation for both younger and older adults when the redundant dimensions were contained within a single object. When the redundant dimensions were spatially separated, however, neither age group showed evidence for coactivation. These results suggest that attention must be focused on both dimensions for coactivation to occur. Importantly, the results provide evidence that coactive processing remains spared in healthy older adults.

## Visual Processes I

Greenway BCD, Saturday Afternoon, 1:30–3:30

Chaired by Stephen E. Palmer, *University of California, Berkeley*

1:30–1:45 (211)

**Visually Directed Actions as Indicators of Distance Perception in Real and Virtual Environments.** CYNTHIA S. SAHM, SARAH H. CREEM-REGEHR, WILLIAM B. THOMPSON, & PETER WILLEMSEN, *University of Utah* (read by Sarah H. Creem-Regehr)—In order for humans to act effectively, it is important for the visual system to determine absolute distances. Blind walking used as a measure of distance perception indicates accurate performance given full-cue real-world environments. In contrast, blind walking in virtual environments (VEs), using head-mounted displays, shows compression of distance. We examined the influence of the response measure itself on absolute distance perception in real and virtual environments. Blind walking involves locomotion and the egocentric updating of the environment with one’s own movement. We compared this measure with blind throwing, a task that involves the initiation of a movement directed by vision but no further interaction within the environment. Both throwing and walking were compressed in the VE but accurate in the real world. We suggest that distance compression found in VEs may be more of a result of a general perceptual bias, rather than specific to the response measure.

1:50–2:05 (212)

**Simultaneous Lightness Contrast: Anchoring or Lateral Inhibition?** ALAN L. GILCHRIST, *Rutgers University*—The simultaneous lightness contrast illusion typically found in textbooks has traditionally been attributed to lateral inhibition. Recently, a new account of this illusion has been proposed as part of a more comprehensive theory of lightness based on principles of anchoring within perceptual groups (Gilchrist et al., 1999). I report three experiments testing the anchoring model against a lateral inhibition account. Consistent with anchoring predictions, the results of these experiments show that (1) the magnitude of the illusion is larger with darker targets, (2) the illusion is primarily caused by the tendency of the target on the black background to anchor on white, and (3) the illusion increases in strength when articulated backgrounds are used, even though this decreases the difference in average luminance of the backgrounds. These and other results show that the simultaneous contrast illusion is not caused by lateral inhibition but can be explained by anchoring within perceptual groups.

2:10–2:25 (213)

**Structure-Based Modulation of Inhibition of Return: Implications for Theories of Object-Based Selection.** E. CHARLES LEEK, *University of Wales, Bangor*—A fundamental issue in understanding visual perception is how we are able to select and attend to individual objects in the environment. One relevant source of evidence has come from studies of inhibition of return (IOR). With this paradigm, it has been shown that detection latencies can be longer for targets presented on previously cued, rather than on uncued, objects independently of their spatial location. This finding has been taken as evidence for the existence of an object-based selection mechanism. The present study provides new constraints on hypotheses about the nature of the shape representations mediating object-based selection. First, I describe a new empirical observation showing that the magnitude of object-based IOR can be modulated by object-internal structure. Second, this structure-based modulation effect is shown to occur at a level of shape representation computed after preattentive image segmentation and in which object surface configuration, but not volumetric part structure, is made explicit.

2:30–2:45 (214)

**Alterations in Müller-Lyer Illusion Magnitude With Functional Fovea Placement Changes.** CLARE K. PORAC, *Pennsylvania State*

*University*, & ALAN SEARLEMAN, *St. Lawrence University*—The functional fovea is a “circle around the center of the physiological fovea, where visual acuity is optimal” (Coren, 1986, p. 397). The goal of saccadic exploration is to collect information about external stimuli. This purpose leads saccades to be affected by target location and by the presence of nontargets placed in proximity to the target. These nontargets bias the endpoint of a saccade programmed to allow the functional fovea to fall into the center of gravity of the stimuli surrounding the final fixation point. In four experiments, we altered figural elements in Müller-Lyer (ML) illusion variants to manipulate the center of gravity of nontarget stimuli near the endpoints of the shafts in the ML forms. Figural changes, which affected the placement of the functional fovea, also changed the magnitude of the ML illusion, suggesting that processes that guide eye movements to intended targets also affect perceptions of visual extent.

2:50–3:05 (215)

**Hypocycloids and the Cycloid Illusion.** THADDEUS M. COWAN, *Kansas State University and Weber State University*—A light on the rim of a rolling wheel will hop in a looping path from point to point (cycloid). A second light at the hub moves in a straight line. The eye is drawn to the linear hub path of the rolling wheel, and the rim light seems to move around it in a circular path (cycloid illusion). Let the circle roll around the inside of a larger circle of twice the diameter (hypocycloid). The rim light will move in a straight line, and the hub light will move in a circle, but the hub light appears to move linearly and orthogonally to the linearly moving rim light; the cycloid illusion is reversed. The implications for the laws of prägnanz are discussed.

3:10–3:25 (216)

**The Occlusion Illusion: Modal Completion or Apparent Distance?** STEPHEN E. PALMER, JOSEPH L. BROOKS, & KEVIN LAI, *University of California, Berkeley*—The occlusion illusion refers to the visible portion of a partly occluded object appearing larger than the same visible region when it is not occluded (Kanizsa, 1979). The partial modal completion hypothesis implies that the visual system fills in a thin strip along the occluded border. The apparent distance hypothesis implies that the occluded region appears larger because it is perceived to be farther away (as in apparent distance theories of the moon illusion). We performed several experiments to understand the mechanisms underlying this illusion. One experiment shows that it cannot be explained by the mere presence of T-junctions but requires the perception of occlusion to occur. Another experiment shows that the magnitude of the illusion varies with the strength of the evidence for occlusion. A final experiment supports modal completion explanations over apparent distance explanations.

**Human Learning and Memory**  
Greenway FGH, Saturday Afternoon, 1:30–3:30

Chaired by Arnold L. Glass, *Rutgers University*

1:30–1:45 (217)

**Repetition Detection: Evidence for All-or-None Learning.** ARNOLD L. GLASS, *Rutgers University*—A continuous sequence of trigrams was presented, and the observer had to respond whenever a trigram previously shown anywhere in the sequence was repeated. Target trigrams were repeated after 0, 2, 4, 8, or 16 intervening items until they were detected. The probability of detecting a repeated trigram was not a function of the number of times it was repeated.

1:50–2:05 (218)

**The Mental Representation of Countries.** PATRICIA A. DEWIN-STANLEY & WILLIAM FRIEDMAN, *Oberlin College*—We examined semantic memory for the countries of the world. Participants recognized approximately two thirds of the countries, but recalled only one third. The number of times a country was mentioned by the *New York Times* was a consistent predictor of both recognition and recall.

A spatial recall strategy based on geographical location predicted free-recall performance. Similarity ratings and free association responses provided evidence of stored semantic and phonetic relations between countries. The relative prosperity of countries also influenced recall and was the main dimension used in ratings of the similarity of countries to the U.S. We discuss implications for the mental representation of countries, as well as for semantic memory in general.

2:10–2:25 (219)

**Generation and Context Memory.** NEIL W. MULLIGAN & JEFFREY P. LOZITO, *University of North Carolina, Chapel Hill*—Generating verbal materials enhances memory for occurrence (item memory) but may not enhance other aspects of memory. A number of experiments investigated the effect of generation on memory for contextual details, such as word color and location, motivated in part by the possibility that generation produces a tradeoff in the encoding of item and contextual information. At study, participants generated some words (e.g., *hot c*\_\_\_) and read others (e.g., *hot cold*). Generation consistently enhanced item memory but did not enhance context memory. More specifically, generation disrupted context memory for the color of the target word but did not affect context memory for location, background color, and cue word color. These results generalized over experimental design, materials, encoding instructions, and generation manipulation. The specificity of the negative generation effect in context memory argues against a general item–context tradeoff. An alternative view, based on the processing account of generation, meets with greater success.

2:30–2:45 (220)

**Using Prior Knowledge to Mediate the Acquisition of New Information.** JAMES A. KOLE & ALICE F. HEALY, *University of Colorado* (read by Alice F. Healy)—Three experiments examined mediated learning of facts. In each experiment, subjects learned facts during a learning phase and were tested on all facts during a test phase. Prior to learning, there was an association phase in some conditions. In Experiments 1 and 2, subjects learned facts about familiar individuals, unfamiliar individuals, or unfamiliar individuals associated with familiar individuals, during the association phase. Using prior knowledge increased the amount learned and recalled even when prior knowledge played only a mediating role through association. In Experiment 3, subjects learned facts about unfamiliar individuals or unfamiliar countries, with half the subjects in each group first learning associations between the unfamiliar items and the familiar individuals. Using prior knowledge to mediate learning aided fact recognition during learning and testing. However, this advantage during learning was greater when the new information was conceptually similar to the prior knowledge. The results argue against domain specificity for fact learning.

2:50–3:05 (221)

**Using Testing to Enhance Learning: A Comparison of Two Hypotheses.** MICHAEL C. MOZER, *University of Colorado*, HAROLD E. PASHLER, *University of California, San Diego*, & MICHAEL HOWE, *University of Colorado*—Students learning paired associates, such as foreign language vocabulary, often rely on self-testing: They cue themselves with the English word and try to recall the foreign language target, instead of simply memorizing cue–target pairs. The value of this strategy has been empirically verified, yet existing computational models of learning do not address the enhancing–learning-through-testing phenomenon. Using a simple, well-studied model—a feedforward neural net with no hidden units—we propose two alternative hypotheses for characterizing the phenomenon. Hypothesis 1 is that self-testing generates a target that is used for additional training. Hypothesis 2 is that self-testing produces a more reliable error signal for training than does rote memorization. Simulation studies show that Hypothesis 2 readily explains the phenomenon, whereas Hypothesis 1 does not. Furthermore, Hypothesis 2 makes predictions worthy of further empirical study and can be interpreted within the framework of temporal difference learning.

**3:10–3:25 (222)**

**The Spacing Effect: Useful or Just Interesting?** HAROLDE E. PASHLER & NICHOLAS CEPEDA, *University of California, San Diego*, DOUG ROHRER, *University of South Florida*, & JOHN WIXTED, *University of California, San Diego* (read by Harold E. Pashler)—The spacing effect has been the focus of hundreds of research articles, but the results have had little impact on instructional design or technology. We suggest that memory researchers have been unable to offer much concrete advice, because virtually all studies have used (1) very short retention intervals and/or (2) tasks and materials remote from what people typically seek to learn. We report the results of new basic research experiments (some Internet based) designed to fill the resulting gaps. The experiments described used retention intervals as long as 6 months and interstudy intervals ranging from minutes to months. In others, we asked whether spacing effects generalize to tasks beyond verbal learning. In still others, we asked whether spacing enhances learning even when the learner has not mastered the content in the first learning session. Participants learned materials drawn from practically relevant domains, such as facts, vocabulary, and mathematical skills.

**Priming and Suppression Processes  
Regency, Saturday Afternoon, 1:30–3:30**

*Chaired by Michael C. Anderson, University of Oregon*

**1:30–1:45 (223)**

**Social Category Priming and Recall: Individualism–Collectivism Versus Autocratic–Democratic Primes.** EVA D. FERGUSON, *Southern Illinois University, Edwardsville*—This research examines immediate and long-term social category primes. Previous studies used lists of autocratic, democratic, and laissez-faire words, as well as neutral words that were presented following paragraphs depicting the three social categories. The present study with a new type of social category replicates the procedures of the prior research. The individualism and collectivism social category was used for the word lists and for the paragraphs used as primes. Neutral words were again used. As in a previous study, primacy effects were found, with word order being significant, and the von Restorff effect was found, with neutral words significantly better recalled than the social category words. Implicit social category processing is demonstrated with both types of social categories (autocratic–democratic vs. individualism–collectivism), and selective attention helps explain not only the von Restorff effect, but also the kind of priming effects that were found for immediate and long-term social category priming.

**1:50–2:05 (224)**

**S–R Set Priming: A New Priming Phenomenon.** JAMES D. MILES & DANIEL T. WILLINGHAM, *University of Virginia* (read by Daniel T. Willingham)—Priming research to date has examined stimulus- or concept-based sources of facilitation and inhibition. Less is known about how motor responses can uniquely prime later behavior. We report a source of priming based on overt motor responses. Experiment 1 used a choice reaction time task with a cue and a *go* signal. Subjects responding to the cue exhibited faster *go* signal RTs than did subjects who merely watched the cue. Experiment 2 showed that, although the effect depended on an overt motor response, the spatial stimulus–response mapping was the source of the priming, rather than the specific motor act. This result implies the existence of a transient representation of spatial stimulus–response mappings that is specific to an overt response to a stimulus and differs from conscious response strategies. The duration of this specific facilitatory effect is also discussed.

**2:10–2:25 (225)**

**Visual Anti-Priming.** CHAD J. MARSOLEK & REBECCA G. DEASON, *University of Minnesota*, & CARMEN E. WESTERBERG, *Northwestern University*—Long-term repetition priming is frequently observed, however little work has been done to test *why* it exists or

what purpose it may serve. We report work supporting a theory that posits a purpose for priming and a new experimental effect (“anti-priming”). Perceptual recognition systems likely utilize superimposed representations. Priming for one stimulus may reflect a form of relearning of previously stored information that is needed to counteract interference from previous learning and relearning that altered the superimposed representation for that stimulus. The predicted interference may be measurable as anti-priming, a negative effect from previous processing of stimuli on subsequent recognition of other stimuli. Neurocomputational models validate such anti-priming and priming effects, and behavioral experiments provide evidence that both anti-priming and priming are found for visual objects, the magnitude of anti-priming is smaller than the magnitude of priming, and anti-priming occurs even when test objects are dissimilar to previously encoded objects.

**2:30–2:45 (226)**

**Neural Mechanisms Underlying Positive and Negative Repetition Priming.** STEPHEN J. GOTTS & DAVID C. PLAUT, *Carnegie Mellon University* (read by David C. Plaut)—Psychological theories of positive and negative repetition priming have relied on mechanisms such as residual activity/active suppression or episodic match/mismatch. Here, we propose an alternative theory developed from a cognitive neuroscience perspective in which positive and negative priming reflect neural learning mechanisms that serve to develop and shape long-term knowledge representations in the brain. We present a biologically constrained connectionist model that incorporates “biased-competition” mechanisms of attentional selection and a synaptic plasticity rule derived from neuroscience studies. In the model, we show that positive priming results from high neural activity levels and overall synaptic strengthening and that negative priming results from lower activity levels and overall synaptic weakening. The competitive interactions that are claimed to occur during attentional selection and the way that these interact with the plasticity rule also make novel behavioral predictions that we are evaluating through complementary empirical studies by manipulating the relative brightness and familiarity of stimuli.

**2:50–3:05 (227)**

**Repetition Inhibition and Response Suppression in Short-Term Serial Recall: Boundaries in Time and Structure.** MATTHEW J. DUNCAN, *Defence Research and Development Canada, Toronto*, & STEPHAN LEWANDOWSKY, *University of Western Australia*—Response suppression forms an integral part of several theories of serial order memory and is linked to a number of phenomena, including repetition inhibition (RI), the failure to recall the second occurrence of a repeated list item. By implication, the properties of response suppression should provide an explanatory basis for RI effects. The results of two experiments were consistent with a suppression mechanism that does not wear off over time and is reset once recall is complete. However, both recall probability of repeat items and effects of separation at input were inconsistent with the predictions of suppression alone. A third experiment, combined with a meta-analysis, suggested that detection and marking of repetitions during encoding can override suppression and can facilitate recall of repeated items. We present a two-factor theory of RI that combines the inhibitory effect of suppression at retrieval with facilitation caused by the marking of repetitions during encoding.

**3:10–3:25 (228)**

**Inhibitory Control and the Suppression of Unpleasant Events.** MICHAEL C. ANDERSON, *University of Oregon*, & BRICE A. KUHL, *Stanford University*—Previous work has shown that excluding an unwanted memory from consciousness can impair its later retention (Anderson & Green, 2001). Here, we report two experiments in which we extend these findings to the suppression of negatively valenced events. Ninety-eight subjects in two experiments learned paired associates composed of neutral stimuli and either neutral or negatively valenced responses. They then participated in the think/no-think task.

Subjects were presented with the stimulus from each pair and were asked either to suppress awareness of the response or to retrieve it, either 0, 1, or 16 times. Afterward, memory for the responses was assessed by explicit recall tests, and valence ratings were also collected. Both experiments showed evidence that neutral and negatively charged memories can be suppressed. Suppression also altered subjects' ratings of emotional valence for suppressed words. These findings provide initial evidence that inhibitory control may be effective in suppressing emotionally unpleasant experiences.

**Category Learning and Classification**  
Nicollet A, Saturday Afternoon, 3:50–5:30

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

**3:50–4:05 (229)**

**Novelty, Shmovelty: The Superficiality of Novelty in Ad Hoc Categories.** KATHRYN E. SANBORN & CURT BURGESS, *University of California, Riverside* (read by Curt Burgess)—Theories of semantic representation need to account for a variety of category types. High-dimensional memory models, such as HAL and LSA, have been used to account for a wide variety of cognitive phenomena. However, it could be seen as difficult to make ad hoc categories (e.g., *wedding gifts, acquired tastes*) correspond to any metrics in a high-dimensional memory model, since the formation of an ad hoc category hinges on personal experience with the category, the novel goals of the person, and a similarity comparison process (Barsalou, 1983). Participants ranked ordered items from both ad hoc and common categories on a dimension of most ad hoc to least ad hoc. Results suggest that novelty is mostly irrelevant in theorizing about ad hoc categories, except for labeling, and that the ad hoc characterization fits nicely in a high-dimensional theoretic framework. High-dimensional models offer a framework for understanding novelty in semantic theory.

**4:10–4:25 (230)**

**Speeded Classification in a Probabilistic Category Structure.** ROBERT M. NOSOFSKY & ROGER D. STANTON, *Indiana University*—Speeded perceptual classification experiments were conducted to distinguish among the predictions of exemplar retrieval, prototype, and decision boundary models. The key manipulation was that, across conditions, individual stimuli received either probabilistic or deterministic category feedback. Regardless of the probabilistic feedback, however, an ideal observer would always classify the stimuli by using an identical linear decision boundary. Subjects classified the probabilistic stimuli with lower accuracy and longer response times than they classified the deterministic stimuli. These results were in accord with the predictions of the exemplar model and challenged the predictions of the prototype and decision boundary models.

**4:30–4:45 (231)**

**Empirical Measures of Attention Allocation in Classification Learning: A Replication of Medin and Schaffer (1978).** JAMES E. CORTER, *Teachers College, Columbia University*, & TOSHIHIKO MATSUKA, *Rutgers University*—Medin and Schaffer's (1978) Experiment 2 has been an influential and oft-replicated study of classification learning. Matsuka, Corter, and Markman (2002) reported simulations showing that several important models of category learning (ALCOVE, RASHNL, and SUSTAIN) perform comparably in reproducing the observed classification response profile reported in Medin and Schaffer's original study. However, those simulation results also showed that the three models' predicted patterns of attention weights for the stimulus dimensions differed markedly. In the present study, we replicated Medin and Schaffer's experiment, but collected data on changes in subjects' attention allocation across stimulus dimensions (as measured by individual feature viewing times) during classification learning, using a MouseLab-type interface (cf. Matsuka & Corter, 2003). The obtained empirical attention allocation learning curves are compared with those predicted by ALCOVE, RASHNL, and SUSTAIN in the simulation studies.

**4:50–5:05 (232)**

**Thirty-Something Categorization Results in No Need of Explanation.** BOB REHDER & AARON B. HOFFMAN, *New York University*—A replication of Medin and Schaffer's (1978) 5–4 category-learning study was conducted with an eyetracker. Numerous studies using the 5–4 structure have shown the exemplar-based GCM to be superior to prototype models. As a result, the exemplar view has enjoyed dominance in categorization theory for over 20 years. However, Smith and Minda (2000) argued that the GCM is psychologically implausible because it assumes that learners allocate their attention suboptimally. To assess the psychological reality of the GCM's fitted attention weights, we measured participants' eye fixations while they learned the 5–4 category structure. We found that category learners' eye fixations reflected both the relative diagnosticity and the physical salience of the four stimulus dimensions. Importantly, we also found the eyetracking data to be consistent with the GCM, despite the fact that its attention weights indicated that learners allocated attention suboptimally. These results corroborate the psychological reality of the GCM's attention weights.

**5:10–5:25 (233)**

**Exemplar-Based Relational Category Learning.** BRADLEY C. LOVE, *University of Texas, Austin*—Research in category learning and analogy has proceeded independently, in part because models cannot address findings from both areas. Category-learning models can replicate learning curves and address generalization data but can be applied only to studies involving spatial or featural stimuli. In contrast, models of analogical comparison focus on how people align representations containing relations (e.g., part of, causes). Here, a model is presented that spans these two areas. The model extends an exemplar-based connectionist model of category learning, ALCOVE (Kruschke, 1992) to the processing of relational stimuli. The model contains two competing attentional pools. As attention shifts to and from the relational and object attentional pools, the model's notion of similarity changes. The object attentional pool is further subdivided into entity (object as symbol) and property (object as bundle of properties) subpools. The model is successfully applied to a series of data sets from the analogy and category-learning literatures.

**SYMPOSIUM: Putting Perspective in Things:  
The Role of Point of View in Spatial Reasoning**  
Nicollet BC, Saturday Afternoon, 3:25–5:30

*Chaired by Amy Lynne Shelton, Johns Hopkins University,  
and Jeffrey M. Zacks, Washington University*

Perspective taking and the transformations it requires are essential components of spatial cognition. The speakers will describe new research showing how perspectives and mental transformations of perspective are expressed in actual navigation in space, development of spatial cognition, brain activity, and spatial language use. The research highlights new distinctions and new relationships among components of spatial reasoning. Sensorimotor inputs, geometry, and landmarks contribute to imagined spatial transformations and to updating one's actual position in space. This supports a strong relationship between spatial reasoning and navigation. However, that relationship is constrained by the fact that imagined transformations of one's perspective can be distinguished from imagined transformations of objects on the basis of individual differences, psychophysical responses, and neurophysiological dissociations. In the use of maps and directions, these two types of transformations may serve to coordinate the perspective of an observer embedded in the environment with the perspective of a bird's eye view.

**3:30–3:55 (234)**

**Functional Equivalence of Spatial Representations From Perception and Language.** JACK LOOMIS, *University of California, Santa Barbara*, ROBERTA KLATZKY, *Carnegie Mellon University*, MARIOS

AVRAAMIDES, *University of Cyprus*, & YVONNE LIPPA, *Miami University*—Can simple utterances specifying the egocentric coordinates of locations give rise to spatial representations that are functionally like those produced by visual and auditory perception (after adjusting for differences in encoding)? I will present two lines of research, one dealing with spatial updating during bodily movement and the other dealing with allocentric judgments, that provide strong evidence of such functional equivalence.

4:00–4:25 (235)

**Switching Perspective in Spatial Descriptions.** BARBARA TVERSKY, *Stanford University*, PAUL LEE, *NASA Ames Research Center*, & HOLLY TAYLOR, *Tufts University*—Although theories of language and theories of mental models claim that maintaining consistent perspective facilitates language comprehension and production, people's spontaneous descriptions of space include frequent perspective switches, without warning. New research shows that although there are small costs in comprehension time to perspective switching, switching costs rapidly dissipate. Why do perspective switches cause so little trouble?

4:30–4:55 (236)

**Perspective Taking and Mental Rotation.** JEFFREY M. ZACKS, *Washington University*—At least two kinds of mental spatial transformation can be distinguished. In an object-based transformation, the reference frame of an object moves relative to the reference frames of the observer and the environment. Mental rotation is a prime example of a task that depends heavily on object-based transformations. In a perspective transformation, the observer's reference frame is updated relative to the reference frames of the environment and of salient objects. Tests that require constructing a view of an environment from another's viewpoint depend heavily on perspective transformations. Recent psychometric, chronometric, and neurophysiological data suggest that these two types of spatial transformation draw on dissociable neural processing systems. This dissociation has implications for rehabilitation after brain injury and for education.

5:00–5:25 (237)

**Developing Reorientation: Modular or Not?** NORA S. NEWCOMBE, *Temple University*—Establishing spatial orientation and reestablishing it when it has been lost are capacities that are key to survival for all mobile animals. Findings that geometric information is used to meet this adaptive challenge have been of great interest to investigators focused on spatial navigation in both humans and nonhuman animals. More dramatically, there have been claims that geometric processing is accomplished using a specialized information-processing module and that language is essential to overcome modularity. Findings that support these claims have been seen as having exciting implications for the nativist–empiricist debate, as well as for the role of language in thought, cognitive architecture, and comparative cognition. This talk will delineate key issues that remain unsettled regarding the nature of geometric sensitivity, the bases for its development, and the extent to which it is modular. It will also critically examine the claim that language leads to a combination of modularized information for humans.

#### Selective Attention II

Nicollet D, Saturday Afternoon, 4:00–5:20

Chaired by Todd S. Horowitz, Brigham & Women's Hospital

4:00–4:15 (238)

**Seeing, Attending, and Remembering While Driving.** DAVID L. STRAYER, FRANK A. DREWS, & WILLIAM A. JOHNSTON, *University of Utah*—Our research examined the role attention plays in seeing and remembering objects encountered while driving. Participants drove a high-fidelity driving simulator, and attention was manipulated by having drivers converse on a hands-free cell phone. Eye-

tracking measures indicated that even when participants looked directly at objects in the driving environment, they were less likely to create a durable memory of those items if they were talking on a cell phone. Moreover, this pattern was obtained for objects of both high- and low-relevance to driving, suggesting that the effect is not modulated by a semantic prioritization of the objects in the driving scene. Both implicit memory measures and ERP measures indicated that the impaired memory in dual-task conditions was due, in large part, to encoding deficits. The inattention blindness observed suggests that drivers are less likely to see and remember objects when they are on the phone, because attention is directed elsewhere.

4:20–4:35 (239)

**Visual Sensing Is Seeing: Why Mindsight, in Hindsight, Is Blind.** DANIEL J. SIMONS, GABRIEL NEVAREZ, & WALTER R. BOOT, *University of Illinois, Urbana-Champaign*—Faced with the surprising failure to notice large changes to visual scenes (change blindness), many researchers have sought evidence for alternative, nonattentional routes to change detection. A recent paper in *Psychological Science* (Rensink, 2004) proposed a new, nonsensory “mindsight” mechanism in which some subjects on some trials report sensing the presence of a recurring change before they can explicitly identify it, and in the absence of a localizable visual experience of change. This mechanism would constitute a previously unknown mode of seeing that, as Rensink suggests, might be akin to a sixth sense. Its existence would have radical implications for the mechanisms underlying conscious visual experience. We question the evidence for mindsight, first, by replicating Rensink's core finding and, then, by demonstrating that the results are consistent with a more mundane explanation that requires no new mechanisms for change detection or awareness.

4:40–4:55 (240)

**High-Capacity Spatial Contextual Memory.** YUHONG JIANG, JOO-HYUN SONG, & AMANDA RIGAS, *Harvard University*—Humans show implicit memory for complex spatial layouts, aiding in subsequent processing of these layouts. Research efforts in the past 5 years have focused primarily on a single session of training involving a dozen repeated displays. Yet every day, we encounter many more visual layouts than are presented in these experiments. In this study, we trained subjects to learn 60 repeated displays randomly intermixed within 1,800 nonrepeated displays, spread over 5 consecutive days. Every day, subjects conducted visual search on 360 new displays and a new set of 12 repeated displays, each repeated 30 times. Contextual memory was observed on all days. One week after the fifth session, subjects still searched faster from the repeated displays learned previously. We conclude that the visual system has a high capacity for learning and retaining repeated spatial context. This ability may compensate for our severe limitations in explicit visual memory.

5:00–5:15 (241)

**How Many Unique Objects Can You Track?** TODD S. HOROWITZ, SARAH B. KLIEGER, JEREMY M. WOLFE, & DAVID E. FENCSEK, *Brigham & Women's Hospital and Harvard Medical School*, & GEORGE A. ALVAREZ, *Harvard University*—Observers can track multiple independently moving objects in the multielement visual-tracking paradigm. Typically, all objects in this task are identical. If observers tracked unique objects, would they know their identity or only their locations? In these experiments, observers tracked four of eight unique cartoon animals. They were asked to localize all four targets or to localize one specific target (Where is the bunny?). In Experiment 1, observers knew the locations of 3.4 targets but only 2.2 identities. This was true whether questions were blocked or mixed (Experiments 2 and 3). Experiment 4 compared tracking unique animals with tracking identical animals. Capacity for unique objects was higher than that for identical objects (3.3 vs. 2.2 items). Observers may know where targets are without knowing which is which. However, some object identities are tracked. If target names are remembered, identity could be used to recover lost targets (Where did the bunny go?).

**Models of Associative Learning**  
Greenway BCD, Saturday Afternoon, 4:00–5:20

Chaired by Ralph R. Miller, SUNY, Binghamton

4:00–4:15 (242)

**Chaining Together Serial and Free Recall.** KELLY A. ADDIS, *Bran-deis University*, & MICHAEL J. KAHANA, *University of Pennsylvania* (read by Michael J. Kahana)—Previous attempts to account for serial and free recall have required separate model implementations for each task. We present a strength model of associative chaining (SMAC) designed to fit to key behavioral results from both serial and free recall, in both single-trial and multitrial paradigms. The model successfully accounts for serial position and output order effects, as well as for changes in these effects over learning trials in both recall conditions. Unlike previous theories, SMAC can simultaneously account for both serial and free recall within a single implementation.

4:20–4:35 (243)

**Modeling False Recall: A Simple Associative Model Is Not Enough.** DANIEL R. KIMBALL, *University of Texas, Arlington*, & MICHAEL J. KAHANA, *University of Pennsylvania*—The eSAM model (Sirotnin, Kimball, & Kahana, 2004) extended the search of associative memory model (SAM; Raaijmakers & Shiffrin, 1980, 1981) by adding semantic associations as retrieval cues, a large extra-list lexicon, and a contextual drift mechanism. The model successfully simulated a number of semantic phenomena, including recall transitions among category members, “unrelated” words, and extra-list and prior-list intrusions. We now apply eSAM to the Deese/Roediger–McDermott (DRM) list-learning paradigm, in which people falsely recall an unrepresented critical word that is semantically related to all list words. The model can easily simulate false recall of the critical word, but in doing so, it counterfactually predicts high rates of extra-list and prior-list intrusions, which actually occur at extremely low rates in behavioral studies using DRM lists. This important failure of a simple associative model points to the necessity of an additional mechanism in modeling false recall.

4:40–4:55 (244)

**Semantic Structure and Episodic Context: The Analogy Between LSA and TCM.** MARC W. HOWARD, ADITYA V. DATEY, & HONG-LIANG GAI, *Syracuse University*—Latent semantic analysis (LSA; Landauer & Dumais, 1997) describes the semantic structure of language as a consequence of the contextual relationships of words. The temporal context model (TCM; Howard & Kahana, 2002) describes episodic associations as mediated by a distributed representation of temporal context. There are several formal similarities between these two models, including a representation of context that is composed of item states and item representations that are a composite of contextual states. Both models also have two sources of association: temporal contiguity and contextual similarity. Here, we construct semantic word spaces, using the formulation of temporal context used for episodic recall in TCM. The resulting space in many respects resembles the LSA space derived from the same body of text. This suggests that retrieval of temporal context could be a common mechanism underlying both episodic and semantic memory.

5:00–5:15 (245)

**Trial Order in Human Contingency Judgment.** RALPH R. MILLER, *SUNY, Binghamton*, STEVEN STOUT, *Valdosta State University*, & JEFFREY C. AMUNDSON, *SUNY, Binghamton*—Both associative and statistical theories have been used to account for contingency judgments. One problem for statistical models is that they are poor at handling trial order effects. This contrasts with associative models, which emphasize recent trials, consistent with recency effects, which are widely viewed as the behavioral norm. As retention intervals were increased after training (A–B followed by A–C), recency effects (A–C) faded into primacy effects (A–B). This seriously challenges traditional associative theories and provides little comfort for traditional

statistical models but suggests that nearly veridical memory underlies human contingency judgments.

**Sentence Processing**  
Greenway FGH, Saturday Afternoon, 3:50–5:30

Chaired by Karen A. Kemtes, University of Nevada, Las Vegas

3:50–4:05 (246)

**Comprehending Anaphoric and Cataphoric Pronouns.** SHELIA M. KENNISON & ELAINE C. FERNANDEZ, *Oklahoma State University*—The research investigated how comprehenders resolved anaphoric pronouns (e.g., *After Mark arrived, he used the phone.*) and cataphoric pronouns (e.g., *After he arrived, Mark used the phone.*). In Experiment 1, reading time was measured on sentences containing two clauses; a pronoun appeared in one clause, and a proper name in the other. The pronoun and the name were either congruent or incongruent in gender. The results showed that anaphoric pronouns were resolved more quickly than cataphoric pronouns when coreference could be achieved but were resolved more slowly than cataphoric pronouns when coreference had to be rejected in gender-incongruent conditions. A series of follow-up experiments indicated that comprehenders use information about the preference for coreference to evaluate the established coreference link between a pronoun and a candidate antecedent. During evaluation, coreference is more rapidly accepted, but it is more slowly rejected when preference for coreference is high than when preference for coreference is low.

4:10–4:25 (247)

**Episodic Affordances Contribute to Language Comprehension.** ARTHUR M. GLENBERG & RAYMOND BECKER, *University of Wisconsin, Madison*, & MIKE RINCK & SUSANN KLÖTZER, *Dresden University of Technology*—Does spatial locations of objects and, thus, how to interact with them contribute to language comprehension? Participants judged whether sentences were about normal objects (e.g., *The apple has a stem*) or odd objects (e.g., *The apple has an antenna*). The *normal* response key was either on the same side of the participant as the object, or on the other side. We demonstrate (1) a compatibility effect in which responding *normal* is faster toward the object’s location, (2) that this effect is equally strong for sentences describing states of the objects and sentences describing actions (e.g., *Touch the apple at the stem*), (3) that the compatibility effect remains when the objects are removed, implying that the effect does not require literal eye movements or a shift of attention to the objects, and (4) that the effect reflects contributions of both spatial location and action-based encoding (affordances).

4:30–4:45 (248)

**Will the True N400 Please Stand Up?** JOSEPH DIEN, *University of Kansas*, CHRIS MAY, *University of California, Davis*, & MICHAEL S. FRANKLIN, *University of Michigan*—Existing high-density characterizations of the N400 conflict regarding the topography of the N400, an event-related potential component sensitive to semantic incongruity. The N400 has been reported to be a left-lateralized, Fz-centered, positive response to congruous endings (Curran, Tucker, Kutas, & Posner, 1993) and a right-lateralized, Pz-centered, negative response to incongruous endings (Nobre & McCarthy, 1994). In the present study, 15 subjects read sentences presented at the rate of one word per second. For half of the experiment, subjects read for comprehension (low load), whereas in the other half, subjects counted the sentence endings (high load). In the first condition, the subjects displayed the left-lateralized (P4b) pattern, whereas in the other condition, the subjects showed the right-lateralized (N4b) pattern. We suggest that the P4b represents a semantic expectancy process, whereas the N4b represents a semantic integration process.

4:50–5:05 (249)

**Syntactic Processing in Aphasia.** DAVID CAPLAN, *Massachusetts General Hospital*, GLORIA S. WATERS & GAYLE DeDE, *Boston*

*University*, & JENNIFER MICHAUD & AMANDA REDDY, *Massachusetts General Hospital*—Accuracy, RT, and residual frequency-regressed listening times were analyzed in 42 aphasic patients with left-hemisphere strokes and 25 control subjects on two variants of three syntactic constructions in object manipulation and full and self-paced listening versions of picture-matching and grammaticality judgment tasks. No patients showed the same deficit on both examples of a construction in both comprehension tasks. Factor analyses on accuracy and RTs for patients and RTs for controls retained one or two first factors in unrotated analyses. The first unrotated factor always accounted for >70% of the variance and contained significant positive loadings for all sentence types. Factors under Varimax rotation did not contain sentence type loadings that could be related to syntactic operations. The main determinant of aphasic and normal performance in tasks of syntactic comprehension is a process that applies to all sentences. Resource reduction is a plausible candidate for this factor.

#### 5:10–5:25 (250)

**Discourse Context Helps Young and Older Readers Avoid the Garden Path.** KAREN A. KEMTES, *University of Nevada, Las Vegas*, & THOMAS A. FARMER & MORTEN H. CHRISTIANSEN, *Cornell University*—Kemtes and Kemper (1997) demonstrated that segment-by-segment RT patterns for complex relative clause sentences were parallel across younger and older participants and, with some minor variations, across working memory span groups as well. Syntactically ambiguous sentences do not appear in isolation, however, but are embedded within a discourse. Altman, Garnham, and Dennis (1992) demonstrated that young participants used information from discourse context to avoid garden path effects on complex relative clause sentences. In the present study, we replicated and extended the results of Altman et al. by demonstrating that (1) older adult participants also take advantage of discourse context to avoid garden path effects and (2) working memory influences this ability across both younger and older groups. These data provide support for the view that discourse context constrains downstream garden path processing. Results are interpreted within theoretical psycholinguistic and cognitive-aging frameworks.

#### Word Processing

Regency, Saturday Afternoon, 3:50–5:30

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

#### 3:50–4:05 (251)

**Effects of Semantic Transparency, But Not Homophonic Family Size, Change With Processing Time in Chinese.** HUA SHU & HAIYAN ZHOU, *Beijing Normal University*, & LAURIE B. FELDMAN, *SUNY, Albany* (sponsored by Laurie B. Feldman)—Chinese is distinctive because a spoken syllable may correspond to multiple orthographically distinct characters. For example, about 40 characters constitute the homophonic family for the syllable /shi/. Usually, semantic transparency of word context (e.g., /zhan4/fight-/shi4/person means *soldier*) helps to distinguish among homophonic characters (/shi4/). In four cross-modal homophone judgment experiments, we asked whether homophonic family size and semantic transparency of word context influence on-line processing of phonology-to-character mapping in Chinese. We found that RT of homophone judgment was generally slower as homophone family size increased, suggesting activation of multiple homophonic characters when the target syllable appeared in isolation. Moreover, when target syllables appeared in a word context, semantic opacity, as well as increased family size, slowed homophone judgment latencies. Finally, with increases in ISI (onset, offset, and 200 msec), the effect of semantic transparency decreased, but the effect of family size was constant. We discuss the implications for processing of the one-to-many mapping of phonology-to-orthography in Chinese.

#### 4:10–4:25 (252)

**The Role of Nonadjacent Phonotactic Dependencies in the Perception of Spoken Language.** CONOR T. McLENNAN, PAUL A. LUCE,

& ROBERT LA VIGNE, *SUNY, Buffalo* (read by Paul A. Luce)—We investigated the learning of nonadjacent phonotactic dependencies in adults. Following previous research examining learning of dependencies at a grammatical level (Gomez, 2002), we manipulated the co-occurrence of nonadjacent phonological segments within a spoken syllable. Each listener was exposed to consonant–vowel–consonant nonword stimuli produced by one of two phonological grammars. Both languages contained the same adjacent dependencies between the initial consonant–vowel and the final vowel–consonant sequences but differed on the co-occurrences of initial and final consonants. Listeners' learning of nonadjacent segmental dependencies was evaluated both in an implicit shadowing task and in an explicit same/different task. The results provide evidence for the role that nonadjacent phonotactic dependencies play in the perception of spoken language.

#### 4:30–4:45 (253)

**Effects of Neighborhood Density and Phonotactic Probability on Word Learning.** HOLLY L. STORKEL, JONNA L. ARMBRUSTER, & TIFFANY P. HOGAN, *University of Kansas*—This study attempted to disentangle the effects of neighborhood density (the number of words that sound similar to a given word) and phonotactic probability (the likelihood of occurrence of a sound sequence) on word learning by adults and children. In one experiment, adults were exposed to novel words varying in neighborhood density and phonotactic probability (i.e., high–high, high–low, low–high, low–low) in a story context, and naming of these novel words was tested. Results showed a main effect of neighborhood density, with high density more accurate than low density, and a main effect of phonotactic probability, with low probability more accurate than high probability. A second experiment examined this same issue in a naturalistic sample of word learning by young children. Results were similar, suggesting that both neighborhood density and phonotactic probability influence word learning across the life span.

#### 4:50–5:05 (254)

**Predicting Naming Times for Low-Frequency Complex English Words.** LEE H. WURM, *Wayne State University*, & HARALD BAAYEN, *Max Planck Institute for Psycholinguistics*—Processing of low-frequency complex words has received increasing attention because of the important role such words play in theoretical models. A word that has never been encountered before cannot have a mental representation. But what about a word that has been encountered on a small number of occasions? Previous research (Alegre & Gordon, 1999) has suggested that for suffixed inflections with surface frequencies below 6 per million, visual processing is strictly decompositional (i.e., no full-form representation exists for such words). We will compare auditory and visual processing of low-frequency English words, examining prefixed derivations, suffixed derivations, and suffixed inflections. We will present the results of six naming experiments (three auditory and three visual). Although there were many similarities between the results across auditory and visual processing modalities, there were also some interesting differences. The roles of word and morpheme frequencies, semantic transparency, and several other variables will be discussed.

#### 5:10–5:25 (255)

**Influence of Aging and Alzheimer's Disease on Word Naming.** PHILIP A. ALLEN, *University of Akron*, BARBARA BUCUR, *Duke University Medical School*, JEREMY GRABBE, *University of Akron*, & DAVID J. MADDEN, *Duke University Medical Center*—We tested healthy younger and older adults (20 of each) and 18 individuals diagnosed with probable Alzheimer's disease on a naming task, using the Taraban and McClelland (1987) stimulus set of exception, regular-inconsistent, and regular matched control words. We manipulated condition (exception vs. control and regular-inconsistent vs. control), frequency, and case type (lowercase vs. mixed case). We failed to find conspiracy effects (poorer performance for exception or regular-consistent words, relative to controls). However, healthy older adults

showed larger case-mixing effects than did younger adults, and Alzheimer's patients showed larger case-mixing effects than did healthy older adults. Also, word frequency did not predict response latencies for Alzheimer's patients, but it did for healthy younger and

older adults. These results are consistent with the notion that individuals use progressively larger units of analysis in word recognition with increased adult age, but that Alzheimer's disease is associated with less word frequency saliency.

**Visual Search****Nicollet A, Sunday Morning, 8:00–10:00***Chaired by Jeremy M. Wolfe, Brigham & Women's Hospital***8:00–8:15 (256)**

**Limits on the Top-Down Guidance of Visual Search for Multiple Targets.** TAMARYN MENNEER, *University of Southampton*, DOUG J. BARRETT, *University of Nottingham*, LUKE PHILLIPS & NICK DONNELLY, *University of Southampton*, & KYLE R. CAVE, *University of Massachusetts* (read by Kyle R. Cave)—In most visual search experiments, the target is a single object or class of objects. We performed a series of experiments on simultaneous search for either of two targets. The stimuli across different experiments included colors, orientations, shapes, or multipart complex objects. In some tasks, the results showed that participants were unable to search for both targets simultaneously and, instead, focused their efforts on one target while ignoring the other. For most tasks, searching for two targets simultaneously was less efficient than performing separate searches for each target. Exceptions to this pattern arose in the easiest searches, in which high target salience makes top-down guidance unnecessary, and the hardest searches, in which targets are so difficult to distinguish from distractors preattentively that no guidance is possible. These results have implications for improving performance in practical applications involving visual search, and also for models of the top-down control of visual attention.

**8:20–8:35 (257)**

**Grouping Effects in Complex Visual Displays: Effects of Color and Motion.** ROBERT S. MCCANN, *NASA Ames Research Center*, & KEVIN JORDAN, *San Jose State University*—Participants performed a visual search for a target in a vertical array of elements. Elements in the upper section were white and oscillating; those in the lower section were green and stationary. Participants were cued to search one section of the array by an arrow located in the center of the array. On some trials, the arrow was white and oscillating, grouping with the upper section. On others, the arrow was green and stationary, grouping with the lower section. Search was faster when the arrow and the target were part of the same group. What was the source of the perceptual grouping? In subsequent experiments, we removed either differential motion between upper and lower sections of the array or differential color between sections. Removing either differential motion or color was sufficient to eliminate the within-group search advantage. Implications for perceptual grouping and the design of head-up displays will be discussed.

**8:40–8:55 (258)**

**Remembering a Location Makes the Eyes Curve Away.** JAN THEEUWES, CHRISTIAN N. L. OLIVERS, & CHRISTOPHER L. CHIZK, *Vrije Universiteit Amsterdam*—Working memory is a system that keeps limited information on line for immediate access by cognitive processes. This type of active maintenance is important for everyday life activities. The present study shows that maintaining a location in spatial working memory affects saccadic eye movement trajectories toward a visual target, as the eyes deviate away from the remembered location. This provides direct evidence for a strong overlap between spatial working memory and the eye movement system. We argue that curvature is the result of the need to inhibit memory-based eye movement activity in the superior colliculus, in order to allow an accurate saccade to the visual target. Where previous research has shown that the eyes may deviate away from visually presented stimuli, we show that the eyes also curve away from remembered stimuli.

**9:00–9:15 (259)**

**False Pop-Out.** JAMES R. POMERANTZ & MARY C. PORTILLO, *Rice University*—When one disparate stimulus is presented in a field of homogeneous distractors, that odd item often pops out. We describe

instances of false pop-out (FPO; Pomerantz, 2002) wherein the item that pops out is one of the distractors. Example: Although it is easy to determine that the middle item is the odd one in the sequence XOX, it is harder in the set ( ) (, where we often mistakenly identify the third item as odd. We define FPO as an uneven distribution of errors across the distractors, we show evidence of FPO across a variety of stimuli, and we analyze some factors that cause FPO. We argue that FPO results from grouping that takes place across the elements in the display, and we discuss the implications of FPO for our understanding of visual search.

**9:20–9:35 (260)**

**Attentional Set and Intertrial Contingencies in Singleton Search.** DOMINIQUE LAMY, *Tel Aviv University*, ANDREW B. LEBER, *Yale University*, & HOWARD E. EGETH, *Johns Hopkins University* (read by Howard E. Egeth)—There is no consensus as to what information guides search for a singleton target. Does the most salient target capture attention automatically? Do subjects adopt a default salience-based search mode? Does knowledge of the target's defining feature (when available) affect search? Finally, can intertrial contingencies account for the disparate results in the literature? We investigated search for a shape singleton when (1) target and nontarget shapes switched unpredictably from trial to trial, (2) they remained fixed, and (3) the target was a singleton on only 1/3 of the trials. We examined overall RT, search slopes, errors, and the slowing caused by a cross-dimensional singleton distractor. Our results argue against the idea that search is guided solely by stimulus-driven factors or that subjects adopt a "singleton detection mode" that is blind to feature information. They show also that intertrial contingencies, while potent, cannot account for the variety of results in the literature.

**9:40–9:55 (261)**

**Visual Search Throws Us a Curve.** JEREMY M. WOLFE, EVAN M. PALMER, TODD S. HOROWITZ, & KRISTIN O. MICHOD, *Brigham & Women's Hospital and Harvard Medical School*—Reaction times by set size functions in visual search experiments are typically assumed to be linear. However, when set size is sampled densely (here, 1, 2, 3, 4, 8, 16, 24, and 32), the functions are clearly compressive. Slopes for the four large set sizes are shallower than for the four small set sizes, reflecting increased search efficiency at larger set sizes. This is true for both "unguided search" [ $TvsL$ ;  $t(10) = 3.23$ ,  $p < .01$ ] and "guided search" [ $color \times orientation$  conjunction;  $t(10) = 5.41$ ,  $p < .0005$ ]. These nonlinearities are not fully explained by speed-accuracy tradeoffs. Models that produce linear RT  $\times$  set size functions must be revised. Moreover, guided searches are more compressive (power function exponent 0.18) than unguided (0.42). This may reflect a relatively slow time course for guidance by color and orientation information. Small set size conjunction searches may be finished before guidance can get started.

**Interference Effects in Performance of Pigeons and Humans  
Nicollet BC, Sunday Morning, 8:00–10:00***Chaired by Richard J. Schweickert, Purdue University***8:00–8:15 (262)**

**The Effect of Saccades on Number Comparison.** DAVID E. IRWIN & LAURA E. THOMAS, *University of Illinois, Urbana-Champaign*—Previous research has shown that saccadic eye movements interfere with dorsal-stream tasks, such as mental rotation but not with ventral-stream tasks, such as object recognition. Judging whether one number is larger or smaller than another is a dorsal-stream task that relies especially on the right parietal cortex (Dehaene, 1996). In the present experiment, subjects judged whether a two-digit number was greater than or less than 65 while making no, short, or long saccades. RT to make this judgment increased with saccade distance, but only when the eyes moved from right to left. Because the right parietal cortex is instrumental in generating leftward saccades, these results provide

further evidence for the hypothesis that cognitive suppression during saccades occurs as a result of neural dual-task interference.

#### 8:20–8:35 (263)

**When Counting Doesn't Count.** FELICIA HUREWITZ, BRIAN SCHNITZER, & ROCHEL GELMAN, *Rutgers University* (read by Rochel Gelman)—Three experiments with college students provided estimates of interference effects when area and number were congruent, incongruent, or neutral with respect to each other. These Stroop studies show that the summed area of  $N$  visual objects interferes with the accuracy and speed of numerical comparisons and, conversely, that numerical incongruence interferes with area comparisons. These results suggest that both numerical and nonnumerical quantitative attributes of visual stimuli are calculated automatically, but probably at different rates. The findings are relevant to the interpretation of the number studies that find that infants preferentially attend to the area or volume of stimuli over the number of items presented or that infants use total area or perimeter when responding to displays with different numerosities (Clearfield & Mix, 2000; Feigenson, Carey, & Spelke, 2002).

#### 8:40–8:55 (264)

**Automaticity and Single Colored Letter Stroop Stimuli.** JOHN S. MONAHAN, *Central Michigan University*—Automaticity and mental set explanations of results with single colored letter (SCL) Stroop stimuli were examined in three experiments. First, 35 participants indicated the color of words and pseudohomophones with a mouse. Pseudohomophones speeded incongruent RT, without affecting congruent or neutral RT. Second, 86 participants indicated the color of normal and SCL stimuli via keypress. Coloring one letter slowed congruent and neutral RT but did not affect incongruent RT. Third, 61 participants indicated the color of normal and SCL stimuli vocally. With vocal responding, coloring one letter again slowed congruent and neutral RT, but it also speeded incongruent RT. SCL stimuli seem to cause a visual search for the colored letter, reduce visual to vocal automaticity, and do not affect silent reading automaticity. The results support automaticity, but not mental set, as an explanation for Stroop interference.

#### 9:00–9:15 (265)

**Cognition Interrupted: The Consequences of an Action Not Taken.** DEREK BESNER & EVAN F. RISKO, *University of Waterloo*—What is the relation between “task set” and “automatic” processing? One view is that “set” prepares the subject to do something specific, whereas automatic processes are triggered by the stimulus and, once started, are ballistic. The latter just “do their thing” regardless of what the task set is. We discuss the results from a simple paradigm in which subjects orient to a stimulus. The data support an account in which mental set dominates putatively automatic processing.

#### 9:20–9:35 (266)

**A Simon Effect in Pigeons.** PETER J. URCUIOLI, *Purdue University*, KIM-PHUONG L. VU, *California State University, Northridge*, & ROBERT W. PROCTOR, *Purdue University*—A well-established finding in the human performance literature is that left versus right responses occur more quickly when the discriminative cue appears ipsilateral to the required spatial response than contralaterally to it. Pigeons also show this Simon effect when trained to peck left versus right keys in reaction to a color appearing either on the key to which the reinforced peck must be made or on the opposite key. Their faster reaction times on the former (corresponding) trials than on the latter (noncorresponding) trials occur under a wide range of conditions and are not simply the product of different reinforcement probabilities associated with the stimuli they must peck.

#### 9:40–9:55 (267)

**Basis for Selective Influence Despite Crosstalk and Resource Sharing.** RICHARD J. SCHWEICKERT, *Purdue University*, DONALD L.

FISHER, *University of Massachusetts*, & KYONGJE SUNG, *Purdue University*—An experimental factor selectively influences a process if it changes the duration of that process, leaving other process durations unchanged. However, there is evidence that processes interrupt each other, send crosstalk, and share resources. Moreover, subjects may not schedule processes the same way on every trial. Despite interdependencies between processes and mixtures of schedules, derivations and simulations show that factors selectively influencing processes are still possible and still informative.

#### Spatial Cognition

Nicollet D, Sunday Morning, 8:00–10:20

Chaired by Laura A. Carlson, University of Notre Dame

#### 8:00–8:15 (268)

**Possible Asymmetries and Effects of Attention in Boundary Extension.** JON R. COURTNEY & TIMOTHY L. HUBBARD, *Texas Christian University* (read by Timothy L. Hubbard)—Memory for a scene often includes unseen elements that might have been present just beyond the boundaries of that scene, and this has been referred to as boundary extension (e.g., Intraub, 2002). Effects of the allocation of attention on boundary extension were examined in a series of experiments. Observers in a divided attention task exhibited larger boundary extension than did observers who did not divide attention. Also, effects of the implied direction of target motion on subsequent boundary extension were examined, and the magnitude of boundary extension in the direction of implied target motion was larger than the magnitude of boundary extension in the direction opposite to implied target motion. Results suggest that the allocation of attention influences boundary extension, support conclusions that boundary extension reflects anticipation of potential target surroundings, and demonstrate that boundary extension may result in an asymmetric distortion in memory for scenes.

#### 8:20–8:35 (269)

**Learning and Perceptual Displacement: Getting Ahead May Not Be an Error.** J. SCOTT JORDAN & MATTHEW HUNSINGER, *Illinois State University*—The perceived vanishing point of a moving stimulus is reliably displaced beyond the actual vanishing point. Such displacements are often modeled as error. This implies that more experience with the task should reduce the error. To test this, we asked one participant (the controller) to control a dot's movements across a computer screen while another participant (the observer), who could neither see nor hear the controller, watched the dot's movements on a separate monitor. When the dot unexpectedly vanished, the observer indicated the vanishing point. After 40 trials, participants switched roles. Sixty pairs participated. Results indicate that both observers and controllers generated forward displacements but that the controllers were significantly larger. Subsequent experiments indicate that the increase was due to the controllers' repeated exposure to the dot's movements. Since more experience resulted in larger displacement, the data challenge the error account while, simultaneously, supporting an account based on common coding and forward models.

#### 8:40–8:55 (270)

**Spatial Representation of Emotionally Evocative Stimuli.** L. ELIZABET CRAWFORD, *University of Richmond*—Orientational metaphors that associate GOOD with UP and BAD with DOWN suggest that spatial concepts are used to represent positivity and negativity. We examined how the association between valence and verticality influences memory and evaluation of spatially distributed, emotionally evocative stimuli, such as images from the International Affective Picture System. Results from spatial memory experiments indicate that memories of stimulus locations are systematically biased by stimulus valence, such that positive items are shifted upward relative to negative items. In contrast, four additional experiments show no evidence that spatial information affects how stimuli are evaluated. The results are consistent with

a metaphorical mediation of affect, even during nonlinguistic tasks, and offer new evidence that stimulus valence biases spatial memory.

9:00–9:15 (271)

**Whose Perspective? Self for Static Scenes, Actor's for Action.** SANDRA LOZANO, BRIDGETTE MARTIN, & BARBARA TVERSKY, *Stanford University* (read by Barbara Tversky)—Viewing a photo, informants were asked to describe the location of a book with respect to a bottle. The object-only photo had only the critical objects; the object-actor photo had a facing actor reaching for the book. A static question (*In relation to the bottle, where is the book?*) yielded self-perspective for the object-only scene. An active question (*In relation to the bottle, where does he put the book?*) yielded actor perspective for the object-actor scene. The static question for the object-actor scene yielded an approximately half-self, half-actor perspective. The presence of an actor in a spatial scene shifts description perspective from self to actor. Spontaneously describing action from an actor's perspective has implications for imitation and learning.

9:20–9:35 (272)

**Learning the Temporal Structure of Human Activity.** KHENA M. SWALLOW & JEFFREY M. ZACKS, *Washington University* (read by Jeffrey M. Zacks)—How does one divide a continuous stream of activity into meaningful events? Part of the answer may be that observers learn about dynamic patterns of activity that recur across different contexts. For example, closing a door occurs in the contexts of having a meeting, going to bed, and many others. The present experiments adapted a paradigm developed by Olson and Chun (2001, *JEPLMC*) to test whether recurring sequences of activity are perceived as meaningful events. Participants monitored a stream of simplified human movements for rare target hand gestures. An arbitrary sequence of movements was repeated throughout and sometimes predicted when targets would occur. This facilitated target detection and led participants to perceive the sequence as a meaningful event. Both effects arose without awareness of the repeating sequence. These results suggest that the perception of events in an ongoing stream of activity can arise solely from sequential structure in the environment.

9:40–9:55 (273)

**Carving Up Space at Imaginary Joints: Can People Mentally Impose Spatial Category Boundaries?** JOHN P. SPENCER & VANESSA R. SIMMERING, *University of Iowa*—Several accounts of spatial category biases propose that people mentally impose category boundaries. However, in virtually all studies that have reported categorical biases, participants have used either visible lines or perceived symmetry axes as boundaries between categories. This raises a fundamental question: Can people mentally impose a category boundary in empty space? Or is spatial categorization better thought of as a process of selecting from among candidate boundaries grounded in the available perceptual structure? Our previous research has shown that spatial category biases can be created and destroyed by adding/deleting perceptual cues in a spatial recall task. Here, we asked whether participants could engage in one form of mental imposition: remembering the location of a previously presented category boundary and using it to divide currently empty space. Results demonstrate that category biases are driven primarily by available perceptual cues, indicating that people cannot carve up space at purely imaginary joints.

10:00–10:15 (274)

**Attention Bridges Geometry and Function in Spatial Language.** LAURA A. CARLSON, *University of Notre Dame*, & TERRY REGIER, *University of Chicago*—Traditionally, the processing of spatial terms has been explained independently of more general cognitive processes, operating upon strictly geometric representations of the objects being spatially related. Further research addressing this view has focused on either process or representation. Specifically, research on process has linked spatial language with attention—while assuming only abstract representations of the objects. Research on representation has shown

that both geometric and functional information about the objects and their interaction influence spatial language, but the process by which this is accomplished is left largely unspecified. We bring together process and representation, and offer an extension of the attention vector-sum model (Regier & Carlson, 2001), in which geometric and functional information is integrated via the process of attention.

#### **False Memories and Autobiographical Memory Greenway BCD, Sunday Morning, 8:00–10:00**

*Chaired by Kathy Pezdek, Claremont Graduate University*

8:00–8:15 (275)

**Output Position of Veridical and False Memories for Words.** TERRENCE M. BARNHARDT, HYUN CHOI, DAVID R. GERKENS, BARBARA CORBISIER, & STEVEN M. SMITH, *Texas A&M University*—Does output position of critical words in free recall occur earlier when words are presented than when they are not presented? Three experiments tested this output position hypothesis, one using pure DRM lists of words, and two using lists that combined DRM (related) words with words unrelated to the meaning of the list. Each list either included or omitted the critical linking word corresponding to the DRM words; whether critical words were presented or not was manipulated within subjects. In all three experiments, the output position prediction was confirmed. These results show that output position may be one characteristic that distinguishes false memories from veridical memories. That false memory of a word should occur later than accurate memory of the same word is consistent with shifting criterion, spreading activation, and fuzzy trace explanations of false memories. Implications of the results for these theories will be discussed.

8:20–8:35 (276)

**Unscrambling Memory: Exploring the Revelation Effect.** DANIEL M. BERNSTEIN, *University of Washington*, RYAN GODFREY, *University of California, Riverside*, MICHAEL E. RUDD, *University of Washington*, & ELIZABETH F. LOFTUS, *University of California, Irvine*—Subjects completed a life events inventory in which one half of the items contained scrambled key words (e.g., *broke a dnwoiw playing ball*). Subjects indicated whether these life events had occurred in their childhood before the age of 10. In a series of experiments involving both recognition and child autobiographical memory, we manipulated the relative difficulty of anagrams by presenting them in predictive (e.g., *witnessed a solar lecsieip*) or nonpredictive (e.g., *participated in a dwendgi*) sentences. We show how the act of unscrambling a key word in an event description can increase subjects' confidence that the word was seen prior or that the event personally occurred (the revelation effect). We discuss the role of familiarity misattribution in the formation of false memories. Specifically, we discuss how fluency can be misattributed to one's past by altering the availability of potential sources that could explain the fluency.

8:40–8:55 (277)

**Evaluating Adult Theories of False Memory With Developmental Data.** CHARLES J. BRAINERD & VALERIE F. REYNA, *University of Texas, Arlington*, & ROBYN E. HOLLIDAY, *University of Kent*—Current theories of semantic false memory differ in their degree of emphasis on processes that are beyond the capabilities of young children, with some theories emphasizing high-level meaning processes (e.g., connecting the gist across items) that are known to be absent in young children and others emphasizing low-level associative processes that are present in young children and undergo little developmental change. We review findings from several recent developmental studies of false memory that illustrate how age comparisons can be used to evaluate predictions from such theories. When high-level meaning processes are involved, false-memory responses display surprising age increases and age  $\times$  treatment interactions in which young children are very resistant to manipulations that elevate false-memory responses in adults, leading to the counterintuitive result that young children's memories are more

accurate, on balance, than older children's or adults'. These results provide tests of alternative associative and semantic hypotheses.

**9:00–9:15 (278)**

**Comparisons of True and False Memories.** IRA E. HYMAN, *Western Washington University*—In a series of experiments, we looked for differences between true and false memories while controlling for memory strength. In some experiments, we used the Deese/Roediger–McDermott word lists, and in other experiments we used a Bransford and Franks (1971) set of sentences. Both methodologies result in false recognition rates equivalent to true recognition rates. In various experiments, participants made remember and know judgments or source memory judgments. We found differences in remember/know judgments and source judgments when there were differences in recognition rates, but no differences between true and false memories when true and false recognition rates were similar. Source memory is constructed with the content of memories, making reliable differentiation of true and false memories impossible.

**9:20–9:35 (279)**

**Varieties of Autobiographical Memory Experience: Structural and Quantitative Comparisons.** JOSEPH M. FITZGERALD, *Wayne State University*—Different forms of autobiographical memory experience were compared in two experiments. In Experiment 1 ( $N = 130$ ), we compared earliest childhood, everyday, and flashbulb memories. In Experiment 2 ( $N = 150$ ), we compared those three along with memories for most stressful/traumatic experiences. Participants recorded memories and immediately rated the memory on scales related to recollection, belief, sensory qualities, setting, narrative quality, and event properties. Structural analysis supported earlier reports that whereas ratings of recollection are related to sensory features of the memory experience, belief in memory accuracy is predicted more by conceptual/spatial features and, in some cases, narrative aspects of the memory. Structural analysis confirmed similar patterns across the four varieties of autobiographical memory. Earliest childhood memories were rated as less life-like than the other three forms. Although participants believed the earliest events were accurate, the belief ratings were significantly lower. Flashbulb and stressful ratings were highly similar, except for the negative valence and consequentiality of stressful memories.

**9:40–9:55 (280)**

**The Difficulty Imagining False Memories for Implausible Childhood Events.** KATHY PEZDEK, IRIS BLANDON-GITLIN, & PAMELA GABBAY, *Claremont Graduate University*—Previous studies have reported that imagination can induce false autobiographical memories. This finding has been used to suggest that psychotherapists who have clients imagine suspected repressed memories of childhood sexual abuse may, in fact, be inducing false memories for the imagined events. In this study, at time one and then 2 weeks later, at time two, 145 participants rated the likelihood that each of 20 childhood events on the life events inventory had happened to them. One week after time one, participants were told that two target events were plausible and two were implausible. They were then asked to imagine one plausible and one implausible target event. Plausibility and imagining interacted to affect likelihood ratings. Imagining plausible events increased the change in likelihood ratings from time one to time two. However, imagining implausible events had no effect on likelihood ratings. Imagining an implausible childhood event is not likely to induce a false autobiographical memory.

**Skill Acquisition and Implicit Learning by Parrots and Humans**  
Greenway FGH, Sunday Morning, 8:00–10:00

*Chaired by Eliot Hazeltine, University of Iowa*

**8:00–8:15 (281)**

**Lack of Referential Vocal Learning From LCD Video by Grey Parrots.** IRENE M. PEPPERBERG, *Brandeis University*—Grey parrots

(*Psittacus erithacus*) do not acquire referential English labels when tutored with videotapes displayed on CRT screens if (1) socially isolated, (2) reward for attempted labels is possible, (3) trainers direct birds' attention to the monitor, (4) live video feed avoids habituation, or (5) one trainer repeats labels produced on video and rewards label attempts. Because birds learned referential labels from live tutor pairs in concurrent sessions, we concluded that video failed because input lacked live social interaction and modeling (Pepperberg, 1999). Recent studies (e.g., Ikebuchi & Okanoya, 1999), however, suggest that standard CRT monitor flickering could instead have prevented learning. Using an LCD monitor, we found that eliminating flickering did not enable birds to learn from video under conditions of limited social interaction. Results emphasize the role of social interaction in referential label learning and may generalize to other systems (e.g., disabled children).

**8:20–8:35 (282)**

**Bases for Strategy Choice and Strategy Transitions in Binary Classification Tasks.** LYLE E. BOURNE, JR., ALICE F. HEALY, JAMES A. KOLE, & WILLIAM D. RAYMOND, *University of Colorado*—In a binary classification task with no strategy pretraining, we found transitions from a rule-based to a memory-based strategy and vice versa, with the type of strategy eventually dominating, depending on the difficulty of the operative rule and on the salience of the cue to use that rule. With pretraining on the operative rule, rule use was initially high even with a new set of stimuli. However, the frequency of memory-based performance increased with practice. When the rule cue was in a salient position, subjects were equally divided between rule and memory strategies at the end of practice. When the cue was in a nonsalient position, the memory strategy became dominant. The results are relevant to contemporary theories of cognitive skill acquisition that assume a transition with practice from rule-based to memory-based performance.

**8:40–8:55 (283)**

**A Connectionist Model of Reading Multidigit Numbers.** TOM VERGUTS & WIM FIAS, *Ghent University*—Adults can easily switch between numerical formats (Arabic and verbal); this is called *transcoding*. Models of transcoding typically posit a set of transcoding rules; these rules produce frames and numbers to fill the slots of the frames, depending on the input stimulus at hand. We follow an alternative modeling strategy and train a connectionist model to transcode from Arabic to verbal notation. The model starts from a small set of lexical primitives (e.g., one, two) but is otherwise undedicated prior to training. After training, the model can name all numbers from 1 to 999. It generalizes to new numbers because the nodes in the network come to encode approximate rules, and these approximate rules apply also to numbers that the model has never seen before. The model accounts for response time data presented in the literature, as well as for data from patients with transcoding deficits.

**9:00–9:15 (284)**

**A Revised Identical-Elements Model of Multiterm Fact Representation: The Case of Arithmetic.** TIMOTHY C. RICKARD, *University of California, San Diego*—The identical elements model proposed by Rickard, Healy, and Bourne (1994) addresses the asymptotic organization of multiterm facts. Rather than assuming a single holistic representation for each fact (e.g., 4, 7, 28,  $x$ , /), it poses a separate representation for each unique combination of stimulus and response elements, ignoring variations in format of presentation, operation symbol, and spatial order when not relevant to the answer. The revision, which allows for reverse associations, is more closely integrated with the memory literature, accommodates previously discrepant findings, and correctly predicts practice and transfer results in simple multiplication, division, and factoring tasks. Prospects for generalization and application will be discussed.

**9:20–9:35 (285)**

**Modality-Specific Subsystems for Statistical Learning.** CHRISTOPHER M. CONWAY & MORTEN H. CHRISTIANSEN, *Cornell Uni-*

versity (read by Morten H. Christiansen)—We investigated whether a single domain-general mechanism, as opposed to separate modality-specific ones, underlies artificial grammar learning. Using a crossover design, we created two distinct grammars that have similar properties (e.g., sequence length) but that generate nonoverlapping sets of items. Participants observed training exemplars from both grammars, randomly intermixed. For each participant, exemplars from one grammar were visual (color sequences), and those from the other grammar were auditory (tone sequences). After 12 min of exposure, participants judged the grammaticality of novel sequences. Half of the participants were tested on visual and half on auditory instantiations of the test set. Crucially, the ungrammatical items for one grammar were grammatical with respect to the other grammar, and vice versa. Participants successfully discriminated grammatical from nongrammatical items, relative to the modality in question, revealing independent learning of both the auditory and visual grammars. This suggests the existence of separate modality-specific subsystems for statistical learning.

#### 9:40–9:55 (286)

**The Representational Nature of Chord Learning.** ELIOT HAZELTINE, *University of Iowa*, PAUL L. APARICIO, *MIT*, & RICHARD B. IVRY, *University of California, Berkeley*—To examine the representational nature of motor learning, we used a task requiring simultaneous keypresses with three fingers, similar to the production of chords on the piano. If the benefits of learning are related to the retrieval of individual stimulus–response mappings, performance should depend on the frequencies of the individual responses comprised by each chord. Alternatively, learning may involve the encoding of configural information concerning the relationship between the chord elements. In Experiment 1, training was restricted to a subset of the 120 possible three-element chords. Test blocks included the practiced chords, chords that consisted completely of practiced elements but themselves were novel (reconfigured), and chords that contained a new element (new). Practiced chords were performed more quickly than reconfigured chords, which were performed faster than new chords. This pattern suggests that learning occurs on both the element and the configural levels. Additional experiments tested whether learning was perceptual or motoric.

#### Visual Processing of Complex Pictures Regency, Sunday Morning, 8:00–10:00

Chaired by Michael Kubovy, *University of Virginia*

#### 8:00–8:15 (287)

**Behavioral and Electrophysiological Evidence for Configural Processing in Fingerprint Experts.** THOMAS A. BUSEY, *Indiana University*, & JOHN R. VANDERKOLK, *Indiana State Police Laboratory, Fort Wayne*—Visual expertise in fingerprint examiners was addressed in one behavioral and one electrophysiological experiment. In an X–AB matching task with fingerprint fragments, experts demonstrated better overall performance, immunity to longer delays, and evidence of configural processing when fragments were presented in noise. Novices were affected by longer delays and showed no evidence of configural processing. In Experiment 2, upright and inverted faces and fingerprints were shown to experts and novices. The N170 EEG component was reliably delayed over the right parietal regions when faces were inverted, replicating an effect that in the literature has been interpreted as a signature of configural processing. The inverted fingerprints showed a similar delay of the N170 over the right parietal region, but only in experts, providing converging evidence for configural processing when experts view fingerprints. Together the results of both experiments point to the role of configural processing in the development of visual expertise.

#### 8:20–8:35 (288)

**Hemispheric Effects in Self-Face Recognition.** CLARK G. OHNE-SORGE, NICK PALMER, & JUSTIN KALEMKIARIAN, *Gustavus*

*Adolphus College*—We present data from several experiments investigating hemispheric specialization for self-recognition. Researchers have recently addressed this issue with techniques ranging from behavioral responding to neuroimaging during self-recognition, often using stimuli created by morphing together each subject's face with that of a familiar other. Generally, split visual field presentation is used to support inferences about lateralization. Although previous studies have shown changes in response probability (i.e., the classification of a particular stimulus as either self or other) as a function of either visual field or response hand, it has remained unclear whether those changes are due to differences in perceptual sensitivity or decisional bias. The present experiments present individualized morphed stimuli, using the split visual field technique, and employ designs based on the theory of signal detectability to reveal large effects in both sensitivity and in bias. In each case the effect is an interaction between visual field and response hand.

#### 8:40–8:55 (289)

**Facial Identity Adaptation Induced by Reflectance- and Shape-Normalized Antifaces.** ALICE J. O'TOOLE & FANG JIANG, *University of Texas, Dallas*, & VOLKER BLANZ, *Max Planck Institute for Computer Science*—Previous studies have shown that adaptation to the identity of a face produces short-term increases in perceptual sensitivity to a face with opposite feature components. We used a morphing program that operates on laser scans to selectively vary the 3-D shape and the colored surface reflectance of faces. Participants adapted to shape- or reflectance-normalized antifaces and identified similarly normalized anticaricatures—that is, original faces morphed toward the average to make them less distinctive. Antifaces were created using a computationally defined face space by reversing a face's values on all of the feature dimensions. Shape- and reflectance-normalized faces were created in this space by replacing the shape or reflectance, respectively, by the average values. Adaptation to normalized antifaces facilitated the identification of similarly normalized anticaricatures. This finding indicates that adaptation can operate on both the two-dimensional reflectance and the three-dimensional shape of a face independently.

#### 9:00–9:15 (290)

**Abnormal Local and Configural Processing in Developmental Prosopagnosics.** CLAUS C. CARBON, *Freie Universität Berlin*, HELMUT LEDER, *University of Vienna*, JOACHIM E. WEBER, *Charité Universitätsmedizin Berlin*, TILMANN SANDER, *Physikalisch Technische Bundesanstalt*, MARTINA GRUETER, *University of Münster*, & ANDREAS LUESCHOW, *Charité Universitätsmedizin Berlin*—Prosopagnosia is an impairment in the recognition of faces which is known in two variants, developmental (DP) as well as acquired (AP) prosopagnosia. Recently, it was shown that AP can lead to negative face inversion effects, whereas DP often leads to a reduction of the face inversion effect. In two experiments using a simultaneous matching paradigm, we tested 13 patients (15–60 years) suffering from DP that is associated with cognitive malfunctioning but with no macroscopic brain lesions. As a control group, normal participants with an adjusted age range were used. In both experiments, DPs demonstrated increased inversion effects for face stimuli, which contradicts the results of recent face recognition experiments. Moreover, the inversion effects were limited not only to configurally manipulated faces, but also to faces differing in local aspects. These results challenge common theories of using the inversion effect as an indicator for experts' configural processing.

#### 9:20–9:35 (291)

**The Reference Frame of Figure–Ground Assignment.** SHAUN P. VECERA, *University of Iowa*—Although reference frames have been studied extensively in the domain of object recognition, little is known about the reference frame of other visual processes, such as figure–ground assignment. We asked whether figure–ground processes use viewer-centered or environment-centered coordinates. In one set of experiments, regions attached to a ground plane were more likely to

be perceived as figure than were other regions, a result consistent with an environment-centered reference frame. In another set of experiments, the lower-region preference (Vecera et al., 2002, *JEP: General*) followed the orientation of observers who viewed figure-ground displays with either upright or tilted heads (Vecera, in press, *PB&R*). These results support a viewer-centered reference frame. A straightforward account of these two sets of results is that figure-ground processes appear to use a viewer-centered reference frame, assuming that some environmental information, such as the ground plane, are represented in viewer-centered coordinates.

#### 9:40–9:55 (292)

**Proximity, Curvature, and Feldman's Eureka!** MICHAEL KUBOVY & LARS STROTHER, *University of Virginia*—Kubovy et al. (1994) proposed a pure distance model that predicts the perceptual grouping of all dot lattices as a function of interdot distance. We present an expanded stimulus domain: dot-sampled structured grids (DSGs). In addition to dot lattices, DSGs include regular dot patterns that can be perceived as curvilinear groupings of dots. Preliminary experiments showed that observers were more likely to perceptually organize our DSGs into curvilinear groupings than into linear groupings even when relative interdot distances for predominant organizations were equal. We discuss our results in terms of Garner's (1974) inferred stimulus sets and Feldman's (2004) Eureka! hypothesis, which addresses the question, How surprising is a simple pattern? We argue that the curvilinear groupings are more Eureka-worthy than the linear ones and that the Eureka principle may serve as a useful combination of the Gestalt idea of prägnanz and Bayesian theories of perception.

#### Recognition Memory II

Nicollet A, Sunday Morning, 10:15–11:55

Chaired by Douglas L. Hintzman, *University of Oregon*

#### 10:15–10:30 (293)

**The Effects of Biological System Variables on Gender Differences in Cognition.** ELLIOT HIRSHMAN, *George Washington University*, PAUL MERRITT, *Texas A&M University*, & WHITNEY WHARTON, BETHANY STANGL, SARAH BENNETT, & LAURIE HAWKINS, *George Washington University*—Meta-analyses examining gender differences in cognition have demonstrated evidence of male advantages on tests of visuospatial processing and female advantages on tests of episodic memory. These effects, however, have varied dramatically in size across empirical studies and, in numerous cases, have failed to replicate. We consider the hypothesis that differences in biological system variables and the differing effects of these variables on cognition across gender may contribute to the variability in empirical results. Our experiment examines the effect of gender on the mental rotation, recognition memory and negative-priming tasks, while measuring percentage of body fat and increases in heart rate following exercise, two general measures of body composition and fitness, respectively. Our statistical analyses examine the effects of incorporating these biological system variables on gender differences in cognition. Our results demonstrate that gender differences on all tasks become more pronounced when biological system variables are incorporated into statistical analyses.

#### 10:35–10:50 (294)

**Effects of Semantic Context on Memory for Verbs and Nouns.** ALAN W. KERSTEN & JULIE L. EARLES, *Florida Atlantic University*—Kersten and Earles (2004) demonstrated that recognition memory for the verb in an intransitive sentence (e.g., *the ball bounced*) is strongly impacted by a change from encoding to retrieval in the noun that accompanies it. The effect of changing the verb on memory for the noun was much smaller. The present research was designed to test the generality of this phenomenon. Experiment 1 examined memory for nouns and verbs in simple commands (e.g., *exit the building*), in which verbs precede rather than follow nouns. Memory for verbs was again

more strongly impacted by changes in nouns than memory for nouns was impacted by changes in verbs. Experiment 2 compared memory for verbs, basic-level nouns, and superordinate nouns. Changing the verb had a larger effect on memory for superordinate nouns than on memory for basic-level nouns, but changes in basic-level nouns had an even larger effect on memory for verbs.

#### 10:55–11:10 (295)

**Cue Asymmetry in Source Discrimination Versus Item Recognition.** IAN DOBBINS, DANIEL MCCARTHY, & SANGHOON HAN, *Duke University*—We examined cue symmetry during item and source recognition. During item recognition, accuracy was similar regardless of whether cues required yes responses to old (old item?) or new (new item?) items for both shallowly and deeply encoded targets. In contrast, source accuracy was affected such that shallow cuing (alphabetic task?) resulted in poorer discrimination than did deep cuing (concreteness task?) for the same items. Lengthening response time did not eliminate the effect, but providing both source options (alphabetic or concreteness task?) did. Such cuing effects may result from strategic monitoring differences (Marsh & Hicks, 1998), or they may reflect differential contributions of task recollection and item memory. Increasing rehearsal of shallow items relative to deep, such that item recognition was equated, rendered source accuracy insensitive to cue direction. This suggests that source-cuing effects may result from nonstrategic, asymmetric influences of item memory and that source memory may often be multidimensional.

#### 11:15–11:30 (296)

**Mirror Effect Absent and List Strength Effect Present in Recognition.** ROBERT L. GREENE, *Case Western Reserve University*—In experiments testing episodic recognition for two stimulus classes, the class with the higher hit rate tends to have the lower false alarm rate (mirror effect). In experiments varying strength of list items, recognition of one item is unaffected by the strength of the others (null list strength effect). The presence of mirror effects and the absence of list strength effects are often seen as being regularities of recognition. However, these patterns depend on the specific manipulations studied. Experiments are reviewed that fail to show mirror effects with manipulations such as the emotional valence of sentences. In addition, vocalization can be shown to cause a list strength effect in recognition.

#### 11:35–11:50 (297)

**Time Versus Items in Judgment of Recency.** DOUGLAS L. HINTZMAN, *University of Oregon*—In the numerical judgment of recency (JOR) task, subjects are asked to judge how many items have intervened since the test item was previously presented. Two experiments were done to determine whether the basis of JOR is the age of the memory (i.e., time) or the number of intervening items. Subjects went through a long, continuous list, made up of alternating fast blocks and slow blocks, but the block structure was disguised by probabilistic selection of a short or a long ITI. In both experiments, JOR was found to be a simple function of time, with no added contribution from the number of items. Apparently, JOR is based on some age-related property (or properties) of the trace itself. Time permitting, other evidence on this issue will be presented.

#### Processing Word Meanings

Nicollet BC, Sunday Morning, 10:15–11:35

Chaired by Debra Titone, *McGill University*

#### 10:15–10:30 (298)

**Listeners Use Thematic Roles to Anticipate Event Participants.** JULIE E. BOLAND, LILLIAN CHEN, & JESSICA COOKE, *University of Michigan*, & ALICIA SEIFERS, *Northwestern University*—Two experiments investigated how verb meaning is accessed and used during comprehension of spoken sentences. We measured the probability of looking at a picture, representing a potential argument, after

verb onset before the argument was explicitly mentioned. Experiment 1 compared transitive-biased and intransitive-biased verbs for which the semantic structure always entailed a theme (e.g., *food* is entailed by *John ate*). Transitive and intransitive bias conditions produced an equally high proportion of anticipatory looks to a potential theme, as compared with an intransitive control. Experiment 2 examined how linguistic context disambiguates verb meaning. The critical verbs (e.g., *pass*) had both a three-argument meaning (*X passed Z the Y*) and a two-argument meaning (*X passed Y*). Listeners made anticipatory looks to a potential recipient only in linguistic contexts that supported the three-argument meaning. We discuss how listeners build semantic representations incrementally, using verb argument structure and the syntactic/semantic interface.

#### 10:35–10:50 (299)

**Accessing Grammatical Gender in a Second Language: Native Language Influences.** CHERYL A. FRENCK-MESTRE, ALICE FOUCART, & EMILIA CAETANO-NUNES, *CNRS and Université de Provence*—In two recent experiments, Guillemon and Grosjean (2000) and Holmes and Dejean de la Bâtie (1999) provided evidence that native English speakers do not have immediate access to gender when processing nouns in French. The aim of the present paper was to determine the generality of this result to all bilingual learners. That is, would the same results be found when the person's native language had gender marking? This was ascertained in 4 independent experiments with German–French, English–French, and Portuguese–French bilinguals. Both behavioral and ERP results provide evidence that the presence of grammatical gender marking in the native language is essential to attaining grammatical gender in the second language.

#### 10:55–11:10 (300)

**Semantic Relations and Lexical Production.** PATRIZIA TABOSSI, *University of Trieste*, & SIMONA COLLINA, *Istituto Universitario Suor Orsola Benincasa*—Current views hold that a crucial step in the production of a word is the selection of its lemma, occurring through a process of competition. This mechanism is typically invoked to explain the interference effects that semantically related distractors have on the production of a target word in picture-naming studies. However, recent findings have cast doubts on the appropriateness of this interpretation. A series of picture-naming experiments addressed the issue, exploring the effects of different distractors on the production of a target word. Semantic relatedness and levels of categorization of distractors and targets were manipulated. The data revealed a complex pattern of facilitation and inhibition effects. The implications of the results for the interpretation of the semantic effects in picture-naming studies and their implications for current models of lexical production are discussed.

#### 11:15–11:30 (301)

**Comprehending Polysemy Depends on the Semantic Overlap of Distinct Meanings.** DEBRA TITONE, CAROLINA ROMERO, & EKATERINI KLEPOUSNIOTOU, *McGill University*—Studies of polysemy are few in number and contradictory. Some show differences between polysemy and homonymy (Frazier & Rayner, 1990); others show similarities (Klein & Murphy, 2000). Here, polysemous words independently rated to have low, moderate, or high semantic overlap of their distinct meanings were studied using the methods of Klein and Murphy. All words were presented with biased modifiers (*shredded paper*, *liberal paper*), and 61 participants judged their sensibility as a function of cooperating, conflicting, or neutral context. Judgment times for high-overlap words did not vary with context and were uniformly fast. Low- and moderate-overlap words were slow in the neutral and conflicting contexts but fast in the cooperating context. Thus, low- and moderate-overlap polysemous words behave similarly to homonyms, whereas high-overlap words do not. Post hoc linguistic analyses revealed that the majority of high-overlap words were metonymic but the majority of low- and moderate-overlap words were metaphoric or homonymous.

### Psycholinguistics

Nicollet D, Sunday Morning, 10:30–11:50

Chaired by Marc F. Joanisse, *University of Western Ontario*

#### 10:30–10:45 (302)

**Connectionist Landscaping: A Tool for Analyzing and Comparing Localist Models of Language Processing.** MARK A. PITT, WOOJAE KIM, DANIEL NAVARRO, & JAY I. MYUNG, *Ohio State University*—Localist connectionist models are popular in psycholinguistics because of the ability to specify multiple levels of representation and how they interact. The high degree of interactivity between and within levels can make model behavior difficult to understand. Questions such as the following are challenging to answer. What range of behaviors can a model exhibit? What are the consequences of the design choices on model performance? A computational method to help answer such questions will be described and demonstrated in the context of two localist models of speech perception, TRACE and Merge, which differ primarily in the priority given to bottom-up information. Analyses from two testing situations will be presented, one intended to assess their degree of similarity, the other to investigate behavioral changes as a function of bottom-up priority.

#### 10:50–11:05 (303)

**The Role of Phonology and Working Memory in Auditory Sentence Comprehension: Evidence From Children With Specific Language Impairment (SLI) and Dyslexia.** ERIN K. ROBERTSON, MARC F. JOANISSE, AMY S. DESROCHES, & STELLA L. NG, *University of Western Ontario* (read by Marc F. Joanisse)—We compared language deficits in SLI and dyslexia, to test whether language problems in SLI are due to phonological or working memory (WM) impairments or to both. We tested phonology and WM with phoneme elision and nonword repetition, respectively. Although both groups scored poorly on these tests, the SLI group had greater difficulty with nonword repetition, whereas the dyslexics were poorer at phoneme elision. Next, we tested syntactic abilities in three sentence–picture matching experiments. Here again, both groups performed poorly, but the SLI group scored worse overall and was more strongly affected by increased auditory storage demands. Similarly, SLI children scored slightly worse than the dyslexics on two WM tests. Overall, these results suggest that poor sentence comprehension in SLI is related to basic deficits in storing on-line auditory information and reflects either poorer overall phonological abilities or a qualitative difference in these children's underlying deficit, as compared with dyslexics.

#### 11:10–11:25 (304)

**Lexical Tone and Lexical Priming in Spoken Mandarin.** LEI XU & SHARI R. SPEER, *Ohio State University* (read by Shari R. Speer)—Previous studies have shown a processing advantage for segmental information over tone information during the recognition of lexical items in tone languages. We present cross-modal semantic priming experiments comparing the processing of tonally ambiguous and unambiguous words in sentence contexts. Ambiguity is constructed by the operation of a phonological rule, third tone sandhi, whereby the first morpheme of a tone 2–tone 3 sequence may be underlyingly either a tone 2 or a tone 3 word. Listeners heard sentence fragments that ended in a tone 2, sandhi tone 2, sandhi sequence tones 2–3, or tone 3 word. Results show that although sandhi tone 2 syllables differ phonetically from tone 2 syllables, all forms of tone 2 are ambiguous—that is, naming times for visual semantic associates of both the tone 2 and the tone 3 meanings were shorter than those for irrelevant targets. In contrast, naming times for tone 3 items are shorter for visual associates of the tone 3 meaning than for associates of the tone 2 meaning.

#### 11:30–11:45 (305)

**Past Tense Priming: Rules and Exceptions or Phonology and Semantics?** ANETA KIELAR & MARC F. JOANISSE, *University of Western Ontario*, MARY L. HARE, *Bowling Green State University*, &

MARK S. SEIDENBERG, *University of Wisconsin* (read by Mary L. Hare)—Dual- and single-mechanism theories of past tense were tested using cross-modal and masked visual priming in a lexical decision task, at 0- and 500-msec ISIs. Priming effects for regular and irregular verbs were compared with those for pseudoregular forms, which are irregular but overlap with regulars (SLEPT, SOLD). In the cross-modal condition at the longer ISI, priming effects for regulars and irregulars were very similar. In both conditions, pseudoregular and regular words showed similar priming. In particular, priming effects for pseudoregulars in the visual condition at the longer ISI were of similar magnitude to regulars and were significantly different from irregulars. Thus, in contrast to previous studies, we observed priming for both irregulars and regulars; moreover, pseudoregulars behaved like regulars. These findings suggest there is continuity between regulars and irregulars and are consistent with the single-mechanism theory that past tense morphology is emergent from semantic and phonological processes.

**Visual Processes II**  
**Greenway BCD, Sunday Morning, 10:15–11:55**

*Chaired by Judith Avrami, Hebrew University of Jerusalem*

**10:15–10:30 (306)**

**Leaky Accumulator Model for RT, Accuracy, and Neural Firing Data.** ROGER RATCLIFF, *Ohio State University*, & PHILIP L. SMITH, *University of Melbourne*—There has been progress in both psychological modeling and neurophysiology in attempts to understand simple decision processes. The kinds of models used are sequential sampling models of the class of diffusion processes. We present a leaky accumulator model with negatively correlated starting points and discuss how it accounts for standard RT phenomena, including accuracy, correct and error RTs, and their distributions. This model assumes that evidence is accumulated in two separate accumulators to separate decision criteria. We then show how simulated paths in the two accumulators mimic neural firing rate data recorded from buildup cells in the superior colliculus of rhesus monkeys in a brightness discrimination task.

**10:35–10:50 (307)**

**The El Greco Effect: Perceptual Distortion From Visual Cortical Reorganization.** DANIEL D. DILKS, MICHAEL McCLOSKEY, JOHN T. SERENCES, & STEVEN YANTIS, *Johns Hopkins University* (read by Michael McCloskey)—Cortical reorganization resulting from loss of sensory input (e.g., digit amputation, retinal lesions) has been studied extensively in the somatosensory and visual systems. However, little work has considered the perceptual consequences of cortical reorganization. We present evidence from stroke patient B.L., who has damage to the right-hemisphere optic radiations that carry information about the upper left visual field (LVF). B.L., whose primary visual cortex is intact, exhibits dramatic distortion of perceived shape for stimuli in the lower LVF: The stimuli appear vertically elongated. For example, a circle in the lower LVF is misperceived as an upright cigar shape. Behavioral and fMRI studies support the hypothesis that B.L.'s perceptual distortions result from cortical reorganization: The visual cortex deprived of input from the upper LVF has apparently become responsive to stimuli in the lower LVF. These results have implications for understanding the nature and consequences of cortical reorganization in the human visual system.

**10:55–11:10 (308)**

**The Time Course of Identification and Suppression: Immediate Repetition Priming of Words and Faces.** DAVID E. HUBER, *University of Maryland, College Park*—Huber and O'Reilly (2003) proposed a theory of neural processing in which near-threshold presentations result in persistence and possible source confusion, whereas above-threshold presentations are suppressed following their identification. Using immediate repetition priming and forced choice perceptual identification, two new experiments are presented that precisely map out the activation and suppression time course for words and faces.

Regardless of stimulus class, qualitatively similar results are observed. Analyses of individual differences revealed greater suppression effects for subjects with better perceptual abilities. A third experiment demonstrated that this greater suppression exists only for upright faces, but not for inverted faces.

**11:15–11:30 (309)**

**Processing of Chromatic Information by the Visual “Zombie” and “Homunculus.”** BRUNO G. BREITMEYER, HALUK OGMEN, & STEVEN TODD, *University of Houston*—We investigated unconscious and conscious color-priming effects of targets on discriminative responses to the color of a subsequently flashed metacontrast mask. Stimulus parameters were used that yielded either complete suppression of the target's visibility (unconscious priming) or only partial to no suppression (conscious priming). Replicating prior findings, we found that unconscious priming relies on wavelength-specific processing most likely occurring at very early, stimulus-dependent levels of processing (e.g., cortical areas V1/V2 or earlier). In contrast, conscious priming relied on percept- and, thus, color-dependent processing occurring most likely at later cortical stages (e.g., V4). Using these and prior results, we discuss theoretical and methodological implications for studies of unconscious and conscious processing.

**11:35–11:50 (310)**

**A New Conceptualization of Visual Information.** JUDITH AVRAMI, *Hebrew University of Jerusalem*—It is well known that change in the visual field produces salient stimulation and that, thanks to fixational eye movements, change in retinal stimulation occurs all the time. It is not known, however, how such change produces meaningful visual information. Here, I propose that information about the content of the visual field is derived from a combination of retinal activation and the characteristics of the fixational eye movements responsible for that activation, similar to the way distance information is gleaned from depth cues of accommodation and convergence combining the retinal stimulus (sharpest image for accommodation and best-matched binocular stimulation for convergence) and the status of eye muscles (the ciliary muscle for accommodation and the two pairs of lateral and medial recti for convergence). This two-component theory of visual information processing sits well with known facts about the visual system, explains many well-known visual phenomena, and provides a variety of predictions for further research.

**Reasoning in Animals and Humans**  
**Greenway FGH, Sunday Morning, 10:15–11:35**

*Chaired by Teresa A. Treat, Yale University*

**10:15–10:30 (311)**

**Relational Matching by Pigeons.** ROBERT G. COOK, *Tufts University*, & EDWARD A. WASSERMAN, *University of Iowa*—Like primates, can pigeons learn higher order relations about relations discrimination? Four pigeons were trained to relationally match five nonoverlapping sets of 20 colored icons. On any given trial, 16 randomly selected icons from one set were randomly placed in a 4 × 4 grid to form a sample. On *same* trials, all 16 sample icons were identical, and on *different* trials, all 16 were different from each other. After 10 pecks, 16-item *different* and 16-item *same* test stimuli were presented. Both of these were made from an icon set different from the samples. Since no icons were shared between these stimuli, processing of the relations within the sample and test stimuli was required to match the correct alternative. We report that pigeons successfully acquire and transfer this type of discrimination. Its comparative implications for understanding the evolution and mechanisms of conceptual behavior will be discussed.

**10:35–10:50 (312)**

**Seeing Versus Doing: Two Modes of Accessing Causal Models in Rats.** AARON P. BLAISDELL & RAYMOND LO, *UCLA*, KOSUKE SAWA, *UCLA and Japan Society for the Promotion of Science, Nagoya*

& MICHAEL R. WALDMANN, *University of Göttingen*—The capacity of nonhuman animals to reason causally from observational experience has been frequently questioned. We tested whether rats are capable of differentiating between predictions that are based on observed cues (seeing) versus predictions that are based on manipulated cues (doing) after observational learning of a common-cause model. Three types of training trials were presented: (1) Stimulus A followed by Stimulus X ( $A \rightarrow X$ ), (2) Stimulus A followed by sucrose ( $A \rightarrow \text{sucrose}$ ), and (3) simultaneous presentations of Stimulus Y and sucrose ( $Y + \text{sucrose}$ ). Subsequently, levers were made available and Stimulus X or Y was delivered either contingent on leverpressing (doing) or noncontingently (seeing). Reduced nosepoking was observed to Stimulus X in the doing versus the seeing condition, whereas the rate of nosepoking to Stimulus Y was similar in both conditions. These results are evidence for causal reasoning in rats, whose behavior is consistent with the normative predictions of causal Bayes nets.

#### 10:55–11:10 (313)

**Seeing Versus Doing: Two Modes of Accessing Causal Models in People.** MICHAEL R. WALDMANN, YORK HAGMAYER, & BJÖRN MEDER, *University of Göttingen*—The ability to derive predictions for the outcomes of potential actions from observational data has been suggested to be one of the hallmarks of true causal reasoning. We will present experiments showing that people indeed make different predictions from identical observationally acquired causal models, depending on whether they believe that an event within the model has been merely observed (“seeing”) or has been actively manipulated (“doing”). Whereas associative theories often postulate separate learning processes for classical conditioning (“seeing”) and instrumental conditioning (“doing”), the present results show that learners can derive predictions for the outcomes of actions from observational data without having ever undergone an instrumental-learning phase. This competency is remarkable because the predictions for potential interventions were very different from the patterns that had actually been observed. Although associative and probabilistic theories fail, recent developments of causal Bayes net theories provide tools for modeling this competency.

#### 11:15–11:30 (314)

**Attention, Memory, and Correlation Detection Processes in Eating Disorders.** TERESA A. TREAT, *Yale University*, & RICHARD M. MCFALL, RICHARD J. VIKEN, JOHN K. KRUSCHKE, & ROBERT M. NOSOFKY, *Indiana University*—This project examines the link between cognitive processing of weight-related information, relative to facial affect information, and clinically significant eating disorder symptoms among 255 undergraduate females. Prior work by the authors has demonstrated that high-symptom women attend relatively more to body size information than to facial affect information depicted in photographs of undergraduate women, when compared with controls. The present research extends this work by examining memory for body size and affect, as well as their perceived covariation. Relative to controls, high-symptom women showed increased attention to body size, decreased attention to and impaired memory for affect, and greater sensitivity to the manipulated covariation between affect and body size. All participants showed a significant bias toward perceiving the covariation information in a stereotypically consistent direction. Ultimately, obtaining a more valid and detailed description of the role of cognitive processing in eating disorders should contribute to the development of more effective treatments for them.

#### Individual Differences

#### Regency, Sunday Morning, 10:15–11:55

Chaired by Ira H. Bernstein, *University of Texas, Arlington*

#### 10:15–10:30 (315)

**What Psychology Majors Know (and What They Don't).** LEWIS BARKER, *Auburn University*—Accrediting agencies are increasingly interested in measuring what college graduates know. Reported here is

a new psychology majors assessment test based on Stanovich's print exposure (PE) test of literacy. Majors were simply asked to discriminate between 50 common psychology terms (i.e., *chunking*, *attachment*, *fundamental attribution error*) and 50 psychological-sounding foils (*hapless motivation*, *unsystematic sensitization*, *circadian movement*). Psychology terms were key terms selected from each of 16 chapters of introductory texts. Foils were also based on terms from these chapters. The results were analyzed within a signal detection framework. The lowest performers scored relatively high on psychology terms, but relatively poorly on foils. Students who performed best not only made more correct responses to psychology terms, but also had fewer false alarms (i.e., identified fewer foils as real psychology terms). Correlations of test performance with standardized tests and pre- and posttest comparisons will be discussed within the theoretical framework of discrimination training.

#### 10:35–10:50 (316)

**Gender Differences in Leadership Expectations.** GEIR KAUFMANN, ANNA METTE FUGLSETH, & KJELL GRÖNHAUG, *Norwegian School of Economics and Business Administration*—The ongoing discussion on glass ceiling effects on the advancement of women into senior management positions concentrates almost entirely on external barriers. This paper addresses the supplemental effects of internal barriers. We introduce the novel suggestion that a significant ingredient in the glass ceiling phenomenon is due to gender differences in expectations regarding personal qualifications needed to fill leadership positions. Three experiments, one randomized between subjects and two counterbalanced within subjects, were designed to test the hypothesis that women will set the required level of personal qualifications higher than their male counterparts. Striking support for this hypothesis was found in all three experiments. Even when women rated themselves equally or more competent than males, our results show that they still did not meet their own required level of qualifications to fill leadership positions. Suggestions are made for further research of this phenomenon within an experimental methodological framework.

#### 10:55–11:10 (317)

**Order Effects in Belief Updating: Different Strokes for Different (Handedness) Folks.** JOHN D. JASPER, STEPHEN D. CHRISTMAN, & J. SCOTT KUNZLER, *University of Toledo*—The order in which information is received alters the evaluation of causal hypotheses. Specifically, research suggests that the last piece of information has the greatest impact on the evaluation and that the difference in subjective value between two pieces of information is the primary factor influencing the magnitude of this recency effect. The present experiment explored individual differences in this phenomenon. One hundred fifty-six participants were given two hypothetical scenarios and related causal hypotheses accompanied by two pieces of additional information and were asked to revise their belief in each hypothesis as information accumulated. Results confirmed predictions that (1) mixed-handers show a larger effect with two pieces of inconsistent weak information and (2) strong-handers show a larger effect with strong and weak pieces of consistent information. Mixed-handers' susceptibility to weak persuasive arguments and a belief-updating theory centered around the communication between the two halves of the brain are used to account for these data.

#### 11:15–11:30 (318)

**Influence of Body Weight Loss on Aggressiveness.** SÉBASTIEN PARADIS, *Université Laval*, MARTIN J. RAMIREZ, *Universidad Complutense de Madrid*, & MICHEL CABANAC, *Université Laval* (read by Michel Cabanac)—At a time when obesity is increasingly prevalent, many people are trying to control their body weight through dieting. Concern over the possible impacts of weight loss on violence and aggressiveness led to the present study. One hundred fifty participants anonymously completed two questionnaires assessing their aggressiveness, age, sex, diet, recent changes in body weight, and reasons for the body weight changes. In comparison with controls, an increased level of aggressiveness was reported by participants who

had deliberately lost weight, but not by those who had lost weight involuntarily (passive weight-losers). The increase was stronger for hostile aggression than for instrumental aggression and is likely due to the discomfort associated with opposing one's body weight set point.

**11:35–11:50 (319)**

**Item Response Theory as a Strength Model.** IRA H. BERNSTEIN,

*University of Texas, Arlington*—Signal detection theory made its formal debut as a psychological model 50 years ago. Depending upon what is considered to be the first such model, item response theory has been used to study individual differences for at least as long. This presentation uses a measure of depression, the Quick Inventory of Depressive Symptomatology, to illustrate linkages between the two approaches, since both are strength models.

## POSTER SESSION I

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

## • MOVEMENT PERCEPTION •

(1001)

**Catching Fly Balls That Change Size.** FRANK T. J. M. ZAAL, *University of Groningen*, & REINOUD J. BOOTSMA & CATHY CRAIG, *University of the Mediterranean*—For an outfielder on a baseball field who sees a ball flying at him along the sagittal plane, the rate of change of the speed of the ball's projection on a flat image plane specifies whether he needs to start running backward or to the front. Previous research has indicated the use of this so-called Chapman strategy in running to catch fly balls. The fact that the projection of the approaching fly ball is not only rising on the image plane but also expanding should be immaterial in this reading of the Chapman strategy. To assess the role of optical expansion, we had observers judge the passing side of simulated balls that could grow or shrink in size. Our manipulation of optical expansion affected the judgments: Compared with balls of constant size, growing balls seemed to pass further to the front, and shrinking balls seemed to pass more backward.

(1002)

**Judgment of Glide Slopes by Untrained Observers.** DAVID L. CARPENTER, ANGELA M. BURDICK, & ELIZABETH A. CAMPBELL, *St. Bonaventure University*—Training glider pilots to make critical judgments in landing requires considerable skill in judging the glide slope to the intended touchdown point. A training program advocated by the Soaring Society of America provides a plan for training student pilots to judge glide slopes, but no scientific basis could be found for this program. To determine baseline proficiency for such judgments, 30 college students made three judgments of the angle of slope to each of five touchdown points on the floor that bracket the optimal glide slope. Errors were significant for each of the slopes, and 99% confidence intervals failed to encompass the actual slopes. Thus, untrained observers are unable to adequately perform this task without training to correct the consistent overestimation of slope angle. The failure to make accurate judgments is consistent with the conclusions of a previous study using a different variation of the task.

(1003)

**Fitts's Law Holds for the Perception of Action.** MARC GROSJEAN & GÜNTHER KNOBLICH, *Max Planck Institute for Human Cognitive and Brain Sciences*, & MAGGIE SHIFFRAN, *Rutgers University*—The way speed and accuracy trade off in human movement is well described by Fitts's law. The aim of this study was to determine whether this law also holds for the perception of movement. Participants were shown displays of a person moving at various speeds between two targets that could vary in amplitude and width and were asked to judge whether the person could perform such movements without missing the targets. Perceived movement times, defined in terms of the speeds at which participants provided an equal proportion of "possible" and "impossible" judgments, were successfully predicted by the index of difficulty of the movements, as stated by Fitts's law. Two subsequent experiments showed that this law also holds for the perception of non-human objects that resemble the human body, but it does not affect the perceived speed of human movement. These findings are consistent with an action-simulation account of action perception.

(1004)

**Visual Recognition of Actions: Time Matters.** GORANA POBRIC & RAFFAELLA I. RUMIATI, *SISSA, Trieste* (sponsored by Raffaella I. Rumiati)—The aim of this study was to assess whether the visual recognition of actions is influenced by familiarity, internal representation, type of encoding, and relative frequency of seen meaningful (MF) and meaningless (ML) actions. A visual recognition paradigm was employed in three experiments, and both accuracy and the reaction times were measured. The results indicate that participants are sensitive to

the content of actions (MF and ML), as well as to their relative frequency. Recognition memory performance was found to be a function of the study time; hence, a significant increase in recognition memory was observed only after several repetitions of stimuli at study. With increased familiarization, a dissociation between implicit (RTs) and explicit (recognition) memory has been observed. Overall, the results provide an empirical dissociation between explicit and implicit memory measures. The findings are discussed within the framework of a two-route cognitive model for imitation (Rumiati & Tessari, 2002).

(1005)

**Depth Order Relationship in Stereo-Motion Stimuli.** MASSIMILIANO DI LUCA & FULVIO DOMINI, *Brown University*, & CORRADO CAUDEK, *University of Trieste* (sponsored by Steven Sloman)—This study explores the combination stereo and motion cues to depth by investigating whether the perceived depth order of two dots could be reversed as a function of surrounding stimulus information. Observers indicated which of two dots presented within a 3-D structure appears closer. The results indicate different depth order for different surrounding conditions. This finding is consistent with the predictions of the intrinsic constraint (IC) model, according to which the visual system uses the linear relation between horizontal disparity and motion of the points of a rigidly rotating object (identifying the IC line) to compute depth. Points that have a ratio between velocity and disparity that is different from the ratio of these signals from the surrounding points are considered as noisy perturbation of their projection on the IC line. Their depth is determined by projecting them on the IC line, and it is, therefore, affected by the surrounding structure.

(1006)

**Bias for Auditory Looming Diminished With Increasing Velocity.** JOHN G. NEUHOFF, *College of Wooster*—Listeners exhibit a perceptual bias to hear looming sound sources as closer than they actually are. This bias for auditory looming could provide a selective advantage by giving advanced warning of the approaching source. In the present work, it is shown that this anticipatory bias breaks down as the source velocity increases. Specifically, as the source velocity exceeds that which might likely be produced by a terrestrial organism, the anticipatory bias is diminished. Three-dimensional binaural recordings of looming sound sources were synthesized, and listeners made auditory time-to-arrival estimates of looming sources. The results indicate a specific velocity range in which the bias for auditory looming occurs.

(1007)

**Mona Lisa's Eyes: No Compensation for Perceived Gaze Direction in Pictures.** MELANIE LUNSFORD & SHEENA ROGERS, *James Madison University*, & LARS STROTHER & MICHAEL KUBOVY, *University of Virginia*—Mona Lisa's eyes follow a moving observer. We report three experiments exploring this uniquely pictorial phenomenon. Perceived gaze direction was measured with a live and a pictured model (Experiment 1). We introduced changes in picture surface slant and either allowed unrestricted viewing (Experiment 2) or removed surface cues with aperture viewing (Experiment 3). Information for the slant of the picture surface has been hypothesized to trigger a compensation mechanism that corrects for surface slant. We found that gazes directed toward the camera pivoted with picture rotation and followed the observer. Gazes not directed toward the camera pivoted less. Availability of surface cues did not influence the effect of rotation on perceived gaze direction. We conclude that there is no evidence that the phenomenon is due to a compensation process. Further research is needed to determine whether compensation occurs in the perception of depicted 3-D objects in similar situations.

## • SPATIAL COGNITION •

(1008)

**Human Spatial Reorientation: Evidence From Dual-Task Paradigms.** KRISTIN R. ROBLER & NORA S. NEWCOMBE, *Temple*

*University*—After disorientation, human adults reorient within a symmetric geometric environment by using nongeometric information as well as the shape of the surrounding space, whereas children younger than 6 years do not. The hypothesis that use of features is due to language has been supported by findings that human adults behave like children when reorienting while performing a linguistic shadowing task (Hermer-Vazquez, Spelke, & Katsnelson, 1999). We conducted a replication of this experiment, together with a condition involving more explicit information regarding the nature of the task. Successful reorientation was more common in the explicit condition than in the exact replication, although above chance even in the latter. These results provide evidence against the idea that language is necessary to overcome the encapsulation found among children and rats when they are trying to integrate geometric and nongeometric information.

(1009)

**Distance Estimation in Real and Virtual Environments.** JODIE M. PLUMERT, JOSEPH K. KEARNEY, & JAMES F. CREMER, *University of Iowa*—Two experiments compared distance perception in real and virtual environments. In Experiment 1, people made time-to-walk estimates for targets between 20 and 120 ft away in real and virtual environments. The real environment was a large grassy lawn in front of a university building. We replicated this scene in our virtual environment, using a large-screen immersive display system. People underestimated time to walk in both environments for distances of 60 ft and beyond. However, time-to-walk estimates were virtually identical across the two environments. In Experiment 2, 10- and 12-year-old children and adults estimated time to walk in real and virtual environments both with and without vision. Time-to-walk estimates were virtually identical in the two environments for children and adults both with and without vision. We conclude that distance perception may be much better in virtual environments involving large-screen immersive displays than those involving head-mounted displays.

(1010)

**The Integration of Spatial Information: Aging and Working Memory.** DAVID E. COPELAND, *University of Southern Mississippi*, & GABRIEL A. RADVANSKY, *University of Notre Dame*—This study examined younger and older adults' ability to integrate spatial descriptions. The task was based on one used by Ehrlich and Johnson-Laird (1982), in which people were given either continuous or discontinuous descriptions of a spatial layout of four items. The experiments used both verbal descriptions and spatial diagrams for presentation. Relative to younger adults, older adults had greater difficulty with integration, particularly for the discontinuous descriptions. The relation of performance to working memory span for both age groups was also considered.

(1011)

**Egocentric Reference Frames in Spatial Memory: Head Versus Body.** DAVID WALLER, ADAM RICHARDSON, & YVONNE LIPPA, *Miami University*—It is generally accepted that the representation of a spatial layout relies heavily on egocentric reference systems; however, the bases for these systems (e.g., retina, head, or body based) have not yet been fully examined. To determine the relative importance of head- and body-based reference frames, we manipulated the disparity (00, 720, 1440) between the facing direction of the head and the body while participants learned an array of objects. Subsequent judgments of relative directions among objects in the array were faster and more accurate from imagined orientations that had been head aligned during learning than from orientations that had been body aligned. Nonetheless, there was a small effect of body alignment that may be enhanced by the task demands during learning or testing.

(1012)

**The Role of Path Information in Visual and Proprioceptive Spatial Learning.** NAOHIDE YAMAMOTO & AMY L. SHELTON, *Johns Hopkins University*—Investigating similarities and differences among

different modalities of spatial learning is critical for developing a comprehensive theory of spatial memory. We have demonstrated that visual and proprioceptive spatial learning yield comparable memories for room-sized layouts (Yamamoto & Shelton, in press). However, in the previous study, visual learning involved simultaneously viewing objects, whereas proprioceptive learning involved experiencing them sequentially along paths. The present study investigated the role of path information in visual and proprioceptive learning. We compared learning individual object locations (no-path condition) with learning the relative locations of objects along paths (path condition; object pairs shown simultaneously or linked by movement). Memory performance was impaired for the no-path condition relative to the path condition, but largely for proprioceptive learning. The results suggest that path information may be more important for proprioceptive learning than for visual learning, providing initial clues to properties that distinguish spatial learning from different modalities.

(1013)

**Capacity Limits in Spatial Updating.** ERIC HODGSON & DAVID WALLER, *Miami University*—Spatial updating is the act of keeping track of one's position and orientation relative to local landmarks and obstacles when moving through an environment. We examined capacity limits in spatial updating in a common intentional learning paradigm. Participants learned the locations of 4, 6, 8, or 10 target objects and then pointed to them while blindfolded, both before and after a small amount of self-rotation. Results showed an increase in mean pointing error after rotation; however, this effect was constant at each set size. Further research investigated capacity limits of spatial updating in an incidental learning paradigm. Implications for the memory systems used in human spatial updating are discussed.

(1014)

**The Interface Between Egocentric and Allocentric Systems in the Retrieval of Spatial Information.** M. JEANNE SHOLL & RYAN J. KENNY, *Boston College* (sponsored by M. Jeanne Sholl)—The self-reference system model of retrieval distinguishes between an egocentric retrieval system and an allocentric representational system in spatial memory. Three experiments were conducted that used an interference paradigm to test predictions made by the self-reference system model, which posits an egocentric system that codes location both in perceptual-motor space and in representational space. The findings showed that orientation to the task environment interferes with the accessibility to relative direction under two retrieval conditions: when the imagined viewpoint is 180° misaligned with the actual viewpoint and when the actual body location is anterior to the imagined body location. Although consistent with the self-reference system model of retrieval, the observed interference pattern was not predicted by the model. More research is needed to articulate the constraints characteristic of the interface between an egocentric encoding and retrieval system and an allocentric representation system in spatial memory.

(1015)

**Individual Differences in the Representations of Novel Environments.** MICHAEL A. MOTES, OLESSIA BLAJENKOVA, & MARIA KOZHEVNIKOV, *Rutgers University*—We conducted two experiments to investigate the relationship between mental representations of a novel environment and visual/spatial abilities. Eighty participants traversed a novel route in either a real or a virtual environment and drew a sketch map of the route. After traversing the route and drawing the sketch maps, the participants completed small-scale visual/spatial ability tasks (spatial visualization and visual memory) and route knowledge tasks (route retracing, shortcut finding, route tracing on a map, orienting to unseen landmarks, and landmark-based route direction identification). We classified participants' sketch maps as landmark-, procedural-, or survey-type maps. Our results showed that small-scale spatial visualization ability predicted map types (i.e., higher spatial visualization scores were associated with survey-type maps) but that visual memory did not. Route knowledge also predicted map types

(i.e., accurate route retracing, route tracing on a map, orienting to landmarks, and landmark-based route direction identification were associated with survey-type maps).

(1016)

**Representation of Orientation in Williams's Syndrome.** DANIEL D. DILKS, *Johns Hopkins University*, JASON E. REISS, *University of Delaware*, BARBARA LANDAU, *Johns Hopkins University*, & JAMES E. HOFFMAN, *University of Delaware*—Williams's syndrome (WS) is a rare genetic disorder, characterized by relatively intact language and profound spatial cognitive impairments. For example, WS individuals are "severely deficient" on Benton's Judgment of Line Orientation Test. We asked whether this deficiency reflected abnormal perception of orientation or task-specific demands in the Benton test. WS children and adults were compared with normal children and adults on their ability to match line orientations when presented one at a time. The Benton line test was also administered. Despite poor Benton scores, WS performances on the matching task clustered around the target orientations, but they were more broadly tuned than those of normal mental-age-matched children or adults. This broad tuning was also found in normal 4-year-old children, suggesting that WS orientation perception may reflect developmental delay rather than qualitatively abnormal representation of orientation.

(1017)

**Touchscreen Studies of Landmark and Beacon Use in Young Children.** JENNIFER E. SUTTON, *University of Western Ontario*—Although it seems that the ability to use information from distal landmarks to search for a goal is acquired sometime in early childhood, few experiments have compared the use of landmark cues and the earlier-acquired ability to use beacon cues in a search task. In the present experiments, 2- to 4-year-olds played a hide-and-seek game presented on a touchscreen. The hiding place on half the trials was a distinctive item (beacon trials) and, on the other half, was one of many identical items that was near something distinctive (landmark trials). All three age groups performed well on beacon trials, but 2-year-olds' accuracy on landmark trials was influenced by the number of identical hiding places present on the screen. The data confirm early acquisition of beacon use in search tasks and suggest that the encoding of landmark information changes between the ages of 2 and 4.

(1018)

**Using a Directional Stroop Task to Assess Spatialization of Concepts.** WILLIAM LANGSTON, *Middle Tennessee State University*—Some theories of text comprehension assume that many concepts (including abstract, apparently nonspatial concepts) contain an explicit spatial component. The purpose of this research was to develop a methodology to assess the extent to which spatialization is a component of concepts. Stroop interference has been used to measure automatic activation of schema knowledge (e.g., spider phobias). This research used a directional Stroop task. Words were written at the top, bottom, left, or right of a box, and participants named the words' locations. One set of words provided explicit interference, one set of words had a conventional association with top and bottom, and one set of words had an association with top and bottom via an orientational metaphor. Results are that there is Stroop interference only in the explicit interference condition. These results have implications for the accessibility of spatial concepts in text comprehension.

(1019)

**Effects of Object Size, Location, and Background Gradient on Boundary Extension.** CARMELA V. GOTTESMAN, *University of South Carolina*—In mental representations of scenes, viewers include layout that was not visible in the view but that was likely to exist outside the view's boundaries (boundary extension). These extrapolations are evident both in explicit memory and in priming. More extension is consistently obtained for close-ups than for wide-angle views. In prior studies, view was confounded with object size and location—

that is, close-ups depict larger objects in the foreground. This study examined the relative effects of object size and distance, as indicated by the background's texture gradient and the object's height in the visual field. More extension was obtained for larger than for smaller objects. Independently, a larger texture gradient yielded more extension than did a smaller gradient. However, height in the visual field did not influence extension. These results suggest that scene depth influences extrapolation but that this depth may relate more to the surfaces in the scene than to object distance.

• SCENE AND PICTURE PROCESSING •

(1020)

**Top-Down Facilitation in Visual Object Recognition.** ANNETTE M. SCHMID, MARIANNA D. EDDY, & PHILLIP J. HOLCOMB, *Tufts University*—Although theoretical models and recent studies support the importance of top-down facilitation in visual object recognition, details still need to be substantiated. The experiment presented here tests specifically the validity of one model mechanism thought to trigger top-down facilitation (Bar, 2003). Using a masked repetition priming paradigm, we examined the temporal dynamics of the event-related potentials (ERPs) after priming with high, low, and full spatial frequency primes in a simple object decision task. We found an early frontal negativity at 100–250 msec and a posterior positivity at about 300–500 msec, both of which were smaller for target objects preceded by masked primes of the same object as compared with a different object (i.e., a repetition priming effect). Importantly, we also found that the spatial frequency composition of the primes differentially modulated these ERP effects. The implications of these findings for models of object recognition are discussed.

(1021)

**Fixation Duration Is Related to Local Image Statistics During Real-World Scene Viewing.** JAMES R. BROCKMOLE, MICHAEL L. MACK, & MONICA S. CASTELHANO, *Michigan State University*, AUDE OLIVA, *Massachusetts Institute of Technology*, & JOHN M. HENDERSON, *Michigan State University*—Prior research has demonstrated that fixation placement in a scene is related to local image statistics. In this study, we investigated whether another aspect of gaze control, the time spent fixating a given scene region, is also related to the local image statistics available at fixation. We report the results of a new analysis method that allowed us to separate the influence of image statistics on fixation duration from their influence on fixation placement. The results of two experiments demonstrated that fixation durations in real-world scenes are associated with local intensity, contrast, and edge density at the fixated region. These results provide the first direct evidence that gaze control decisions concerning how long to maintain a fixation are related to local image statistics. We conclude that fixation durations, as well as fixation locations, should be considered in stimulus-based models of human gaze control for real-world scene perception.

(1022)

**Effects of Distance and Texture Size on the Experience of Realism While Viewing a Photograph.** ALBERT YONAS & AMELIA J. ALEXANDER, *University of Minnesota*—When one normally views a photograph of a scene, the experience of a two-dimensional surface is readily available. If frontoparallel photographs of carpet and fabric are viewed from beyond 87 cm for the carpet and 49 cm for the cloth, observers report that the pictures' surfaces appear real and three-dimensional rather than flat. The photograph of the carpet presented information for a depth variation of 4 mm, whereas the photograph of the cloth appeared to vary in depth by 1 mm. The photographs were presented through an elliptical aperture, and the observers were told that they were viewing photographs at the beginning of the study. The displays were so effective that several observers did not believe that they were viewing photographs until they touched them. Apparently, the visual system compares the depth specified by pictorial cues with

the information provided by disparity and weights the binocular information by the perceived distance to the display.

(1023)

**Effects of Hue, Luminance, and Instructions on Perceived Size in Pictures.** ROBERT J. MILLER, MELISSA J. LINSNER, & ASHLEY E. ANKER, *SUNY, Brockport*—Using PowerPoint displays, 38 young adults viewed a photograph that was rich in distance cues. In the picture were a near object (standard stimulus, always black) and a far object (variable stimulus) in one of four hues (green, red, blue, or gray) and one of two luminances (23.5 or 47.0 cd/m<sup>2</sup>). The stimuli were viewed under two instruction conditions, one encouraging size constancy, the other encouraging size perception based on retinal image size. Participants indicated perceived size by adjusting the size of the variable stimulus to match the standard. The instructions condition was highly influential, in the expected direction. There was a significant interaction between hue and luminance: Low luminance stimuli were perceived as larger than high luminance stimuli for gray and green, with the opposite true for red and blue. Likewise, the effect of hue on perceived size varied with luminance.

(1024)

**Detecting Changes to Familiar Scenes.** WILLIAM J. SKAGGS & LUKE J. ROSIELLE, *Louisiana Tech University* (sponsored by Veronica J. Dark)—The purpose of the study was to investigate visual change detection for familiar scenes in long-term memory. College students were shown photographs of familiar locations on their campus, some of which were digitally altered (e.g., a building was deleted from the photograph). The participants' task was to determine what, if any, change had been made to the scene. Although participants were poor at explicitly identifying even large-scale changes, when change detection failed they were able to guess (at a rate above chance) that something was indeed wrong with the scene. The results suggest that people may be sensitive to changes to familiar locations, even if the changes cannot be explicitly reported.

(1025)

**The Role of Saccade Targeting in the Integration of Information Across Eye Movements.** DANIEL A. GAJEWSKI & JOHN M. HENDERSON, *Michigan State University* (sponsored by John M. Henderson)—The presence of location-dependent and location-independent benefits in a parafoveal preview paradigm has been taken as support for the transsaccadic integration of object types and object tokens (Henderson, 1994). An alternative model advanced by Germeys, De Graef, and Verfaillie (2002), however, suggests a critical role for saccade targeting. By this account, location-dependent benefits are derived preattentively, and location-independent benefits are derived only for saccade targets. In the present study, parafoveal preview benefits were examined as a function of saccade landing position in the original naming task, as well as in a buttonpress version of the task. In each case, both location-dependent and location-independent benefits were observed regardless of the saccade target status of the preview object. The findings support the view that two representational systems contribute independently to the integration of information across eye movements and suggest a dependence on the presaccadic allocation of attention, rather than on saccade targeting.

(1026)

**Task Influences on Eye Movement Control in Scenes.** MONICA S. CASTELHANO, MICHAEL L. MACK, & JOHN M. HENDERSON, *Michigan State University*—In a classic study, Yarbus (1967) showed that eye movement patterns differ dramatically with task instructions. However, this demonstration was based on a single participant viewing the same picture for 3 min in each condition. Furthermore, although there is little doubt that top-down processes influence viewing patterns, it is unclear which specific eye movement parameters are affected by task. In the present study, 20 participants viewed color photographs of natural scenes under two instruction sets: visual search

and memorization. Results showed that task influenced the number of fixations and gaze duration on specific objects, but that average saccade length and individual fixation duration remained consistent across tasks. Additional analyses revealed that the image statistics at fixated regions were qualitatively different between the two tasks. The present study demonstrates that task biases the selection of scene regions and aggregate measures of fixation time on those regions.

• MOTOR CONTROL •

(1027)

**The Development of the Internal Body Representation.** CORRADO CORRADI-DELL'ACQUA, *SISSA/ISAS, Trieste*, CLAUDIA SABATANO, *Università Federico II, Naples*, & RAFFAELLA I. RUMIATI, *SISSA/ISAS, Trieste*—The representation of the human body is held to closely reflect distances and proportions of the real body. To investigate changes of such representation during development, an experiment in which 64 children (3, 5, and 7 years of age) were required to judge the distance between two body parts or parts of a building has been carried out. Subjects' responses were a function both of their age and of the distance between the body parts of their real bodies. This pattern was not found for parts of the building. These results suggest that the representation of the human body is homeomorphic with the physical body structure, is already present in 3-year-old children, and changes its size from childhood to adult age.

(1028)

**Bimanual Responses Are Fastest When They Are Slightly Delayed: A Paradoxical RT Effect?** GERHARD RINKENAUER, *University of Tübingen*, & ALAN M. WING, *University of Birmingham*—To investigate how simultaneous and successive movements are controlled, participants were instructed to produce isometric finger flexions with identical target forces and specified interresponse delays (IRDs = 0, 100, and 800 msec). In Experiment 1, IRDs were blocked, and the force pulses were performed either bimanually with the index fingers of the two hands or unimanually with the index and middle fingers of the dominant hand. Experiment 2 employed bimanual force pulses with blocked and mixed IRDs. Both experiments revealed reduced reaction times (RTs) at IRD = 100 msec in comparison with the other IRD conditions and single-response control conditions. Because the RT patterns did not differ between the unimanual and the bimanual conditions in Experiment 1, the response facilitation cannot be explained by changes in interhemispheric communication. The facilitation effect, however, was reduced in the mixed condition of Experiment 2, which suggests that differences in preparation may be partially responsible for the facilitation effect.

(1029)

**Compatibility Interference Within and Across Different Visuo-Cortical Streams.** MATTHEW WIEDIGER & LISA R. FOURNIER, *Washington State University*—When actions are based on stimulus identity, planning and withholding an action to a stimulus (X1) can delay the response execution to a second stimulus (X2) if X2 is response compatible with X1 (compatibility interference, CI). We show that CI occurs when the planned action to X1 is identity based (ventral stream) and when the action to X2 is either identity based or ego location based (dorsal stream). Identity-based actions required a sequence of keypresses, whereas location-based actions required pointing to a stimulus location on a touch screen. Our results suggest that CI can occur with two tasks designed to utilize different visuo-cortical processing streams. Consistent with Stoet and Hommel's (1999) code occupation hypothesis, action planning may temporally integrate all components controlling planned actions, preventing any one of these action components from being readily available for another action until the current plan is executed/abandoned.

(1030)

**Intercepting Moving Targets on Foot: Target Direction Change.** JUSTIN M. OWENS & WILLIAM H. WARREN, *Brown University*

(sponsored by William H. Warren)—Humans walk to moving targets by turning onto a straight interception path that achieves a constant target-heading angle. Warren and Fajen (2004) proposed a dynamical model of interception based on first-order information about target motion, which nulls change in the target-heading angle. The model successfully reproduces human paths when intercepting constant-velocity targets and targets that are accelerating or decelerating (Owens & Warren, *VSS*, 2004). Here, we test model predictions for targets that travel in a constantly changing direction. Participants walk in a 12 × 12 m virtual environment with a head-mounted display (60° H × 40° V) and a sonic/inertial tracking system (latency, 50 msec). Twelve conditions include 3 turning radii, 3 target velocities, and 3 straight-path controls. The model predicts that participants will lag behind changing-direction targets and not anticipate target direction change.

(1031)

**Stimulus Versus Task Information: Dynamic Field Theory of Response Generation.** CLAUDIA WILIMZIG & GREGOR SCHÖNER, *Ruhr-Universität Bochum* (sponsored by Howard Hock)—Dynamical field theory (DFT) is a neurophysiologically based account of movement preparation (Erlhagen & Schöner, *PsychRev*, 109:545, 2002) predicting reaction time in sensorimotor tasks, including the effect of metrics, with more similar movements leading to faster choice reaction times. In contrast, classical paradigms involving categorical responses to continuously varied stimuli have shown the opposite metric effect, with more similar stimuli leading to longer reaction times (distance effect). How may this discrepancy be understood? Within DFT, three factors determine reaction time: (1) the imperative sensory input specifying the appropriate response, (2) the source of prior activation of the possible responses (“task input”), and (3) neuronal interaction generating competition between alternative responses. We show that the sensorimotor metric effect arises when (1) dominates (2), whereas its inverse is observed when (2) dominates (1). In both cases, strong neuronal interaction is crucial for the decision-making process and response stabilization.

(1032)

**Response Preparation in Younger and Older Adults.** KIM-PHUONG L. VU, *California State University, Northridge*, & ROBERT W. PROCTOR & DAVID F. PICK, *Purdue University*—Adam et al. (1998) tested younger and older adults, using a response precuing task for which the responses were keypresses made with the index and middle fingers of each hand. With precuing intervals up to 2 sec, they found a substantial age-related deficit in preparing two fingers on two hands, but not on one hand (p. 870). The present study extended the precuing interval beyond 2 sec, using both a normal hand placement and an overlapped hand placement for which the fingers from the hands were alternated. With both hand placements, older adults benefited at least as much as younger adults from precuing any pair of responses. Although older adults may require longer than younger adults to select and prepare precued responses, they show no deficit in the ultimate level of preparation that can be achieved even for responses on different hands.

(1033)

**Auditory Feedback in Music Performance: Effects of Sequence Structure and Skill.** PETER Q. PFORDRESHER, *University of Texas, San Antonio*—Four experiments examined whether fluency in sequence production relies on congruence between the planned outcomes of actions and auditory feedback. Participants performed unfamiliar melodies from memory on a keyboard while listening to auditory feedback over headphones. During certain performances, perceived pitches were altered but were always presented in synchrony with actions. Disruption from altered feedback (measured in error rates) varied inversely with similarity of the planned sequence of actions to the sequence of feedback pitches. For example, maximal disruption occurred when feedback pitches matched previously produced events, whereas no disruption occurred when feedback pitches were randomly selected or

when feedback was absent. Similar results emerged for pianists and individuals without musical training. These results suggest that sequence production is sensitive to perception/action congruence at an abstract, structural level, and that this coupling is domain general.

(1034)

**Moving and Holding Still: Two Control Systems or One?** RAJAL G. COHEN & DAVID A. ROSENBAUM, *Pennsylvania State University*—Recent research on motor control suggests that distinct neural systems are used to control the maintenance of static positions and to control motion from one static position to another. Yet it is possible that these control regimes are not as distinct as has been assumed. To investigate the possibility that static posture and movement are controlled by a single system, we compared large-scale movements involved in redirecting the hand from one location to another with the tiny movements (including tremors) involved in maintaining static postures between successive large-scale displacements. Analysis of the detailed kinematics of the two classes of movement sheds light on the utility of maintaining the distinction between their respective control regimes.

• FALSE MEMORIES •

(1035)

**An Investigation of False Memory in a Short-Term Memory Task.** JENNIFER H. COANE, J. SCOTT JORDAN, & DAWN M. McBRIDE, *Illinois State University* (sponsored by J. Scott Jordan)—Recent investigations into experimentally induced false memory have employed a list-learning paradigm known as the Deese/Roediger–McDermott (DRM) paradigm. Following study of lists of words associated to a nonpresented lure, participants reliably recall or recognize the critical lure at high rates. False memories are thought to arise as a result of spreading activation from the list items to the lure. Prior studies have indicated that false alarms to lures increase as list length increases (Robinson & Roediger, 1997). McDermott & Roediger (1998) found significant rates of false memory in a single-item, forced-choice recognition test administered immediately after study. The present study employed a short-term memory task to investigate the time course of activation. Participants studied three, five, or seven items from DRM lists and were given an immediate probe. Response accuracy and reaction times were analyzed. As set size increased, false alarms to lures and nonstudied associates increased.

(1036)

**Criterion Shifts in False Recognition.** ANGELA M. MAGUIRE & MICHAEL S. HUMPHREYS, *University of Queensland*, & SIMON DENNIS, *University of Colorado* (sponsored by Michael S. Humphreys)—Three experiments address the false memory effect in recognition. Experiments 1 and 2 examine old–new and forced-choice procedures in the DRM paradigm. Experiment 1 employed both associative and taxonomic categories (length = 1 or 5). Experiment 2 replicated Experiment 1 using taxonomic categories only. Results suggest that category-based criterion shifts play a role in producing the false memory effect in taxonomic categories. Alternatively, the category label may acquire familiarity that adds to item familiarity. Experiment 3 examined the effect of context-based categorization of unrelated items in old–new recognition. The conclusion was that category-level information that is extrinsic to an item either can produce item-by-item shifts in bias or can act as a source of familiarity that is additive with item familiarity. Both explanations remain viable in application to the false memory effect in recognition.

(1037)

**Habitually Accepting Misinformation: Source Attribution Patterns and Individual Differences.** DAVID R. CANN & ALBERT N. KATZ, *University of Western Ontario*—Previous work has identified people who are habitually susceptible to accepting postevent misinformation across testing on three separate events (Tomes & Katz, 1997). The major aim here was to examine the pattern of source attri-

butions made by habitually susceptible and nonhabitual participants. The findings are clear. From a source-monitoring perspective, individuals identified as habitually susceptible demonstrated a different pattern of source attributions than those identified as nonhabitual when both groups accepted misinformation. Moreover, the source attribution patterns for the groups were similar when correctly rejecting misinformation and on items not containing misinformation. Taken together, these findings suggest two possible explanations: Either habitual acceptors of misinformation cannot discriminate between viewed event information and postevent misinformation presented in text, or alternatively, they recognize the misinformation was presented in the text but accept it as an accurate representation of the viewed event.

(1038)

**False Memory and Instructional Biases: A Familiarity Versus Recollection Debate.** DONNA J. LAVOIE & HEATHER K. MERTZ, *Saint Louis University*—Multiple false memory studies have utilized the Deese/Roediger–McDermott paradigm (Roediger & McDermott, 1995) as a methodological tool to understanding false memory and its underlying processes. Some arguments have been made that familiarity-based processing promotes false memory. In this study, we examined the question of whether retrieval instructions themselves may endorse the engagement of familiarity processes, rather than recollection processes, during retrieval. We hypothesized that standard retrieval instructions may increase an individual's reliance on familiarity, consequently increasing the probability of false recognition, as compared with retrieval instructions asking for the identification of items that had not been previously studied. We hypothesized that the latter type of instruction would encourage recollection and more careful item processing and, thus, reduce false recognition. Results generally support our hypotheses and are described in terms of a dual-process model of recognition framework.

(1039)

**False Memories May Not Be in Memory.** BRADLEY J. NEADERHISER & BARBARA A. CHURCH, *SUNY, Buffalo*—These studies explored whether illusory memories for unrepresented associates (critical lures) are attached to the same information as memories for presented items (list items). Using a context-dependent memory paradigm, the first experiment examined whether the critical lures are bound to the learning context in a similar manner as the list items. Although more list items were recalled when the retrieval context was the same as encoding, the illusory memories for the critical lures were not affected by this manipulation. Previous research has shown that source attributions are given to illusory memories (e.g., Payne et al., 1996). The remaining experiments examined the information driving those source attributions. The experiments examined three primary variables derived from theories explaining the false recall effect. Results suggested that none of these predicted variables consistently influenced the source attribution of the critical lure. Implications for theories of false recall are discussed.

(1040)

**Illusions of Inference: Are People With Schizotypal Tendencies More Vulnerable?** SHARON L. HANNIGAN, *St. Lawrence University*, & CATHERINE L. HARRIS, *Boston University*—People sometimes mistake the schematic and backward causal inferences they draw for actual occurrences (Hannigan & Reinitz, 2001, 2003). This study explored whether students who report schizotypal personality traits are more susceptible to illusions of inference than are nontrait controls. Participants completed the Schizotypal Personality Questionnaire and then viewed four thematically coherent action sequences (e.g., shopping). Twenty minutes later, a recognition test was administered consisting of old (previously seen) and new (not seen) slides. New slides set the stage for schematic (high and low schema relevant) and causal (forward and backward) inferential memory errors. Compared with controls, those with schizotypal features had lower mean confidence in old and higher mean confidence in all new conditions,

signaling difficulty discriminating old and new information. Elevated confidence in schema-relevant and backward—but not forward—inference foils in the schizotypal group indicate overreliance on contextual and causal schemas in the face of impoverished episodic memory.

(1041)

**Activation at Test Contributes to False Recognition in Fast Response Conditions.** EMILIANO DIEZ & ANGEL FERNANDEZ, *Universidad de Salamanca*, & MARÍA A. ALONSO, *Universidad de La Laguna*—The extent to which additional activation at the time of a memory test can contribute to false memory in the DRM paradigm was examined in one experiment. The subjects studied lists of words strongly associated to unstudied critical words, as indicated by backward association indexes. In a subsequent final recognition test, the critical words were either preceded by a subset of the studied associates or not preceded by them. The results showed that false recognition was higher when the critical words were preceded by their associates in the testing sequence, but only when fast recognition responses were required from the subjects. These results are consistent with accounts of false recognition that emphasize the roles played by activation and monitoring processes.

(1042)

**Cats, Dogs, and Bones: Eliciting False Memories With Categorical and Semantic Associates.** JENNIFER H. COANE, JOHN C. CUTTING, & DAWN M. McBRIDE, *Illinois State University*—Typically, the DRM task has used lists that combine two kinds of semantic relationships: items from the same semantic category (e.g., for the lure HORSE: zebra, donkey) and items that are typically associated with the critical lure (e.g., for HORSE: saddle, gallop). Buchanan, Brown, Cabeza, and Maitson (1999) used lists that separated these two types of relationships and found that associative lists resulted in more false memories. Our first experiment failed to replicate this effect. We found the opposite result; categorical lists resulted in a higher rate of false memories. Our second experiment used hybrid lists by substituting one third of the categorically related words for associatively related words (matched on backward associative strength) or vice versa. Both kinds of hybrid lists, whether predominantly categorical or associative, resulted in similar rates of false memories. The results are discussed with respect to theories of false memories and theories of lexical representation.

• METACOGNITION •

(1043)

**The Influence of Memory for Prior Test Performance on the Underconfidence-With-Practice Effect.** BRIDGID FINN & JANET METCALFE, *Columbia University*—We investigated the Trial 2 underconfidence effect (Koriat, 1987, 2002). Experiment 1 revealed a high correlation between Trial 2 judgments of learning (JOLs) and Trial 1 test performance. This backward correlation was higher than the forward correlation between Trial 2 JOLs and Trial 2 performance. It was also stronger when JOLs were immediate than when JOLs were made at a delay. In Experiment 2, a critical comparison was made between items given five repetitions on Trial 1 followed by one repetition on Trial 2, as compared with one on Trial 1 and five on Trial 2. Trial 2 performance was identical, whereas Trial 2 JOLs were higher in the 5/1 than in the 1/5 case, indicating reliance on first trial test performance. These results indicate that the underconfidence effect may be due to memory of one's item-specific performance on the preceding trial and to a failure to adequately take into account new current-trial learning.

(1044)

**Investigations Into the Underconfidence-With-Practice Effect on Judgments of Learning.** HEATHER L. TIEDE, MAY LEE, & JASON P. LEOBOE, *University of Manitoba*—Koriat, Sheffer, and Ma'ayan (2002) have presented evidence that repeated presentation and recall

of a list of words reduces the absolute accuracy of judgments of learning (JOLs), producing a shift toward underconfidence. One possible explanation for this underconfidence-with-practice (UWP) effect is that people discount the benefit of repeated study when each exposure is highly similar. Using a list-learning paradigm, Experiments 1 and 2 revealed that encoding words differently, or increasing the effortfulness of the encoding process during each successive exposure, did not eliminate the UWP effect. In Experiment 3, participants were explicitly informed either that (1) repetition is beneficial or (2) repetition is not beneficial. Although participants in the benefit condition reported significantly higher ratings for the benefit of repetition, they did not recall more words and were not better calibrated than participants in the no-benefit condition. The results are discussed within the framework of Koriat's (1997) cue utilization theory.

(1045)

**Second-Order Judgments About Judgments of Learning: Exploring Learners Confidence in Their Monitoring.** JOHN DUNLOSKY & MICHAEL J. SERRA, *Kent State University* (sponsored by John Dunlosky)—We present evidence from multiple experiments involving second-order judgments (SOJs) about judgments of learning (JOLs). To make SOJs, participants merely state their confidence in the accuracy of each first-order JOL, which is a prediction of the likelihood of correctly recalling recently studied items. Evidence relevant to the following conclusions are highlighted: (1) Confidence in one's predictions cannot be ascertained directly from JOLs, (2) participants often know when JOLs are relatively inaccurate, and (3) measures of absolute JOL accuracy during an initial study trial should be interpreted with caution.

(1046)

**I Remember/Know/Guess I Knew It All Along!** MICHELLE M. ARNOLD & D. STEPHEN LINDSAY, *University of Victoria*—The knew-it-all-along (KIA) effect occurs when individuals report that they had previously known something that they learned only recently. It is sometimes implied that when participants demonstrate a KIA effect, they experience false beliefs regarding their prior knowledge and, perhaps, false memories of using that knowledge, but little research has directly addressed this issue of the subjective phenomenology of the KIA effect. Arnold and Lindsay (2002) collected remember/know/guess judgments in a standard KIA paradigm with trivia questions; a KIA effect was obtained, but participants rarely falsely claimed to know or remember that they had known it all along. We report new experiments using word puzzles, which we expected to be better suited to inducing a feeling of having known it all along. Answers to trivia questions typically seem arbitrary, whereas solutions to word puzzles give rise to *ah-ha* experiences. Our results help to clarify the phenomenology of the KIA effect.

(1047)

**Examining the Basis of Illusory Recollection: The Role of Remember/Know Instructions.** LISA GERACI, DAVID P. MCCABE, & HENRY L. ROEDIGER III, *Washington University*—Curiously, studies using the remember/know paradigm to measure recollective experience show that people often vividly remember events that never occurred. We tested the hypothesis that false remember responses arising from the converging associates, or DRM, paradigm reflect accurate memory for the study episode and not necessarily illusory recollection of the critical lures. To test this hypothesis, we used standard remember instructions that allowed participants to use memory of surrounding list items as evidence for recollection or item-specific instructions that did not emphasize recollection of the study context. Results from the standard instructions condition replicated previous studies and showed that false recognition of critical lures was accompanied by high levels of remembering. In contrast, when participants were not instructed to consider memory for surrounding items as evidence of recollection, false recognition was accompanied by fewer judgments of remembering and more judgments of knowing.

(1048)

**Improving Metacomprehension Accuracy: Delay Is Critical.** KEITH W. THIEDE & THOMAS GRIFFIN, *University of Illinois, Urbana-Champaign*—Accurate metacomprehension monitoring leads to effective regulation of study and improved reading comprehension. Generating keywords for a text prior to judging comprehension improves accuracy, but only when keywords are generated after a delay (vs. immediately after reading). We will present two experiments that suggest that delaying generation of keywords is critical to improving accuracy. The results will be discussed within a cue utilization framework of metacognitive monitoring (Koriat, 1997) and the construction-integration model of text comprehension (Kintsch, 1988).

(1049)

**Metacognitive Control of the Spacing of Study Repetitions.** RANDY D. BIRD & AARON S. BENJAMIN, *University of Illinois, Urbana-Champaign*—Rememberers play an active role in learning not only by committing material more or less faithfully to memory, but also by selecting judicious study strategies (or not). In this experiment, subjects chose whether to mass or space the second presentation of to-be-learned paired-associate terms that were either normatively difficult or easy to remember. Under the constraint that subjects needed to mass exactly half of the items (and space the other half), and in contrast to recent results in which no such constraint was imposed (Son, 2004), subjects chose to mass more of the easy pairs. There were no differences in cued recall performance between this metacognitive control group and groups for which (1) all of the easy items were spaced, and the hard items massed, (2) all of the hard items were spaced, and the easy items massed, and (3) assignment of word pairs to massing or spacing conditions was random.

(1050)

**Effects of Processing Fluency on Performance Evaluation.** ROLF REBER, *University of Bergen*, & MARIE-ANTOINETTE RUCHMONACHON & MARA TIBERINI, *University of Bern*—Research has shown that people often compare themselves with external standards in order to assess the quality of their own performance. Such external standards are often not available, however. We demonstrated a different way in which people evaluate their performance in both cognitive and motor tasks: by assessing ease of task execution. In three experiments, participants in an easy condition gave themselves more favorable assessments, in comparison with others, than did participants in a difficult condition. Participants judged their performance more favorably if they named colors of neutral words rather than non-matching color words (Experiment 1), or if they had to generate 6 words of a category rather than 12 words (Experiment 2); running in place for 15 sec made participants believe that they are better, as compared with peers, than doing the same task for 2 min (Experiment 3). We conclude that processing fluency affects the evaluation of one's own performance.

(1051)

**Irrelevant-Context Effects on Subjective States of Remembering.** PATRICK O. DOLAN, *Drew University*, DAVID I. DONALDSON, *University of Stirling*, & DAVID A. GALLO, *Harvard University*—Previously, we have found dramatic differences in subjective states of remembering, depending on test context: “Remember” and “familiarity” are dissociated on the standard remember/know test (yes/no recognition, followed by remember/know/guess) but not on separate remember (say “yes” only to items that were “remembered”) and familiarity (say “yes” only to items that were “familiar”) tests. Previously, we have employed words as stimuli, and subjective states of remembering words may be too impoverished to distinguish remembering from familiarity. Here, we compared performance when subjects studied words and pictures, reasoning that the subjective difference between recollection and familiarity should be exaggerated (i.e., recollection of a picture vs. familiarity of a test word). Extending previous findings, correlational analyses revealed that familiarity judgments (on the *F* test) were more likely to cor-

relate with remember judgments than with familiarity judgments (on the standard test). Thus, even though test context should be irrelevant, subjective states of remembering are indeed heavily influenced by it.

(1052)

**Semantic-Memory–Based Recognition Without Identification.** ANNE M. CLEARY, *Iowa State University*—Recognition without identification (RWI) is the finding that people can recognize isolated feature sets as belonging to studied items without being able to identify the items to which the feature sets belong. The present study extends the RWI finding to a situation in which participants first viewed a list of single-word answers to general knowledge questions, then received a test list containing general knowledge questions whose answers were studied and general knowledge questions whose answers were not studied. Several experiments demonstrated that when participants could not provide answers to general knowledge questions at test, they gave higher recognition confidence ratings to unanswered questions whose answers were studied than to unanswered questions whose answers were not studied. This discrimination ability persisted regardless of whether a tip-of-the-tongue state was reported and can be explained in terms of classic signal detection theory.

(1053)

**Metacognitive Control: Short-Term Versus Long-Term Retrieval Strategies in Children.** LISA K. SON, *Barnard College*—First graders (ages 5–7) performed two metacognitive tasks. In one, after studying and making judgments of learning (JOLs) on noun–adjective pairs, either they could see the target adjective or they could test themselves by telling the experimenter the target adjective. Results showed that the higher the child's JOL, the more likely it was that he or she would choose to test themselves, indicating that when using this short-term flashcard technique, their metacognitions controlled their retrieval strategies. In the second task, after studying and making JOLs on noun–synonym pairs, they could study the pair again either immediately (massed) or after a delay (spaced) in which a long-term retrieval strategy was tested. In this case, results showed that children's JOLs did not influence spacing strategy. Furthermore, in general, children chose to mass more often than to space. Both results will be compared with those of adults who make systematic metacognitively controlled decisions for both short-term and long-term retrieval strategies.

(1054)

**Stability in Metacognitive Judgments: A Pilot Study.** BRETT D. CAMPBELL & MARK A. GAUDAGNOLI, *University of Nevada, Las Vegas*—This study examined the relationship between different types of metacognitive judgments (judgment of learning, feeling of knowing, and reading comprehension) among different domains of knowledge. It was hypothesized that metacognitive judgments would be correlated between domains and between types of judgments. It was further hypothesized that judgments would be more accurate with familiar domains than with unfamiliar domains. Participants rated how familiar they were with 10 different domains (sociology, history, nutrition, forestry). They were tested on the two most familiar and the two least familiar domains. After reading a passage, participants made a judgment of learning and were then given a free recall test. Participants made judgments of how well they comprehended the reading. Finally, participants made a feeling-of-knowing judgment. There were correlations between domains and between judgments-of-learning and feeling-of-knowing judgments, but no significant correlations with reading comprehension. There was no difference in accuracy of metacognitive judgments between familiar and unfamiliar domains.

• INDIVIDUAL DIFFERENCES IN WORKING MEMORY •

(1055)

**Individual Differences in Working Memory Span and Attentional Resource Allocation.** JOEL A. HAGAMAN & WILLIAM H. LEVINE, *University of Arkansas*—Negative priming is defined as a delay in re-

sponding to stimuli that were recently encountered in a distracting role. One explanation for negative priming is that inhibitory processes in working memory are recruited to suppress the representations of distractors, leading to a slowdown in subsequent processing. By this account, individual differences in working memory capacity should be associated with individual differences in negative priming; individuals with high working memory spans should be better able to inhibit representations of distracting stimuli than individuals with low working memory spans. In the present research, working memory capacity was measured by the operation span task, and negative priming was measured using a lexical decision task where target stimuli were previously attended, ignored, or not present on the prior trial. Working memory span was positively related to the magnitude of negative priming. These results are discussed with respect to competing explanations of negative priming.

(1056)

**Age Differences in Working Memory for Temporal Order Information.** JENNIFER McCABE & MARILYN HARTMAN, *University of North Carolina, Chapel Hill*—Two experiments used *N*-back tasks to test three explanations for age differences in working memory: reduced memory for temporal order information, reduced memory for item information, and inefficient inhibition of no-longer-relevant information. Accuracy and reaction times for rejecting lures were examined as a function of their recency and temporal relationship to the *N*-back target. Both age groups showed higher performance for the most and least distant lure positions, as compared with intermediate ones. In addition, the age effect in accuracy shown for all positions was increased for adjacent-to-target lure positions, supporting the temporal memory hypothesis. Contrary to the predictions of the inhibition and item memory hypotheses, age differences did not systematically increase or decrease, respectively, as lure distance increased. These results were similar for two- and three-back tasks, and for verbal and nonverbal stimuli. Overall, the findings were consistent with the hypothesis that older adults have difficulty encoding temporal order information.

(1057)

**Ability and Nonability Predictors of Individual Differences in Current Events Knowledge.** DAVID Z. HAMBRICK, *Michigan State University*, ELIZABETH J. MEINZ, *Southern Illinois University*, & FREDERICK L. OSWALD, *Michigan State University*—Knowledge of current events is critical for many everyday decisions. For example, making an informed decision in the voting booth depends on having knowledge of the candidates, while staying abreast of breakthroughs in medicine may prolong one's life. Why, then, do some people know more about the world than others? We evaluated the relative importance of two pathways through which individual differences in current events knowledge might emerge—one involving cognitive ability and the other involving nonability factors, such as interests. Approximately 500 participants completed tests of current events knowledge, as well as tests and questionnaires to assess a number of ability and nonability factors. Not surprisingly, there was a positive effect of cognitive ability on individual differences in current events knowledge. However, the contribution of nonability factors was similar in magnitude. This study increases understanding of human intelligence, in general, and individual differences in current events knowledge, in particular.

(1058)

**Working Memory Capacity Predicts Strategic, But Not Automatic Semantic Priming.** PATRICK A. O'CONNOR & BART A. VANVOORHIS, *University of Wisconsin, La Crosse*—One hundred four individually tested University of Wisconsin, La Crosse undergraduates performed Turner and Engle's (1989) operation span (OSPAN) measure of working memory capacity followed by a single-prime lexical decision task. Prime type (related, ELECTION–vote; unrelated, DRAWER–vote; neutral, \*\*\*\*\*–vote) and stimulus onset asynchrony (SOAS, 300 msec; SOAL, 1,250 msec) were manipulated randomly within participants and blocks of trials. Of interest are the novel findings that,

despite no overall prime type  $\times$  SOA interaction, (1) OSPAN was significantly correlated only with SOAL, presumably strategic, priming, and (2) priming with SOAL was eliminated for the lowest OSPAN quartile, yet fully retained for the highest quartile. This dissociation did not occur for SOAS priming, which was robust and equivalent for both high and low spans. These results warrant closer attention to individual cognitive differences as moderators of certain semantic priming effects.

(1059)

**When High-Powered People Fail: Working Memory and Choking Under Pressure in Math.** SIAN L. BEILOCK, *Miami University*, & THOMAS H. CARR, *Michigan State University*—We examined the impact of working memory capacity on pressure-induced performance decrements, or choking under pressure, in mathematical problem solving. Pressure is thought to harm cognitively based skills such as math by consuming working memory resources normally devoted to information storage and manipulation. Consistent with this view, decrements under pressure were limited to math problems that made the largest demands on working memory. Surprisingly, however, only individuals high in working memory capacity showed this decline. Individuals lower in capacity performed less well on high-demand problems in the absence of pressure but did not decline from their established (although significantly lower) levels of achievement when pressure was applied. This pattern suggests that higher capacity individuals outperform their lower capacity counterparts by employing more complicated strategies and computational algorithms that rely upon greater working memory capacity. If this extra capacity is compromised, the superior but computationally more expensive strategies it supports are not possible.

(1060)

**Phonological Memory Predicts Adult Second-Language Grammar and Vocabulary Acquisition.** IRENA O'BRIEN, *Université du Québec, Montréal*, NORMAN SEGALOWITZ, *Concordia University*, & JOE COLLENTINE, *Northern Arizona University*—We investigated the role of phonological short-term memory (PSTM) in second-language oral grammar and vocabulary acquisition by adults over one semester. PSTM (tested by serial nonword recognition) and oral abilities (grammar, vocabulary, and narrative abilities) were assessed in English speakers learning Spanish, at the beginning (pretest) and end (posttest) of the semester. Cross-lagged correlation analyses revealed that pretest PSTM correlated more strongly with many posttest oral ability scores and gain scores than the reverse (pretest oral abilities with posttest PSTM). In particular, cross-lagged correlations implicated initial PSTM in posttest performance and performance gains in vocabulary, narrative abilities (in terms of past tense verbs, third-person morphology, past participles, present participles, and public verbs), and frequency and/or use of the copula, prepositions, indicative verbs, subordinate conjunctions, plural pronouns, and subordinate clauses. The special role that PSTM appears to play in adult second-language oral ability acquisition is discussed.

(1061)

**Working Memory in Language and Music.** ZACHARY A. SCHENDEL, *Ohio State University*, & CAROLINE PALMER, *McGill University* (sponsored by Neal F. Johnson)—Berz (1995) hypothesized a separate musical memory loop independent of the phonological loop (Baddeley, 1990) responsible for the working memory rehearsal and retention of music. Four experiments investigated whether the properties of the phonological loop for working memory and language are mirrored in working memory for music. Two standard/comparison experiments were conducted in which digits or tones served as the to-be-remembered material with concurrent, self-produced suppression (speaking thehe or singing C5 lala) during the standard-comparison interval. Standard/comparison pairs were presented visually (Experiment 1) and auditorily (Experiment 2). Substituting a visual interference task into the standard-comparison interval (Experiment 3) im-

paired only retention of visually presented notes, indicating that they were not translated into a phonological form. A visual-to-auditory standard/comparison procedure with suppression (Experiment 4) forced subjects to translate visual notes. Together, these experiments suggest that music and language are governed in the same manner in working memory.

(1062)

**The Effect of Cell Phone Distraction on Working Memory.** JILL A. SHELTON & EMILY M. ELLIOTT, *Louisiana State University*, & RICHARD L. METZGER, *University of Tennessee, Chattanooga* (sponsored by Janet L. McDonald)—The present study examined the effect of cell phone distraction on working memory performance. Forty-nine participants completed a lag task, an operation word span task, and a digit span task. A cell phone rang halfway through the lag task. Two randomly assigned groups were either warned that a distraction would occur during the lag task or not warned. Although the groups performed equally well on the easier lag conditions, there were group differences in the most difficult lag condition; the warned group had higher performance on the most difficult lag condition before the distraction, and those not warned had superior performance following the distraction. Operation span, as a continuous between-subjects variable, predicted lag performance but did not interact with the distraction. The results will be discussed with respect to current views of working memory.

• AUTOMATIC PROCESSING •

(1063)

**Evaluating Reading Automaticity Through Dual-Task Stroop.** MARK G. VAN SELST, *San Jose State University*—In the PRP paradigm, two tasks are presented in close temporal proximity in order to investigate the intertask interference observed. In the current iteration, an auditory-manual task is followed by a visual-verbal Stroop (color identification) task. Previous research has indicated that the Stroop interference on Task 2 is additive across Task 1: Task 2 stimulus onset asynchrony (SOA). In the present study, this finding is replicated. An additional condition, in which each letter of the color words are individually rotated 180°, is also substantially additive across SOA. Although the observed interference is less than in the standard Stroop condition, the lack of a substantive interaction with SOA is interpreted to indicate that reading the letter-disoriented text is involuntary (Stroop interference is still observed) but attention demanding (there is no differential effect produced by the participants having the opportunity to clean up the disoriented words while performing the auditory discrimination task).

(1064)

**Timecourse of the Color-Color Stroop Task.** CHRIS KOCH, *George Fox University*—Traditional Stroop interference combines color and word dimensions to produce interference (Stroop, 1935). Stroop-like interference also occurs when two color blocks are presented together (Koch & Kubovy, 1996). Studies manipulating SOA in the traditional Stroop task have shown that interference is greatest when the two dimensions are presented within 100 msec of each other (cf. MacLeod, 1991). This study examines the timecourse of interference in the color-block version of the Stroop task. Color block pairs were randomly presented to 16 subjects for 50, 100, 150, 200, and 250 msec in a within-subjects design using neutral, congruent, and incongruent stimuli. The results show that RTs decline across stimulus conditions as presentation increases. The results also indicate that the greatest interference occurs at 50 msec. Therefore, the interference obtained in the color-block version of the Stroop task occurs earlier in processing than in the color-word task.

(1065)

**Pop-Out in the Right Context: How Context Properties Affect Target Detection.** ANNA SCHUBÖ, *University of Erlangen-Nürnberg*,

ERICH SCHRÖGER, *University of Leipzig*, & CRISTINA MEINECKE, *University of Erlangen-Nürnberg*—Search efficiency for targets in visual displays does not depend only on the feature contrast to the single context elements, but also on global properties of the context as a whole—for example, regularity and spatial arrangement. We investigated the influence of context properties (number, density, regularity, and type of context elements) on the processing of an orientation pop-out target, predicting that contexts enabling global processing of the display will support pop-out processing. Event-related brain potentials (ERPs) elicited in blank and target trials were compared for different contexts. Variations increasing the global character of the display (e.g., an increase in number and density of context elements) simultaneously improved pop-out detection. Only these contexts showed a typical pattern in the ERP data (an enhanced N2p amplitude for target than for blank trials). Thus, processing of the same pop-out target is influenced mainly by the spatial features of the complete visual display.

(1066)

**Examination of Color Population Stereotypes and Visual Search.** KIMBERLY R. RADDATZ, TUAN Q. TRAN, JODI E. FOURA, & CHRIS P. BARLETT, *Kansas State University* (sponsored by Jerome Frieman)—In many cultures, the color red has an established symbolic meaning of danger that does not require explanation (i.e., a population stereotype). Using a visual search task, this experiment examined whether the over-learned association of red with danger gives red inherent attention-capturing qualities that blue and green do not have. Half of the participants were cued in advance to target location, whereas the other half were given no cue. Response times for red and blue targets did not differ, and red distractors were no more distracting than blue, suggesting that red has no inherent attention-getting properties. Surprisingly, search times were longer when target location was cued, especially for green targets; however, target color had no effect on visual search when target location was not cued. This result suggests that cuing target location may initiate a slower serial search process influenced by color-related issues such as contrast and saliency, but not by inherent meaning.

(1067)

**A New Look at the Relationship Between Perception and Action.** FLORIAN WASZAK, *Max Planck Institute for Human Cognitive and Brain Sciences*, & ANDREI GOREA, *CNRS, Paris*—A visual stimulus may affect a motor response although its visibility is prevented by a mask. This implies that the sensorimotor system is more susceptible to stimulation than the perceptual system. We report experiments where both the observer's perceptual state related to the presence/absence of a masked stimulus and the motor behavior elicited by the same stimulus were jointly assessed on a trial-by-trial basis, which showed that masked visual stimulation at constant visibility ( $d'$ ) has two types of effects on the motor system. When the physical energy of the masked stimulus is weak, it affects the motor response only if it exceeds the observer's perceptual response criterion. It is only when the physical energy of the masked stimulus is relatively strong that its impact on the motor response is independent of the state of the perceptual system. This indicates that reflex, nonconscious behavior has a high energy threshold.

(1068)

**Vehicle Braking Is Subject to Dual-Task Slowing: Evidence for Central Interference.** JONATHAN L. LEVY & HAROLD E. PASHLER, *University of California, San Diego*, & ERWIN R. BOER, *ERB Consulting* (sponsored by Harold E. Pashler)—Participants attempted to perform two tasks concurrently where the stimulus onset asynchrony (SOA) was varied. In the choice task, they responded either manually or vocally to whether a visual or an auditory stimulus was presented once or twice; in the braking task, they depressed a brake pedal upon the onset of red lights. The tasks were superimposed on a car-following task in Experiment 1, which employed a driving simulator, but were

the only tasks in Experiment 2, which was a traditional laboratory study. In both experiments, the stimulus and response modalities of the choice task had either no or small effects on the braking response, which were, however, affected by the SOA manipulation: As the delay decreased, brake reaction times increased. The results demonstrate that a well-practiced, simple task such as vehicle braking is subject to dual-task slowing and are consistent with the central bottleneck model of information processing.

• TASK SWITCHING •

(1069)

**Inhibitory Control Over a Prior Task During Task Switching.** MARK E. FAUST, *University of North Carolina, Charlotte*, STEVE SANOW, *University of South Alabama*, & MICAH RAMSEY, *University of North Carolina, Charlotte*—To what extent does effective task switching depend upon inhibitory control over processes associated with the switched-from task? Prior task interference (PTI), the influence of a no-longer-relevant stimulus attribute on the performance of the switched-to task, was assessed during a task-switching paradigm. When the irrelevant stimulus attribute associated with the switched-from task has been held constant or systematically alternated, we have previously found generally robust PTI effects in RTs. By contrast, when the irrelevant stimulus attribute was varied randomly in the present experiments, we found that PTI in RTs was limited to a condition with a high working memory load and a short switch delay. We also found generally robust PTI in intrusion errors. The results suggest a limited ability to prepare for prior task interference and a base rate of lapses in cognitive control where responses may be inappropriately driven by no-longer-relevant aspects of the stimuli.

(1070)

**Are Specific Stimulus Values of the Irrelevant Task Inhibited During Task Switching?** RUSSELL E. COSTA & FRANCES J. FRIEDRICH, *University of Utah*—Switching between two tasks (e.g., color identification, line orientation) typically results in longer RTs than performing the same task repeatedly, producing task switch costs. Mayr and Keele (2000) suggest that one component of the switch cost may be backward inhibition; that is, inhibition is needed to switch away from an active task but will slow reactivation of the same task set on subsequent trials. That type of inhibition was shown to occur at the abstract task level, but it is possible that, when bivalent stimuli are used, a separate process inhibiting specific value of the irrelevant task also is required. For example, if a stimulus consists of red vertical lines and the task is color, the line orientation task set is inhibited, according to Mayr and Keele. The question of whether an additional process specifically inhibits the vertical feature (relative to a horizontal feature) is the focus of these experiments.

(1071)

**Identifying Components of Switch Costs in the Voluntary Task-Switching Procedure.** CATHERINE M. ARRINGTON & GORDON D. LOGAN, *Vanderbilt University*—In voluntary task switching, subjects choose which task to perform on a series of multivalent targets, with instructions to perform each task equally often and in random order. RTs are longer for task switches than for repetitions. Subjects produce more repetitions than expected for random task sequences. Switch costs may reflect executive processes involved in choosing the task to perform or in preparing the subordinate-level processes to perform the chosen task. Across experiments, we examined time course functions for conditions involving repetitions or switches and free choice or instructed task performance, separating task-switching and task choice components of switch costs. In addition, the choice probability provides another measure of task choice. We examined choice probability under multiple task conditions to study the relationship between executive processes associated with task switching and task choice. On the basis of these investigations, we present a model of the executive processes involved in voluntary behavior in multitask environments.

(1072)

**The Effects of Task Similarity and Stimulus Consistency on Task-Switching Performance.** TIMOTHY K. MIURA, *University of Illinois, Chicago*, & ANDREW R. A. CONWAY, *Princeton University*—Task-switching paradigms provide a method to illuminate the control processes underlying flexible adherence to changing goals and environmental contingencies. The present research used a modified task-switching paradigm to disentangle the often confounded contributions of task set similarity and stimulus bivalence to switching difficulty. Participants switched from a numeral classification task to a numeral classification task (similar tasks) and from a numeral classification task to a hue discrimination task (dissimilar tasks). Stimuli either remained digits (same stimulus class) or changed from digits to letters or from digits to number words, such as NINE (different stimulus class). The paradigm allowed us to assess switching difficulty across three different indices: local switch costs, global switch costs, and within-run slowing. Results indicated that switching to a dissimilar task was comparable in difficulty to switching to a similar task only when the stimuli possessed an attribute that had previously been relevant.

(1073)

**Task Switching: Evidence for the Parallel Activity of Task Sets.** ANDREA KIESEL, *University of Würzburg*, WILFRIED KUNDE, *University of Halle*, & JOACHIM HOFFMANN, *University of Würzburg*—One main theoretical issue in the task-switching paradigm concerns whether the currently irrelevant task set remains active or not. Introducing subliminal primes in a task-switching context enables us to investigate the processing of stimuli that do not themselves have the potency to activate tasks (Kunde, Kiesel, & Hoffmann, *Cognition*, 2003). Whether subliminally presented primes are processed according to a certain task rule is demonstrated by prime congruency effects: When a prime activates another compared to the same response as the one to be performed in a given trial, RT and error rates increase. In two experiments, a prime congruency effect for the irrelevant task was observed, indicating that subliminal primes are processed according to the irrelevant task rule. A control experiment verifies the assumption that subliminally presented primes do not themselves activate task sets. Thus, data support the idea that tasks are active in parallel in a task-switching context.

(1074)

**Is the Response Selection Bottleneck Dependent Upon Task Switching?** ROY LURIA & NACHSHON MEIRAN, *Ben Gurion University* (sponsored by Nachshon Meiran)—In the psychological refractory period (PRP), the response to the second stimulus is slowed as the time interval between the two stimuli is decreased (the PRP effect). One of the leading models accounting for the PRP effect is the response selection bottleneck (RSB) model (Pashler, 1994). According to the RSB model, the response selection stage is limited to structural serial processing, but other processing stages can proceed in parallel. One prediction of the RSB model is that if processing stages before the response selection of the first task are prolonged, it should also prolong the second task to the same extent. However, the PRP paradigm typically involved two different tasks (i.e., letter and digit). This prediction (and others) was tested also with two identical tasks (i.e., letter and letter). The results indicated that some overlap between the response selection of the two tasks was evident when identical tasks were used.

(1075)

**Reduction in Switching Costs for Difficult Tasks With Task Priming.** PADMANABHAN SUDEVAN, JOHN HOLMES, AMBER CORRY, JEFFREY WILLEMS, MARISA HOFFMAN, & CARRIE GIEBEL, *University of Wisconsin, Stevens Point*—We studied task priming effects in a new task-switching paradigm we have been developing, in which two classification tasks are presented in succession, with either repeated or switched tasks and with a large intertrial interval between the task pair. In the present work, we use a task prime interpolated between two relatively difficult tasks to obtain reductions in task-switching costs with

the use of the cue. We also explore the effects of different prime–task intervals and fixed and variable response–stimulus intervals in this paradigm.

(1076)

**A Priming Account of Explicitly Cued Task Switching.** DARRYL W. SCHNEIDER & GORDON D. LOGAN, *Vanderbilt University*—Some evidence for task set reconfiguration in task switching comes from studies involving the explicit task-cuing procedure, where tasks are indicated by cues preceding target stimuli. Switch costs are reduced with increased preparation time, suggesting that partial reconfiguration by executive control can occur in advance of task alternations. Recent research has challenged this idea, however, by demonstrating that switch costs are primarily due to benefits of repeated cue encoding. We present a short-term priming account of explicitly cued task switching that involves two mechanisms: compound cue retrieval of response categories from long-term memory and priming of cues from residual activation in short-term memory. The sufficiency of our priming account is demonstrated by modeling and simulating data from three experiments, illustrating how basic psychological processes can produce so-called switch costs and other effects without any task set reconfiguration.

• VISUAL ATTENTION •

(1077)

**The Effect of Dimensional Cuing of Targets on Cross-Dimensional Interference in Visual Search.** TAKATSUNE KUMADA, *National Institute of Advanced Industrial Science and Technology*—The present study examined whether attentional control setting to a target dimension, given by endogenous dimensional cues, eliminates interference of task-irrelevant singleton distractors. Target displays contained two feature singletons (one color and one onset) with five nontargets. A tone cue presented prior to target displays (700 or 300 msec of SOA) specified the target dimension to be responded to. Participants discriminated a reported attribute (H or S) presented in the target. The effect of response congruency between a target and a singleton distractor upon RTs was a dependent variable. Although overall, RTs were reduced with SOA, the congruency effect did not vary across SOAs. The results suggest that attentional control setting to a feature dimension affects only on the detection of target features. Consistent with previous studies (e.g., Theeuwes, 1991), prior knowledge of target dimensions showed no effect on reducing of cross-dimensional interference.

(1078)

**Stimulus-Driven Attentional Capture During Visual Search: Memory for Attended Information.** ARTEM V. BELOPOLSKY, RICHARD GODIJJN, & ARTHUR F. KRAMER, *University of Illinois* (sponsored by Arthur F. Kramer)—Several studies have demonstrated that new objects capture attention in a stimulus-driven fashion. It is important to understand how much processing is devoted to these salient events. In the present study, participants searched for a gray letter among red distractor letters. All letters were presented by removing segments from premasks and were remasked after 350 msec. On 50% of the trials, a new red distractor appeared. Unpredictably, on 25% of the trials, after the search trial, participants were presented with two nontarget letters and were required to judge whether one of the letters had been present in the display that was just viewed. Participants were better at recognizing the onset letter, whereas recognition of other distractor letters was at chance. Also, we found a positive relationship between the magnitude of attentional capture and recognition performance across subjects. Thus, information attended to in a stimulus-driven manner is processed and transferred to memory.

(1079)

**Visual Search Within and Across Dimensions: No Search, Only Response Selection.** KAREN MORTIER & JAN THEEUWES, *Vrije Universiteit, Amsterdam* (sponsored by Mieke Donk)—In feature search tasks, uncertainty about the dimension on which targets differ

from the surrounding nontargets hampers search performance, relative to a situation in which this dimension is known in advance. Typically these cross-dimensional costs are associated with less efficient guidance of attention to the target. In the present study, participants had to perform a visual search task—that is, search for a within- or cross-dimensional target element. Either the stimulus-to-response mappings or response compatibility effects were manipulated. It is concluded that effects that typically have been attributed to early top-down modulation of attentional guidance may represent effects that occur later in processing, possibly related to response selection factors.

(1080)

**Aging and Memory for Distractors in Visual Search.** WALTER R. BOOT, ENSAR BECIC, & ARTHUR F. KRAMER, *University of Illinois, Urbana-Champaign*, JASON S. MCCARLEY, *Mississippi State University*, & MATTHEW S. PETERSON, *George Mason University*—Memory of younger and older adults for inspected search items was tested using two dynamic search paradigms. In one paradigm, participants searched for a target among distractors both when landmarks were present in the display (a schematic drawing of an apartment) and when landmarks were absent. Younger and older adults demonstrated similar memory, and refixations for both younger and older adults were reduced when landmarks were present. A task similar in nature to this search task was used to assess automatic and intentional memory in search for younger and older adults. Participants moved their eyes on the basis of memory instructions (intentional) or were allowed to move their eyes freely (automatic). Although older adults tended to show less automatic memory and more intentional memory, this difference is almost entirely explained by lengthened saccadic reaction times for older participants. In conclusion, memory for previously examined search items remains robust across the life span.

(1081)

**Setting Up the Target Template in Visual Search.** TIMOTHY J. VICKERY, LIVIA L. KING, & YUHONG JIANG, *Harvard University* (sponsored by Yuhong Jiang)—Top-down knowledge about the target is essential in visual search. It biases visual attention to information that matches the target criteria. Extensive research has examined visual search when the target is defined by fixed criteria throughout the experiment, yet few studies have investigated how subjects set up the target template. To examine this, we conducted four experiments using random polygons and real-world objects, allowing the target to change from trial to trial. On each trial, subjects first see a cue informing them about the target. The search display is presented 200 msec later. We find that when the cue matches the target exactly, search speed increases, and slope decreases. Deviations from the exact match in size or orientation produce a cost, although they are advantageous, as compared with a neutral cue. We conclude that the template set-up process uses concrete visual information, rather than abstract semantic information, to find the target.

(1082)

**A Spotlight on Distance Effects in Visual Spatial Attention.** MATTHEW M. DORAN, JASON E. REISS, & JAMES E. HOFFMAN, *University of Delaware* (sponsored by James E. Hoffman)—Attention to one object often facilitates the identification of nearby objects, but recent research also indicates that close objects may inhibit each other (Bahcall & Kowler, 1999). The present research was designed to investigate the conditions leading to facilitation and inhibition effects in visual attention. Subjects were cued to simultaneously attend to two locations with various spatial separations and make a speeded response to a target appearing in one of them. A single compatible or incompatible flanker letter was always adjacent to the target. Consistent with Bahcall and Kowler, identification accuracy improved as separation increased. However, flanker compatibility effects were also found, as predicted by an attentional spotlight. Interestingly, competition effects were constant across cue separations, contrary to an inhibition explanation. These results indicate the presence of a facilitatory attentional spotlight, even when attention is divided, suggesting that inhibition

may not explain reported improvements of target identification with increased separation.

(1083)

**Memory Search Following Valid and Invalid Abrupt Onset Cues.** DONALD HOMA, TERRY DONOVAN, & SCOTT SCHAFFER, *Arizona State University*—The impact of an abrupt onset cue was investigated in three experiments. In Experiment 1, targets drawn from memory sets of size 2–5 occurred randomly at one of four corners of an imaginary square surrounding a central fixation. On 75% of the trials, the test flash cued the location of the test probe (valid), and on 25%, the test flash cued a different location (invalid). Experiment 2 reversed these probabilities. In Experiment 3, all test probes occurred at the fixation point but were preceded by an irrelevant cue either at the point of fixation or at a location away from the fixation point. Experiments 1 and 2 showed a sizable cost to an invalid cue, localized primarily in the slope of the RT function. Experiment 3 produced reduced but significant cost as well. These outcomes suggest that the abrupt onset cue attracted attention mostly by delaying the onset of the search, even when the onset cue was random or irrelevant.

(1084)

**Spatial Modulation of Spreading Attention Within and Across Visual Objects.** GARY C. SHYI & YUAN-CHI TSENG, *National Chung-Cheng University*—One hypothesis to explain the same-object effect (SOE) proposes that the spread of attention within an object may be faster and/or more efficient than that across objects. The fact that physical objects always occupy some expanse of space suggests that they can be viewed as specific spaces marked by various geometric and surface properties. One implication of this view is that spreading attention within an object may be spatially modulated. In three experiments, we used the cuing paradigm popularized by Egly et al. (1994, *JEP:G*) and asked participants to detect the presence of a small 3-D shape. We not only replicated the basic finding of the SOE (Experiment 1), but also found that it could be modulated by the distance attention spreads within and across objects (Experiments 2 and 3). In particular, the SOE was eliminated when the spreading distance within an object was 50% greater than that across objects.

(1085)

**What Can Patterns of Eye Movements Tell Us About the Role of Memory in Visual Search?** JIYE SHEN & EYAL M. REINGOLD, *University of Toronto*—The present investigation studied the involvement of a memory-based selection mechanism in visual search. In a series of experiments employing a repeated search of a previously fixated display, we examined the influences of the first search task on the second one. Participants first performed a difficult color  $\times$  shape conjunctive search, followed by a search for an announced target letter. We found a difference in the fixation rate and response time between a previously fixated location versus an unfixated location. This effect also changes as a function of lag in the fixation history, indicating a temporal dynamics of memory effect in visual search.

• READING •

(1086)

**Effects of Frequency and Predictability on Eye Movements in Pure Alexia.** REBECCA L. JOHNSON & KEITH RAYNER, *University of Massachusetts* (sponsored by Jerome L. Myers)—Pure alexia (letter-by-letter [LBL] reading) is an acquired dyslexia in which premorbidly literate individuals have difficulty reading. The disorder is often characterized by an increase in naming latencies as a function of word length (the word length effect). The present eye-tracking study addresses the following research questions: What are the eye movement patterns of LBL readers? Do LBL readers display a word length effect while reading sentences? Are LBL readers sensitive to word frequency and predictability? The eye movement data from G.J. (a pure alexic with left occipito-temporal brain damage and right homonymous hemianopia)

demonstrate a pattern strikingly similar to that for normal readers given a one-letter moving window, display a significant word length effect, and exhibit a sensitivity to both word frequency and predictability. The influence of top-down effects in the presence of serial processing of letters supports an interactive account of reading in pure alexics.

(1087)

**Insights Into the Modulation of Nonfoveal Preprocessing by Foveal Processing Difficulty.** SARAH J. WHITE, *University of Durham*, KEITH RAYNER, *University of Massachusetts*, & SIMON P. LIVERSEDGE, *University of Durham* (sponsored by Martin A. Conway)—Henderson and Ferreira (1990) suggested that foveal load modulates nonfoveal preprocessing, as is shown by preview benefit. This issue is fundamental to understanding the control of eye movements in reading and to the architecture of current models (Reichle, Pollatsek, Fisher, & Rayner, 1998). Our experiment investigated this issue further using four-letter-long critical words. There are three important results. First, foveal load modulated nonfoveal preprocessing as shown by preview benefit only for those participants who did not notice saccade-contingent changes that occurred in the experiment. Second, contrary to suggestions made by Schroyens, Vitu, Brysbaert, and d’Ydewalle (1999), foveal load modulated preview benefit for both short and long single-fixation durations on the foveal word. Third, foveal load did not modulate the probability of skipping the following four-letter word. These three findings have important implications for understanding the way in which foveal load modulates nonfoveal preprocessing.

(1088)

**Parafoveal Preview Information as a Function of Reading Skill Level.** KATHRYN H. MARSZALEK, KEITH RAYNER, & ARNOLD D. WELL, *University of Massachusetts*—Previous research has demonstrated that readers extract meaningful phonological information from the parafovea during reading (e.g., Pollatsek, Lesch, Morris, & Rayner, 1992). The present study expanded the previous work on this topic by dividing participants into more and less skilled readers on the basis of their scores on the Nelson–Denny reading test. Participants read sentences containing a homophone target (e.g., *beach*). The target had a parafoveal preview that was identical to the target (*beach*), its homophone pair (*beech*), an orthographically similar word (*bench*), or a random string of consonants (*xjgkq*). Results for the more skilled readers replicated previous findings that target words are fixated for less time when the preview is a homophone, as compared with an orthographic control. However, the less skilled readers did not show a clear effect of preview condition. Areas of future research to clarify the results from the less skilled readers are discussed.

(1089)

**Sentence Context Modulates Orthographic Neighborhood Effects.** BRIAN M. FRIEL & RICHARD J. HARRIS, *Kansas State University*—The relationship between sentence context and orthographic neighborhood size in reading was investigated. Reading time was measured for target words that had either many or few orthographic neighbors (words differing by one letter, maintaining letter position). Target words were embedded in sentences varying in the degree to which the sentence context semantically and/or pragmatically constrained the number of neighbors that would fit in the target’s position (e.g., Looking for gemstones, the geologist examined the shiny ROCK closely vs. Gary said he left the ball near the ROCK yesterday). Results indicated that sentence constraint mattered only for words with few orthographic neighbors, since faster reading times were recorded for such targets embedded in high-constraint sentences. Reading times for targets with many neighbors differed little between sentence conditions. Implications for models of sentence reading and word recognition are discussed.

(1090)

**Semantic and Syntactic Category Ambiguity Resolution: An Eye Movement Analysis.** ANGELA C. JONES & JOCELYN R. FOLK, *Kent State University*—In two experiments, eye movements were mon-

itored as participants read sentences containing biased ambiguous words with semantically distinct noun interpretations (*calf*), semantically distinct interpretations that cross syntactic category (*duck*), semantically similar interpretations that cross syntactic category (*jump*), or unambiguous controls. We found that the different types of ambiguity were resolved similarly when preceding context was neutral, with syntactic category ambiguity being more difficult to resolve. There was no evidence of readers delaying syntactic category ambiguity resolution. However, when a disambiguating context consistent with the subordinate interpretation preceded the ambiguous words, differences emerged. When a disambiguating semantic context preceded semantically ambiguous words, reading times were longer for ambiguous words than for controls. When a disambiguating syntactic context preceded syntactic category ambiguous words, there were no reading time differences for ambiguous words versus controls. Results are discussed in terms of the timing of availability of lexical information and implications for models of ambiguity resolution.

(1091)

**The Skipping of Words During Reading Revisited.** DENIS DRIEGHE, *Ghent University*, & KEITH RAYNER & ALEXANDER POLLATSEK, *University of Massachusetts* (sponsored by Nancy A. Myers)—In two experiments, we replicated Balota, Pollatsek, and Rayner (1985) and Henderson and Ferreira (1990). Balota et al. examined the skipping rates of a predictable word (.11), a neutral word (.02), a semantically anomalous word (.01), a nonword that was visually similar to the predictable target word (.01), and a dissimilar nonword (.00). By using shorter target words, we showed that these findings were not due to floor effects and that skipping of a visually similar and a visually dissimilar nonword did not differ at close launch site. Our second experiment replicated Henderson and Ferreira’s finding that foveal load influenced preview benefit. We also examined subsequent skipping rates. A high- or a low-frequency word preceded a three-letter target word of which the preview was either correct or misspelled. Results show that an increased foveal load reduces the skipping of the following word.

(1092)

**Key Assumptions of the GO Model for the Missing Letter Effect Are Confirmed and Disconfirmed Using Eye Movement Monitoring.** ANNIE ROY-CHARLAND & JEAN SAINT-AUBIN, *Université de Moncton*, & RAYMOND M. KLEIN, *Dalhousie University*—When asked to detect target letters while reading a text, participants miss more letters in frequent function words than in less frequent content words. To account for this pattern of results, known as the missing-letter effect (MLE), Greenberg, Healy, Koriat, and Kreiner (*PB&R*, in press) put forward the GO model. The GO model was evaluated by monitoring eye movements of 32 subjects who read a continuous text while searching for a target letter. Results revealed the usual MLE, and the usual pattern of eye movements, with more skips for function than for content words. Confirming GO’s guidance assumption, gaze durations were shorter for function words when the target letter was omitted than when it was detected. However, contrary to GO’s unitization assumption, response latency was longer for function than for content words, and gaze duration upon content words was independent of target letter detection time.

• JUDGMENT/DECISION MAKING •

(1093)

**How Many Alternatives Matter in Probability Judgments of a “Focal” Outcome?** KUNINORI NAKAMURA & KIMIHIKO YAMAGISHI, *Tokyo Institute of Technology*—The aim of this study was to explore how many alternative outcomes are considered for probability judgments. Windschitl and Wells (1998) claimed that, when judging the probability of a “focal” outcome, people compare the might of the focal outcome with the might of the strongest alternative outcome. Our investigation improved Windschitl and Wells’s analysis

by testing whether only one alternative outcome—that is, the mightiest alternative outcome—affects probability judgment for the focal outcome, by using a variable selection criterion in multiple regression. Results indicated that the might of the strongest alternative outcome is the best predictor of probability judgments.

(1094)

**Improving Bayesian Responses to Word Problems Through Direct Experience and Format.** PHILIP T. DUNWOODY, *Juniata College*, & ADAM S. GOODIE, *University of Georgia*—Two experiments examined methods of increasing Bayesian responses to word problems. In Experiment 1, the consistency of directly experienced base rates was manipulated. Choice proportions and transfer to subsequent word problems were assessed. Consistent base rates resulted in choice proportions favoring base rates and an increase in base rate sensitivity on subsequent word problems (defined as a difference score for responses to problems with high and low base rates). Despite the increased usage of base rates in subsequent word problems, responses were no more accurate. In Experiment 2, the information representation was manipulated by presenting five word problems in either a frequency or a percentage format. Results replicated work by Gigerenzer and Hoffrage (1995) showing an increase in Bayesian responses when word problems were presented in the frequency format. Whereas increasing base rate saliency through direct experience is insufficient for producing an increase in Bayesian responses, a format change is sufficient.

(1095)

**On the Psychological Reality of the Pearson Correlation Coefficient: Effects of Objective Covariation on Subjective Estimates.** RICHARD B. ANDERSON, ANDREA M. ANGOTT, & MICHAEL E. DOHERTY, *Bowling Green State University*—Participants viewed stimulus sets containing multiple pairs of bars. Within each pair, the height of one bar represented the value of  $X$  and height of the other bar represented the value of  $Y$ . The participants' task was to estimate the  $XY$  covariation in each set by marking a point on a response scale. The results showed that the pattern of estimations matched the objective Fisher's  $z$  coefficients better than it matched the objective Pearson  $r$  coefficients. In addition, there was a tendency toward illusory correlation insofar as the estimates were above zero in conditions where the objective covariation was zero. This data pattern occurred whether or not participants received accuracy feedback on each trial. The pattern also held regardless of whether the feedback was scaled according to Pearson  $r$  or according to Fisher's  $z$ .

(1096)

**Temporal Discounting: A Direct Comparison Between the Adjusting Amount and the Adjusting Delay Procedures.** DANIEL D. HOLT, LEONARD GREEN, & JOEL MYERSON, *Washington University*—We compared experimental procedures typically used to assess the rate of temporal discounting. Specifically, we examined whether adjusting amount (AA) and adjusting delay (AD) procedures provide similar estimates (i.e., indifference points) of the amount of an immediate reward judged to be subjectively equivalent to a delayed, larger reward. Systematic differences between the indifference points obtained from the two procedures were observed: Individuals required a larger immediate reward under the AA procedure than that predicted by their indifference points from the AD procedure, and required a briefer delay to the receipt of the larger reward under the AD procedure than that predicted by their indifference points from the AA procedure. The results from a follow-up experiment that included an adjusting delayed amount procedure addressed the role of delay/speed-up asymmetry (e.g., Loewenstein, 1988). The systematic differences observed represent an anomaly that creates problems for current theoretical models of temporal discounting.

(1097)

**Real-Life Decisions: Parents Choosing Educational Options.** KATHLEEN M. GALOTTI, HOPE E. ALTENBAUMER, HEATHER

J. GEERTS, & ALLISON RUPP, *Carleton College*—We report on a multi-cohort, short-term longitudinal study of parents ( $N = 190$ ) making school and program placement decisions for their kindergarten children, an important, everyday decision made by nonexperts. The specific decision chosen for study is one made by parents of local kindergartners as they select from among eight options in which to place their child for first grade. We compare the information gathering and decision structuring of couples who report themselves as having different decision-making styles with those of couples who report similar styles, we examine the relationship between the performance variables (amount of information gathered, complexity of the decision structure), the affective response variables (ratings of stress, satisfaction, comfort, enjoyment with the decision-making process itself), and the eventual, retrospective evaluations of the decision making, and we compare the decision making of novice and experienced parents and that of less educated and more educated parents.

(1098)

**Children's Misperception of Facial Expressions: Effects of Interpersonal Status and Emotional Contexts.** SHIH-TSENG T. HUANG & CHIA-CHEUNG CHANG, *National Chung-Cheng University* (sponsored by Gary Chon-Wen Shyi)—Facial expressions are a major source for regulating and achieving effective social interactions. Children with unpopular interpersonal status may have deficiencies in accurately perceiving other people's facial expressions. We conducted two experiments to test this hypothesis. Children of elementary school were asked to judge a set of standardized pictures of facial expressions, after being emotionally primed by either passively viewing a short affect-laden video (low involvement) or actively engaging in a (virtual) interaction with an actor, leading to positive or negative affective consequences (high involvement). Consistent with our hypothesis, we found that with low involvement, rejected children tended to misperceive sadness more frequently than did either the popular or the average children; in addition, they were more likely to misperceive non-euphoric expressions as euphoric. Similarly, with high involvement and negative affective consequence, rejected children were more likely to misperceive disgust and surprise as some alternate expressions than were the other children.

(1099)

**Gender Differences and the Perception of Campus Climate: Is it a Bit Chilly Up Here?** KARYN PLUMM & KIMBERLY M. CHRISTOPHERSON, *University of North Dakota* (sponsored by F. Richard Ferraro)—This study investigated students' perceptions of campus climate at a Midwest university. Participants ( $N = 353$ ) filled out a questionnaire assessing their perceptions of sexual harassment and the campus climate for women and their knowledge of different involvement centers on campus. Results indicated that, overall, women were more likely to have experienced sexual harassment and to perceive a chilly climate than men. Women were also more likely to rate campus climate as not improving and as varying among departments than were men. Moreover, students' knowledge about university centers available for student involvement indicated more specific areas of a chilly climate on this campus, especially for women and Native American students. Implications within the educational environment are discussed.

(1100)

**Fuzzy Signal Detection Theory: Tests of Assumptions and Comparison With Traditional Analyses.** LAUREN L. MURPHY, JAMES L. SZALMA, & PETER A. HANCOCK, *University of Central Florida*—Both traditional signal detection theory (SDT) and fuzzy signal detection theory (FSDT; see Parasuraman, Masalonis, & Hancock, 2000) methods of analyses were compared using a duration discrimination task of brief light flashes. Both difficulty and response bias (by instruction) were manipulated. The main research question for FSDT was whether the assumptions of traditional SDT hold for this new model. The present study indicates that at both difficulty levels and

for all 6 participants, the assumption of normally distributed noise and signal-plus-noise distribution holds. In addition, the equal variance assumption holds for the more difficult discrimination for all participants. Results for the traditional SDT analysis varied across subjects

and may depend upon how the stimulus dimension is categorized for treatment, using traditional methods. These results suggest that traditional SDT may have limited utility in cases where stimuli can vary in their signal value.

## POSTER SESSION II

Exhibit Hall, Friday Noon, 12:00–1:30

## • VISUAL PERCEPTION •

(2001)

**Negative and Positive Congruence Effects in Letters and Shapes.**

THOMAS LACHMANN, *Brain Science Institute, Riken & University of Leipzig*, & CEES VAN LEEUWEN, *Brain Science Institute, Riken*—In six experiments using a binary classification task, letter and non-letter targets (geometrical shapes, pseudoletters, or rotated letters) were presented either in isolation or surrounded by a geometrical shape. The surrounding shape could be congruent or incongruent to the target. When the classification required a distinction between letters and nonletters, either explicitly (Experiments 1–3) or implicitly (Experiment 4), a negative congruence effect was obtained for letters, contrasting with a regular, positive congruence effect for nonletters. When no distinction was to be made, letters and nonletters invariably showed a positive congruence effect (Experiments 5 and 6). In particular, between Experiments 1–4 and Experiments 5 and 6, the occurrence of negative or positive congruence effects for the same stimuli depended on the task. Feature interaction, target selection, and response competition explanations were tested against a feature integration approach; the results were explained in terms of different feature integration strategies for letters and nonletters.

(2002)

**Exclusion Failure Is an Invalid Indicator of Unconscious Perception.**

GARY D. FISK, *Georgia Southwestern State University*, & STEVEN J. HAASE, *Shippensburg University*—Systematic failure to follow exclusion instructions (i.e., providing responses that do *not* match a target presentation) has been proposed as an indicator of unconscious perception. The following experiments were performed to test the validity of exclusion tasks. The first experiment replicated Experiment 1 of Merikle et al. (1995) by showing elevated exclusion failure of masked word stimuli in a stem completion task. The second and third experiments were similar to Experiment 1, except that discrimination performance (word vs. nonword) was also examined in separate blocks or concurrently on each trial. Exclusion failure occurs at levels of discrimination sensitivity that are significantly above zero. This suggests that exclusion failure is not unconscious, but rather a subjective threshold effect. The fourth experiment shows that increasing the response possibilities in the stem completion task eliminates the exclusion failure effect. Altogether, these results demonstrate that exclusion techniques may not validly measure unconscious perception.

(2003)

**Estimation of Relative Area.** JOHN B. PITTINGER, *University of Arkansas*, STEVEN B. FLYNN, *Louisiana State University Health Sciences Center*, & TONY REALINI, *West Virginia University Health Sciences Center*—Participants viewed pairs of circles, each pair consisting of a smaller circle centered within a larger one, and estimated the areas of the inner circles as proportions of the area of the outer circles. The resulting psychophysical function was clearly nonlinear and demonstrated systematic overestimation of relative area. The mean estimates were accurately fit ( $r^2 = .99$ ) by a power function: estimated ratio = 1.05 (actual ratio)<sup>0.73</sup>. In an attempt to discover the perceptual basis of the relative area estimates, we had participants make three additional sets of estimates: areas of individual circles, lengths of individual lines, and relative lengths of line pairs. Relative-area estimates could not be predicted on the basis of estimates of individual circle's area, linear extent (i.e., diameters of the circles), or relative linear extent. This suggests that errors occur in the estimation of relative area itself, rather than in the estimation of lower order aspects of the figures.

(2004)

**Looking at Object Substitution Masking in Depth.** TODD A. KAHAN & ANDREA S. LICHTMAN, *Bates College*—When attention is di-

vided, a briefly presented target surrounded by four small dots is difficult to identify when the dots persist beyond target offset, but not when those same dots terminate with the target. This object substitution masking effect likely reflects processes at the image and object levels. At the image level, visual contours of the mask make feature extraction difficult. Recent data (Lleras & Moore, 2003) suggest that at the object level, an object file is created for the target-plus-mask, and this token is later updated with the mask alone (i.e., one object that changes over time). Using a novel approach (3-D displays), the present experiment ( $N = 21$ ) indicates that object substitution masking also arises when the mask occludes the target (i.e., two distinct object tokens). Implications for theory and research are discussed.

(2005)

**The Role of Scene Stability in the Rapid Resumption of Visual Search.**

ALEJANDRO LLERAS, *University of Illinois*, & RONALD A. RENSINK & JAMES T. ENNS, *University of British Columbia*—In an interrupted visual search paradigm, a search display is presented briefly (look time, 100 msec), followed by a blank display (wait period, 900 msec). Search and blank displays cycle until participants find the target. Rapid resumption (RR) refers to the surprising ability of participants to rapidly resume the search, as evidenced by a large proportion of correct responses in the 500 msec following a display re-presentation (about 40%) than in the 500 msec following the initial presentation of the display (less than 5%). We examine what features of the display must remain stable between looks to observe RR. When the entire display configuration is changed, RR is not observed. When such target features as orientation, location, color, and response are varied between looks, RR is observed despite changes in some of these features, but not in others. We discuss implications of these results for the memory representations underlying search.

(2006)

**Fixation Control During Visual Search.**

HAROLD H. GREENE, *University of Detroit–Mercy*—In experiments with direction-coded displays, search fixation durations preceding correct and errant saccades were comparable during image-driven search. However, during image+knowledge-driven search, fixation durations depended on peripheral information preview. With ample access to peripheral preview, durations preceding errant saccades were longer than those preceding correct saccades (Experiments 1 and 2). Durations preceding errant saccades became relatively shorter when preview was constrained by a gaze-contingent moving window (Experiment 2). The findings suggest that image-driven search is controlled by a mechanism that presets durations with no regard to moment-by-moment information acquisition. Such an adaptation would facilitate image-driven search in which the primary processing may be a simple check of the target/distractor status of the currently fixated object. For image+knowledge-driven search, durations are controlled directly by the processing of object(s) of scrutiny. The results are explained by a fixation control model based on sigmoid functions.

(2007)

**Challenges to the Objective Threshold (Zero  $d'$ ) Criterion of Null Awareness.**

STEVEN J. HAASE, *Shippensburg University*, & GARY D. FISK, *Georgia Southwestern State University*—Several experiments were performed to replicate unconscious perception effects reported by Snodgrass, Shevrin, and Kopka (1993) and Van Selst and Merikle (1993). In these studies, identification performance was significantly different from chance when display parameters were set up so that detection  $d'$  was zero (i.e., an objective threshold for stimulus detection). Tachistoscopes were used in these studies to display the target words for 1 msec. In our experiments, target words were displayed on a CRT for 16 msec in between several forward and backward masks. In two of the three experiments, detection  $d'$  was not different from zero; however, identification performance was above chance. A persistent problem was that the individual words were not equally detectable and may have been correlated with the noise. These findings violate the

assumptions of overall zero  $d'$  as an objective measure of unawareness. Future experiments will be directed at solving these problems for computer-displayed stimuli.

(2008)

**Postural Stabilization of Visually Guided Eye Movements.** CED-RICK T. BONNET, *University of Minnesota*, BENOIT G. BARDY, *University of Paris XI*, & THOMAS A. STOFFREGEN, *University of Minnesota* (sponsored by Thomas A. Stoffregen)—We related eye movements to body sway. Standing subjects viewed horizontally moving (0.5 Hz) and stationary targets. In Experiment 1, subjects also stood with their eyes closed, with eyes steady or moving horizontally (0.5 Hz, in time with a metronome). In Experiment 2, we varied the frequency at which the visual target oscillated (0.5, 0.8, and 1.1 Hz). We measured motion of the head and torso, and we collected data on eye position. When following the visual target eye movements exhibited the same amplitude as target displacement (110), movements made with closed eyes were larger. In Experiment 1, sway amplitude was reduced (relative to the stationary target) with the moving visual target, but not during eyes-closed movement. In Experiment 2, sway was reduced when following the visual targets, but there was no effect of target frequency on sway. Overall, sway was influenced only by visually guided eye movements.

(2009)

**Within-Subjects Eye Movement Measures of Prior Knowledge.** FRANK M. MARCHAK, TODD DAVIDSON, & PAMELA B. WESTPHAL, *Veridical Research and Design Corporation*—Ryan, Althoff, Whitlow, and Cohen (2000) used eye movements to indirectly assess memory for scenes and found a relational manipulation effect, indicated by increased viewing of manipulated scene elements for subjects who had viewed the original scenes, when compared with control subjects who had not seen the originals. This effort replicated Ryan et al. and expanded the paradigm through development of a within-subjects analysis methodology to permit determination of prior knowledge of scenes without comparison with a control group. Details of relevant eye movement measures, clustering techniques, and analysis methods will be presented, as well as discussion of the implications of this approach for the study of implicit memory.

(2010)

**Border Elements Deter Shape-From-Shadow Via Negative Polarity, Not Motion, Not Color.** JOHN M. KENNEDY & JUAN BAL, *University of Toronto, Scarborough*—Motion of border elements of a shape-from-shadow Mooney face does not prevent shape-from-shadow percepts, and neither does border color, provided the border is dark to light from the shadowed to the illuminated side. This favors a perceptual theory (see Cavanagh & Leclerc) over figure-ground attention in explaining Hering's ringed shadow effect. Perception distinguishes eight borders (combining luminance/spectral, binocular/monocular, and static/moving borders). All eight trigger percepts of surfaces, but shadow percepts require positive luminance polarity at the border. The perceived border in the shape-from-shadow stimulus disrupted by Hering's line is figure-figure, not figure-ground—and not other feasible combinations that we list, in accord with Peterson, such as ground-figure-ground or figure-ground-figure.

• SKILL ACQUISITION •

(2011)

**Implicit Learning of Category Sequences.** ANNETTE BOLTE, *Technical University, Braunschweig*, & THOMAS GOSCHKE, *Dresden University of Technology*—We used a serial naming task to investigate the acquisition of an abstract categorical structure underlying a random sequence of specific exemplars. Participants named pictures of specific objects (e.g., *table*). The sequence of objects was random, but the semantic categories from which objects were selected (e.g., *furniture*) followed a repeating pattern. When participants were given full explicit knowledge of the category sequence (Experiment 1), or when they in-

tionally focused attention on the categories (Experiment 2), object naming latencies increased when the repeating category sequence was switched to a random category sequence. When segmentation of the sequence according to the underlying deep structure was facilitated by a fixed marker element, participants learned the category sequence even under incidental learning conditions, although they showed no explicit knowledge (Experiment 3). These results indicate that the acquisition of abstract sequential structures depends on attention and/or the presence of surface cues to the underlying deep structure.

(2012)

**The Representation and Processing of Fractions.** ARAVA KALLAI & JOSEPH TZELGOV, *Ben Gurion University*—In a series of experiments, we investigated the representation and processing of fractions. Participants were presented with pairs of numbers made up of positive integers, fractions, or a fraction and an integer. In one task, the numbers were of equal physical size, and the participants had to perform numerical size comparisons. In another task, the pairs differed physically and numerically, and the participants had to perform physical size comparisons. The effects usually obtained for integers were replicated, including the distance effect and the size congruity effects for physical comparisons. The results for pairs of fractions and mixed pairs were consistent with the idea that although a fraction may be represented as a numerical primitive smaller than one, there is no representation of specific-value fractions as primitives.

(2013)

**Top-Down Influences in Cognitive Skill Learning.** WILLIAM J. HOYER, JOHN CERELLA, & SERGE V. ONYPER, *Syracuse University*—Expertise in cognitive skill domains rests largely on the direct retrieval of solutions to familiar items. The bottom-up models of Logan (1988) and Rickard (1997) describe skill learning as an accumulation of item information in associative memory that occurs automatically, dependent only on the frequency of repetition. Because computing a solution is always an alternative to direct retrieval, it is possible that trainees may decide to continue to compute items, rather than to encode and retrieve items, depending on which strategy involves less effort. We report data from a skill task in which younger adults chose to compute and elderly adults chose to retrieve, because the computation was more costly for older adults. Increasing the difficulty of the computation reversed the strategy of the younger adults (and exposed typical age-related memory deficits). These results demonstrate that skill acquisition is influenced by top-down (strategic), as well as bottom-up (associative), factors.

(2014)

**Is Older Adults' Strategic Skill Acquisition Influenced by a Deficient Mental Task Model?** DAYNA R. TOURON, *Appalachian State University*, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology*—In skill acquisition tasks that involve a transition from rule-based processing to retrieval-based processing, older adults shift more slowly than young adults. In previous research, we adopted the noun pair (NP) lookup task to demonstrate that older adults are reluctant to rely on a memory retrieval strategy despite adequate NP learning, amplifying observed age differences in rates of skill acquisition. The present study examines how age differences in on-line cognitive monitoring influence strategy selection. In order to develop a mental task model that emphasizes the utility of shifting from scanning to retrieval, individuals must understand the relative costs and benefits of these strategies. We assess a monitoring deficit hypothesis, which predicts that older adults who are slow to shift to retrieval (1) have less accurate monitoring of trial-level response latencies and (2) fail to learn over trials that retrieval leads to faster responding than does scanning.

(2015)

**Routine Procedural Recipes for Rapid Learning in Choice-Reaction Tasks.** STEVEN C. LACEY, ADAM KRAWITZ, JONATHON

KOPECKY, DAVID E. KIERAS, & DAVID E. MEYER, *University of Michigan*—Exactly how do people become skilled at basic choice-reaction tasks? To help answer this question, we had participants learn to perform such tasks under controlled study and test conditions with various typical mappings between visual stimuli and manual responses. In several of these cases, participants mastered individual S–R pairs very rapidly, achieving essentially asymptotic response speed and accuracy within one or two trial blocks after 10 or fewer trials per pair. Frequently, their RT learning curves deviated significantly from the standard power law of practice; instead, they were low and flat or had steep exponential descents to a floor level. Our results suggest that skill acquisition in choice-reaction tasks may rely on one or both of two processes: (1) extremely rapid creation of new “production rules” for individual S–R pairs and (2) use of preestablished “routine procedural recipes” that efficiently interpret and apply new declarative knowledge on the basis of verbal task instructions.

(2016)

**Inferential Order Judgments in Rhesus Monkeys and Humans.** DUSTIN J. MERRITT & HERBERT S. TERRACE, *Columbia University*—In the present experiments, rhesus monkeys and human subjects were trained on a transitive inference task (e.g., AzzzB, BzzzC, etc.) and were later tested on previously untrained nonadjacent pairs (e.g., BzzzD). Accuracy and reaction time patterns during training and testing were consistent with both an ends-inward scanning process (positional and associative) and a positional comparison process. To discriminate associative versus nonassociative mechanisms, associative interference was created by randomly presenting one of two possible items per position during adjacent-pair training (e.g., B1zzzC1, B2 C1, B1zzzC2, etc.) Second, positional mechanisms were discriminated by training nine- and five-item lists and then testing between list pairs in order to determine whether positional information was organized according to relative or absolute position. Preliminary evidence suggests that both monkeys and humans use positional information and, further, that they may use relative positional markers when inferring overall list order.

## • SOURCE MEMORY •

(2017)

**Binding of Focally Encoded Versus Peripherally Encoded Information.** JEFFREY J. STARNES & JASON L. HICKS, *Louisiana State University*—Research in fields such as source monitoring has explored the binding of item (or focally processed) features and context (or peripherally processed) features (Chalfonte & Johnson, 1995), and research on multidimensional source monitoring has highlighted the possibility that context features may be bound to other context features (Meisser & Broder, 2002). The present study was conducted to determine whether episodic encoding processes involve mechanisms that bind context features to other context features (context–context binding) in the same way that context features are bound to item features (item–context binding). Results showed that the ability to recognize context features (color and location) was enhanced when a focally encoded feature (shape) was reinstated at test. In contrast, reinstating one context feature had no effect on recognition for the other context feature. We interpret the results as evidence that context features are bound to item information, but not directly to other context features.

(2018)

**Multidimensional, Nonthreshold Gaussian Model of Source Memory.** WILLIAM P. BANKS, *Pomona College*, CLAYTON STEPHENSON, *Claremont Graduate University*, NISHA GOTTFREDSON, *Pitzer College*, & ANDREW A. SPARROW, *Pomona College*—Linear source memory ROCs (and curved  $z$ -ROCs) have been taken as evidence that source memory is a recollective process with threshold properties. Indeed, the dual-process model (which assumes that recognition memory is some combination of recollection and familiarity) must use recol-

lection to model source memory because, by definition, familiarity of an item cannot provide source discrimination. However, the shape of the ROC is a weak source of evidence about the underlying processes that produced it. We provide direct evidence (as opposed to the good, but indirect, evidence of Slotnick et al., 2000) that continuous variations in item strength, combined with Gaussian source discrimination, can create a linear component in the ROC. We provide a multidimensional model that integrates source, old/new, and associative recognition memory. We argue that familiarity and recollection are intuitive terms inappropriately elevated to theoretical status and can themselves be explained by the more comprehensive multidimensional model.

(2019)

**Memories of Memory Sources: How Independent Are They?** HELENA KADLEC & RONA KERTESZ, *University of Victoria*—Remembering the sources of our memories provides important clues, and we often rely on these source clues to help us remember a particular memory. Because many extant models of memory assume that the sources are remembered independently of each other, we tested this assumption for a number of different sources, using the multidimensional signal detection theory paradigm. The present study, part of an ongoing series of experiments using lists of words associated with various sources, examines the independence of memories of associated sounds and font colors. In contrast to previous experiments that found strong dependencies between font size and vertical (but not horizontal) spatial location (the headline effect), evidence from two experiments here suggests that sounds and colors are remembered independently at the global level (separability holds) but that some local-level dependencies exist.

(2020)

**Independent Effects of Emotion on Item and Source Memory.** PATRICK S. R. DAVIDSON & ELIZABETH L. GLISKY, *University of Arizona*—Emotional experiences are easier to remember than neutral ones, but whether memory for all aspects of an experience is improved by emotion remains unclear. Some have argued that the influence of emotion is different on memory for item versus source information, whereas others have argued that emotion affects both similarly. Also, the effect of aging on this relationship is unclear. We examined item and source memory for emotional and neutral materials in young and older adults. In both age groups, memory for emotional items was superior to memory for neutral items, whereas the emotional content of the stimulus had no effect on source memory. However, source memory was improved when the source itself (tone of voice) was made emotional, although item memory was unaffected by this manipulation. The dissociable influences of emotion on item and source memory suggest that these two kinds of memory processing occur independently of one another.

## • RETRIEVAL PROCESSES •

(2021)

**Directed Forgetting and Autobiographical Memory.** MARK A. OAKES, SUSAN JOSLYN, MONICA A. SILVERMAN, & LIMOR NADAV, *University of Washington*—Joslyn and Oakes (in press) found that subjects who were told to forget autobiographical events (forget group) recalled fewer events than did subjects told to remember events (remember group). In a series of follow-up studies using the same paradigm, (1) we tracked the sequence of recalled events in order to examine whether order effects could explain the memory cost for the forget group, and (2) we administered a yes–no recognition test. Results of the recognition test revealed that the forget group ( $d = 0.92$ ) had a significantly more difficult time discriminating an old event from a foil than did the remember group ( $d = 2.19$ ).

(2022)

**Segregation Accuracy in Item Method Directed Forgetting Across Repeated Tests.** PHILLIP N. GOERNERT, *Brandon University*,

ROBERT L. WIDNER, JR., *Minnesota State University*, & HAJIME OTANI, *Central Michigan University*—We examined changes in the accuracy of recall following item method directed forgetting instructions. Consistent with the account that following segregation from forget instruction items (F-items) remember instruction items (R-items) receive more rehearsal at study, accurate recall for R-items exceeded that for F-items. However, inconsistent with this segregation/differential rehearsal account, participants sometimes inaccurately reported F-items from study as R-items and R-items from study as F-items. Moreover, the inaccurate recall of F-items from study as R-items exceeded the inaccurate recall of R-items from study as F-items. These errors increased across tests showing hypermnnesia for immediate recall (Experiment 1) and for delayed recall (Experiment 2). The differentially increasing inaccurate recall across tests is consistent with the adoption of a memory strength heuristic to guide the identification of accessed items. The adoption of such a strategy suggests that segregation of items at study is an error-prone process susceptible to systematic bias at recall.

(2023)

**The Influence of Scripts on Retrieval-Induced Forgetting.** MALEN MIGUELES & ELVIRA GARCÍA-BAJOS, *University of the Basque Country*—Research has demonstrated that the act of remembering can prompt temporal forgetting or inhibition of related contents in memory. This study extends the retrieval-induced forgetting procedure to event memory. On the basis of a normative data study, high- and low-typicality actions of a mugging event were selected. The participants studied eight verified facts (high-typicality actions mentioned by over 25%) and eight nonverified facts (low-typicality actions produced by fewer than 5%). Then they practiced retrieving half of the high- or low-typicality actions of the event, and a nonpractice control group was added. In the final test, the three groups tried to recall both verified and nonverified facts about the event. The conventional retrieval-induced forgetting was found for low-typicality actions, but a comparable forgetting effect did not emerge in the high-typicality actions. This finding suggests that the activation of scripts may inoculate typical event information from retrieval-induced forgetting.

(2024)

**Further Predictions From a Neural Network Model of Retrieval-Induced Forgetting.** KENNETH A. NORMAN, EHREN L. NEWMAN, & GREG J. DETRE, *Princeton University*—Previously (Norman et al., 2004), we presented a neural network model that can account for basic retrieval-induced forgetting (RIF) results (e.g., cue-independent forgetting; more forgetting after retrieval practice vs. additional study). Here, we use the model to address several puzzles relating to RIF—for example, why does repeatedly trying to retrieve the subordinate meaning of a homograph (e.g., *prune*) first boost, then lower the accessibility of the dominant meaning (Johnson & Anderson, in press)? We also show that the model makes novel predictions regarding how target strength and competitor strength will affect the magnitude of RIF. Finally, we show that the model can account for puzzles in the list-learning literature—for example, the finding that, on AB-AC list-learning tests, forgetting of an AB pair is independent of memory for the corresponding AC pair, and the finding that generating a word leads to better memory than merely reading the word.

(2025)

**Strength-Based and Retrieval-Based Interference in Cued Recall.** MICHAEL F. VERDE & CAREN M. ROTELLO, *University of Massachusetts*—Studies of retrieval-based interference have cast doubt on the long-held idea that the strength of other items in memory per se can interfere with recall. Subjects studied sets of related pairs, either random nouns (*dog-leaf*, *dog-sand*, etc.) or category exemplars (*bird-raven*, *bird-pigeon*, etc.). Weak pairs belonged to a set in which other items were studied three times. Baseline pairs belonged to a set in which other items were studied once. With test position and presence of related items controlled for, cued recall of weak pairs was worse than baseline, evidence of strength-based interference. How-

ever, the effect was observed to interact with test position, evidence of retrieval-based interference.

(2026)

**Retrieval Inhibition and Impression Formation.** BENJAMIN C. STORM, ELIZABETH LIGON BJORK, & ROBERT A. BJORK, *UCLA*—Retrieval is a “memory modifier” (Bjork, 1975) in two senses: Information that is retrieved becomes more recallable than it would have been without such retrieval, and other information associated with the same cue or cue configuration becomes less recallable. Over time, therefore, retrieving information in response to current needs and demands acts to update, shape, and possibly distort our memories, including those involved in shaping our feelings toward others. To explore this possible role of retrieval-induced forgetting (Anderson, Bjork, & Bjork, 1994) in maintaining and modifying earlier formed impressions, we examined whether retrieving some memories associated to a given person, rather than others, would influence how we feel about that person. Or more generally, Can retrieval-induced forgetting act to alter the affective valence of our previously formed impressions? Alternatively, as has been indicated by certain directed-forgetting findings (Bjork & Bjork, 1996, 2003), perhaps our impressions persist despite the inhibition of certain specific memories.

(2027)

**Cumulating Retrieval Inhibition in Semantic and Lexical Domains.** ALAN S. BROWN, SANDY L. ZOCOLI, & MATTHEW M. LEAHY, *Southern Methodist University*—Three experiments examine changes in retrieval probability across successive exemplar generation within categories defined semantically and lexically. A common set of 144 category-plus-letter cues was blocked either semantically (*fruit-P*, *fruit-A*, *fruit-M*) or lexically (*insect-C*, *sport-C*, *car-C*), with a mixed control (*fruit-P*, *insect-C*, *disease-M*). All participants received the same set of cues, but in one of three different arrangements. There was a linear decline in retrieval probability across successive cued retrievals within both semantic and letter categories, with no change for the mixed control. Semantic retrieval inhibition was also reflected in the decline in retrieval probability across successive letter categories and successive 12-item blocks in the mixed condition. Semantic and lexical retrieval inhibition is unrelated to the normative frequency of target exemplars, although access to high-frequency exemplars declines across successive semantic categories. Finally, verbal ability level influences lexical, but not semantic, retrieval inhibition.

• VISUAL WORKING MEMORY •

(2028)

**The Role of Attention in Binding Features in Visual Working Memory.** JEFFREY S. JOHNSON, ANDREW HOLLINGWORTH, & STEVEN J. LUCK, *University of Iowa*—Recent studies of visual working memory have suggested that maintaining feature bindings, as opposed to single features, is dependent on the continued engagement of attention. For example, Wheeler and Treisman (2002) found that memory for bindings was worse than memory for features, but only under conditions that may have challenged attention. To more directly explore the role of attention in maintaining feature bindings in visual working memory, an attention-demanding visual search task was interposed during the delay interval of a change detection task. Although binding memory was worse than feature memory overall, the interposed search task produced only modest performance decrements, and these decrements were equivalent for feature memory and binding memory. Similar results were obtained when irrelevant distractor items were presented along with the stimulus array at test. Thus, the maintenance of bindings in visual working memory does not depend on the continued engagement of attention.

(2029)

**Cross-Cultural Differences in Contextual Processing in Visuospatial Short-Term Memory.** AYSECAN BODUROGLU, PRITI SHAH, &

RICHARD NISBETT, *University of Michigan*—Recent studies have shown differences in contextual information processing between East Asian and Westerners, with the earlier group characterized by a holistic cognitive style (Nisbett et al., 2001). For example, Kitayama et al. (2003) found that in the framed line task, Americans performed worse when trying to replicate the proportional relationship between the line and its frame than when they tried to replicate the absolute length of the line, whereas the Japanese showed the opposite pattern. However, the extent to which these cultural patterns arise because of differences in visuospatial representations and spatial attentional processing have not been directly investigated. Using such tasks as serial spatial recall (Boduroglu & Shah, 2003) and visual change detection (Jiang et al., 1999), which have provided evidence for configural rather than absolute location-based representations, we investigated cultural differences in visuospatial representations and the relationship between the amount of configural information preserved and attentional style.

(2030)

**Location-Based Selection for Storage in Visual Working Memory.** ANTONINO RAFFONE, *University of Sunderland and Brain Science Institute, Riken*, JOSE L. HERRERO & ROS CRAWLEY, *University of Sunderland*, & CEES VAN LEEUWEN, *Brain Science Institute, Riken* (sponsored by Gezinus Wolters)—Visual working memory (VWM) is characterized by a limited storage capacity. Previous studies suggest that a biased competition may occur between objects for storage in VWM—for example, on the basis of color. In a series of experiments, we investigate a location-based attentional filtering of objects in a change detection VWM paradigm (Luck & Vogel, 1997). In a selective condition, the location of either targets (response-relevant objects) or distractors is cued by landmarks (frames) in a preview display, with and without a maintenance delay between preview and sample displays. The results generally show the high efficiency of activation- or inhibition-based parallel selection of locations and suggest that the underlying biased competition is time dependent at both encoding and maintenance of location selectors, often in interaction with the number of cued locations. Maximum filtering occurs when target locations are cued without delay. Our findings are explained by a simulated neurocomputational model bridging the gap with related neurophysiological studies.

(2031)

**An Object Benefit for Encoding Two Color Features of an Object in Visual Short-Term Memory (VSTM).** YAODA XU, *Yale University*—The object benefit in VSTM refers to the observation that two features of an object are better remembered in VSTM than the same two features located on two separate objects. Although this object benefit has been observed for encoding between-dimensions features (e.g., a color and an orientation of an object), it is generally absent for encoding within-dimension features that share the same set of possible feature values (e.g., two color features of an object). Here, in a VSTM change detection study (Luck & Vogel, 1997), instead of using one set of color values for the two color parts of an object, as in previous studies, two sets of distinct color values were generated, one for each color feature of the object. With this manipulation, an object benefit in VSTM was observed for encoding two color features of an object in VSTM. Implications of this result will be discussed in detail.

• PROPERTIES OF WORKING MEMORY •

(2032)

**Nonvisual Coding of Visual Information in Working and Short-Term Memory.** BRADLEY R. POSTLE, *University of Wisconsin, Madison*—I will present evidence that the short-term retention of color and shape information depends, in part, on a verbal code and that the short-term retention of locations can depend on a prospective motor code. In the color task, subjects performed span tasks with color and with location stimuli, and visuomotor (pointing) or verbal (digit-naming) distraction tasks were interpolated into ISIs of the span tasks. The results revealed a robust double dissociation, with strong effects of naming distraction

on color span and strong effects of pointing on location span. With Attneave shapes, the memory task was the  $n$ -back working memory task with a comparable interference procedure, and the results were the same. These results are consistent with the view that humans automatically re-code visuo-object information into a verbal code for its retention in memory. Delayed recognition of locations was selectively disrupted by saccades, consistent with the prospective motor coding hypothesis.

(2033)

**Evidence of Cross-Domain Attention Limitations in Working Memory.** CANDICE C. MOREY & NELSON COWAN, *University of Missouri, Columbia*—Within current theories of working memory, there has been a debate regarding whether attention serves as a memory-storage device (Cowan, 2001) or whether all storage takes place in automatically held buffers. We have investigated this question using concurrent auditory verbal and visuospatial stimuli. The visual stimuli are pairs of arrays, including 4–8 colored squares, that are identical or differ in the color of at most one square (Luck & Vogel, 1997). The auditory stimuli are series of random digits to be recalled. Two experiments taken together indicate a cost of concurrent memory loads in both modalities. Also, this cost is increased when the digit load is overtly rehearsed, and therefore retrieved, during the retention interval for the arrays. The data imply that some resource—presumably, the focus of attention—is shared between visuospatial and auditory verbal stimuli in working memory.

(2034)

**Exploring the “Conceptual Span” Task of Semantic Working Memory.** TINA M. MIYAKE & MICHAEL J. KANE, *University of North Carolina, Greensboro*—Haarmann, Davelaar, and Usher (2003) argued that verbal short-term memory (STM) comprises phonological and semantic buffers, with the latter important to comprehension, and they created a conceptual span task to tap semantic STM. Subjects saw lists of words grouped into three taxonomic clusters (e.g., *fruits, animals, and appliances*) and were cued to recall items from only one cluster. Conceptual span scores predicted comprehension scores better than did traditional STM tasks. We tested whether the semantic nature of the conceptual task or its processing demands (e.g., categorical encoding, selective recall) determined its predictive utility by creating nonsemantic analogues: orthographic (clustered by first letter), color (clustered by presentation color), and phonological (clustered by first vowel sound). In two experiments, subjects completed conceptual and STM tasks along with comprehension and intelligence tests. The conceptual span tasks were strongly intercorrelated, and the semantic task was generally not a superior predictor of cognitive abilities.

(2035)

**Asymmetric Interference in Processing of Information Structure: Elements Interfere With Relations, but Not Vice Versa.** AARON S. YARLAS, *Grand Valley State University*, & VLADIMIR M. SLOUTSKY, *Ohio State University*—Recent studies (Yarlas & Sloutsky, 2003) provide evidence indicating that while elements are directly detected and identified during initial stimulus encoding, relations are not but, rather, are only represented indirectly through emergence from binding. If this preferential encoding for elements is the case, it follows that variation in relations should not affect detection of elements, but that variations in elements should affect detection of relations. In the present study, undergraduates were asked to sort object arrangements according to either shared elements (e.g., shapes) or shared relations among elements (e.g., ABA, such as square–circle–square). The nonattended feature was correlated, fixed, or orthogonal to the attended feature. Data indicate that while variations in relations did not affect sorting of elements, variation in elements affected both speed and accuracy of relational sorting. This study thus supports the dominance of elements over relations during initial encoding of stimuli.

(2036)

**Similarities in Error Patterns Across Modalities and Codes in Serial Memory.** SÉBASTIEN TREMBLAY, KATHERINE GUÉRARD,

CINDY CHAMBERLAND, & MATHIEU COUTURE, *Université Laval*—The capacity to remember the order of events in the short term has been a key topic of study within experimental psychology. The most usual method for studying serial memory is typically to present a person with a sequence of items and to require the reproduction of the sequence. Features of such tasks and the typical pattern of errors that can be produced are well documented in relation to serial recall that involves auditory or visual presentation of verbal items, but less is known about their analogue for spatial stimuli. In the present study, the same participants performed serial recall for each code and modality. Serial position curves and typical migration distributions are observed regardless of the nature of the stimuli. The data yielded by the experiment inform the current debate as to the nature of the mechanisms underlying serial memory and will serve to constrain modeling efforts.

(2037)

**Hebbian Auditory Sequence Learning: The Role of Passive Perceptual Processes.** ROBERT W. HUGHES & DYLAN M. JONES, *Cardiff University* (sponsored by Markus Damian)—It is well known that auditory-verbal serial recall improves for a sequence that is intermittently repeated across a series of trials (Hebb, 1961). The present study sought to isolate the contributions of response production, rehearsal, and passive perceptual processes to this long-term implicit auditory sequence learning effect. Hebbian auditory sequence learning occurred regardless of whether or not participants overtly responded to the repeating sequence (Experiment 1) and irrespective of whether or not participants engaged in articulatory suppression (Experiment 2). However, irrespective of articulatory suppression, no learning was found when the repeating sequence was rendered perceptually incoherent by presenting its constituent items in different voices (Experiment 2). The results suggest that long-term implicit auditory-verbal sequence learning bypasses processes typically associated with a discrete short-term store (e.g., phonological storage, verbal rehearsal) and may reflect the legacy of an automatic passive order encoding process that is a by-product of auditory perceptual organization.

(2038)

**The Time Course of the Irrelevant Sound Effect: When Is a Little Enough?** THOMAS J. DOMANGUE & EMILY M. ELLIOTT, *Louisiana State University*—We investigated Jones and Macken's (1993) equipotentiality hypothesis (i.e., that the amount of disruption caused by irrelevant speech and tones in a serial recall task will be equivalent) by presenting irrelevant speech and tones during different segments of a serial recall task. Participants were shown printed digit lists (eight digits in length), and the irrelevant sounds were presented during one of five 4-sec blocks per trial. Results showed that the greatest disruption from tones was in the second half of the presentation of the to-be-remembered items. The disruption from speech was most severe in this same segment (the second half of presentation). Speech was also significantly disruptive in the first half of the retention interval. The findings did not support a strict interpretation of the equipotentiality hypothesis and were interpreted with respect to a two-process theory that incorporates characteristics from current models of irrelevant sound effects.

(2039)

**Forgetting Rates Constrain Working Memory Span Independently of Processing and Storage Abilities.** DONNA M. BAYLISS & CHRISTOPHER JARROLD, *University of Bristol*, & STEVEN RODENRYS, *University of Wollongong*—Working memory is typically measured using span tasks that combine processing and storage operations. Research has shown that individual differences in both processing and storage abilities are important constraints on children's working memory span performance (Bayliss et al., 2003). However, recent models of working memory have suggested that individuals may also vary in the rate at which they forget information (e.g., Hitch et al., 2001). This study examined the relationship between forgetting rates and working

memory span performance in 9-year-old children. Forgetting rates were measured using a modified Brown–Peterson task involving the recall of words following a continuous processing activity. Results showed that scores on the forgetting rate tasks explained unique variance in working memory span performance that was independent of that accounted for by processing and storage abilities. This suggests that variation in forgetting rates may be an additional constraint on working memory that is important for higher level cognition (Bayliss, D. M., Jarrold, C., Gunn, D. M., & Baddeley, A. D., 2003, The complexities of complex span: Explaining individual differences in working memory in children and adults, *Journal of Experimental Psychology: General*, **132**, 71–92; Hitch, G. J., Towse, J. N., & Hutton, U., 2001, What limits children's working memory span? Theoretical accounts and applications for scholastic development, *Journal of Experimental Psychology: General*, **130**, 184–198).

• EYEWITNESS MEMORY •

(2040)

**A Memory Trace Strength Based Account of Misattribution Errors in Eyewitness Testimony.** ROBERT L. WIDNER, JR., *Minnesota State University*, PHILLIP N. GOERNERT, *Brandon University*, HAJIME OTANI, *Central Michigan University*, & SARAH E. WINKELMAN, *Minnesota State University*—Widner, Goernert, Otani, and Winkelman (2004) examined misattribution errors in eyewitness testimony by crossing hypernesia and directed-forgetting paradigms. Hypernesia, as well as directed forgetting, was observed for correctly and incorrectly recalled characteristics. Furthermore, more misattribution errors were committed for forget, relative to remember, characteristics. The authors speculated that moderate, relative to strong and weak, memory traced information has a greater likelihood of being misattributed. In the present study, we empirically examined this by manipulating memory trace strength. Using the item method of directed forgetting and multitrial free recall, target characteristics were processed at either a semantic (pleasantness rating) or an acoustic (rhyming task) level. We observed that semantically processed information replicated the patterns observed in Widner et al. In addition, we observed a greater number of misattribution errors at the acoustic level relative to the semantic level. These findings shed light on hypernesia and directed-forgetting phenomena and have implications for eyewitness interrogation.

(2041)

**Eyewitness Memory Following Forced Confabulation and Memory Implantation: Does a Warning Make a Difference?** JENNIFER K. ACKIL, *Gustavus Adolphus College*—Research has established that witnesses are prone to developing false memories for events that they were knowingly forced to make up, or confabulate (e.g., Ackil & Zaragoza, 1998). Whether the incidence of false memory development following forced confabulation differs from that which follows interviewer-provided suggestions is an issue that has been relatively unexplored. Thus, the present study compared the consequences of these two suggestive interview techniques (forced confabulation vs. memory implantation) and assessed the influence of an instructional warning at the time of retrieval. After viewing video events, all participants were knowingly forced to confabulate answers and read experimenter-provided answers in response to an interviewer's blatantly false questions. Whereas forced confabulation led to fewer false memories than did memory implantation when participants were warned that they may have been misled, the incidence of false memory resulting from these suggestive techniques was comparable in the absence of a warning.

(2042)

**SUSPECTS: Distinctiveness, Recollection, and the Sequential Lineup Advantage.** CURT A. CARLSON, SCOTT D. GRONLUND, SHAWN R. SINGER, & DEBRA L. TOWER, *University of Oklahoma*—A sequential lineup (view lineup members one at a time) often results in superior performance, as compared with a simultaneous lineup

(view all lineup members at the same time). A framework called SUSPECTS posits that the sequential lineup advantage occurs when distinctive information is encoded and recollection is used to access that information and that recollection is more likely in a sequential lineup (Gronlund, in press). An initial test of this framework focused on the role of distinctiveness. Item- and event-based distinctiveness were created at encoding (Hunt, 2003). As is predicted by SUSPECTS, the sequential lineup was more sensitive to distinctiveness than was the simultaneous lineup. Follow-up experiments will manipulate the likelihood of recollection in the two types of lineups. It is possible that it is the type of processing, rather than the type of lineup, that produces the so-called sequential lineup advantage.

(2043)

**Biases of Typicality in Eyewitness Memory.** ELVIRA GARCÍA-BAJOS & MALEN MIGUELES, *University of the Basque Country*—This study looks at the effects of typicality on eyewitness memory. If individuals have prior knowledge of common crime script actions and robber stereotypes and use it to comprehend and retrieve events, their memory may also include typical but false information. The actions involved in a bank robbery and the characteristics of the bank robbers were determined in a normative study, and a sequence for a bank robbery was selected. Taking into account normative data and the content of the robbery, a recognition task was designed based on high- and low-typicality true and false actions from the event and the characteristics of the robbers. The recognition was better with high- than with low-typicality actions and characteristics of the robbers, while at the same time the contents with high typicality generated a greater proportion of false alarms. Prior knowledge is relevant in cognitive processes, but it can also bias eyewitness memory.

• COGNITIVE CONTROL •

(2044)

**Emotional Modulation of Cognitive Control: Positive Affect Reduces Perseveration at the Cost of Increased Distractibility.** THOMAS GOSCHKE, GESINE DREISBACH, & BRIT REIMANN-BERNHARDT, *Dresden University of Technology*—Organisms pursuing goal-directed behavior in changing environments face two fundamental challenges: to maintain and shield goals from distraction, on the one hand, and to flexibly switch between goals and update working memory in response to significant changes, on the other. Here, we show that positive affect plays an important role in dynamically modulating the balance between stable maintenance and flexible switching. Both in a cognitive set-switching task and a visual search task requiring cross-dimensional attention shifts, mild increases of positive (as compared with neutral or negative) affect induced by briefly presented emotional pictures reduced perseveration from a previous cognitive or attentional set but, at the same time, incurred a cost in terms of increased distractibility. This pattern of increased cognitive flexibility and reduced attentional shielding fits with recent neuropsychological models of cognitive control, according to which effects of positive affect may be mediated by increased dopamine levels in frontal brain areas.

(2045)

**Cue Validity and Cognitive Control in the AX-CPT.** JASON F. REIMER, *California State University, San Bernardino*, THOMAS C. LORSBACH, *University of Nebraska*, & VIARA STANKOVA, *California State University, San Bernardino*—Braver and his colleagues (e.g., Braver & Barch, 2002) have argued that attention and inhibition functions on the AX-CPT yield information about the ability to represent and maintain context information in working memory. Specifically, attention to a valid context cue leads to benefits on AX trials, as well as to costs on AY trials, whereas attending to invalid cues improves performance on BX trials by helping inhibit a strong tendency to provide a target response. In previous research, only one dimension of the cue has been manipulated in the AX-CPT. In order to examine how cue validity (partial vs. complete) affects AX-CPT performance,

multiple dimensions of the cue were manipulated. Our results indicate that partially valid cues decrease performance on BX but increase performance on AY trials, a pattern previously found to be diagnostic of impaired context processing. These results have implications for the use of context representations in cognitive control.

(2046)

**Inhibitory Control Is Associated With Neuronal Tryptophan Hydroxylase (TPH2) Genotype.** JENNIFER M. GLASS, SCOTT F. STOLTENBERG, STEPHEN T. CHERMACK, HEATHER A. FLYNN, SHENG LI, & MARGARET E. WESTON, *University of Michigan*—Response inhibition is an important aspect of executive control frequently studied with the stop signal procedure, where the reaction time to stop a response (stop-RT) is estimated. Stop-RT is correlated with impulsivity, aggression, and attention problems. Since serotonergic function is also related to impulsivity and aggression, we hypothesized that genetic variation in serotonin components would be associated with stop-RT. Participants of white, non-Hispanic race/ethnic origin (56 males, 79 females) completed the stop signal procedure, and buccal cells were genotyped. Five variants in the serotonin system were examined. We observed main effects of sex and neuronal tryptophan hydroxylase (TPH2, intron 8 T/C) genotype on stop-RT, as well as a sex  $\times$  TPH2 genotype interaction. TPH is the rate-limiting enzyme in the biosynthesis of serotonin and is an important candidate gene for several psychiatric disorders. This appears to be the first reported association between neuronal TPH2 genotype and a laboratory measure of inhibitory control.

(2047)

**Neuroanatomical Correlates of Cue Switching Versus Task Switching.** RICHARD L. BRYCK, KEITH B. C. GORDON, & ULRICH MAYR, *University of Oregon* (sponsored by Ulrich Mayr)—Mayr and Kliegl (2003) recently provided evidence that switch costs can be dissociated into two independent processing components. Using a random-cueing task-switching paradigm, with a 2:1 mapping between cues and tasks, they showed that a large share of the total switch cost could be attributed to changes in cues and a smaller, though reliable, component was associated with actual task changes. Here, we use rapid, event-related fMRI in an attempt to dissociate neuroanatomical correlates of cue switching and task switching. Preliminary results show activation in the bilateral striatum and the left hippocampus for the cue-switch contrast and in the left lateral prefrontal and left superior parietal regions associated with the actual task-switch contrast. These results support the claim that task switching can be dissociated into a cue-driven retrieval component and a fronto-parietal component associated with translating task rules into an appropriate attentional setting.

(2048)

**Effects of Task Interference on Neurons in the Posterior Parietal Cortex (PPC).** GIJSBERT STOET & LAWRENCE H. SNYDER, *Washington University*—Interleaving two similar but distinct tasks leads to task interference, manifest as a delayed reaction time. This has been demonstrated, for example, with the Stroop task in humans, as well as with task-switching paradigms in both humans and animals (e.g., Stoet & Snyder, 2003). Here, we report the effects of task interference on neural activity in the PPC. Rhesus monkeys switched between two sensory-motor mapping tasks, in which half of the stimuli required opposite responses in the two tasks (incongruent trials). We recorded from 392 neurons in the PPC. Neuronal responses on incongruent trials were delayed by 47 msec, as compared with congruent trials, but were otherwise identical. Given that neuronal activity is delayed but, otherwise, similar following congruent and incongruent stimuli, we conclude that PPC reflects but is not itself the site of increased processing due to conflict. We discuss the implications of these data for theories of task interference.

(2049)

**Evidence for Conflict Monitoring in the Simon Task.** PETER WÜHR, *University of Erlangen-Nürnberg*—The Simon effect denotes faster

responses when the task-irrelevant stimulus position corresponds to the response position than when it does not. Accounts of this effect assume that stimulus position automatically activates a spatially corresponding response while the correct response is being computed. Yet the Simon effect has been found to be reduced after noncorresponding trials, which has been taken as evidence for conflict monitoring in the Simon task. Alternatively, sequential modulations have been explained in terms of feature integration processes because, in the typical Simon task, different sequences of spatial correspondence conditions covary with different amounts of feature overlap between subsequent trials. Two experiments investigated whether sequential modulations of the Simon effect can occur when feature overlap in the different conditions is the same. Sequential modulations of the Simon effect were found in both experiments. Although the feature integration account cannot explain these results, it is consistent with the notion of conflict monitoring.

(2050)

**Effects of Phonological and Semantic Similarity on Cross-Task Repetition Amnesia.** ADDIE JOHNSON & SANDER MARTENS, *University of Groningen*, & MARK R. NIEUWENSTEIN, *University of Utrecht*—Contrary to predictions of attentional capture by items held in memory, recent research (Nieuwenstein, Johnson, Kanai, & Martens, 2004) has shown that identification of a target presented in rapid serial visual presentation (RSVP) is impaired when that target is also held in working memory for a memory search task, relative to when the items held in memory are different from those to be identified in the RSVP task. This effect seems to be a result of difficulty in assigning a new stimulus–response rule to a stimulus nominally identical (or similar) to that used for another task. Here, we report experiments that explore the level of representation (e.g., phonological, semantic) involved in the stimulus representations and show that the amnesia for stimuli repeated across tasks is dependent on both memory- and capacity-related factors.

(2051)

**Spatial Numerical Congruency Effect Overruled.** WIM NOTEBAERT, WIM GEVERS, WIM FIAS, & ANDRE VANDIEREN-DONCK, *Ghent University*—The SNARC (spatial numerical association of response codes) effect shows that reactions on small numbers are faster with the left than with the right response key and vice versa. This is observed even when the magnitude of the number is irrelevant. The SNARC effect is explained by long-term memory (LTM) associations between the magnitude and the position on a mental number line. On half of the trials, subjects had to react to the magnitude. On the other half of the trials, subjects had to respond to the orientation of the number. Subjects responding compatible (<5 left, >5 right) in the magnitude task showed a SNARC effect. Subjects responding incompatible (<5 right, >5 left) started off with a regular SNARC effect but ended up with a reversed SNARC effect. The results show that LTM spatial associations of numbers can easily be overruled by short-term memory spatial associations.

(2052)

**Effects of Postcue Time on Intentional Forgetting.** YUH-SHIOW LEE & HUANG-MOU LEE, *National Chung-Cheng University*—This study examined the effect of time on directed forgetting and suppression. Experiment 1 followed the procedure in Anderson and Green (2001) and manipulated both the number of response (think)/suppression (no-think) attempts and the duration of response/suppression for each word pair during the think/no-think phase. The result showed that increasing the number of suppression attempts led to worse recall in the subsequent memory test, suggesting that people can voluntarily forget information by willfully suppressing it, as was found in Anderson and Green. However, increasing the duration of suppression led to a smaller suppression effect. Experiment 2 used the item method of directed forgetting. The interval between the cue to remember/forget and the presence of the next item was manipulated. As the interval in-

creased, the correct cued recall and recognition rates of the to-be-forgotten words also increased. These results provide insights into the time course of intentional forgetting and suppression.

(2053)

**How Two Share a Task: Co-Representing S–R Mappings.** NATALIE SEBANZ, GÜNTHER KNOBLICH, IRING KOCH, & WOLFGANG PRINZ, *Max Planck Institute for Human Cognitive and Brain Sciences*—When two people engage in a joint action to achieve a common goal, each actor must form a representation of the other's actions. Previous studies suggest that this is achieved by observing the other's actions. The present study investigated whether individuals also form shared representations at the level of tasks—that is, whether stimulus–response mappings are co-represented. Identical and different tasks were distributed among pairs of participants. The results show that performance was affected by the nature of a co-actor's task even when no feedback about the other's actions was provided, suggesting that individuals formed shared representations of stimulus–response mappings. We propose that the advantage of co-representing tasks in joint actions lies in the ability to anticipate others' actions.

• DIVIDED ATTENTION •

(2054)

**Searching for the Gap: Comparing Young and Older Adults.** ELIZABETH T. DAVIS, *Georgia Institute of Technology*, TERRY SHIKANO, *ClickFox*, SCOTT A. PETERSON, *Cameron University*, & RACHEL K. MICHEL, *Georgia Institute of Technology*—What causes age-related differences in visual search performance? Does performance always suffer as age increases? To find out, we deconstructed search into component parts and applied predictions of several quantitative models (e.g., Davis, Shikano, Peterson, & Michel, 2003). Both young and older adults were tested with a Landolt-C target embedded among Os or mirror-image Landolt Cs. Target–distractor discrimination was equated across participants and search conditions. Older adults had worse acuity and needed Landolt Cs with larger gaps; however, they were better at sharing attention across spatial locations and showed less confusion about the target's location than did younger adults. Mirror-image search performance for both groups suggests capacity limitations, whereas simple-feature search performance does not. Although visual acuity declines with age, equating target–distractor discrimination overcomes mild deficits. Moreover, age-related differences in search performance are quantitative in nature and probably are not caused by changes in attention strategies or demands placed on attention.

(2055)

**When Similar Distractors Lead to Spared Performance: Target–Distractor Similarity and Lag 1 Sparing.** CORINNE DAVIS, TROY A. W. VISSER, & ROBERT BOURKE, *University of Melbourne*—When two targets are embedded in a temporal stream of distractors, identification of the first target (T1) is highly accurate, whereas identification of the second (T2) is impaired if it follows the first within about 500 msec. This second-target deficit is known as the attentional blink (AB). Previous studies have shown that increasing the similarity between targets and distractors leads to a larger AB. We extend these findings by examining the influence of target–distractor similarity on a phenomenon known as Lag 1 sparing (L1S) in which T2 performance is relatively unimpaired when it is presented immediately after T1 (i.e., at Lag 1). Our results show that L1S increases with greater target–distractor similarity, partly as a result of more accurate T2 performance at Lag 1. We explain these findings in terms of an intelligent input filter that is designed to process target-like stimuli on the basis of task parameters and to exclude nontargets.

(2056)

**Spatial Processing During a Period of Inattention: Evidence From the Attentional Blink and the Shooting-Line Illusion.** SHAHAB M.

GHORASHI & LISA N. JEFFERIES, *University of British Columbia*, & JUN-ICHIRO KAWAHARA, *Hiroshima University*—The present study examined the nature of spatial processing during a period of inattention. An inattentive state was produced by means of the attentional blink (AB), in which the perception of the second of two rapidly sequential targets (T1 and T2) is impaired. In three experiments, the AB was combined with the shooting-line illusion (SLI), in which a static line is perceived as growing from the location of a preceding cue and which depends critically on the locus of attentional focus. Observers reported the identity and location of the targets and the direction of the SLI. Two important findings emerged, related to T2. First, observers could report T2 location even when unaware of its identity. Second, the SLI occurred only when T2 was identified correctly. The finding that the SLI is predicated on conscious awareness of the spatial cue has important implications for the relationship between attention and conscious awareness.

(2057)

**Dynamic Spatial Tuning of Attentional Focus in the Attentional Blink.** LISA N. JEFFERIES, *University of British Columbia*, JUN-ICHIRO KAWAHARA, *Hiroshima University*, & SHAHAB M. GHORASHI & VINCENT DI LOLLO, *University of British Columbia*—When two targets (T1 and T2) are inserted in an RSVP stream of distractors, perception of T2 is impaired at intertarget lags shorter than about 700 msec. Paradoxically, this deficit (attentional blink, AB) is absent when T2 is presented directly after T1 (a phenomenon known as Lag 1 sparing). Visser et al. (1999) have shown that Lag 1 sparing occurs only when T1 and T2 are presented in a single RSVP stream. Yet Shih (2000) obtained Lag 1 sparing with T1 and T2 in separate streams. We manipulated the presence or absence of a second stream and the observer's foreknowledge of T1 location. Lag 1 sparing always occurred when T1 and T2 were in the same location. It also occurred when T1 and T2 were in different locations, provided that the observer had no foreknowledge of T1 location. We interpret this outcome as reflecting dynamic spatial tuning of attentional focus.

(2058)

**Attentional Enhancement for Arousing Distractors and Targets in RSVP Search.** KAREN M. ARNELL, KAREN MATHEWSON, DAVID FIJAVZ, & KASSANDRA V. KILLMAN, *Brock University*—Will negative, positive, or arousing words receive preferential processing in RSVP? In Experiment 1, participants searched RSVP streams of neutral words for color names. A pseudotarget word that appeared as a normal distractor but was neutral, negative, positive, or arousing was presented before the target word. Only arousing/taboo distractors reduced accuracy on the subsequent color target task. In Experiment 2, an attentional blink (AB) task was used, and arousing first targets led to a larger AB than did other emotion words. In Experiment 3, participants identified a lone word in a stream of nonwords. Target accuracy was higher for arousing words. In each experiment, the arousal ratings, but not the valence ratings, that participants gave to the words predicted target accuracy. The number of anxiety/depression symptoms reported by the participant predicted bias toward arousal words. Results provide evidence that arousing targets and distractors readily capture and hold attention in RSVP.

(2059)

**Scheduling Mental Processes in Dual Stroop Tasks With the Critical Path Method: The Effects of Task Difficulty and Practice.** MINSHENG CHEN, *National Yunlin University of Science and Technology*, JENN-YEU CHEN, *National Chung-Cheng University*, & CHING-FAN SHEU, *DePaul University* (sponsored by David W. Allbritton)—Schweickert (1983) applied the critical path method of scheduling to analyze reaction times in a dual task. Although the method provided a useful technique to deduce the schedule of the mental processes, its applicability has rarely been examined. We conducted four dual-task experiments to examine the effects of task difficulty and practice on the scheduling of mental processes, using the critical path method.

The results showed that when task difficulty increased, the scheduling network of a subject's mental processes shifted from one containing a Wheatstone bridge to one of serial process. Through practice, the scheduling network changed from a serial form to one that contained a Wheatstone bridge. These results may be accounted for by the adaptive executive control model (Meyer et al., 1995), according to which the scheduling of mental processes might be responsive to the subject's strategy.

(2060)

**Random-Walk Analyses of Posture Control: Life Span Changes and Dual-Task Costs.** RALF T. KRAMPE, MICHAEL RAPP, & FLORIAN SCHMIEDECK, *Max Planck Institute for Human Development*—Posture control (bodily sway) was investigated in a large-scale sample ( $N = 300$ ), with participants' ages ranging from 7 to 80 years. Balance performance (areas of center of pressure [COP] movements during 30-sec trials) showed U-shaped functions as a function of age. Older adults in their 60s showed stability similar to that of young adults; however, sway was markedly increased in individuals in their 70s. We used a random-walk analysis of COP trajectories (Collins & de Luca, 1995) to determine characteristics of unsupervised diffusion and supervised diffusion (presumably reflecting correction toward a stable center). Individually determined diffusion plots revealed that older adults compensate for increased unsupervised sway (resulting from their larger body mass indices) by stronger correction, whereas increased sway in children results from the relative absence of correction. Concurrent cognitive demands (working memory task during balancing) affected unsupervised diffusion rather than correction.

(2061)

**Responding in the Absence of Information: A Race Network Account.** DENIS COUSINEAU, *Université de Montréal*—Responding when no physical stimulation is present cannot be explained unless the cognitive system has some perception of the time and uses this information to make a default response. This implies that processing a stimulus, when present, takes a random amount of time and that a decision can be based on the perception of time. A simple extension to the race models accommodates these two assumptions. Such race models simplify into two distinct versions. These two versions were fitted to an experiment. To avoid perfect correlation between the motor response and the decision, we used a task more complex than the detection task: Participants had to make Response 1 if none or two signals were present and Response 2 otherwise. The results favor the version of the race model in which decision time distributions are more spread in time, caused by an absence of information.

(2062)

**Effects of Familiar Background Music on Working Memory and Motor Tracking.** DONALD J. POLZELLA & SCOTT SCHOELING, *University of Dayton*—Two groups of college students participated as listeners or nonlisteners, based on whether or not they preferred background music while working or studying. Half the participants in each group were trained according to a standardized memory search or unstable motor tracking task protocol. Testing consisted of multiple trials at varying levels of difficulty, with and without familiar background music. Background music enhanced motor tracking, particularly when the task was challenging. In contrast, background music disrupted aspects of working memory. There were no differences between listeners and nonlisteners. The results suggest that, regardless of an individual's predilection, familiar background music can affect human performance. The specific effect, whether enhancing or disrupting, may reflect the similarity between the task demands and certain objective characteristics of the music.

(2063)

**Line Bisection Across the Life Span.** LINDA M. RUECKERT, *North-eastern Illinois University*—Patients with neglect due to right hemisphere (RH) lesions tend to underestimate the left side of long lines

and overestimate the right side of short lines. Normal young adults show a mirror reversal of this pattern. Normal elderly adults show a pattern similar to neglect patients for long lines. If this reflects diminished RH capacity, elderly adults would be expected to exhibit a crossover similar to neglect patients for short lines. Seventy-seven subjects between the ages of 18 and 71 were shown 1-, 2-, 8-, 16-, and 28-cm bisected lines and were asked whether they were bisected too far to the left or the right. There was a positive correlation between *left* choices and age, indicating that older subjects perceived the right side of the line as longer, at all lengths. This suggests that the change in performance with age is due to a general shift in perceptual bias and is not merely a mild form of unilateral neglect.

• WORD PROCESSING •

(2064)

**Effects of Word Frequency and Degradation in Lexical Decision and Naming.** MELVIN J. YAP & DAVID A. BALOTA, *Washington University*—Word frequency and stimulus degradation produce large and additive effects in mean response latencies in lexical decision performance, implicating a separate stage before the lexical processes involved in lexical decision. Using distributional and higher order moments analyses, we further explored this pattern and found converging evidence of an early clean-up process reflected by the main effect of degradation (see also Plourde & Besner, 1997). Importantly, additive effects of word frequency and degradation appear incompatible with interactive activation models of lexical processing. We provide evidence that one indeed finds interactive influences of frequency and degradation in naming, consistent with extant models. Hence, the additive effects of frequency and degradation appear to reflect task-specific operations, as opposed to general characteristics of the lexical-processing architecture.

(2065)

**Categorization Based on Familiarity: A Words-Only Lexical Decision Study.** ROSTAM AZARBEHI & C. DARREN PIERCEY, *University of New Brunswick*—According to the referent model of lexical decision, words and nonwords are categorized on the basis of an average measurement of familiarity. Items more familiar than the average are categorized as words, and those less familiar than the average are categorized as nonwords. We performed simulations with high- and low-frequency words and no nonwords to determine whether low-frequency words would be categorized as nonwords. Results indicated that, regardless of the fact that the network had learned all of the items, low-frequency words were categorized as nonwords because their level of familiarity was lower than the average. As is predicted by the referent model, these results were successfully replicated with human participants. When instructed to complete a lexical decision task where all of the stimuli were high- or low-frequency words, participants incorrectly categorized low-frequency words as nonwords.

(2066)

**When Are Neighbors Hostile? Inhibitory Effects in Visual Word Recognition.** WENDY DE MOOR & TOM VERGUTS, *Ghent University* (sponsored by Tom Verguts)—Using masked priming, Segui and Grainger (1990) reported inhibitory effects of higher frequency neighbors on lower frequency targets (e.g., form–DORM), but not of lower frequency neighbors on higher frequency targets (e.g., dorm–FORM). Conversely, with unmasked (conscious) priming, they observed inhibition for word pairs of the type dorm–FORM, but not for word pairs of the type form–DORM. The results under masked priming were explained in terms of spreading activation; the effects with conscious primes were attributed to strategic effects. Here, we demonstrate that the results can be explained by the single and, therefore, more parsimonious explanation of inhibition. Furthermore, on the basis of this account, we predict inhibition of neighbors of the same frequency if prime and target are both high frequency, but not when they are low frequency. Importantly, we predict the same results for conscious and

unconscious conditions. Results were confirmed. Theoretical implications are discussed.

(2067)

**Examining the Impact of Time Perception Processes in Speeded Word Recognition Tasks.** TAMSEN E. TAYLOR & STEPHEN J. LUPKER, *University of Western Ontario*—Past research has suggested that participants use a time criterion to guide responding in a number of speeded-response tasks. Any unadorned time criterion account, however, incorrectly predicts equivalent latencies for all stimulus types (e.g., words and nonwords) when those stimuli are presented in the same mixed trial block. We investigated the possibility that stimulus type latency differences could be due to effects of stimulus difficulty on time perception, a conclusion consistent with the time criterion account. In several experiments, when participants were required to perform a lexical decision or naming task but to respond only once they estimated that 1 sec had elapsed, participants produced longer duration estimates to more difficult stimuli. In general, these results suggest that understanding speeded task performance—and speeded word recognition performance, in particular—necessitates looking beyond processes involved in acquiring information about the presented letter strings and examining more general response processes.

(2068)

**“ROSE” is Faster Than “rose”: Proper Name Advantage Using Ambiguous Words.** REMO JOB, *University of Padua and University of Trento*, FRANCESCA PERESSOTTI, *University of Padua*, ROBERTO CUBELLI, *University of Urbino*, & LORELLA LOTTO, *University of Padua*—In this work, we further explore the advantage of proper names with the first letter as a capital recently reported by Peressotti, Cubelli, and Job (2003) using ambiguous words, such as ROSE, that are both common nouns and proper names. Ambiguous words of this type were presented written in uppercase or in lowercase for a lexical decision task. The experimental lists also contained either unambiguous proper names and nonwords or unambiguous common nouns and nonwords. Context effects, as well as letter case effects, were found: When items were presented in uppercase, ambiguous names were responded to more quickly than control common nouns, but such effect decreased when items were presented in lowercase letters.

(2069)

**Lexical Processing and Episodic Memory: Influences of Regularity, Concreteness, and Frequency.** JASON M. WATSON & DAVID A. BALOTA, *Washington University*—Two experiments investigating the relation between lexical processing and episodic memory are reported that crossed frequency, imageability, and regularity. In Experiment 1, we replicated Strain, Patterson, and Seidenberg’s (1995) observation of a three-way interaction in speeded naming and extended their results by demonstrating that this interaction generalized to a subsequent surprise free recall test. This interaction suggests that concreteness contributes to the resolution of irregular spelling-to-sound correspondence for low-frequency words, which also appears to boost the recall of low-frequency, irregular, concrete words (e.g., *worm*). In Experiment 2, the orienting task was lexical decision, and the influence of regularity was eliminated. However, irregular words were still better recalled than regular words, with a greater influence of phonological distinctiveness for concrete than abstract words. The results suggest that phonological distinctiveness may exert an influence on subsequent recall performance in either an on-line (naming) or post-access (lexical decision) manner during verbal processing.

(2070)

**Consequences of Type Activation Without Token Individuation in Repetition Blindness.** ALISON L. MORRIS, *Iowa State University*, & CATHERINE L. HARRIS, *Boston University*—The type/token theory of repetition blindness claims that a word’s type is activated but is not bound to a separate token, leading to a failure of conscious perception. Type activation can be inferred from implicit measures, such

as priming. Two experiments showed differing effects depending on the nature of the prime–target relation. In Experiment 1, RSVP sequences, such as TORCH *cream touch* were sometimes followed by a pronounceable nonword (LOUCH). Participants either reported all the words or named the nonword. Equal amounts of priming of the irregular pronunciation of the nonword were observed under RB and non-RB conditions. In Experiment 2, an RSVP sequence was followed by a naming target that was sometimes semantically related to the last of the RSVP words. Here, a small interference effect on time to name the target was observed; again, the same magnitude of effect was found under RB and non-RB conditions.

(2071)

**Nonword Mixing and Visual Distraction in the Tempo-Naming Task.** LAURA M. LEACH, *SUNY, Stony Brook*, & CHRISTOPHER KELLO, *George Mason University*—Two experiments are reported that examined the effects of nonword mixing and visual distraction on performance in the tempo-naming task. Fast tempos were used to generate naming errors by means of severe time pressure. Under this time pressure, the presence of nonwords reduced the percentage of naming errors for words. The beneficial effect of nonwords was diminished when a dynamic mask was used to interfere with processing of the visual stimulus. It is argued that these results cannot be accounted for by mechanisms of route emphasis or control over criteria to respond. Instead, the results suggest a mechanism of control over the relative influence of bottom-up versus top-down information on lexical processing.

(2072)

**Limits on Automaticity; Both Context and Dual-Task Load Influence the Orthographic Effect on Auditory Rhyme Judgment.** BRUCE D. McCANDLISS, JASON D. ZEVIN, SAM ROBERTS, & ROBERT F. COLVIN, *Sackler Institute, Cornell University*, & THOMAS H. CARR, *Michigan State University* (sponsored by Thomas H. Carr)—Auditorily presented pairs of rhyming words are identified more quickly if they have the same spelling pattern (KITE–BITE) than if their spelling patterns differ (KITE–FIGHT). In a series of experiments, we found that this effect was modulated differently by two different experimental context manipulations, suggesting a limit on the automaticity of orthographic processing. Judgments to the same rhyming pairs were contrasted within two distractor contexts: pairs that shared one phoneme (KITE–MINE) or none (KITE–SOON). When nonrhyming pairs shared a phoneme, endorsements of rhymes were more difficult and displayed a more pronounced orthographic effect. A dual-task manipulation of difficulty demonstrates that enhancement of the orthographic effect is not the result of a generic increase in difficulty. Orthographic effects were found under low load but were attenuated under high-load conditions. Results suggest a limited form of automaticity modulated by task demands and available resources.

(2073)

**Young and Older Adults' Responses to Homophones: Free Associations and Dominance Ratings.** KATHERINE K. WHITE, *College of Charleston*, & LISE ABRAMS, *University of Florida*—Homophones are words that share phonology but differ in meaning and spelling (e.g., *beach, beech*). We present the results of normative surveys that asked young and older adults to free associate to and rate the dominance of 197 homophones. Although norms exist for young adults on word familiarity and frequency for homophones, these results supplement the literature by (1) reporting the four most frequent responses to visually presented homophones for both young and older adults and (2) reporting young and older adults' ratings of homophone dominance. Results indicated that young and older adults gave the same first response to 67% of the homophones and rated homophone dominance similarly on 66% of the homophone sets. These results identify a subset of homophones that are preferable for research with young and older adults because of age-related equivalence in free association and dominance ratings.

• PSYCHOLINGUISTICS •

(2074)

**Does an Implicitly Mentioned Instrument Require a Pitch Accent?** STACY L. BIRCH, *SUNY, Brockport*, & CHARLES E. CLIFTON, *University of Massachusetts*—In spoken discourse, new entities generally receive pitch accents. Given entities need not. We investigated whether entities not mentioned but merely inferred are treated as new or given. Experiment 1 developed discourses in which inferences would be made. It showed that sentences mentioning an instrument (*She blew out the match*) were read quickly both following a context that supported the instrument inference (. . . *lit a cigarette*) and one that explicitly introduced the instrument. Experiments 2 and 3 presented these discourses to listeners for acceptability judgments. When context mentioned the instrument, participants preferred sentences without pitch accent on the instrument. When the context merely supported the instrument inference, participants preferred sentences with pitch accent on the instrument, just as when context provided no support for the instrument. Results suggest that entities that are “given” by way of implication nevertheless require pitch accents, as do entities that are “new” to the discourse.

(2075)

**Lexical Stress in the Processing of Spoken Italian.** LARA TAGLIAPIETRA & PATRIZIA TABOSSO, *University of Trieste* (sponsored by Patrizia Tabossi)—The study explored the role of lexical stress in the processing of spoken Italian. Lexical decision to a visual target (e.g., MOMENTI–MOMENTS) was faster after a semantically related than after an unrelated acoustically presented priming word (*attimi–instants* vs. *gesti mi[steriosi]–gestures mysterious*). Similar effects obtained when the related prime spanned two words, whether or not it matched the stress pattern of the one word prime (*atti misteriosi–acts mysterious* vs. *atti mistici–acts mystic*; Experiment 1). Degrading the signal did not alter the results (Experiment 2). However, when the task was one of repetition rather than semantic priming, stress showed its effectiveness: The two-words stress-mismatched prime (*atti mistici–acts mystic*) failed to produce facilitation (Experiment 3). Experiments 4 and 5 traced the time course of stress effects as tapped by the semantic and repetition priming tasks. The findings are discussed with respect to the role of suprasegmental information in current models of speech processing.

(2076)

**The Role of Prosody in a Silent Reading Task.** JENNIFER GROSS & BRIAN D. BARTEK, *Grand Valley State University*—Prosody (variations in length, intensity, and intonation of speech) is found in all spoken languages. Yet the role of prosody in written languages is poorly understood (Fodor, 2002). To avoid interpretative ambiguities associated with speech production tasks, we utilized a silent reading task to investigate prosody in written English. Participants read short paragraphs, in which select words were capitalized. As per a cover story, some instances of capitalization were intentional, a new technique to enhance the reading experience. In contrast, other instances of capitalization were the result of a computer virus. As was hypothesized, participants judged (on a 5-point Likert scale) target sentences as more helpful when the select, capitalized words were in prosodic focus (“MARK was arrested”). In contrast, sentences with capitalized words that were not in prosodic focus (“Mark was ARRESTED”) were judged as less helpful. These findings are consistent with Selkirk's (1995) theory of focus projection.

(2077)

**Can Talker Identity Constrain Spoken Word Recognition?** DALE J. BARR & EDMUNDO KRONMULLER, *University of California, Riverside*—Successful language comprehension depends on the access of talker-relevant knowledge during the comprehension process. How might such knowledge be characterized, and how does it constrain com-

prehension? Traditionally, research has focused on common ground—information that is shared and known to be shared. However, recent research has also noted that listeners maintain long-lasting episodic traces of speech events in implicit memory that preserve detailed talker information (e.g., Goldinger, 1996). We investigated the impact of these explicit and implicit sources of talker-specific information on spoken word recognition. We used eye tracking in a lexical competition paradigm (*bucket–buckle*) in which we manipulated whether a potential competitor was known to the current talker and, additionally, whether he or she had mentioned it previously. Although priming strongly attenuated competition, competitors produced equivalent interference inside or outside of common ground. These results pose problems for strongly interactive theories of language comprehension.

(2078)

**Processing English Left-Dislocations and Topicalizations.** KIEL CHRISTIANSON & LYN FRAZIER, *University of Massachusetts*—Left-dislocations (1, 2b) and topicalizations (2a) lie at the interface between syntax and discourse, but little is known about how they are processed. Two written questionnaire experiments were conducted investigating the processing of such constructions. Prince (1998) argues that left-dislocation, where a phrase at the beginning of the sentence is resumed by a pronoun, is used to introduce a new topic. Topicalization (2a) is used to highlight an open proposition, with the fronted phrase bearing a set relation (identity, subset, etc.) to prior discourse. (1) *The doctor who my wife sees, he thinks she is very attractive/she thinks he is very attractive/nobody thinks he is very attractive.* (2) *Mary took some of the neighborhood kids shopping. a. Her daughter-i, she bought t-i a doll. b. Her daughter-i, she-i bought a doll.* The results of the two studies supported the predictions made by Prince's account of both constructions.

## • TEXT PROCESSING •

(2079)

**Gist Representations of Argument Claims.** M. ANNE BRITT, CHRISTOPHER A. KURBY, & EVELYN COMBER, *Northern Illinois University*, & CHRISTOPHER R. WOLFE, *Miami University* (sponsored by Christopher R. Wolfe)—People create both gist and verbatim representations of the material they encounter (Brainerd & Reyna, 1998; Kintsch & van Dijk, 1978; Roediger & McDermott, 2000). Depending upon a gist representation for informal argument processing, however, can cause difficulties. Three experiments were conducted to examine the extent to which readers precisely represent claims. In each experiment, simple two-clause (claim–reason) arguments were presented to participants. They were then asked to recall the argument either immediately or after a short delay. The findings consistently show that the participants did not always reason from a precise representation of the claim. In fact, recall was very high (about 95%) for the theme (e.g., “recycling”) and the side (pro/con), but much lower (about 74%) for the stance (e.g., “should mandate” or “is important”). In a final experiment, we show how training participants to attend to the stance term results in improved validity judgments.

(2080)

**The Identification of Theme in Short Stories.** BLAINE MULLINS & PETER DIXON, *University of Alberta*—The appreciation of literary narrative generally involves the identification of a story theme—that is, a message or idea that unifies or motivates the content of the story and its presentation. In the present research, we manipulated the availability of potential themes by providing either thematically unconstraining or thematically constraining information about the story source. For example, the same story could be attributed either to “Oxford Anthology of the World’s Best Short Fiction” or to “Alfred Hitchcock’s Borrowers of the Night”; we conjectured that the latter title would constrain the possible themes readers would consider and, thus, make the search for a theme more efficient. Consistent with the view that readers search for themes at the story conclusion, reading time

was shorter and story content was more expected in final story segments when the information about story source was constraining rather than unconstraining.

(2081)

**Readers’ Sensitivity to the Match Between Characters’ Goals and Actions.** GIOVANNA EGIDI & RICHARD J. GERRIG, *SUNY, Stony Brook*—Are readers sensitive to the match between characters’ goals and the means the characters take to achieve those goals? To address this question, we wrote stories in which we manipulated both goals and actions. Each narrative began with a goal that was of either moderate or urgent importance to a character (e.g., Nell wants to leave her office because its 5:00 or to escape an earthquake). The texts continued with either moderate or extreme actions (e.g., Nell prints a file, turns off the light and leaves, or she springs down the stairs and forces her way out through the crowd). Both actions fulfilled the goal. Readers were quicker to integrate extreme actions with urgently important goals and moderate actions with moderately important goals. The results indicate that readers find it easier to construct situation models when characters’ actions are appropriate with respect to the importance of specific goals.

(2082)

**Semantic Knowledge Influences on Memory for Narrative and Expository Text.** MICHAEL B. WOLFE & JOSEPH A. MIENKO, *Grand Valley State University*—The influence of semantic knowledge associations on memory for text was examined. Semantic associations were operationalized as the semantic relatedness between individual text concepts and the semantic context created by a text and were assessed with latent semantic analysis (Landauer & Dumais, 1997). These semantic associations were used to predict recall, while controlling for the strength of concepts based on the text structure, as assessed with the construction integration model (Kintsch, 1998). In Experiment 1, semantic associations were predictive of both narrative and expository recall, but much more so for expository recall. In Experiment 2, common factual content was presented in narrative and expository formats, and subjects read as if studying for a test. Semantic associations were predictive of recall in both formats. Results are discussed in terms of differences in processing strategies that can influence the relevance of prior semantic associations during text comprehension.

(2083)

**The Influence of Repeated Reading on Perspective Effects: An Eye Movement Study.** JOHANNA K. KAAKINEN & JUKKA HYÖNÄ, *University of Turku* (sponsored by Jukka Hyönä)—Sixty participants read either a low or a high prior knowledge text three times from a given perspective while their eye movements were tracked. Before the third reading, the perspective was changed. The magnitude of the perspective effect remained unchanged across the first two readings. A facilitatory effect of repetition was observed for the first-pass reading, whereas such an effect was not observed for the look-back fixations. The results corroborate our previous findings that a reading perspective can already influence the initial stages of text processing and that the perspective effect is larger for a low prior knowledge text. The instruction to switch perspective reversed the pattern of results on the initially relevant and irrelevant target sentences, since first-pass rereading and look-back times for the initially irrelevant sentences were increased on the third reading. On the other hand, first-pass progressive fixation time decreased on the third reading regardless of perspective relevance.

(2084)

**How Memory Feeds Logical Reasoning During Reading.** BROOKE LEA, *Macalester College*, & ELIZABETH MULLIGAN, *University of Colorado*—Current psychological models of deduction claim that people can draw inferences on the basis of information that they receive from different sources at different times. Three reading comprehension experiments demonstrated that (Experiment 1) premises

that appear far apart in a text (distant) are not accessed and are, therefore, not used as a basis for logical inferences, unless (Experiment 2) the premises are reinstated by a contextual cue. Experiment 3 investigated whether these deductions are then integrated into the reader's situation model of the text. The results are interpreted in terms of a collaboration between memory-based text processing and higher level schema-driven logical reasoning.

(2085)

**Inconsistency Effects in Reading: The Role of General World Knowledge.** ANNE E. COOK, *University of Utah*, SABINE GUERAUD, *University of New Hampshire*, CHRISTOPHER A. WAS, *University of Utah*, & EDWARD J. O'BRIEN, *University of New Hampshire*—Previous research has shown that readers exhibit a slowdown in reading times on a target sentence (e.g., *Mary ordered a cheeseburger and fries*) when that sentence was inconsistent with previous text (e.g., *Mary was a vegetarian*). Presumably, the effect occurs because the two portions of text conflict with information in general world knowledge (i.e., vegetarians don't eat meat). If correct, the magnitude of this inconsistency effect should be a function of the semantic overlap between the two portions of text. We tested this hypothesis by varying the semantic relation between the target sentence and the previous text. When the relation between the two portions of text was high (e.g., *vegetarian/cheeseburger*), the inconsistency effect was larger and appeared earlier than when the relation was low (e.g., *vegetarian/tuna salad*). Results will be discussed in terms of memory retrieval during reading.

(2086)

**Processing Scientific Texts: Effects of Prior Knowledge and Text Structure.** PANAYIOTA KENDEOU & PAUL VAN DEN BROEK, *University of Minnesota*—College students with and without misconceptions in science were asked to think aloud during reading of scientific texts with a refutation structure that explicitly contradicted and explained students' misconceptions or with a traditional expository text structure. The results showed that the misconception group employed more conceptual change strategies than did the nonmisconception group, particularly during reading of the refutation text, and generated more incorrect inferences than did the nonmisconception group for both types of texts. The nonmisconception group generated more correct inferences than did the misconception group for the refutation text. Across the groups, the traditional expository text elicited more connections to prior knowledge and more intrasentential ties than did the refutation text. These findings were independent of students' individual differences in working memory capacity and need for cognition. Thus, readers adjust their processing of texts as a function of both their prior knowledge and the structure of the text.

• MATHEMATICAL REASONING •

(2087)

**The Development of Computation Estimation Skills.** DANA GANOR-STERN & ROBERT S. SIEGLER, *Carnegie Mellon University* (sponsored by Marlene Behrmann)—The present study investigated the development of estimation from preadolescence to adulthood. Sixth and eighth graders and college students were presented  $2 \times 2$  and  $3 \times 3$  digit multiplication problems and, on separate tasks, were asked to estimate the answers to the problems, to decide whether the answer would be above or below a given reference number, to evaluate the estimation procedure and the answer advanced by a hypothetical subject, and to indicate desirable corrections to the hypothetical subject's estimates. Performance improved substantially with age and experience, mainly due to greater sensitivity to place-value information and to greater reliance on strategies focused on magnitudes, rather than ones based on simplifications of standard algorithms. In addition, strategy use became more adaptive to problem characteristics and more varied with age and mathematical experience.

(2088)

**The Role of Perception and Measurement in Learning Mathematics.** PATRICIA BAGGETT, *New Mexico State University*, & ANDRZEJ EHRENFEUCHT, *University of Colorado*—Mathematics is taught in the early grades mostly with hands-on activities. Later, hands-on experiments are replaced by word problems and, in the present day, by computer graphics and animation. Both of these are a form of story telling, in which learners are presented with only one source of information—namely, what they are told or shown. But in applied mathematics, when learners perform activities, they often have three different sources of information: direct perception, results of measurements, and predictions from mathematical models. Resolving conflicts among these different data is an important aspect of learning mathematics. We show and interpret experimental data from subjects dealing with estimating volumes on the basis of visual cues, direct measurements, and mathematical formulas, when these three sources provide different and sometimes inconsistent answers.

(2089)

**ERP Measure of Conceptual Integration Between Mathematical and Semantic Relations.** AMY GUTHORMSEN, MIRIAM BASSOK, & LEE OSTERHOUT, *University of Washington*—People tend to align the symmetry of mathematical and semantic relations. For example, college students prefer to add taxonomically related objects (tulips + daffodils) and divide thematically related objects (tulips/vases), but not vice versa. We used event-related potentials to examine the conceptual fluency of such structural alignments. Students read and solved addition or division problems that were either structurally aligned (4 tulips + 2 roses; 8 tulips/2 vases) or misaligned (4 tulips + 2 vases; 8 tulips/2 roses). Despite some task and individual differences, we found increased N400 amplitude for misaligned, relative to aligned, items. These results are analogous to encountering a semantic anomaly in a sentence. They indicate that integration of semantic and mathematical relations occurs with the speed and fluency of text comprehension and has a highly invariable time course. Notably, the N400 amplitude is sensitive to conceptual integration between distinct analogous domains.

(2090)

**Children's Intuitive Mathematics: Development of Knowledge About Exponential Growth.** MIRJAM EBERSBACH & FRIEDRICH WILKENING, *University of Zurich*—Exponential growth is a demanding concept, and its effect in the long run is often grossly underestimated by adults. In our study, we investigated how the implicit knowledge about exponential growth develops. Children 7 to 13 years of age, as well as adults ( $N = 160$ ), estimated the resulting amounts of linearly and exponentially growing water plants after a certain time. As was expected, merely the estimations of the 13-year-olds and of the adults for exponential growth were in accordance with the shape of the normative function. These participants are assumed to have access to explicit knowledge about nonlinear processes. However, children from the age of 9 years on distinguished significantly between the two growth types in their estimations, and even the 7-year-olds showed such a tendency. These results point to the existence of an early intuitive knowledge about exponential growth.

• PROBLEM SOLVING •

(2091)

**Problem Solving in a Virtual Environment: Effects of Specific and General Experience.** BRADLEY R. STURZ, KENT D. BODILY, & JEFFREY S. KATZ, *Auburn University*—A 3-D virtual environment was constructed to investigate specific and general experience effects in problem solving. Participants were assessed for level of previous video game experience (PVE) via questionnaire and were divided into two groups (training and testing) that were matched on PVE scores. The training group learned specific skills (i.e., box pushing, box

pulling, and jumping) within the virtual environment before being presented a novel problem that required a combination of the skills for successful completion. The testing group was presented only the problem. Solution times were shorter for the training group. In the testing group, participants with higher PVE scores were faster to complete the test than those with lower scores. The present study indicates an interaction between specific and general problem-solving experience within a virtual environment and demonstrates a method for dissociating these two facets of experience.

(2092)

**Skill and Age Effects on Problem Solving in Chess.** MICHAEL TUFFIASH & NEIL CHARNESS, *Florida State University*, RALF T. KRAMPE, *Max Planck Institute for Human Development*, KATHERINE VASSIOUKOVA, *Moscow State University*, & EYAL M. REINGOLD, *University of Toronto*—Although there is substantial evidence to suggest that problem-solving capacities decrease with age, it may also be possible for experts to sustain high levels of problem-solving performance in a specific domain of skill. In the present study, a large ( $N > 150$ ), international sample of tournament-rated chess players, varying widely in ages and skill levels, provided think-aloud protocols while attempting to choose the best move for mid-game chess positions of varying difficulty. Consistent with Charness (1981), stronger players generated more candidate moves and searched those moves more deeply. There was also a significant age  $\times$  skill interaction for depth of search: Younger experts searched deeper into candidate moves than younger subexperts and intermediates, but search depth for older experts declined to levels shown by subexperts. We discuss several compensatory mechanisms that may allow older experts to generate solutions equivalent in strength to those of younger experts while searching less deeply.

(2093)

**Incentive Effects on Problem Solving Via Memory Processes.** MAREIKE WIETH & BRUCE D. BURNS, *Michigan State University*—An increasing number of studies are showing a connection between (1) emotion and motivation and (2) cognitive processes. Most of these studies, however, have been correlational in nature, limiting the conclusions that can be drawn. We directly manipulated motivation through the use of an incentive and investigated its effects on insight and incremental problem solving. In four experiments, we found that an incentive (the opportunity to leave the experiment early) increased problem-solving performance for all problems presented, regardless of problem type. In addition, we found evidence that the incentive increased recall memory and, to some extent, increased problem-solving duration, perhaps indicating more thorough processing for participants in the incentive condition. These findings provide further evidence for motivational influences on problem solving and imply that motivation should not be ignored when investigating cognitive processes.

(2094)

**Working Memory Span Differences in Strategy Choice.** MELANIE CARY, *University of Wisconsin, La Crosse*—This study examined how low and high working memory span individuals differ in the strategy choices they make when choosing between equally viable problem-solving strategies. Participants performed two tasks: They completed the operation span task as a measure of working memory span, and they practiced solving several income calculation problems. Each income problem could be solved by using one of two types of solution strategies. The working memory demands associated with the two strategy types were either equivalent or nonequivalent; this factor was manipulated between participants. The results indicate that in the equivalent demands condition, low- and high-span participants differed very little in their strategy choices throughout practice. However, in the nonequivalent demands condition, high-span participants were more likely than low-span participants to develop a preference for the less demanding strategy. These results suggest that working

memory ability and strategy demands interact to influence strategy choice.

(2095)

**Interruption Length and Complexity: A Goal Activation Approach.** HELEN M. HODGETTS & DYLAN M. JONES, *Cardiff University*—The effects of interruption length and complexity are assessed within the theoretical framework of ACT-R (Anderson & Lebiere, 1998). Results suggest that, contrary to the predictions of the goal stack, goal retrieval is neither without time cost nor without error. Following interruption to the execution phase of Tower of London problems, goals suffered decay like that of any other declarative memory events such that longer interruptions resulted in a greater loss of base-level activation and, subsequently, took longer to reinstate (Experiment 1). Furthermore, time taken to retrieve goals was greater following a more complex interruption (Experiment 2), indicating that processing limitations may be as important as time-based limitations in determining the ease of goal retrieval. The results are evaluated in relation to current models of goal memory (Altmann & Trafton, 2002; Anderson & Douglass, 2001) and suggest that these could provide a useful basis for the investigation of interruption effects.

(2096)

**Why Some Problems Are Harder: Analysis of Illegal Moves.** MARTIN E. KNOWLES & PETER F. DELANEY, *University of Florida*—Most accounts of problem difficulty have focused on analysis of legal moves, but moves that violate the rules (illegal moves) also contribute to problem difficulty. In several experiments using the Hobbits and Orcs problem and its isomorphs, we found that illegal move rates decline with practice, for various reasons. Fewer illegal moves may come to mind because the correct move is selected more often. With practice, people may check the rules more frequently or become more accurate in checking the rules. Several experiments focused on discriminating among these alternatives are presented. In addition, techniques for producing more complete verbal reports were developed, and their limits and utility are discussed.

• REASONING •

(2097)

**Beyond Discovery: Repeated Actions Predict Transfer of Relational Knowledge.** JEREMIAH J. TRUDEAU & JAMES A. DIXON, *University of Connecticut*—A fundamental issue in cognition is how discrete experiences give rise to abstract representations. One account, redescription, proposes that embedded relational information is extracted from repeated actions, yielding abstract representations. An untested prediction of this account is that a greater number of actions should lead to a more abstract representation, facilitating transfer. Participants predicted the turning direction of the final gear in a sequence. More frequent use of a strategy that contains embedded information (tracing alternating circles around each gear) should predict better transfer of a strategy based on that information (explicitly using the alternating sequence) after it is discovered. Consistent with the redescription account, an event history analysis showed that the number of previous uses of the tracing strategy predicted transfer of the alternation strategy to novel gear problems. These results demonstrate the incremental effect of repeated actions on the extraction of relational information and, ultimately, abstract representations.

(2098)

**A Symbolic-Connectionist Model of Relation Discovery.** LEONIDAS A. A. DOUMAS, JOHN E. HUMMEL, & KEITH J. HOLYOAK, *UCLA*—Relational reasoning is central to many aspects of human cognition. Numerous computational models address the component processes of relational reasoning, including analogical mapping, analogical inference, and schema induction. However, these models require the modeler to hand-code the vocabulary of relations on which the mapping and inference processes operate. The acquisition of these

relational concepts remains poorly understood. We present a theory of relation discovery instantiated in a symbolic connectionist model. This model can learn structured (i.e., symbolic) representations of attributes and relations through a process of comparison and, subsequently, refine these representations through a process of mapping-based schema induction.

(2099)

**A Rational Account of Elemental Causal Induction.** THOMAS L. GRIFFITHS, *Stanford University*, & JOSHUA B. TENENBAUM, *Massachusetts Institute of Technology* (sponsored by Joshua Tenenbaum)—We present a framework for the rational analysis of elemental causal induction—learning about the existence of a relationship between a single cause and effect—based upon causal graphical models. This framework makes precise the intuitive distinction between causal structure and causal strength: the difference between asking whether or not a causal relationship exists and asking how strong that causal relationship might be. We show that both of two leading rational models of elemental causal induction, delta-P and causal power, estimate causal strength, and we introduce a new rational model, causal support, that assesses causal structure. Causal support provides a better account of a large number of existing data sets than does either delta-P or causal power. It also predicts several phenomena that cannot be accounted for by other models, which we explore through a series of experiments.

(2100)

**Brain-Based Mechanisms Underlying Complex Causal Thinking.** JONATHAN A. FUGELSANG & KEVIN N. DUNBAR, *Dartmouth College*—An important issue for cognition is to determine how lower level cognitive processes, such as attention and working memory, are involved in higher level cognition, such as problem solving and reasoning. Using fMRI, we examine the extent to which attentional and

working memory mechanisms mediate processes that occur when reasoning causally about data that follow from plausible versus implausible theories. Region-of-interest analyses revealed preferential recruitment of established brain networks involved in attention and working memory when data were evaluated for plausible, relative to implausible, theories. In addition, these processes were dependent on the amount of data presented, whereby the preferential recruitment of neural tissue in prefrontal, parietal, and anterior cingulate cortices predominantly occurred when more data had been accrued. Taken together, these findings provide a brain-based account of how lower level attentional and working memory mechanisms mediate the integration of theory and data when judging causality.

(2101)

**The Effects of Domain Information on the Structured Use of Analogy for Enhancing Innovation.** CYNTHIA SIFONIS, *Oakland University*—The present research examines the manner in which source and target domain information is presented when workshop participants are taught a structured methodology for using analogy to enhance innovation. We manipulated the degree of instructor input during source domain instruction, as well as the target domain representation, and examined their effects on the degree of innovation and relational thinking present during idea generation. When learning about the source domain, participants (1) received no instructor input, (2) received instructor input, or (3) received instructor input and mapping assistance. The target domain was represented as either (1) goals to be achieved or (2) problems to solve. Those receiving a goal-based representation of the target domain and instructor input and mapping assistance when learning about the source domain exhibited the greatest degree of innovation. However, instructor input and mapping assistance resulted in the least amount of relational thinking during idea generation.

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

• PERCEPTION •

(3001)

**Peripheral Mechanisms for Gain Control in the Auditory System.** MICHAEL S. GORDON, BRUCE A. SCHNEIDER, & MEREDYTH DANEMAN, *University of Toronto, Mississauga* (sponsored by Meredith Daneman)—There is evidence that the auditory system uses non-linear gain control to adjust its response to stimulus intensities (Parker, Murphy, & Schneider, 2002). To investigate the precise location and nature of this mechanism, we examined whether gain control in one ear was influenced by acoustic events in the other ear. Listeners judged the absolute intensity for a set of four acoustic stimuli presented to the left ear (25, 30, 35, 40 dB SPL). Subsequent test sets included an 80-dB SPL stimulus presented either ipsilaterally or contralaterally. Ipsilateral presentations of this stimulus caused a greater reduction of discriminability among the original four tones than did contralateral presentations. Subsequent tests, which varied the illusory position of the stimulus (while actually presenting the 80-dB SPL stimulus bilaterally), caused equivalent ipsilateral and contralateral losses in sensitivity. These results suggest that a peripheral gain control mechanism may modulate sensitivity separately within each ear.

(3002)

**Data Collection Methods for Multidimensional Scaling With Auditory Stimuli.** COLIN R. HARBKE & STEPHEN LAKATOS, *Washington State University*, & GARY P. SCAVONE, *Stanford University*—Pairwise comparisons are the traditional data collection method for multidimensional scaling (MDS), but they may induce response biases that weaken the validity of derived MDS representations. Four potential shortcomings of pairwise comparisons were investigated in the context of testing a new interactive mapping technique for MDS. Thirty-nine participants judged the dissimilarity of mental images evoked by 24 sounds using (1) pairwise comparisons, (2) hierarchical sorting, or (3) the new mapping task. Multiple goodness-of-fit measures revealed that the mapping task yielded excellent fit with lower dimensional representations but was not an appropriate substitute for pairwise comparisons with intermediate or higher dimensional representations. Participants needed the most time to complete their pairwise comparisons and found them to be the least enjoyable. Final MDS representations were similar via visual inspection and canonical correlation for all three data collection techniques. Because of potential constraints, caution should be exercised when selecting MDS data collection techniques.

(3003)

**Measures of Tactile Anisotropy.** GREGORY O. GIBSON & JAMES C. CRAIG, *Indiana University*—Tactile spatial sensitivity was measured using a gap detection (GaD) task. For the GaD task, psychometric functions were generated at seven locations of varying sensitivity: upper arm, forearm, palm, and four locations on the index finger. For most locations, sensitivity was greater in the lateral/medial orientation, approximately 1.5 times more sensitive. The largest difference was found on the forearm, where the threshold in the proximal/distal orientation was 22.9 mm and in the lateral/medial orientation was 9.8 mm, a ratio of 2.3/1. Additional measurements were made with the grating orientation (GO) task, a spatial measure, and the smooth-grooved (SG) task, an intensive measure. The GO task showed the same significant pattern of anisotropy as the GaD task. Smaller differences in performance were found with the SG task (in most cases, not significant). The results will be discussed in terms of what anisotropy may reveal about the underlying neural and mechanical factors mediating tactile sensitivity.

(3004)

**Haptic Illusions Are Influenced by Spatial Orientation and Exploration Mode.** MORTON A. HELLER, MELISSA R. MCCARTHY,

ASHLEY N. CLARK, SAMANTHA SKOCZYLAS, JAYME B. GREENE, & MELISSA M. SHANLEY, *Eastern Illinois University*—The Müller-Lyer illusion and the horizontal-vertical illusion were affected differently by changes in spatial position. The gravitationally vertical position yielded overestimation of horizontals in the horizontal-vertical illusion, whereas the Müller-Lyer illusion was not altered with this placement. It was possible to attenuate the Müller-Lyer illusion by the use of two index fingers. This manner of exploration practically eliminated the illusion, which was limited to a very slight overestimation of wings-out patterns. The theoretical implications of these results will be discussed.

(3005)

**Tactile Discrimination in Three Species of Garter Snakes (*Thamnophis*).** VICKI L. KEATHLEY & ROGER L. MELLGREN, *University of Texas, Arlington*—Tactile perception and the utilization of tactile information has been little studied in snakes. Three species of garter snakes served as subjects—*Thamnophis: marcianus, radix,* and *sirtalis*. In Experiment 1, preference for different substrates was tested by putting the subject in a box where the two sides of the box contained small-, medium-, or large-sized rocks in three possible pairs. All subjects preferred large over medium and medium over large. In a second phase, the cephalic mechanoreceptors were covered with plastic wrap, resulting in a significant decrease in time spent on the previously preferred substrate. In Experiment 2, the snakes were trained in a Y-maze using large (S−) and medium (S+) rock substrate. All snakes showed improvement, with a majority reaching a 70% criterion in 65 trials or less. Probe trials conducted in the dark resulted in continued effective tactile discrimination in most of the subjects. The ecological importance of tactile discrimination in snakes is discussed.

(3006)

**Elevated Ethanol Withdrawal in Low-Saccharin-Consuming Rats.** NANCY K. DESS, PATRICIA O'NEILL, & VINCENT CHEN, *Occidental College*—Among inbred mouse strains and rats selectively bred for differential ethanol consumption, voluntary ethanol intake is inversely related to withdrawal severity. The present study replicated and extended this finding in rats selectively bred on a phenotype that is different from, but predicts, voluntary ethanol intake. Occidental low-saccharin-consuming (LoS) rats drink less saccharin and ethanol than do high-saccharin-consuming (HiS) rats; moreover, LoS rats score higher on several measures of emotionality and stress vulnerability. Forty-eight hours after withdrawal from ethanol, acoustic startle amplitude was elevated in LoS rats, relative to nonethanol-exposed LoS counterparts; no evidence of withdrawal was apparent among HiS rats. In addition, prior ethanol exposure increased ethanol preference and dose among LoS, but not HiS, rats. Implications for the relationship between taste, emotionality, and vulnerability to drug abuse are discussed.

(3007)

**Expertise and Typicality: What Makes a Chardonnay Wine a Chardonnay?** JORDI BALLESTER, *UMRA INRA/ENESAD*, CATHERINE DACREMONT, *Université de Bourgogne*, YVES LE FUR, *UMRA INRA/ENESAD*, HERVÉ ABDI, *University of Texas, Dallas*, & DOMINIQUE VALENTIN, *Université de Bourgogne*—The existence of a Chardonnay wine concept was explored in two experiments. The aim of the first one was to assess the typicality of Chardonnay wines, and that of the second one was to identify the key odorants that might have underlined typicality judgments. Twenty-eight French wine experts assessed the Chardonnay typicality of 18 wines made from Chardonnay or other white grape varieties. As was expected, wines from the Chardonnay variety were judged more typical than other wines. In addition, the strong agreement observed between experts indicates the existence of a shared Chardonnay concept. A gas chromatography-olfactometry analysis using 17 trained panelists revealed 72 odorant areas (OA) in the 18 Chardonnay wines. Partial least square regression between typicality judgments and the detection frequency of each OA showed that 10 of the OAs predicted the typicality judgments. This suggests that ex-

perts have abstracted a common Chardonnay wine concept through weighting of perceptual features corresponding to the identified OAs.

(3008)

**Magnitude Representation and Retrieval by Deaf and Hearing Children.** REBECCA BULL, *University of Aberdeen*, MARC MARSCHARK, *National Technical Institute for the Deaf*, & GEORGIA THEODOROU, *University of Aberdeen*—This study examines the automatic retrieval of magnitude information in 20 deaf children (5–12 years) and 20 hearing children matched by age, sex, and arithmetic ability. Children were presented two numbers of different physical size and were asked to pick the physically larger number. Magnitude of the numbers was irrelevant to the task, but studies show that magnitude information is activated automatically and influences response times, resulting in a congruity effect (faster responses when physical size matches magnitude size). Analyses revealed congruity effects for both groups of participants. Further analyses examining differences in response times between congruent, incongruent, and neutral (no magnitude difference between the numbers being compared) trials revealed that deaf children showed a high level of interference from incongruent magnitude information and no facilitation when magnitude and physical size matched. The hearing children showed small amounts of interference and facilitation in incongruent and congruent trials, respectively.

• VISUAL PROCESSING OF COMPLEX STIMULI •

(3009)

**Hierarchical Processing of Stimuli by Adults, 5-Year-Olds, and Monkeys.** JULIE J. NEIWORTH, AMY GLEICHMAN, & ANNE OLINICK, *Carleton College*—Adult humans process visual stimuli predominantly by global properties. The origin of this ability remains unclear, especially because the data from infant studies suggest equivalent processing of local and global cues more often than global processing. Primate researchers have suggested that the predisposition toward global processing may have occurred in recent primate evolution, splitting the processing styles of monkeys from those of apes, including humans. In this study, adult humans, 5-year-old humans, and monkeys played a categorization game involving two different stimuli for rewards. Training sets provided both global and local cues and, in later phases, tested subjects with examples that manipulated global or local processing. Adults showed a global bias, regardless of manipulation of density of arrays of the stimuli, whereas 5-year-old children showed an increased local bias with arrays using few elements. Cotton top tamarins' tendencies toward global and local processing were also tested.

(3010)

**Proposed Model for Efficiency Variability in a Visual Search Task.** MARIO FIFIC & JAMES T. TOWNSEND, *Indiana University* (sponsored by James T. Townsend)—In visual search studies, it is widely accepted that the slope of the linear function describing the relationship between latency and load is a crucial statistic in determining whether a search was serial/parallel. Near-to-zero slopes are considered to reflect parallel processing, whereas slope values  $>20$  msec are considered serial processing. Some researchers defined slope value variability as the processing efficiency, bypassing the distinction between serial and parallel models. We challenge previous ideas, using a double factorial paradigm (DFP) with two search items. The DFP test is nonparametric and based on the factorial difference between survivor functions. The DFP test revealed a serial-processing signature. However, it significantly departed from the prediction based on a serial independent model when selective influence holds. We propose that variability in efficiency/slope in visual search could be attributed to changes in either selective influence or stochastic dependency, rather than to change in processing architecture (serial/parallel).

(3011)

**Perceptual and Cognitive Processing in Autism Spectrum Disorders.** SHANNON A. JOHNSON, LESLIE M. BLAHA, MARIO FIFIC,

JAMES T. TOWNSEND, & JULIE C. STOUT, *Indiana University* (sponsored by Thomas Busey)—Multiple cognitive studies of individuals with high-functioning autism (HFA) and Asperger's disorder (ASP) have indicated altered perceptual processing, including enhanced discrimination of nonsocial stimuli and deficits in face processing. In particular, studies of global–local information processing suggest that the presence of a gestalt stimulus does not slow local processing in HFA/ASP individuals, who exhibit enhanced local information processing and intact global processing. The double factorial paradigm (DFP) and capacity measures developed by Townsend (Townsend & Ashby, 1983; Townsend & Nozawa, 1995; Wenger & Townsend, 2000) provide methods for defining the information-processing system of perceptual-processing tasks in terms of processing architecture, stopping rule, dependencies, and capacity. Applying these methods to a global–local processing task, we developed information-processing models for HFA/ASP individuals, age-matched controls, and adult controls. Comparisons between these groups help to more rigorously define the processing differences characteristic of autism spectrum disorders.

(3012)

**Boundary Extension: A Special Case of Rectilinear Boundaries?** KAREN K. DANIELS & HELENE INTRAUB, *University of Delaware*—Observers remember seeing beyond the edges of a view (boundary extension; BE). Perhaps this facilitates integration of successive views (e.g., Intraub, 2002). However, only “artificial” rectilinear views (photographs and window views) have been tested. Perhaps the visual field's tapering boundaries and the irregular boundaries in nature (e.g., looking out a cave) mitigate against BE and thus provide more veridical representations than prior research suggests. To test this, in Experiment 1 ( $N = 124$ ), 15 views (color photos; same aspect ratio) were presented for 10 sec each with one of four boundary types: (1) rectilinear, (2) oval, (3) irregular/angular, or (4) irregular/curved. At test, boundary ratings revealed significant BE, with no differences across types. Results were replicated using a boundary placement task in Experiment 2 (rectilinear and oval conditions;  $N = 84$ ). Results demonstrate the generality of BE to virtually any view shape, including ones that mimic characteristics of the visual field itself.

(3013)

**Similarity Between an Imaginary Middle and the Extremes: Does Equal Distance in Representational Space Correspond to Equal Similarity?** STEFAN GELISSEN & GIDEON KEREN, *Eindhoven University of Technology*—Geometric models of similarity represent objects as points in a representational space, and similarity between objects is a function of the metric distance between their respective points. These models assume that equal distance corresponds to equal similarity. This assumption was tested by presenting participants with two physical objects that varied along a single physical dimension (e.g., length, area). Participants were instructed to imagine an object exactly in the middle of the relevant dimension and then judge to which of the two physically presented objects it was more similar. Following the equal-distance equal-similarity assumption, the middle object should be judged equally similar to either of the two original objects. Our empirical results show unequivocally that the middle object is judged to be more similar to one over the other object. Possible accounts for this asymmetry in similarity judgments will be presented along with additional empirical tests.

(3014)

**The Distinctiveness Effect Reexamined: Poorer Recognition of Distinctive Face Silhouettes.** NICOLAS DAVIDENKO, *Stanford University* (sponsored by Gordon H. Bower)—A recognition advantage for distinctive versus typical faces has been widely reported (e.g., Valentine, 1991). The effect is robust and appears as both an increased hit rate for distinctive targets and a reduced false alarm rate for distinctive distractors. Because distinctive faces lie in a sparse, peripheral region of face space, the recognition advantage could be due to the fact that they are more dissimilar than typical faces to any ran-

domly chosen set of distractor faces. To control for target–distractor distances, we constructed parameterized face silhouettes. In a forced-choice recognition paradigm, we tested whether distinctive faces retain their advantage over typical faces when target–distractor distances are matched for the two types of faces. Contrary to previous claims, our results reveal a recognition disadvantage for distinctive faces. We consider an explanation for this reverse distinctiveness effect in terms of norm-based coding.

• IMPLICIT MEMORY •

(3015)

**The Effect of Midazolam on Visual Search.** HEEKYEONG PARK, *Carnegie Mellon University*, JOSEPH J. QUINLAN, *University of Pittsburgh Medical Center*, & EDWARD THORNTON & LYNNE M. REDER, *Carnegie Mellon University*—Recent patient studies have called into question the implicit/explicit memory distinction and selective hippocampal involvement only in explicitly learned material. In this study, normal participants were tested on a visual search task under midazolam, an anesthetic that induces temporary amnesia. Unlike the control condition, participants did not show facilitation in search times for repeated configurations under the influence of midazolam, although there was a general speedup in performance across blocks in both the midazolam and the saline conditions. The findings support the hypothesis that amnesia affects the building of novel associations in memory and that the deficit does not hinge on accessibility to consciousness.

(3016)

**Implicit Memory for Bizarre Sentences.** LISA GERACI, *Washington University*, & MARYELLEN HAMILTON, *Saint Peter's College*—Two experiments examined whether the effects of bizarreness could be obtained on an implicit memory test when the test required the type of analysis that mediates the bizarreness advantage in explicit memory. To examine this issue, we created a new implicit memory test called the noun–verb verification task, in which participants judged the feasibility of noun–verb pairs (e.g., *birds flew*). Participants studied either common or bizarre versions of sentences containing these pairs (e.g., *The birds flew across the sky* vs. *The birds flew the airplane*) and were later given the implicit test. Results demonstrated implicit memory for bizarre sentences, as measured by a decrease in accuracy to correctly verify the noun–verb relationship for studied bizarre items. In addition, accuracy was reduced for studied bizarre sentences, as compared with studied common sentences, evidence that our new implicit measure was sensitive to this type of distinctiveness manipulation.

(3017)

**Immediate and Delayed Recall for Subject-Performed, Autobiographical, and Verbal Stimuli.** KATINKA DIJKSTRA & MICHAEL P. KASCHAK, *Florida State University*—Younger and older adults participated in a task in which they were asked to remember verbal stimuli, subject performed tasks (SPTs), and autobiographical memories. Participants were tested on their memory for these items immediately after study and, again, after 1 week. On the immediate test of recall, SPTs and autobiographical memories were remembered equally well, and both were remembered better than verbal stimuli. Recall was generally worse for all tasks on the recall test given a week later, although SPTs showed less of a decline across the retention interval than did the other stimulus types. On both the immediate and the delayed recall test, younger adults remembered more items than did older adults for all item types except the verbal stimuli. We discuss the results with regard to the similarities and differences that exist in the three types of stimuli used in this study and in the context of theories of aging.

(3018)

**Retrieval-Induced Forgetting in Implicit Memory Tests: The Role of Test Awareness.** GINO CAMP, DIANE PECHER, & HENK G.

SCHMIDT, *Erasmus University, Rotterdam*—Retrieval-induced forgetting has been demonstrated in studies using explicit memory tests, and this effect has been attributed to inhibitory mechanisms. An inhibitory account predicts similar effects in implicit memory tasks. In our experiments, we found retrieval-induced forgetting, using an explicit memory test with independent extralist retrieval cues. With the same materials, we also found retrieval-induced forgetting, using an implicit memory test with independent extralist retrieval cues. However, this effect was limited to participants who were aware of the relationship between the study and the test phases. Thus, test awareness seems to mediate retrieval-induced forgetting in implicit memory tasks. Noninhibitory explanations can be offered for these findings. Moreover, if inhibition did occur, the results indicate that inhibition was not general but episode specific and restricted to the context of the learning phase.

(3019)

**An Information-Theoretic Analysis of Implicit Learning.** RANDALL K. JAMIESON & DOUGLAS J. K. MEWHORT, *Queen's University* (sponsored by D. J. K. Mewhort)—Subjects recall stimuli constructed with a Markov grammar better than stimuli constructed at random. Several theorists have interpreted the advantage for grammatical stimuli as evidence that subjects learn the grammar. An alternative view is that subjects exploit local structure that derives from grammatical constraints. Using information theory and W. R. Garner's (1974) concept of an inferred subset, we developed tools to measure structure in sets of stimuli (grammatical redundancy), structure in individual stimuli (local redundancy), and structure in individual stimuli on the basis of how they are encoded (organizational redundancy). We tested serial recall for color sequences while varying grammatical, local, and organizational redundancy in the stimuli: Performance was predicted best by organizational redundancy. By tracing performance through a chain of relationships from grammatical to local redundancy and from local to organizational redundancy, we show that the advantage for grammatical stimuli results from subjects' exploitation of organizational redundancy that derives from grammatical constraints.

(3020)

**Response Selection and Sequence Learning.** NATACHA M. DEROOST & ERIC L. L. SOETENS, *Vrije Universiteit Brussel*—Using the logic of the additive factors methodology of Sternberg (1969), we manipulated the stages of information processing to investigate the role of response selection in sequence learning. Subjects performed a serial reaction task, in which the target followed a probabilistic sequence structure. In Experiment 1, we manipulated stimulus discriminability to assess the influence of the identification stage. Using a between-subjects design, participants either discriminated between four distinct colors or between four shades of the same color. In Experiment 2, we manipulated response selection through stimulus–response compatibility. Subjects had to react to the location of the target following a compatible or incompatible mapping in a between-subjects design. The results show that learning was affected by stimulus–response compatibility, but not by stimulus discriminability. The amount of sequence learning increased with an incompatible mapping. This indicates a crucial role for response selection in sequence learning.

(3021)

**Partial Reinstatement of Context: Are All Contextual Cues Equal?** CHRISTOPHER T. BALL, *College of William & Mary*—Reinstatement of the encoding context can result in improved recall and recognition of target information at test. However, it is unclear whether all contextual cues are encoded with the target information and whether all contextual cues are of equal value in assisting retrieval. The present research adapts the contextual reinstatement methodology of Macken (2002) to examine this problem. Two experiments will be reported where participants were required to recognize words that were presented previously in one of two contexts (i.e., background color, font color, spatial location on screen). In both experiments, it was found that reinstating the

background color significantly improved recognition performance, whereas reinstating the spatial position did not. It would appear from this research that not all contextual cues are treated equally in memory.

(3022)

**When Function Follows Form: Conceptual Priming Differences Between Natural and Man-Made Objects.** IRENE P. KAN, AMANDA VAN SCOYOC, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Man-made objects and natural kinds tend to differ with regard to both their defining features and the interrelations between these features. Here, we used conceptual priming of specific attributes (i.e., color and action) to explore differences between these classes of objects. Priming on a feature verification task was measured following one of three initial tasks—picture naming (Experiment 1), location judgment (Experiment 2), or shape judgment (Experiment 3)—and stimuli were either line drawings (Experiment 1) or object names (Experiments 2 and 3). Results from these experiments suggest that (1) during picture processing, color information is more likely to be retrieved for natural kinds and action information is more likely to be retrieved for man-made objects, (2) likelihood of retrieving a specific attribute is influenced by stimulus modality, and (3) the modality difference may be explained by the strong relationship between shape of man-made objects and their associated actions.

(3023)

**Trilingual Translation Processes: Evidence From Response Times and Repetition Priming.** WENDY S. FRANCIS & SABRINA L. K. GALLARD, *University of Texas, El Paso*—Translation responses to individual words were elicited from 48 English–Spanish–French trilinguals, who translated in six directions at study and two directions at test. Patterns of translation response times and error rates at study reflected the relative proficiency of the trilinguals in comprehension and production of their three languages. At test, repeated items were translated faster than new items, with the strongest priming effects occurring for identical repetitions. Repetition priming was also substantial when only the stimulus language or only the response language matched from study to test, implying that repeated comprehension and production processes contribute to priming in translation. Patterns of response times and repetition priming indicate that translation in all directions involved conceptual access. Additive patterns in response time asymmetries and repetition priming were consistent with the treatment of word comprehension and production processes of translation as independent and sequential processes.

(3024)

**Mnemonic Benefit of Perceptual Interference in Young and Older Adults.** GROVER C. GILMORE & BETH A. PATTERSON, *Case Western Reserve University*—Words that are perceptually challenging for young adults are better remembered on an incidental recall task. We reported that the mnemonic advantage was driven by the proximal stimulus strength of the read words being close to threshold reading levels (Gilmore & Patterson, 2003). Older adults in that study did not exhibit a weak stimulus recall advantage. Here, the impact of the overall level of processing difficulty on the mnemonic effect was examined. Two groups of young adults were tested. One received the same distal stimulus contrasts as the older participants, whereas the other group viewed stimuli at contrasts chosen to simulate the proximal strength of older adults. The proximally matched young and older adults yielded the same reading and memory performance. The results suggest that the mnemonic advantage for weak stimuli occurs only when stimuli are both near threshold and distinctly harder to process than other stimuli.

• LEARNING AND MEMORY •

(3025)

**Undoing a Good Deed: Using Study and Test Phase Interference to Isolate the Basis of Gains in a Memory-Training Paradigm.** HEA-

THER R. ROTH, DALE DAGENBACH, & JANINE M. JENNINGS, *Wake Forest University*—A memory-training procedure developed by Jennings and Jacoby (2003) has been found to significantly improve recollection memory performance in older adults in a relatively short number of sessions. That same procedure has been found to produce some gains in measures of working memory and attention (Jennings et al., in press). Although these gains are noteworthy, they also raise the question of exactly which cognitive processes are being trained. The present research begins to address this by looking at the consequences of interference during the study versus the test phases of the training process. Interference during study diminished, but did not eliminate, the within-task improvement, whereas interference at test had little effect. The corresponding effects on transfer are also described.

(3026)

**Training Recollection in Individuals With Mild Cognitive Impairment: Preliminary Results.** ERIKA A. CARELLO, JANINE M. JENNINGS, & DALE DAGENBACH, *Wake Forest University*, & STEPHEN R. RAPP, GRETCHEN A. BRENES, & HAL H. ATKINSON, *Wake Forest University School of Medicine*—A memory-training technique known as the repetition-lag procedure has been shown to improve recollective processing in cognitively healthy older adults across gradually increasing intervals (Jennings & Jacoby, 2003). Moreover, improvements with this opposition/exclusion technique have been found to transfer to measures of working memory (*n*-back, self-ordered pointing), cognitive speed (digit symbol substitution), and source discrimination (Jennings et al., in press). The present study was designed to determine whether such gains are also possible with those suffering from more marked deficits in memory—specifically, older adults with mild cognitive impairment (MCI). The results show that individuals with MCI can show improvements with the repetition-lag technique, and these gains appear to generalize outside the procedure to some of the measures of cognitive function mentioned above.

(3027)

**The Influence of Learning Instructions on the CE: Immediate and Delayed Testing.** TAMAR SILBERG & ELI VAKIL, *Bar Ilan University*—The facilitation of target memory due to correspondence of context in learning and in test is the context effect (CE). Two experiments were conducted in order to evaluate the effects of learning instructions and testing conditions on CE. In the first experiment, participants were presented with pairs of faces, of which one of the two was marked as target. The effects of instructions regarding target (memory vs. attention) and depth of processing (deep vs. shallow) were manipulated. The findings revealed a different CE pattern under deep encoding and instructions to remember versus to pay attention. Only in the former condition was a specific association between target and context formed. The interaction between time delay (1 week) and learning instruction on the CE was tested in the second experiment. CE emerged only under the memory instructions. It was also found that the time delay prevented the formation of specific association between target and context.

(3028)

**Lecture First or Text First? Optimizing Undergraduate Instruction.** BRUCE G. LEE & ROBERT A. BJORK, *UCLA*—Students are typically advised to read assigned readings before coming to class (i.e., “come to class prepared”). Going to class first, which many students prefer, could, however, be the optimal order. In general, lectures focus on and illustrate main points, whereas texts are more encyclopedic and detailed, which may yield better transfer from lecture to text than from text to lecture. To explore the question, we gave participants a short lecture on property law, followed by the corresponding text, or the text followed by the lecture. A subsequent test included both verbatim-type and inference questions on material that occurred only in the text or only in the lecture or on material common to the lecture and the text. Performance on verbatim-type questions exhibited a clear recency effect, with no main effect of order, whereas performance on

inference questions was better when the lecture–text order was given, for both specific and overlap questions.

(3029)

**How Does Learning Facts From Fiction Compare With Learning From Other Sources?** MICHAEL B. HUTSON & ELIZABETH J. MARSH, *Duke University*—Students use both correct and false information from fictional stories to answer questions on a later general knowledge test (Marsh et al., 2003). Having read misinformation led to its production on the final test and also reduced correct responding below baseline. The present research compares suggestibility following story reading with suggestibility following reading a list of facts. Stories and lists contained equal numbers of true and false facts. Reading the list of facts also led to use of correct and false information on the final test; however, reading the list increased correct answers more than did reading the story. Reading the list also increased responding with misinformation on the final test, as compared with reading the story. These results will be interpreted within a material-appropriate processing framework (e.g., McDaniel & Einstein, 1989).

(3030)

**A Multiple-Cue Hypothesis for the Testing Effect.** SHANA K. CARPENTER & EDWARD L. DELOSH, *Colorado State University* (sponsored by Carol Seger)—Two experiments investigated whether contextual variability explains the testing effect. In both experiments, participants encoded cue–target pairs (*dough: bread*) by rating their relatedness. Test trials consisted of retrieving the target from the cue, whereas study trials consisted of additional rating between cue and target. In Experiment 1, test and study cues were related to the target and were either the same (respectively, *dough: \_\_\_\_\_*; *dough: bread*) or different (respectively, *toast: \_\_\_\_\_*; *toast: bread*) from the encoded cue. In Experiment 2, test and study cues were either related (respectively, *dough: \_\_\_\_\_*; *dough: bread*) or unrelated (respectively, *basket: \_\_\_\_\_*; *basket: bread*) to targets and were the same as the encoded cue. The testing effect was eliminated using different cues in Experiment 1 and was enhanced using unrelated cues in Experiment 2. These results suggest that the testing effect may be explained by contextual variability from multiple target candidates generated during retrieval.

• MEMORY PROCESSES •

(3031)

**Topics in Free Recall.** MARK STEYVERS, *University of California, Irvine*, & TOM L. GRIFFITHS, *Stanford University*—The topics model is a probabilistic approach to semantic cognition in which topics are represented as probability distributions over words. From a corpus of educational text documents, we were able to estimate, in an unsupervised manner, a large number of interpretable topics. We show how these topics can be used in a simple gist-based model for free recall to explain variability in eliciting false memories across study lists. The model assumes that study words activate a distribution of topics (the gist) that concentrates on one or more topics, depending on the number of categories/themes in the study list. At retrieval, free recall is modeled as a reconstructive process using the stored topic distribution, as well as verbatim memory traces, as cues. We compare this probabilistic approach with the spatial framework of latent semantic analysis, where words are represented as points in a high-dimensional semantic space.

(3032)

**The Effect of Different-Language Repetition on Spacing Effects in Free Recall: An Investigation of the Enabling Conditions of Study Phase Retrieval.** PETER P. J. L. VERKOEIJEN, REMY M. J. P. RIKERS, & HENK G. SCHMIDT, *Erasmus University, Rotterdam*—Free recall of repeated items increases with the length of the interrepetition interval. However, this spacing effect emerges only if a repeated item's first presentation is retrieved at its second occurrence. The present

study was conducted to determine how much overlap, in terms of linguistic representation, is required between repetitions for study phase retrieval. In Experiment 1, participants studied, for a free recall test, a word list containing same-language and different-language repetitions under incidental semantic-learning instructions. A spacing effect was demonstrated for same-language repetitions, but not for different-language repetitions. In Experiment 2, participants received incidental orthographic-learning instructions. The results failed to show a spacing effect for same-language repetitions and different-language repetitions. The present study suggests that study phase retrieval is successful if (1) repeated items share the semantic and the orthographic level of representation and (2) these representation levels are accessed at both occurrences of a repeated item.

(3033)

**Familiarity Affects Reconstructing the Order of Items in Semantic Memory.** THOMAS F. CUNNINGHAM, *St. Lawrence University*, & ALICE F. HEALY & JAMES A. KOLE, *University of Colorado*—Students were presented one of three different lists of 18 names of consecutive U.S. presidents, each arranged in alphabetical order, and were asked to rate each name in terms of its familiarity and, then, to reconstruct the order of the names on the basis of presidential terms in office. Six consecutive presidents occurred in all three lists, as the first, the middle, or the last 6 names in a given list with respect to terms in office. Serial position functions for the order reconstruction task were examined to evaluate predictions based either on the distinctiveness of the absolute or relative positions of the presidents' terms in office or on the familiarity of the presidents' names. There was no evidence for predictions based on distinctiveness, but significant correlations between performance on the order reconstruction task and the familiarity ratings provided support for the influence of familiarity on reconstructing the order of items in semantic memory.

(3034)

**Judgments of Associative Memory: Why is JAM Overvalued?** WILLIAM S. MAKI, NICOLE J. HOLSTROM, & AMBER G. THOMPSON, *Texas Tech University*—In several experiments, college students rated the association between many pairs of cue and response words. Invariably, they overestimated the frequency of the response word, given the cue word, especially for weakly associated pairs. The functions relating JAM to free association (FA) norms were mostly linear, averaging  $JAM = 50 + 0.40 * FA$  (on 100-point scales). The overestimation effect generalizes across rating methods and materials and is not caused by context-induced bias or semantic relations. The overestimation does not appear to be easily explained by some kind of retrieval inhibition; manipulations designed to make alternative associates available failed to reduce the overestimation. We entertain the possibility that the overestimation effect, instead of some judgmental artifact, may be a natural product of our memory system. Simulations of a multitrace model (a modified MINERVA 2) are promising; MINERVA 3 yields linear JAM functions with shallow slopes.

(3035)

**How Diagnostic Is Output Order for Isolating Memory Errors?** SEAN M. LANE, JEFFREY J. STARNES, & CRISTINE C. ROUSSEL, *Louisiana State University*—Schwartz, Fisher, and Hebert (1998) found that intrusion errors were more likely to be produced near the end of a person's recall, suggesting that output order could be a useful heuristic for gating out memory errors. However, these findings may not apply to situations where inaccurate memory is based on confusing potential sources of an item. In this experiment, participants studied items by viewing pictures, reading words, and forming images of objects. Items from each source were presented either once or three times. Later, participants were asked to recall items from a single modality and exclude items from the remaining modalities. Results revealed that modality confusion errors appeared throughout the output sequence and that items from nontarget modalities that were strengthened through repetition were output earlier than nonrepeated items.

We conclude that output order is largely based on the strength of recalled items and is not useful for identifying source confusions.

(3036)

**Optimizing Paired-Associate Learning.** PHILIP I. PAVLIK & JOHN R. ANDERSON, *Carnegie Mellon University*—Widely spaced practice consistently produces better recall at test, given a sufficiently long retention interval. However, these investigations have not looked at the efficiency of wide spacing; rather, they have noted that wide spacing results in the most memory gain per fixed cost trial. While an ACT–R model of the spacing effect predicts monotonically increasing memory gain per trial for wider spacing, it also predicts that more widely spaced test trials will produce slower recall and require more time-consuming feedback following incorrect responses. Due to the shapes of these memory gain and time cost functions, the model predicts that an expanding schedule should optimize long-term recall, given a fixed-duration training session. We tested this prediction for recall 1 day after training with a set of Japanese–English paired associates and found that an optimization algorithm based on the model performed significantly better than cycling through the set to achieve maximal spacing.

(3037)

**Are First Impressions Lasting Impressions? An Exploration of the Generality of the Primacy Effect in Memory for Repetitions.** JEREMY K. MILLER, MARIANNE E. LLOYD, & DEANNE L. WESTERMAN, *SUNY, Binghamton*—Five experiments investigated the primacy effect in memory for repetitions, the finding that when participants are shown a study list that contains two similar versions of the same stimulus, memory is biased in the direction of the version that was presented first (DiGirolamo & Hintzman, 1997). The reported experiments examined the generality of the effect by manipulating the orientation and features of the repeated stimuli. Results confirmed that the effect is reliable when stimulus changes are limited to properties that give information about distance or angle. However, the effect was not found when changes were made to aspects of the stimulus that changed the identity of the stimulus. The results suggest that the primacy effect in memory for repetitions is not robust across all stimulus changes and converge with previous findings that demonstrate that stimulus properties such as orientation and size are represented differently in memory than other stimulus characteristics.

(3038)

**The Effect of an Interpolated Task on Following Navigation Instructions.** VIVIAN I. SCHNEIDER & ALICE F. HEALY, *University of Colorado*, IMMANUEL BARSHI, *NASA Ames Research Center*, & JAMES A. KOLE, *University of Colorado*—This study investigated factors influencing participants' ability to follow navigation instructions in a situation meant to mimic communication between air traffic controllers (ATCs) and flight crews. In our task, participants hear navigation instructions describing movement within a two-dimensional computer display of a three-dimensional space. They repeat the instructions and then follow them by clicking with a mouse on the computer screen. We examined the effects on participants' ability to follow the navigation instructions of an interpolated reading comprehension task inserted between repeating the instructions and following them. A very easy and a much more difficult interpolated task were compared. Participants' performance on following the navigation instructions was impaired by the interpolated task, regardless of the difficulty of the task. The results suggest that the presence of an interruption is more important than the magnitude of the interruption in disrupting pilots' ability to execute ATC instructions.

(3039)

**Relations Between Emotion and Memory: A Further Test of Binding Theory.** CHRISTOPHER B. HADLEY, RONIT A. MENASHE, MELISSA A. MURREN, & DONALD G. MACKAY, *UCLA*—Under binding theory (MacKay et al., 2003), taboo words presented in RSVP lists are better recalled than neutral words matched for familiarity,

length, and category coherence, because emotion-linked words capture the list context binding mechanisms and become bound more effectively to their list context. However, when a taboo word captures the list context binding mechanisms, this impairs the encoding of immediately prior and subsequent neutral words in mixed lists containing taboo and neutral words. The present experiment tested another binding theory prediction: that taboo words will not become more effectively bound to their list context in unmixed lists containing only taboo words. Results replicated the superior recall of taboo words in mixed lists and, consistent with binding theory, demonstrated equivalent recall of taboo and neutral words in unmixed lists. These results suggest that the superior recall of taboo words reflects word-specific binding processes, rather than context-free effects of arousal triggered by emotion-linked words.

(3040)

**Emotional Modulation of Familiarity and Recollective Processes in Recognition: An fMRI Study.** SONYA DOUGAL, ELIZABETH A. PHELPS, & LILA DAVACHI, *New York University*—Research indicates that emotion modulates recognition memory. However, it is unclear which recognition process (familiarity or recollection) is modulated by emotion. Recent fMRI studies suggest that encoding processes in the hippocampus and parahippocampal cortex support recognition judgments involving recollection, whereas the perirhinal cortex supports judgments involving only familiarity (Davachi et al., 2003). The present study sought to determine the role of these structures, and the amygdala, in emotional memory formation. In particular, recent claims (Kensinger & Corkin, 2003; Ochsner, 2000) that the recognition memory enhancement seen for emotional stimuli depends on recollection were tested. fMRI data were acquired during encoding of emotional and neutral words presented in different font colors while subjects performed an imagery task. Behavioral measures of recognition and source memory for the words were collected. Analyses will be aimed at elucidating the neural substrates of later item and source memory for emotional, as compared with neutral, stimuli.

• ATTENTION AND PERCEPTION •

(3041)

**New Hazard Functions for Response Times Combined With Accuracy.** JAMES T. TOWNSEND & KAN TORII, *Indiana University*—Hazard functions have proven to be important in information-processing model testing and the analysis of response times. Traditional hazard functions apply only to response times. We present two novel hazard functions that combine accuracy, or the exact response information, with response times. Such statistics may considerably expand the class of models testable, including strategic information about speed–accuracy tradeoffs. We obtain predictions for several common two-choice models and present some preliminary data.

(3042)

**Direct Selection by Color for Visual Encoding.** ESTHER VIERCK & JEFF MILLER, *Otago University*—In two experiments, we used a rapid serial visual presentation (RSVP) task to examine the usefulness of color for the direct selection of visual information for perceptual encoding. The participants' task was to discriminate whether a target letter within the sequence appeared in its upper- or lowercase version, and an advance cue indicated the color in which the target letter was most likely to occur. Unlike previous studies, which found no evidence for direct selection by color (Puder, 2001; Shih & Sperling, 1996), we used sequences in which the target was the only item appearing in the cued color in validly cued trials. In both experiments, accuracy was highest for valid trials. Cost–benefit analysis revealed a facilitatory effect of valid cues and an inhibitory effect of invalid ones. These results provide strong support for the idea that color cuing allows the direct selection of objects for further perceptual processing.

(3043)

**Search for a Matching Color–Word in a Set of Stroop Distractors.**

ANTHONY J. KRSNICH, DEVIN LAND, MARK YATES, AMBER JONES, SETH D. DORNBUSCH, & JAMES F. JUOLA, *University of Kansas*—Subjects searched for the one or two matching color–word pairs in an RSVP sequence of Stroop color–word distractors. Accuracy of single target detection was 75% at an SOA of about 300 msec. Addition of a second target produced an attentional blink. Additional research is aimed at separate priming of word or color information to reduce the size of the attentional blink.

(3044)

**Attentional Influences on Metacontrast Masking.** JENNIFER L. BOYER & TONY RO, *Rice University*—The influence of attention on perceptual awareness was examined using metacontrast masking. Attention was manipulated with endogenous cues to assess the effects on the temporal and spatial parameters of target visibility. Experiment 1 examined the time course of effective masking when the target and mask set were presented at an attended versus an unattended location. The invalid allocation of attention increased the magnitude of the masking effect (i.e., decreased visibility) for approximately 100 msec. Furthermore, even with no target and mask spatial overlap and center-to-center separations of 1.7° or 2.7° of visual angle (Experiment 2), target visibility was decreased when attention was invalidly allocated. These results indicate that attention influences low-level visual processes to enhance visual awareness.

(3045)

**What Stage of Processing Is Influenced by Four-Dot Masks?** JOOSEOK HYUN & STEVEN J. LUCK, *University of Iowa*—Recent studies have demonstrated two relatively late masking effects. First, four small dots surrounding a target can produce substantial masking of late object identification processes in visual search tasks. Second, backward pattern masks can disrupt the transformation of perceptual representations into working memory representations in change detection tasks. The present study asks whether these two types of masking are the same or different. Specifically, we compared backward pattern masks with four-dot masks in search and change detection tasks that were designed to challenge perceptual encoding and VSTM encoding, respectively. We found that four-dot masks interfered with search performance, but not with change detection performance, whereas pattern masks primarily disrupted both change detection performance and search performance. This pattern of results suggests that four-dot masks interfere with the formation of perceptual encoding, whereas backward pattern backward masks interfere with multiple processes, including the transformation of fleeting perceptual representations into durable working memory representations.

(3046)

**Examining Attention and Preattentive Sensory Processing With Onset and Offset Cues.** MICHAEL D. DODD, *University of Toronto*, TIMOTHY N. WELSH, *McMaster University*, & JAY PRATT, *University of Toronto*—Wright and Richard (2003) posited that cuing effects are mediated by two components: a preattentive sensory component and an attention-related component. With multiple simultaneous cues, sensory processing is carried out in parallel with activity distributions forming at each cued location. These activity distributions increase the speed at which a channel of attention can be opened when a target appears at a previously cued location. The present experiments tested the sensory-processing account by using onset and offset cues, since these cues involve a quantitatively identical but qualitatively opposite sensory experience. On each trial, one or three onset or offset cues appeared prior to a detection target. Cuing effects were found for both cue conditions and were larger following single cues than after triple cues. However, the pattern of reaction times between the cue conditions differed substantially, a finding inconsistent with the sensory-processing account.

(3047)

**Not All Features Are Created Equal: The Encoding of Location Versus an Object Feature.** ZHE CHEN, *University of Canterbury*—

Previous research has shown that attending to an object feature such as color or shape entails attending to its location. The present study examined whether attending to an object's location would lead to the encoding of its object feature. In several experiments, participants performed a go/no-go task in which they saw a response cue followed by a target. The results showed that not all features were created equal. When the cue was based on an object feature, its location was encoded independently of task irrelevancy, although the latter mediated the magnitude of the effect in some conditions. In contrast, when the cue was based on location, its object feature was processed only when it was task relevant. These results suggest that the extent of processing of an attended object is a joint function of the nature of the specific feature that receives attention and task relevancy.

(3048)

**Voluntary Guidance of Auditory Attention by Frequency and Location: The Importance of Discriminability.** CHRIS E. TYSIACZNY & TODD A. MONDOR, *University of Manitoba*—According to attentional engagement theory (e.g., Duncan & Humphreys, 1989), detection of a visual target among distractors will vary as a function of both the similarity of the target and the distractors and of the similarity of the distractors to one another. These influences on auditory target detection were studied in two experiments. Subjects listened for a target sound embedded in a rapid irregular sequence consisting of 24 pure tones. The similarity of the target to the distractors and of the distractors to each other in both location and in frequency was varied across several conditions. The results show that auditory target detection is influenced both by target–distractor similarity and by distractor–distractor similarity.

(3049)

**Visual Search for Change Is Memory-Limited, But Tactile Search for Change Is Process-Limited.** TAKAKO YOSHIDA, *JSPS & Chiba University*, & AYUMI YAMAGUCHI & TENJI WAKE, *Chukyo University* (sponsored by Jack M. Loomis)—In some transsaccadic memory theories and active touch theories, the sensory integration process is thought to require some memories. In a previous study (Yoshida et al., 2004, Vision Sciences Society), we compared visual and tactile searches for change to compare the amount of visuo- (tactile-) spatial working memory involved in visual scanning and active touch. We reported that tactile search for change required much less memory (below 1.0) than did visual search for change (upper limit: 6.57). However, it is possible that our stimulus exposure durations were not sufficiently long to establish stable tactile representations. In this study, we further increased the stimulus exposure time (5,000 msec). The estimated tactile memory traces increased as the stimulus exposure time increased but did not reach to the upper limit of the visuospatial working memory. Our result implies that visual search for change is basically memory limited but that tactile search for change is process limited.

• SPEECH PERCEPTION •

(3050)

**Representational Specificity of Within-Category Phonetic Variation in the Mental Lexicon.** MIN JU & PAUL A. LUCE, *SUNY, Buffalo* (sponsored by Paul A. Luce)—This study examines whether within-category phonetic variation in voice onset time (VOT) is encoded in long-term memory and affects subsequent word recognition and whether these effects can be modulated by degree of lexical discriminability. Three long-term repetition-priming experiments were conducted using words containing word-initial voiceless stops varying in VOT. The magnitude of priming was compared between same and different VOT conditions in words with voiced counterparts (*pat/bat*) and without (*cow/\*gow*) and words whose counterparts were high frequency (*peer/beer*) or low frequency (*pile/bile*). The results show that within-category variation is indeed encoded in memory and can have demonstrable effects on priming under certain circumstances. However, there were also robust effects of prototypical representations on priming. Encoding of within-category variation was also affected by

the presence of lexical counterparts and by the frequency of counterparts. Implications of these results for the specificity and abstractness of phonetic representations in long-term memory are discussed.

(3051)

**Phonological Similarity Effects in Speech Perception and Production.** KAYOKO OKADA & GREGORY HICKOK, *University of California, Irvine* (sponsored by Myron L. Braunstein)—Previous behavioral experiments demonstrate that words belonging to dense phonological neighborhoods are perceived less accurately and more slowly than are words belonging to sparse phonological neighborhoods. Presumably, this effect arises because words compete with one another, making perception of the target more difficult as the number of competitors in the neighborhood is increased. In speech production, words from dense neighborhoods are produced more rapidly than are words from sparse neighborhoods. We conducted an fMRI experiment to investigate whether cortical activity varies with phonological similarity. We present results demonstrating that phonological similarity influences neural activity in the superior temporal lobe during speech perception, but not during production. We found greater activation during perception of words belonging to high-density neighborhoods, as compared with words from sparse neighborhoods. Results from our studies demonstrate that regions in the superior temporal cortex are sensitive to phonological similarity manipulations and suggest that the posterior temporal lobe is involved in phonological processing.

(3052)

**Are Both Languages of a Bilingual Automatically Activated by Spoken Input?** TANYA KRALJIC, ARTHUR G. SAMUEL, SIYUN LIU, & XOCHITL DE LA PIEDAD, *SUNY, Stony Brook* (sponsored by Arthur G. Samuel)—When bilinguals listen to speech, are words from both languages activated if they match some of the input? For example, if a Spanish–English bilingual is asked to select the “leaf” from a display of pictures that also includes a book, is the Spanish word “libro” also activated because it matches the /li/? Conversely, is the second-language (L2) word “leaf” activated when “libro” is in a Spanish context? Previous studies have tested Russian–English bilinguals in the U.S., and Dutch–English bilinguals in the Netherlands. For the latter, no evidence was found for L2 activation; for the former, activation did occur. Using an eye-tracking measure of lexical activation (as in the prior work), we test this question, using bilinguals whose languages are similar (Spanish–English) or different (Mandarin–English). Critically, we divide our bilinguals on the basis of whether they acquired English by age seven, or later, testing the effect of L2 acquisition age on language automaticity.

(3053)

**The Effect of Cross-Language Variation on Perception and Lexical Access.** MEGHAN SUMNER & ARTHUR G. SAMUEL, *SUNY, Stony Brook*—The phonetic variation of a foreign accent may be more severe than phonological or dialectal variation, but it is also quite systematic. Can listeners use the regularity of cross-language variation to normalize the input? Using auditory–auditory semantic priming and phoneme monitoring, we examine (1) whether unaspirated voiceless stops are perceived by native English speakers as voiced when produced by native Spanish speakers, (2) whether lexical status affects this categorization, and (3) whether listeners can correct for the accent when a new voiced counterpart is introduced. Three sets of words address these issues: English words that have only a voiced word-initial interpretation (e.g., *beef*/\**peef*), words with only a voiceless interpretation (e.g., *poach*/\**boach*), and words with both interpretations (e.g., *time/dime*). All words were produced with initial voiceless unaspirated stops by a native Spanish speaker (with an obvious accent). This research addresses cross-language variation specifically, while advancing our knowledge of how listeners accommodate variation in general.

(3054)

**Remote Phonotactic Influences on Speech Perception.** JAMES R. SAWUSCH & LIN-CHIH LIU, *SUNY, Buffalo*, ROCHELLE S. NEW-

MAN, *University of Maryland*, & PAUL A. LUCE, *SUNY, Buffalo*—Previous studies have investigated how lexical status, lexical neighborhood, phoneme frequency, and phonotactics influence phoneme perception and word recognition. In these experiments, we investigated the potential influence of remote phonotactics on phoneme perception. Using a computerized lexicon, the probabilities of pairs of phonemes at the beginning and end of syllables (separated by a vowel) in American English words were determined. Pairs of nonword series were created in which one end of one series (e.g., *bowsh* in a *bowsh-powsh* series) contained a consonant pair (b and sh) that was more common than the pair in the other end of the series. In the second series, the opposite end contained the more common sequence (*pows* in *bows-pows*). Listeners identified ambiguous items from the middle of the series, with the phoneme label corresponding to the more probable pair of consonants. Implications of these results for theories of word recognition will be discussed.

(3055)

**Diminutives Facilitate Word Segmentation in Natural Speech.** VERA KEMPE, *University of Stirling*, STEVEN GILLIS, *University of Antwerp*, & PATRICIA J. BROOKS, *CUNY, Staten Island*—Varying final syllable onset and rhyme invariance in bisyllabic synthesized stimuli, we previously demonstrated that final syllable onset invariance, as shown in the affricates of Dutch diminutives (e.g., *glasje*), facilitates word segmentation (Kempe, Brooks, & Gillis, in press). Here, we present the same stimuli, produced by a human speaker and embedded in natural speech. In two experiments, we varied the frequency of final syllable schwa endings in the sentential context. The findings showed that regardless of context, and unlike in the synthesized materials, the final syllable rhyme invariance of the schwa aided word segmentation. This effect of rhyme invariance is similar to Russian, where the final *ik* typical for masculine diminutives was shown to aid word segmentation. Our results confirm the robustness of ending invariance as a cue to word boundaries and show how a morphological derivation pervasive in child-directed speech aids word segmentation in various languages and contexts.

(3056)

**Speech Prosody as an Aid to Language Comprehension: The Effects of Aging and Right-Hemisphere Brain Injury.** KEN J. HOYTE, ANN KIM, HIRAM BROWNELL, & ARTHUR WINGFIELD, *Volen National Center for Complex Systems, Brandeis University* (sponsored by Robert Sekuler)—Although the left hemisphere is traditionally considered the language hemisphere, the right hemisphere plays an important role in analysis of speech prosody (pitch contour, patterns of word durations, and word stress). This study examines how each of these features operates in terms of hemisphere specialization and how aging affects the use of speech prosody. Participants heard sentences with prosodic patterns indicating a canonical [The teacher said the doctor is late (doctor is late)], or a noncanonical [The teacher, said the doctor, is late (teacher is late)] interpretation. Computer editing was used to selectively remove each of the three prosodic features in turn. The task was to indicate who in the sentence is being described. Results indicate differences in response latency between the young and the older adults. Right-hemisphere brain-injured patients were substantially impaired in their ability to use speech prosody, when compared to healthy non-brain-injured adults.

(3057)

**Intelligibility of Alternated Speech: Effects of Adult Aging.** RAJ A. STEWART, ETHAN J. YETTON, & ARTHUR WINGFIELD, *Volen National Center for Complex Systems, Brandeis University* (sponsored by Arthur Wingfield)—In 1954, Cherry showed that when a speech message presented over earphones was rapidly alternated between the left and the right ears, intelligibility declined progressively as the rate of alternation was increased, up to a rate of 125 msec per ear. Cherry also found that intelligibility improved when rates of interaural alternation were increased beyond this point. Although this classic V-shaped

intelligibility curve has been replicated a number of times, the perceptual mechanisms underlying this phenomenon are not fully understood. Young and older adults (who are known to exhibit perceptual slowing) heard speech passages at eight rates of interaural alternation ranging from 500 to 31 msec per ear. Older adults showed a similar pattern of intelligibility as the young adults, except that the point of minimal intelligibility differed from that of the young adults. Results are discussed in terms of arguments for slowing of speed of attentional switching in normal aging.

(3058)

**Cognitive Abilities and Hearing Acuity as Contributors to Older Adults' Recall of Speech.** SANDRA L. McCOY, PATRICIA A. TUN, MARIANNE COLANGELO, & ARTHUR WINGFIELD, *Volen National Center for Complex Systems, Brandeis University*—In order to examine the relative contributions of aging, hearing acuity, and cognitive abilities to memory for spoken materials, we studied groups of younger and older adults who ranged from poor to good in hearing acuity. Listeners heard spoken strings of words presented at a relatively high sound level, at which everyone was able to shadow words well. The strings varied in contextual constraint from random words, to syntactically correct but meaningless sequences, to text. We found that effects of chronological age on recall performance could be accounted for by contributions of hearing and cognitive abilities, including memory span and processing speed. These effects were moderated by the degree of semantic and syntactic constraint afforded by the to-be-remembered stimuli. In general, memory span was an effective predictor of recall for all of the spoken materials, whereas hearing played a role mainly in memory for less constrained materials.

(3059)

**Evaluation of the Perceptual Magnet Effect and Categorical Perception for Musical Timbre.** MELISSA K. GRIFFITH & MICHAEL D. HALL, *University of Nevada, Las Vegas*—Recent auditory research has raised fundamental questions about the perceptual magnet effect (PME; Kuhl, 1991), where discrimination performance is poorer for stimuli that approach best exemplars of a (phonetic) category. It has been suggested that the PME reflects between-category comparisons—that is, categorical perception (Lively & Pisoni, 1997)—and might not generalize to nonspeech (Acker, Pastore, & Hall, 1995). Three experiments addressed these concerns. In Experiment 1, prototype/nonprototype stimuli were determined from goodness ratings of synthesized (violin) timbres varying in the center frequencies of  $F1$  and  $F2$  formants. Timbres along an  $F1$ – $F2$  diagonal were used in subsequent experiments. Experiment 2 evaluated for a PME, using discrimination data and influences from other categories, by comparing goodness ratings from stimuli in prototype, nonprototype, and no context. Experiment 3 used labeling and discrimination tasks to assess whether categorical perception occurs with timbres. Implications for the structure of speech and nonspeech categories will be discussed.

(3060)

**Lipreading and Auditory–Visual Asynchrony Detection.** BRIANNA L. CONREY & DAVID B. PISONI, *Indiana University*—The ability to understand visual-only speech varies widely in the normal-hearing population, but little is known about the underlying causes of this variability or the possible relationships between lipreading ability and performance on other perceptual or cognitive tasks. Previous studies have hypothesized that lipreading ability might be positively correlated with the ability to detect asynchronies in auditory–visual (AV) signals, because good lipreaders might be more attuned to detailed temporal relationships between auditory and visual information. However, this hypothesis had not been explicitly tested in normal-hearing individuals prior to this study. Thirty normal-hearing participants were given a modified clinical test of sentence intelligibility under auditory-only, visual-only, and AV presentation conditions. The same participants also performed an AV asynchrony detection task for speech and nonspeech stimuli. The results suggest a relationship between lipreading

ability and the detection of AV asynchrony. Implications for AV integration are discussed.

(3061)

**When Less Is Heard Than Meets the Ear.** KIMBERLY M. FENN, *University of Chicago*, ALEXANDRA S. ATKINS, *University of Michigan*, & JEREMY I. SKIPPER, VERONICA C. BOND, & HOWARD C. NUSBAUM, *University of Chicago*—Subjectively, it seems that we automatically encode all acoustic features present in speech. Researchers have claimed that we automatically derive talker information when comprehending a linguistic message (Goldinger, 1998). In the visual modality, many changes are missed; people do not always notice when a conversational partner changes (Simons & Levin, 1998). Vitevich (2003) reported deafness to talker change in a shadowing task. However, listeners can be deaf to talker changes without a shadowing load. During a phone survey, participants were put on hold, and a new experimenter continued the survey. Only 20% noticed the change. In a second experiment, participants expected a new experimenter would resume the conversation, but the experimenter stayed the same. Only 10% noticed that the same person conducted the entire survey. Results suggest listeners attend to speech consistent with listening goals and that perception of a talker's voice is not an automatic consequence of attending the linguistic message.

• WORD AND SENTENCE PROCESSING •

(3062)

**Age-Related Changes in Brain Activation Patterns for Semantics and Phonology: An fMRI Study.** STEPHEN J. FROST, W. EINAR MENCL, REBECCA SANDAK, & DINA L. MOORE, *Haskins Laboratories*, JAY G. RUECKL, *Haskins Laboratories and University of Connecticut*, & KENNETH R. PUGH, *Haskins Laboratories and Yale University*—A large body of behavioral research suggests that becoming fluent at word identification is associated with a relative shift in the weighting of semantic versus phonological codes. Using fMRI, we examined the neurobiological signature of these developmental changes with a large cohort of readers ranging from 12 to 40 years of age. Participants performed a go/no-go naming paradigm with stimuli factorially crossed on lexico-semantic (frequency and imageability) and phonological (spelling–sound consistency) variables. Behavioral, neurobiological, and functional connectivity analyses were used to refine our understanding of changes in the functional architecture of the reading system and, particularly, the interplay between phonology and semantics, in the developing reader.

(3063)

**How Different Learning Conditions Affect the Way the Brain Reads Words.** REBECCA SANDAK, W. EINAR MENCL, STEPHEN J. FROST, & DINA L. MOORE, *Haskins Laboratories*, JAY G. RUECKL, *University of Connecticut and Haskins Laboratories*, & KENNETH R. PUGH, *Haskins Laboratories and Yale University School of Medicine*—In an earlier fMRI 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, anterior, and occipitotemporal regions; attention to semantic features during training increased activation in anterior ventral areas. We hypothesized that learning conditions requiring attention to both phonological and semantic attributes would optimize learning. A behavioral study confirmed this hypothesis. A recent fMRI experiment replicated our earlier findings and revealed the unique effects of the mixed training on ventral cortical regions. Implications for reading theory, instruction, and dyslexia are discussed.

(3064)

**Effects of Stimulus Type on Brain Activation Patterns in Typically Developing and Reading-Disabled Cohorts.** KENNETH R. PUGH, *Haskins Laboratories and Yale University School of Medicine*, STE-

PHEN J. FROST, REBECCA SANDAK, & DINA L. MOORE, *Haskins Laboratories*, STEPHANIE A. MASON, *Yale University School of Medicine*, & W. EINAR MENCL, *Haskins Laboratories*—Using fMRI, we compared a cohort of typically developing adolescent readers with a cohort of reading-disabled (RD) participants performing a go/no-go naming task. Following from our initial fMRI study of skilled adult readers (Frost et al., 2004), we targeted the complex brain activation patterns associated with the modulation of the consistency effect for low-frequency words by imageability (demonstrated behaviorally by Strain, Patterson, & Seidenberg, 1996, 2002). We were particularly interested in determining whether an often reported reading group difference reduced left-hemisphere posterior activation with increased right-hemisphere and frontal activation for RD, relative to controls, was invariant across more or less difficult tokens. Activation, functional connectivity, and brain/behavior analyses were conducted. We found that group differences in the reading circuitry are partially modulated by stimulus (particularly, phonological) difficulty. Implications for a neurobiological model of RD are considered.

(3065)

**An Event-Related fMRI Study of Task Comparisons for Word Identification in Reading.** DINA L. MOORE, STEPHEN J. FROST, W. EINAR MENCL, & REBECCA SANDAK, *Haskins Laboratories*, JAY G. RUECKL, *University of Connecticut and Haskins Laboratories*, & KENNETH R. PUGH, *Haskins Laboratories and Yale University School of Medicine* (sponsored by Kenneth R. Pugh)—The present study explored the roles of the major circuits involved in reading by contrasting the neurobiological response patterns associated with changing task demands. Reading tasks that place different demands on the reader should differ with respect to the involvement of these cortical systems. In the present experiment, we examined performance on simple naming, go/no-go naming (implicit lexical decision), and go/no-go semantic naming (implicit semantic classification) tasks. Importantly, the tasks are matched on the nature of the stimuli presented to participants (pronounceable letter strings) and on the nature of the response (pronouncing stimuli aloud) but vary in demands on lexical and semantic processing. Results from both activation and functional connectivity analyses allow a more precise understanding of the nature of information processing within and across the major left-hemisphere reading-related circuits in coping with progressive demands on word identification components.

(3066)

**An ERP Investigation of Concreteness Effects.** NATASHA TOKOWICZ, SUSAN DUNLAP, & CHARLES A. PERFETTI, *University of Pittsburgh*—In a variety of language and memory tasks, concrete words are processed more quickly and accurately than abstract words. However, the concreteness advantage in lexical decision disappears when both word types are presented in sentence contexts. The aim of the present study was to determine whether providing a context leads to identical brain responses for concrete and abstract words or whether underlying differences remain in the absence of a behavioral difference. We measured event-related brain potentials of native English speakers who performed a lexical decision on words in isolation and in sentence contexts. We found increased N400 amplitude for concrete words in isolation at frontal and central scalp locations, as well as for concrete words in context at central scalp locations. Our results do not support the context availability theory account of concreteness effects, which proposes that out-of-context concreteness effects are due to differences in the availability of context for concrete and abstract words.

(3067)

**Event-Related Potentials Elicited by Violations of Morphological Structure.** JOANNA M. FLORACK, *Hampshire College*, & PHILLIP J. HOLCOMB, *Tufts University*—Event-related brain potentials were recorded to morphologically correct and incorrect regular and irregular verb forms presented in sentences and in lists. If syntactic and morphological processes share similar brain mechanisms, we should

expect to see a P600 or LAN to violations of morphological structure, just as we see these components to violations of syntactic structure. In the 300–500 msec time window, we found that correct irregular past tenses were more negative than incorrect ones at anterior sites but that, for regular verbs, correct and incorrect past tense forms did not differ. All incorrect verb forms elicited a P600 response, but this response was greater for incorrect irregular past tenses than for regular ones. The results from these studies show that morphological and syntactic violations produce similar patterns of brain activity, suggesting that these two systems engage cognitive processes with similar underlying neural substrates.

(3068)

**First Words: Text Integration Processes Exposed Through ERPs.** CHARLES A. PERFETTI & CHIN-LUNG YANG, *University of Pittsburgh*, & FRANZ SCHMALHOFER, *University of Osnabrück*—Do readers integrate the first words of a sentence into a discourse model or postpone integration until there is more information? On the availability hypothesis, such integration occurs if a referent is available in the discourse model; otherwise, the reader establishes a new referent. Availability is explicit when an antecedent word is identical to the current word: *On CNN, Trisha saw a soldier walking through Baghdad. The soldier.* But semantic frames also (implicitly) establish an antecedent, as in *On CNN, Trisha saw an army unit walking through Baghdad. The soldier.* ERP components on the first words of the second sentence (e.g., *soldier*) differentiate explicitly available from frame-available antecedents; other components distinguish both from sentences with no antecedent available. Whereas readers do not routinely make inferences to establish a referent, they do integrate the first words of a sentence into a semantic frame that entails the referents associated with the word.

• MENTAL LEXICON •

(3069)

**Can Attention Modulate Hemispheric Sensitivity to Grammatical Form-Class Cues Within Sentences?** STELLA R. ARAMBEL, *University of New Hampshire*, & CHRISTINE CHIARELLO, *University of California, Riverside*—It is commonly accepted that the left hemisphere (LH) is responsible for grammatical processing, and the right hemisphere (RH) is assumed to have little involvement in this important aspect of language comprehension. In a previous experiment, we reported results that were consistent with this idea: Semantic priming was modulated by form-class cues for right-visual-field/LH targets (e.g., *The pizza was too hot to . . .* primes EAT but does not prime CHEESE), but left-visual-field/RH targets showed equivalent priming for both of these target words, relative to an unrelated baseline condition (Liu & Chiarello, 2004). In the present follow-up experiment, a neutral jabberwocky baseline was included to evaluate whether the priming effects reflected facilitation and/or inhibition. Surprisingly, including the jabberwocky baseline within the same stimulus set resulted in bilateral sensitivity to form-class constraints. We will discuss whether task difficulty or attentional mechanisms can account for the change in priming across studies.

(3070)

**Qualitatively Different Semantic Processing in Left and Right Hemispheres: The Role of Conceptual Structure.** LEA PILGRIM & MARK JUNG-BEEMAN, *Northwestern University* (sponsored by Paul J. Reber)—We previously found that people had greater difficulty responding to nonliving concepts than to living concepts presented to the right, but not to the left, hemisphere. We argue that the underlying structure of concepts mediates this asymmetry. In this study, we explicitly manipulated both domain of knowledge (living/nonliving) and the distribution of properties within each domain. We found an advantage for concepts with many shared properties as compared with those with many distinctive properties. Furthermore, there was an interaction of distinctiveness, domain, and visual field of presentation:

When responding to right-hemisphere stimuli, participants had particular difficulty responding to living things with many distinctive properties than to living things with many shared properties. There were no effects of distinctiveness for nonliving things presented to the right hemisphere or either domain presented to the left hemisphere. We discuss these findings within the framework of differing conceptual structure and qualitatively different processing across hemispheres.

(3071)

**Culture Fair IQ Mediates Vocabulary Set Size Effects in Morphology Learning.** PATRICIA J. BROOKS, *CUNY, Staten Island*, & VERA KEMPE, *University of Stirling*—Native English speakers learned, over six sessions, a reduced case-marking paradigm consisting of masculine and feminine Russian nouns presented in nominative, dative, and genitive cases. In a between-subjects design, training vocabulary size was varied from 6 to 24 nouns. The number of learning trials was held constant by providing more repetitions for the small and medium vocabulary size groups. Following training, generalization ability was tested by presenting novel nouns in the nominative case and requiring subjects to inflect them in the dative and genitive cases. Cattell's culture fair IQ was shown to mediate the vocabulary set size effect on generalization ability: Only subjects with above median culture fair scores showed the predicted critical mass effect of better generalization with a larger training vocabulary. Our results indicate considerable individual differences in the use of input variability in morphology acquisition and suggest that executive functioning and attention allocation capacity play a major role in second-language learning.

(3072)

**Relative Frequency of Morphological Forms Modulates Determiner Competition.** KATHARINA SPALEK & HERBERT SCHRIEFERS, *University of Nijmegen*—Determiner selection during language production is regarded as a lexical–syntactic process in the mental lexicon. Janssen and Caramazza (2003) show that when producing diminutive or plural noun phrases in Dutch, determiner information about the corresponding (singular) base form is active. The co-activation of different determiners leads to competition. This is reflected in a time cost for producing the plural or the diminutive with a gender-marked determiner when these forms and the corresponding singular or base form require different determiners. No such cost is observed when singular and plural or base form and diminutive require the same determiner. In several picture naming experiments, we show that the competition effect is modulated by the relative dominance of the morphological forms. The modulation of co-activation effects in the lexicon can be explained within an extension of the “primed unitized activation account” proposed by Alario and Caramazza (2002).

(3073)

**Expectancy for the Morphological Form of Active and Passive Verbs During Noun–Verb Semantic Priming.** TODD R. FERRETTI, *Wilfrid Laurier University*, KEN McRAE, *University of Western Ontario*, JEFFREY L. ELMAN, *University of California, San Diego*, & CANDACE RAMSHAW, *Wilfrid Laurier University*—Do participants in events (i.e., agents and patients) prime the activities in those events (i.e., the verbs describing them)? And if so, does the nature of the prime—good agent or good patient—generate expectations about the morphological form of the verb, active or passive? Experiment 1 investigated how quickly participants pronounce verbs inflected with -ing or -ed (arresting vs. arrested) when preceded by primes consisting of a good agent or a good patient and the auxiliary “was” (“cop was” vs. “crook was”). In Experiment 2, the primes included the determiner “The,” and participants made lexical decisions to the same target verbs. Participants responded more quickly to active verbs when preceded by good-agent, rather than by good-patient, primes. Alternatively, response latencies for passive verbs were similar regardless of noun type. This provides further evidence that early activation of event knowledge is modulated by morphosyntactic information.

(3074)

**How Neural Networks Learn to Inflect Italian Verbs.** LUCIA COLOMBO & IVILIN STOIANOV, *University of Padua*, MARGHERITA PASINI, *University of Verona*, & MARCO ZORZI, *University of Padua*—We investigated the performance of networks with two different architectures to explore the degree of learning in generating the past participle form of Italian verbs with different inflectional paradigms (conjugations). This was done by examining the morpho-phonological regularities that characterize each conjugation and type and token frequency. We presented the networks with four inflected forms of the same verb. Some of these inflections included the critical thematic vowel that differentiates the verb class; some were ambiguous. The networks were required to generate the past participle form of each verb. We examined the degree of learning relative to the following critical aspects: identity of the verb, type of inflection given as input, classification of each verb according to the thematic vowel, and regularity of the stem and of the suffix. The pattern of results displayed by each network is discussed in term of the implications for theoretical models of verb inflection.

(3075)

**Distinguishing Pour, Load, and Fill Verbs in High-Dimensional Memory Space.** NICHOLAS DURAN & CURT BURGESS, *University of California, Riverside*, & KEVIN LUND, *Postini, Inc.*—Pinker's (1984) position on the utility of lexical co-occurrence information in concept and grammar acquisition has been clear: the properties that the child can detect in the input, such as co-occurrence relations among words, are in general linguistically irrelevant. Thus, the argument goes, induction suffers from the poverty of the stimulus, and the child needs other acquisition devices to overcome the complexity of the language. An example of a semantically and grammatically subtle distinction would be the pour–load–fill distinction. These verbs, while semantically similar, have different thematic role requirements (see Seidenberg, 1997, for discussion). Could an inductive learning model, with a simple learning algorithm, that encodes the contexts in which words occur provide a sufficient mechanism? The HAL model was able to reliably categorize these classes of verbs, offering another result building toward an empirical alternative to deductive linguistic theory.

(3076)

**Learning Syntax and Semantics From Redundancies in Text.** MICHAEL N. JONES & DOUGLAS J. K. MEWHORT, *Queen's University* (sponsored by S. J. Lederman)—We present a hyperspace model that learns word meaning and usage from statistical redundancies in a large corpus of text. Words are represented by holographic vectors that store composite information about word meaning and usage. The model encodes information about context and word transitions within each sentence learned. The information is updated continuously in the lexicon. It is able to account for several benchmark semantic tasks, can determine parts of speech, and can generalize meaning and usage for novel words. The model demonstrates that knowledge of limited syntax can be learned from redundancies, and stored in the lexicon, without additional storage or explicitly coded rules.

(3077)

**Is Overt Repetition Critical to Learning New Words?** BRANDON ABBS & PRAHLAD GUPTA, *University of Iowa* (sponsored by Prahlad Gupta)—To what extent can language learners acquire new words through mere exposure to word–referent pairings? In a series of three experiments, participants were exposed to pairings of novel auditory word forms (the names) and pictures of novel objects (the referents). During this study phase, participants (1) repeated the names, (2) did not repeat the names, or (3) did not repeat the names but performed an attention-demanding task. Participants were tested for receptive learning (picking out the correct referent when cued with the name) and expressive learning (producing the correct name when cued with

the referent). The first experiment showed that overt repetition was necessary for long-term retention of expressive, but not receptive, learning. The second experiment showed that the benefit of overt repetition is attributable to the act of repeating, rather than to a greater number of auditory exposures. The third experiment extended these findings to four-syllable nonwords.

• INFERENCES AND SITUATION MODELS •

(3078)

**When Anaphor Resolution Fails: Partial Activation of Antecedent Information.** CELIA M. KLIN, KRISTIN M. WEINGARTNER, ALEXANDRIA E. GUZMAN, & ANGELA RALANO, *SUNY, Binghamton*—Levine, Guzman, and Klin (2000) and Klin, Weingartner, Guzman, and Levine (2004) identified text conditions under which readers fail to resolve noun phrase anaphors without any resulting disruption to comprehension. They concluded that when an antecedent is not automatically reactivated from memory and readers' standard of coherence is met without this information, it is inefficient to devote attentional resources to retrieving that antecedent. In the present set of experiments, we found that although readers did not fully retrieve an antecedent, they reactivated some of its traces and used these traces to integrate the anaphor into the ongoing text representation. Importantly, although readers knew that there was an antecedent in the passage, they did not devote sufficient attentional resources to fully retrieve it. It appears that readers were able to make fast metacognitive judgments about the importance of the anaphoric concepts and the amount of attention to devote to them.

(3079)

**Resolving Anaphors After Reading Negative Sentences.** BARBARA KAUP, *Technische Universität Berlin*, KATINKA DIJKSTRA, *Florida State University*, & JANA LÜDTKE, *Technische Universität Berlin*—In three experiments, subjects resolved pronominal anaphors referring to critical entities after reading a sentence or clause in which the critical entity was introduced within the scope of a negation. There were two types of materials: (1) disjunction (Either John does not have a sister, or she) and (2) double negation (I denied that John does not have a sister. I had met her.). Anaphor resolution times were longer relative to affirmative introductions (If John has a sister; I confirmed that John has a sister.) for Type 1 materials, but not for Type 2 materials. Different results were obtained for control conditions, in which a noncritical entity was referred to (i.e., John): Here, Type 2, but not Type 1, materials produced the negation effect. The results only partly replicate earlier results by Kuschert (1999) and will be discussed in the context of situation model theories of language comprehension.

(3080)

**Updating Situation Models: The Memory-Based Contribution.** SABINE GUERAUD, MARY E. HARMON, & KELLY A. PERACCHI, *University of New Hampshire* (sponsored by Edward J. O'Brien)—O'Brien, Rizzella, Albrecht, and Halleran (1998) demonstrated that when a protagonist was introduced with information that was inconsistent with an action described in a subsequent target sentence, reading times on that sentence were disrupted. This occurred even when the inconsistent information was followed by consistent information that outdated the inconsistent information. In three experiments, we examined factors that may have contributed to the reactivation of outdated information. In Experiment 1, the order of introduction of the consistent and inconsistent information was reversed so that the initial character information was consistent with the target sentence. Despite introducing the protagonist with information consistent with the target sentence, reading times were still disrupted. In Experiments 2 and 3, the amount of consistent information was increased. Adding consistent information eliminated comprehension difficulty on the target sentence; however, Experiment 3 confirmed that the inconsistent information continued to be reactivated.

(3081)

**fMRI Signal Reveals Semantic Integration During Story Comprehension.** SANDRA VIRTUE, JASON HABERMAN, THERESE SWAN, ZOE CLANCY, TODD PARRISH, & MARK JUNG-BEEMAN, *Northwestern University*—To successfully comprehend stories, people must draw causal inferences. Although researchers have investigated different types of inferences, the neural mechanisms that underlie the component processes of inference generation are poorly understood. In this study, we used functional magnetic imaging (fMRI) to examine semantic integration at different time points while subjects drew inferences. During fMRI scanning, subjects listened to stories that implied or explicitly stated causal events. Evidence for semantic integration was found in the right superior temporal gyrus when the story event was implied and in the left superior temporal gyrus at the coherence break. These findings suggest that this right temporal area is sensitive to subtle manipulations that tax semantic integration, such as merely implying an event rather than stating it. To further investigate this process, we also manipulated the causal constraint of these stories. These results suggest that unique cognitive and neurological processes are involved during inference generation.

(3082)

**Texts and Pictures and Procedures, Oh My! Multimedia Format Effects on Learning Procedures.** TAD T. BRUNYE & HOLLY A. TAYLOR, *Tufts University*, & DAVID N. RAPP, *University of Minnesota*—Research has examined the working memory subsystems underlying the production and application of mental models following multimedia learning (Mayer, 1997). But are all multimedia formats equivalent? The present study examined the influences of multimedia integration and redundancy on the structure and content of memory for procedures. In two experiments, participants learned assembly sequences from text descriptions, picture instructions, or combined picture and text presentations. The multimedia presentations included either redundant or nonredundant information, and for the combined case, formats were either interleaved or simultaneous. Dependent measures included free recall, memory for the order of procedural steps, and source memory for the presentation format. Experiment 1 demonstrated an advantage of multimedia redundancy, above and beyond standard dual-format influences. Experiment 2 showed that redundant and interleaved multimedia presentations produced equivalent memory performance. These results provide limited support for theories emphasizing the role of dual-format presentations for multimedia learning.

(3083)

**Making Inferences From Web Pages.** CHRISTOPHER A. SANCHEZ, IVAN K. ASH, & JENNIFER WILEY, *University of Illinois, Chicago*—Text comprehension research has generally used printed texts or computer displays of short independent texts to investigate how and when readers draw inferences. In a series of studies, we have been examining how readers may learn best from multiple electronic texts on a single scientific topic (i.e., Web pages on the cause of ice ages or volcanic eruptions). Our studies examine how the design of a Web page can impact the ability to draw inferences from text, how individual differences can interact with page design features, and which reading behaviors, measured with eye movement methodology, lead to the best comprehension of scientific information.

(3084)

**The Effects of a Visuospatial Secondary Task on Situation Model Formation.** JOHN F. GEIGER, *Cameron University*—Perrig and Kintsch (1985) found that text type may affect how a situation model is formed during reading, since route texts led to a linear model, whereas survey texts led to a spatial model, in females. Males were found to always prefer a spatial model. In the present study, participants received route and survey texts, at the same time typing up their visuospatial working memory (WM) with the visuospatial tapping task. This task will limit their use of visuospatial WM during reading, so it should affect how

a spatial situation model is formed. Both route and survey inference questions were asked about the text. Results of the present study showed that survey inferences were answered correctly more often than route inferences, regardless of text type [ $F(1,89) = 5.07, p < .05$ ]. This finding suggests that spatial situation models were formed by readers even when visuospatial WM was tied up.

• SENTENCE PRODUCTION •

(3085)

**Phonological Planning During Sentence Production: Beyond the Verb.** TATIANA T. SCHNUR, *Moss Rehabilitation Research Institute & University of Pennsylvania*—The extent of phonological planning may be influenced by grammatical and/or phonological phrase boundaries. I conducted three experiments to investigate whether phonological planning crossed grammatical phrase boundaries within a single phonological phrase. Using the picture–word interference paradigm, I found, in two separate experiments, a significant phonological facilitation effect to both the verb and the noun of sentences like *She kicks the ball*. In a third experiment, I altered the frequency of the direct object and found longer utterance initiation times for sentences ending with a low-frequency versus a high-frequency object, offering further support that the direct object was phonologically encoded at the time of utterance initiation. These results indicate that phonological planning is not necessarily restricted by grammatical phrase boundaries. That postverb phonological properties were activated suggests that the grammatical importance of the verb did not drive the extent of phonological planning.

(3086)

**Flexibility, Simultaneity, and Exchange Errors in Sentence Production.** ERIC S. SOLOMON & NEAL J. PEARLMUTTER, *Northeastern University*—We investigated interactions between syntactic flexibility (Ferreira, 1996) and semantic integration (Solomon & Pearlmutter, in press) during phrase formulation in English. Forty-seven participants described pictures (e.g., an airplane above a cloud), using a given preposition, which forced one noun ordering (“the airplane above the cloud,” “the cloud below the airplane”), or using “and,” which allowed either ordering. The pictures varied in (rated) degree of integration (e.g., unintegrated, an airplane above a cloud; integrated, a signature on a check), and each picture had a preferred preposition/noun ordering combination. For unintegrated pictures, speech onset times were shorter when ordering was flexible (“and”) than when constrained by a preposition (replicating Ferreira), but integrated pictures did not differ, suggesting that increased semantic integration leads to increased simultaneity of planning, which makes both nouns available quickly. Exchange errors were more frequent for integrated than for unintegrated pictures, further supporting this view.

(3087)

**Minimal Effects of Order of Noun Activation on Sentence Production.** LORI J. ALTMANN, D. ASHLEY MULLIN, & TAMI MANN, *University of Florida*—Sentence production theory states that the argument of a verb activated first takes the sentence subject position, thus determining sentence structure. However, previous studies show that young adults prefer animate nouns as sentence subjects, regardless of their prominence in the stimulus. This study uses a constrained sentence production task to directly examine the impact of the temporal order of noun activation on sentence structure choice. Fifty-two participants produced sentences using three stimulus words, a verb, and two nouns differing in animacy, presented vertically on a computer screen. For half of the subjects, the top noun appeared 100 msec before the other two words; for the rest of the subjects, words appeared simultaneously. Staggered presentation of words led to faster sentence production times but had little effect on sentence structure choice. We conclude that animacy constrains young adults’ sentence production more strongly than order of activation does.

(3088)

**Balancing Commitments in Sentence Production.** KRISTINE SCHUSTER & PADRAIG G. O’SEAGHDHA, *Lehigh University*—How do speakers regulate current and future commitments while speaking? We examined direct measures of on-line production and indirect measures of the accessibility of ingredients within prepared sentence plans in a “spatial descriptions of word locations” paradigm. Direct performance measures showed (1) sensitivity to the sizes of initial and downstream phrases and (2) benefits of phonological similarity of words within phrases but costs when similarity spanned phrases. These findings confirm the pivotal role of phrasal planning units. In recognition tests, we found a strong sensitivity to linear position in speech plans, in contrast to a nearly flat function for the same words in a no-plan control condition. We outline an account of horizontal syntactic and phonological sentence planning and production in which immediate obligations to the current phrase are balanced against executive-level commitments beyond it.

(3089)

**On-Line Metaphor Production: Effects of Gender and Friendship Status.** KAREN A. HUSSEY & ALBERT N. KATZ, *University of Western Ontario* (sponsored by Albert N. Katz)—Sixty-four dyads engaged in two persuasive conversations over chat software. We manipulated the gender and friendship status of the dyad members. Dyads were of the same gender and were either friends or strangers. The conversations were scored for the frequency with which metaphors were employed in this everyday conversation task. We find a main effect of gender, with males producing more metaphor, both conventional and novel, than did females. The interaction of gender and friendship status indicated that females produced more metaphor with friends than with strangers. There was no significant difference in metaphor production between male strangers and friends. We speculate that the tendency by males to use more metaphor, especially more novel metaphor, regardless of friendship status, reflects risk-taking behavior on their part. In contrast, the more literal conversations between female strangers reflects a more selective use of metaphor to avoid miscommunication.

(3090)

**Grammatical Agreement Processes in Young and Older Adults.** ROBERT THORNTON, KRISTEN SKOVBRÖTEN, & DEBORAH BURKE, *Pomona College*—A central topic in cognitive aging concerns how normal aging affects language ability, but relatively few studies have examined how linguistic processes themselves change with age. We addressed this question by examining the on-line production of subject–verb agreement in young and older adults. We presented Bock and Miller’s (1991) preambles (e.g., “the key[s] to the cabinet[s]”) to 32 young and 32 older participants, who were to produce a complete sentence beginning with the preamble. The number of the nouns was manipulated (singular vs. plural). Replicating Bock and Miller, participants produced more subject–verb number agreement errors when the subject and the local nouns mismatched in number. Older adults produced more agreement errors, but crucially, age did not interact with the number variables. This finding suggests that older adults compute number agreement like young adults. Discussion will focus on the implications for models of cognitive aging and for language production more generally.

(3091)

**Speech Planning in Freely Generated Picture Descriptions in Younger and Older Adults.** WILLIAM S. HORTON & DANIEL H. SPIELER, *Georgia Institute of Technology*—Speakers may vary the amount of advanced planning in their speech in response to the difficulty of the production task. Such tradeoffs may be particularly important for older speakers, who may try to maintain fluency by simplifying utterances or planning farther ahead. To explore this possibility, we allowed younger and older participants to choose how to describe a se-

ries of displays containing three pictures of familiar objects. The three objects appeared in different configurations across displays, forcing speakers to plan a suitable description on every trial. By examining the type of descriptions produced, along with the speakers' eye movements, we can assess the degree of advanced planning in different descriptive contexts. Importantly, by varying the name agreement and frequency of a critical object on each trial, we are able to investigate the processes by which older speakers compensate for limitations in lexical retrieval through modifications of speech-planning processes.

• REASONING •

(3092)

**Development of Analogical Reasoning: Inhibitory Control and Working Memory.** LINDSEY E. RICHLAND, *UCLA*, ROBERT G. MORRISON, *Xunexis*, & KEITH J. HOLYOAK, *UCLA*—A picture-mapping task was used to examine the roles of inhibition and working memory constraints in children's development of analogical reasoning. Children ages 3–4 and 9–11 mapped corresponding objects between pictures of scenes involving relations familiar to young children (e.g., chasing). The number of relations that needed to be integrated (relational complexity) and the presence or absence of a featural distractor (need for inhibition) were manipulated. To minimize knowledge-related errors, simple relations were used, and the experimenter verbalized the relationships depicted in the source pictures. Both relational complexity and need for inhibition interacted with age to determine accuracy of relation-based mappings. Error data indicated that inhibition is a primary constraint on children's analogical mapping. The data support the role of inhibition and working memory changes in the development of analogical reasoning and challenge the hypothesis that the development of analogical reasoning is driven solely by knowledge accretion.

(3093)

**Analogical Priming of Abstract Relations.** ADAM E. GREEN & KEVIN N. DUNBAR, *Dartmouth College*—The hypothesis that assessing analogies leads to the activation of abstract relations was investigated using a modified Stroop task. Participants saw four-word sets in which they had to determine whether an analogical relation or a categorical relation was present. Participants were then asked to name the ink color of a single colored word. The word referred to either an analogical or a categorical relation in the four-word set. In the analogical condition, colored words were more strongly primed (longer RTs) when they referred to analogical relations. This effect was reversed in the categorical condition. These results lead to a model of how relational and categorical knowledge is invoked during analogical reasoning.

(3094)

**How Forgetting Aids Heuristic Inference.** LAEL J. SCHOOLER, *Max Planck Institute for Human Development*, & RALPH HERTWIG, *University of Basel*—To explore how forgetting benefits memory-based inferences, we bring together two research programs with strong ecological foundations: the program on fast and frugal heuristics (Gigerenzer, Todd, & the ABC Research Group, 1999) and the ACT-R research program (Anderson & Lebiere, 1998). Although many have argued that forgetting filters out obsolete information (e.g., Bjork & Bjork, 1988), we provide new specificity to this and other benefits of forgetting. Our simulations show that forgetting helps to maintain systematic recognition failures that are critical to the functioning of the recognition heuristic. Our simulations of the fluency heuristic, which makes judgments based on the speed with which items are recognized, show that forgetting helps maintain the discriminability of these judgments. These results highlight that what are often characterized as cognitive limitations, such as forgetting, may have unsuspected benefits.

(3095)

**Belief Updating in the Assessment of Threat: Implicit Processes and the Role of Inconclusive Information.** JOSEPH V. BARANSKI, *Defence Research and Development Canada, Toronto*, & MARIE-EVE

JOBIDON, *Université Laval*—The process of belief updating was examined in a military threat assessment task involving diagnostic and inconclusive information. In Experiment 1, recency effects were observed when sequential processing required judgments to be made after each new piece of information was presented (step-by-step: SbS), and no recency effects were evident when information was presented all at once (end-of-sequence: EoS). A condition in which information was presented sequentially but judgment was required after all information was presented (lag-end-of-sequence: Lag EoS) likewise revealed evidence of recency-based presentation order effects, suggesting an implicit process of belief updating. In Experiment 2, participants previously exposed to EoS and SbS processing modes participated in the Lag EoS condition. Belief-updating effects were evident when there was prior exposure to SbS processing, but not for participants previously exposed to EoS processing. This suggests malleability in implicit belief-updating processes and, thus, sensitivity to the prior processing context.

(3096)

**The Influence of Print Exposure and Print Type on Syllogistic Reasoning.** GUY L. LACROIX, HELENA P. OSANA, BRADLEY J. TUCKER, & EINAT IDAN, *Concordia University*—Research on literacy has established a robust relationship between print exposure and vocabulary in children and adults (Stanovich, 2000). Siddiqui et al. (1998) further hypothesized that print exposure might be related to decontextualized reasoning. The authors failed to find strong support for this hypothesis, however. One possible explanation for the lack of a clearly established relationship between print exposure and reasoning is that only texts that have a high inference load foster decontextualized reasoning skills (Kemper, 1988). The goal of this study was to evaluate this possibility. One hundred twelve participants completed measures of print exposure (popular and science authors), vocabulary, nonverbal IQ, and syllogistic reasoning. Text comprehension was measured using passages that varied in vocabulary level and inference load. Preliminary results show that exposure to both popular and scientific authors is correlated with vocabulary but that exposure to scientific authors correlates more strongly with syllogistic reasoning than does exposure to popular authors.

(3097)

**Nonverbal Transitive Inference: Effects of Task and Awareness on Performance.** OLGA F. LAZAREVA & EDWARD A. WASSERMAN, *University of Iowa*—We studied nonverbal transitive inference in two different tasks: with choice stimuli orderable along a physical dimension and with nonorderable choice stimuli. Participants were trained to discriminate four overlapping pairs of choice stimuli: A + B−, B + C−, C + D−, and D + E−. Half of the participants were provided with post-choice visual feedback stimuli that were orderable by size, whereas the other half were not. In later testing, we presented novel choice pairs: BD, AC, AD, AE, BE, and CE. We measured task awareness with a questionnaire developed by Greene et al. (2001). Contrary to earlier results, transitive responding depended on task awareness for all participants. In addition, participants given ordered feedback showed clearer task awareness and stronger transitive responding than did participants not given ordered feedback. These and other results suggest that ordered and nonordered transitive inference tasks support decidedly different patterns of performance.

(3098)

**The Role of Fear of Isolation in Observed Cultural Differences in Reasoning.** KYUNGIL KIM & ARTHUR B. MARKMAN, *University of Texas, Austin*—Research on cultural differences has uncovered a number of important differences in the performance of Eastern and Western participants. Two shortcomings of this research are that (1) it does not specify the psychological variables underlying the performance differences and (2) it focuses on between-culture variation at the expense of within-culture variation. We propose that reasoning differences may be explained by cross-cultural differences in level of fear of isolation

(FOI) between members of Eastern and Western cultures. We support this view by manipulating FOI within a sample of American undergraduates and demonstrating that people with a high level of FOI exhibit reasoning performance more similar to that of East Asians in previous research than do people with low FOI. Level of FOI (as measured by the Fear of Negative Evaluation scale) accounts for the variability in performance in our studies. This variable may explain both within- and between-culture variability in performance.

(3099)

**Generation and Exploration: Separable Creative Processes in Persons With Autism.** BEVERLY ROSKOS-EWOLDSSEN, AMITY C. MONCRIEF, MARK R. KLINGER, & LAURA G. KLINGER, *University of Alabama*—Generation and exploration are considered two separable processes in creative cognition, but little empirical evidence

supports this distinction. Individuals with autism have impaired flexible thinking and imaginative play. We hypothesized that these impairments would lead to impaired creativity, particularly in generation. High-functioning adolescents with autism ( $n = 14$ ) and typical adolescents ( $n = 14$ ) matched on chronological and mental age completed two creativity tasks. First, they generated objects, using Toobers and Zots (generation). Second, they were given objects made from the same materials and were asked what they could be (exploration). Fluency, flexibility, and statistical rarity were assessed separately for performance on both tasks. Individuals with autism made less creative figures, as compared with typical individuals in the generation task. However, the two groups performed similarly on the exploration task. These data suggest that (1) generation and exploration may be distinct creative processes and (2) persons with autism may be selectively impaired in generation, but not in exploration.

POSTER SESSION IV  
Exhibit Hall, Saturday Noon, 12:00–1:30

• MULTISENSORY INTEGRATION •

(4001)

**Two Wrongs Make a Right: Accuracy in Manual Matching in Rod-and-Frame Illusion.** WENXUN LI & LEONARD MATIN, *Columbia University*—The two-visual-system hypothesis suggests the existence of two separate visual systems in the brain, one generating our perception of objects and another guiding our actions. We show that whereas human observers err in setting (verbally) a rod to the visually perceived vertical (VPV) when viewing a variably oriented, roll-tilted, two-line visual field, the accuracy of open-loop matching of hand orientation to the perceptually misoriented, visible rod-set-to-VPV depends linearly on hand-to-body distance, being accurate with the fully extended arm but remaining near true vertical with the hand in the midfrontal plane. Setting the hand's roll-tilt to feel vertical under induction is similarly distance dependent. Thus, we suggest that the accuracy of manual orientation matching to a perceptually misoriented rod is not due to motoric immunity from the distorting influences of visual stimulation, but to distance-dependent manual errors that also are induced by the visual field and that compensate for the perceptual errors.

(4002)

**Visual–Haptic Cross-Modal Priming for Three-Dimensional Objects.** ALAN C. SCOTT & RANDOLPH D. EASTON, *Boston College*—Previous research has demonstrated that object identification on repeated exposures is performed more quickly than initial identification, a phenomenon referred to as priming (e.g., Cave & Squire, 1992). When a visual identification task of common 3-D objects is performed, priming is unaffected by 180° rotations of the objects between study and test. When participants had to identify and appropriately wield the objects, using haptic exploration without the aid of vision, orientation changes between study and test reduced the facilitating effects of the object priming. In an additional experiment, participants identified objects visually at study and identified objects in the same or the new orientation haptically at test. Regardless of orientation change, the level of facilitation was equal for all primed objects. This suggests that the orientation-invariant representation encoded through the visual modality is accessible at a later time when the same task is performed with haptic exploration.

(4003)

**Auditory Localization Performance: Prediction From a Visual–Spatial Orientation Task.** CECIL W. WAMPLER, ALAN D. MUSCANT, & MICHAEL B. HEIN, *Middle Tennessee State University*—A pencil-and-paper visual–spatial orientation task was used to select the upper and lower 20th percentile of performers for inclusion in an auditory localization task. Ten college age female students, 6 in the upper 20th and 4 in the lower 20th percentile, were selected. The auditory localization task consisted of identifying, from among 36 possibilities, the location of a sound source. Sources were located 10° apart along the horizontal plane. After selection, with the visual–spatial orientation test, all subjects participated in a short orientation session and five practice sessions for the auditory task. A final auditory test session was conducted 72–90 h after the last of the practice sessions. Briefly, although both groups improved with practice, there was no overlap of the error distributions between the two groups on the auditory task. We interpret these results as evidence for a connection between auditory and visual–spatial processes.

(4004)

**Children With Developmental Coordination Disorder Respond Poorly to Altered Sensory Inputs While Standing.** RONG-JU CHERNG, YUNG-WEN HSU, & YUNG-JUNG CHEN, *National Cheng Kung University* (sponsored by Jenn-Yeu Chen)—Seventeen boys and 5 girls (age, 4–6 years) with developmental coordination disorder (DCD) and

the same number of gender- and age-matched normal children were tested for their standing stability under normal and altered sensory conditions, using a Kistler force platform. The conditions were created by factorially manipulating the type of visual input (eyes open, eyes closed, sway-referenced vision) and the type of somatosensory input (fixed-foot support, compliant foot support) during standing. The center-of-pressure total length (excursion) and the sway area served as the indices of standing stability. The DCD children presented poorer stability than did normal children under all conditions, but more so under the conditions where the sensory inputs were unreliable or conflicting. These results suggest that the DCD children might suffer from a deficit in sensory organization.

(4005)

**Influences of Observer Roll and Pitch on Tilt-Induced Effects Are Attenuated for Observers Actively Maintaining an Upright Posture.** JENNIFER E. CORBETT & JAMES T. ENNS, *University of British Columbia*—Both vision of the environment and proprioception of the body inform our perception of upright, with vision dominating when the environment is tilted (tilt-induced effects). Rolling (rotating clockwise or counterclockwise) and pitching (rotating up or down in front of the observer) the visual environment have been reported to contribute independently to the magnitude of tilt-induced effects (Nelson & Prinzmetal, 2003). Moreover, rolling the observer congruently with the environment increased tilt-induced effects, whereas rolling them incongruently decreased effects (Corbett & Enns, 2004). The present study asked how the illusion was influenced by whether observers actively maintained an upright posture in a rolled and pitched environment versus when roll and pitch were passively imposed. The main finding was that proprioceptive influences on the tilt illusion have been greatly exaggerated for passive observers.

(4006)

**Learning to Integrate Auditory and Visual Information in Speech Perception.** JOSEPH D. W. STEPHENS & LORI L. HOLT, *Carnegie Mellon University*—Integration of auditory and visual cues greatly affects speech perception. Current theories of speech perception make different assumptions about the perceptual representations underlying cross-modal integration. A method was developed for testing these theoretical assumptions by training participants on novel visual speech cues that can be controlled and manipulated in ways that normal visual speech cues (i.e., speakers' faces) cannot. Participants played an hour-long video game on each of five consecutive days. During the game, they learned to identify consonants on the basis of the movements of an animated robot, whose features bore no resemblance to speech articulators. Subsequent to training, participants accurately identified consonants solely on the basis of the newly learned visual cues. In addition, participants' identification of acoustically presented consonants was influenced by simultaneous presentation of the trained visual stimuli. The data are relevant to current theoretical issues and provide a basis for investigating the development of cross-modal integration through learning.

(4007)

**Hearing Sights and Seeing Sounds: Cross-Modal Encoding of Temporal and Spatial Sequences.** SHARON E. GUTTMAN, LEE A. GILROY, & RANDOLPH BLAKE, *Vanderbilt Vision Research Center*—When faced with intersensory conflict, vision dominates spatial processing, and audition dominates temporal processing. Here, we ask whether this sensory specialization results in cross-modal encoding of unisensory input into the task-appropriate modality. In a series of experiments, observers made similarity judgments regarding either the temporal or the spatial structures of two successive sequences. We probed underlying representations by measuring the extent to which both irrelevant auditory information and irrelevant visual information interfered with task performance. Incongruent auditory information significantly disrupted discrimination of visually portrayed temporal structure, but not visually portrayed spatial structure; by contrast,

varying the visual similarity of the sequences impacted spatial, but not temporal, discriminations. Ongoing experiments point to complementary effects in the discrimination of auditory sequences. Evidently, the perceptual system automatically abstracts temporal and spatial structure from its perceptual form and represents this structure by using a code in the “appropriate” modality.

(4008)

**Effect of Cross-Modal Distractors on Auditory and Visual Apparent Motion Presented in the Periphery.** THOMAS Z. STRYBEL & ARGIRO VATAKIS, *California State University, Long Beach*—Previously, we measured auditory and visual apparent motion (AM) and its direction in the presence of cross-modal moving and stationary distractors for stimuli centered on the participant’s midline. We found that auditory distractors improved the perception of visual AM but that visual distractors did not affect auditory AM. Moreover, the direction of auditory AM was negatively affected by conflicting visual distractors, but conflicting auditory distractors did not affect the direction of visual AM. In the present investigation, we determined whether we would obtain these asymmetrical distractor effects for cross-modal auditory and visual AM when both target and distractor stimuli were presented in the periphery (8° from the participant’s midline). Here, the effects of the cross-modal distractors were more symmetrical. Moving auditory distractors had less effect on visual AM, and both auditory and visual distractors negatively affected the direction of AM. However, the effect of auditory distractors was observed at a shorter range of SOAs.

(4009)

**Calibration and Alignment Aftereffects of Prism Exposure.** GORDON M. REDDING, *Illinois State University*, & BENJAMIN WALLACE, *Cleveland State University*—Aftereffects of prism adaptation were obtained under conditions that varied in similarity with exposure to measure recalibration or that employed only the reference frames involved in exposure to measure realignment. Calibration demonstrated associative generalization. Alignment was specific to reference frames. These are functionally distinct kinds of prism adaptation.

• TIMING AND ASSOCIATIVE LEARNING •

(4010)

**Factors Affecting Tempo Discrimination of Tone Sequences: Evidence for a Generalized Multiple-Look Model.** NATHANIEL MILLER & J. DEVIN MCAULEY, *Bowling Green State University*—Factors responsible for reductions in tempo-discrimination thresholds were investigated to test a generalized version of the multiple-look model. Participants listened to standard-comparison pairs of isochronous tone sequences and judged the tempo of the comparison relative to the standard. Four groups of listeners were exposed to one of four sequence conditions, which varied the number of intervals comprising the standard and the comparison sequences. For all participants, the standard interonset interval varied randomly from trial to trial and took on one of three values (400, 500, or 600 msec). In contrast to a previous study using a fixed standard, tempo-discrimination thresholds were affected by the number of intervals in both the standard and the comparison sequences. Moreover, the effect of the number of standard intervals was most pronounced for the two extreme standard values making up the session context (400 and 600 msec). The results provide support for the proposed generalization of the multiple-look model.

(4011)

**Temporal Integration in Pavlovian Appetitive Conditioning.** KOSUKE SAWA, *UCLA and Japan Society for the Promotion of Science, Nago*, & KENNETH LEISING & AARON P. BLAISDELL, *UCLA*—Several conditioned suppression experiments by R. R. Miller and colleagues suggest that rats can integrate multiple temporal relationships. In the present experiments, we explored temporal integration in Pavlovian appetitive conditioning, using sensory preconditioning. In Phase 1, hungry rats were presented with a 30-sec Stimulus A in com-

pound with a 5-sec Stimulus X. For rats in group early, Stimuli A and X onset simultaneously, whereas Stimulus X onset 20 sec after Stimulus A for rats in group late. In Phase 2, all rats received Stimulus X paired with sucrose solution. Subsequently, nose poke responses to Stimulus A were assessed on nonreinforced probe trials. Although subjects in group early nose-poked primarily during early portions of Stimulus A, subjects in group late showed considerable nose-poking during latter portions of Stimulus A. These results suggest that rats acquired A–X and X–sucrose temporal maps and provide the first direct evidence for temporal integration in rats.

(4012)

**Evaluating Mechanisms in Time–Place Discrimination.** MATTHEW J. PIZZO & JONATHON D. CRYSTAL, *University of Georgia*—The problem was to identify the mechanism(s) that rats use in time–place discrimination. Rats earned two 1-h meals by pressing levers at two different locations. The first meal started 3.5 h into the session, whereas the second meal was 3.5 or 7 h after the onset of the first meal for independent groups. The rats’ performance during training was significantly higher than expected by chance. In order to test timing and alternation strategies, meals were omitted. Rats responded at the temporally correct location after omitting meals, suggesting that they were not alternating. To test interval and circadian timing mechanisms, meals were put into conflict with one another by testing 3.5 h prior to the time of day at which the second meal normally occurred. Approximately half of the rats responded at the location predicted by time of day, and the other half responded at the location predicted by interval timing.

(4013)

**The Effect of Event Timing Characteristics on Causal Contingency Learning.** MARCI SAMMONS, SHARON MUTTER, LESLIE PLUMLEE, & LAURA STRAIN, *Western Kentucky University*—Detecting contingency relationships between causal events allows us to adapt to and control these events. Research has shown that although people are reasonably accurate at discriminating causal contingencies (Chatlosh, Neunaber, & Wasserman, 1985), variations in the temporal characteristics of causal events may affect contingency learning. However, findings on the latter issue have not been entirely consistent (e.g., Chatlosh et al., 1985; Shanks, Pearson, & Dickinson, 1989). This study further examined how variations in the temporal characteristics of causal events affect contingency learning. Participants completed a set of positive, negative, and noncontingent response–outcome (R–O) contingency judgment problems with discrete sampling intervals. The time allowed for response generation and R–O temporal contiguity was manipulated between subjects. Performance was not affected by generation time, but judgments were less accurate with decreased temporal contiguity, particularly for stronger contingencies (10.75). These findings are consistent with an associative learning theory of contingency detection (Shanks, 1987).

(4014)

**Timing Specificity in Rats After Backward Fear Conditioning: Assessment With the Fear-Potentiated Startle (FPS) Paradigm.** ROBERT C. BARNET, *College of William & Mary*—The FPS paradigm is a valuable tool for investigating the time course of fear, because the precise moment at which a startle-eliciting noise is presented within a test CS can be controlled. Davis, Schlesinger, and Sorenson (1989) observed that after forward fear conditioning (CS→shock), the magnitude of FPS at test progressively increased as the noise approached the temporal location within the CS at which shock had been delivered during earlier fear training. The present experiments explored predictions derived from a temporal coding hypothesis (Miller & Barnet, 1993) concerning backward fear conditioning (shock→CS), using the FPS paradigm. Startle was probed in the early, middle, or late portion of a 10-sec CS that had been backward paired with shock. Startle magnitude was greatest in the early, relative to the latter, portions of the CS, consistent with the proposal that fear is dynamic and varies in relation to expected time of shock delivery.

(4015)

**Comparison of Spatial Behavior in the Sand Maze and Water Maze.** GRETCHEN H. GOTTHARD, *Randolph-Macon Woman's College*, & EDAENI HAMID, *Carleton College*—The present study compared spatial behavior in the sand maze and the water maze. Rats were trained to find a given location in the sand maze or the water maze, and on the final day of training, that location was rotated 180°. Both tasks produced similar patterns of acquisition and retention (i.e., shorter latencies across training days and greater preferences for the previously correct quadrant); however, rats had shorter latencies and higher quadrant preference scores in the water maze than in the sand maze. Although both are spatial tasks, these tasks appear to differ with regard to the motivational systems involved. The sand maze elicits exploratory foraging behavior, whereas the water maze produces escape behavior. This fundamental difference may make the sand maze a better alternative for some studies that would like to examine spatial behavior without the side effects of aversive tasks (e.g., increased amygdala activity and fight-or-flight responses).

(4016)

**Learning About Absent Cues: Opposite Effects in Human Contingency Judgments.** LEYRE CASTRO, *University of Iowa*, & HELENA MATUTE, *University of Deusto*—Holland's (1990) studies of mediated conditioning with animals showed that responding to an absent cue can be changed in the same direction as it can when the cue is presented. But retrospective reevaluation studies, with both animals (e.g., Kaufman & Bolles, 1981) and humans (e.g., Chapman, 1991), have shown the opposite result: An absent cue's value is changed in the opposite direction from that when the cue is presented. This pattern of conflicting results poses a challenge for contemporary learning theories, because theories that can explain one directional effect cannot explain the opposite one. In the present experiments, we obtained mediated conditioning in human contingency judgments. In addition, we attempted to identify the variables that might be responsible for the opposite effects. The experimental scenario (predictive vs. causal), in interaction with the presence or absence of reinforcement during training, affected the obtained result: mediated conditioning or retrospective reevaluation.

(4017)

**Fundamental Processes Underlying the Nonoverlap Advantage.** JESSICA R. CHAMBERLAND & RICHARD A. CHECHILE, *Tufts University*—Clark and Hori (1995) showed that the existing global recognition memory models predict an advantage in forced choice recognition for associative pairs with item overlap, in comparison with the forced choice testing of pairs with no item overlap. Clark and Hori also showed that this prediction was not supported experimentally. In three experiments, the findings of the Clark and Hori study were replicated. Furthermore, confidence ratings, along with recognition accuracy data, were used to enable the estimation of latent memory parameters for two multinomial processing tree (MPT) models. The MPT models were used to examine the overlap/nonoverlap effect. The nonoverlap advantage was found to be due to better guessing when there is fractional storage. This study highlights a fundamental problem with the approach used by the existing global memory models in representing associative memory in terms of the algebra of random variables linked to memory strength.

(4018)

**Percentile Reinforcement Through the Avoidance of Video Disruption.** JOSHUA S. BECKMANN, ERIC A. JACOBS, & JOSE L. MARTINEZ, *Southern Illinois University, Carbondale* (sponsored by Michael E. Young)—Sensitivity to consequences arrayed over short and extended time scales was assessed using a percentile schedule that juxtaposed control by local contingencies of reinforcement and control by molar contingencies of reinforcement. Participants were exposed to a percentile reinforcement schedule that maintained a constant ratio of responses to reinforcers while continually differentially

reinforcing relatively long interresponse times. Nine adults participated in three 90-min sessions in which they watched movies that were subject to brief, random disruption; leverpressing produced disruption-free viewing periods. The results provided evidence for control by consequences arrayed over short and long time spans, individual differences in sensitivity to each, and a role for history of reinforcement in determining those differences.

• PROSPECTIVE MEMORY •

(4019)

**Do Personality, Environmental Demands, and Age Influence Prospective Memory Performance?** CARRIE CUTTLER & PETER GRAF, *University of British Columbia* (sponsored by Peter Graf)—Prospective memory—the ability to recollect intentions, plans, and agreements—varies greatly among individuals. We explored whether some of this variability stems from individual differences in personality, environmental demands (i.e., busyness), and age. Participants completed various indicators of personality, environmental demands, and cognitive ability, as well as three different prospective memory tasks. Two of the latter tasks were lab based; they focused on an intention that had to be executed in the laboratory, whereas the third was field based, concerned with an intention that had to be executed in the context of the participants' day-to-day lives. The data revealed differences in the best performance predictors across the three tasks: Socially prescribed perfectionism predicted performance on all three tasks; conscientiousness and self-deceptive enhancement predicted performance on two of the tasks; neuroticism and age predicted performance on one of the tasks.

(4020)

**The Effect of "Vigilance" Variables on Strategic Monitoring in Event-Based Prospective Memory.** MELISSA J. GUYNN & JOSEPH M. BAKER, *New Mexico State University*—Researchers have suggested that certain conditions promote strategic monitoring or vigilance in a prospective memory task and have recommended avoiding such conditions. We explored three such conditions. We manipulated the instructions about the prospective memory task (direct, incidental), the opportunity to practice the prospective memory task (practice, no practice), and the delay between the prospective memory instructions and the cover task in which the prospective memory task was embedded (no delay, delay). Strategic monitoring was indexed by impairment on a concurrent task when participants were (vs. were not) given a prospective memory task. Experiment 1 confounded the factors and revealed more strategic monitoring with direct instructions, practice, and no delay. Experiment 2 did not confound the factors and revealed that only delay significantly affected the amount of strategic monitoring. We suggest that it is not necessary or even desirable to implement conditions (e.g., delay) that reduce or eliminate strategic monitoring.

(4021)

**Effects of Implementation Intentions on Prospective Memory Performance.** KATRINA S. KARDIASMENOS, *Catholic University of America and Veterans Affairs Medical Center*, DEBORAH M. CLAWSON, *Catholic University of America*, JEFFREY A. WILKEN, *Veterans Affairs Medical Center and University of Maryland*, & MITCHELL T. WALLIN, *Veterans Affairs Medical Center and Georgetown University*—Prospective memory (PM) is remembering to complete tasks that have been planned for the future. Two experiments examined the effectiveness of forming implementation intentions on PM. In Experiment 1, adult participants, half of whom had multiple sclerosis, played a board game that included dozens of PM tasks. In addition, we asked them to remember a paper-and-pen PM task until the end of the experiment. Participants were instructed to form implementation intentions or to rote rehearse the tasks. In Experiment 2, college students were instructed to form implementation intentions, rote rehearse, or use a daily planner to aid performance on the same PM tasks. Results of the

instruction manipulations were mixed, with limited evidence for the effectiveness of implementation intentions. The daily planner in Experiment 2 had paradoxical effects, improving performance on the game tasks but markedly depressing performance on the paper task.

(4022)

**Context Expectation Affects Time-Based Prospective Memory.** GABRIEL I. COOK & RICHARD L. MARSH, *University of Georgia*, & JASON L. HICKS, *Louisiana State University*—Three experiments investigated time-based prospective memory, defined here as remembering to fulfill an intention during a later window of time. When people associated the response window with a future context, time-based responding was better if that context expectation was correct, as compared with having no context expectation at all. By contrast, if the response window occurred in a context that preceded the expected context, time-based performance was worse than when there was no context expectation at all. An explicit reminder about the intention was sufficient to ameliorate the decrement found with an incorrect context association. However, successfully completing a different, event-based prospective memory intention was not sufficient to overcome the incorrect context association. The authors assert that possessing such associations alters normal monitoring of the passage of time, which in turn leads to the pattern of results obtained.

• INDIVIDUAL DIFFERENCES IN MEMORY •

(4023)

**Individual Differences in Working Memory and Interference From Part-Set Cues.** EDWARD T. COKELY, COLLEEN M. KELLEY, AMANDA L. GILCHRIST, & CONNIE MYERSON, *Florida State University* (sponsored by Colleen M. Kelley)—A series of studies investigated individual differences in working memory (as measured by operation span) and resistance to interference in the part-set cuing recall paradigm. Experiment 1 showed a curvilinear relationship such that low-span participants actually benefited from part-set cues, medium-span participants were disrupted by part-set cues, and the highest span participants were not disrupted. Experiment 2 tested the role of encoding strategies and differential attention to part-set cues in these individual differences. Results are discussed in terms of inhibitory control, encoding strategy selection, and retrieval strategy disruption.

(4024)

**Memory Conjunction Errors in Healthy Aging and Alzheimer's Disease.** JESSICA M. LOGAN, DAVID A. BALOTA, JANET M. DUCHEK, & SUSAN SERGENT-MARSHALL, *Washington University*—Conjunction errors in a continuous recognition test were examined in healthy younger and older adults and individuals with very mild dementia of the Alzheimer's type (DAT), in order to explore the potential role of medial temporal breakdowns in binding failures. Participants made old/new judgments on single words that were either new, repeated (old), or conjunction words made by recombining parts of previously viewed words. Both syllable conjunctions (BAPTIST, DENIM, DENTIST) and compound word conjunctions (SIDEWALK, OUTLINE, SIDELINE) were tested at varying lags and retention intervals. Results do not provide any evidence of a disproportionate increase in conjunction errors in healthy aging or DAT patients. Correlations were examined between conjunction errors and other tests purported to measure frontal and medial temporal functioning, in order to further understand the underlying substrates of this memory illusion.

(4025)

**Aging and Noncritical Recollection in the Remember-Know and Dual-Process Signal Detection Procedures.** COLLEEN M. PARKS, *Georgia Institute of Technology*, JEFFREY P. TOTH, *University of North Carolina, Wilmington*, & ANDERSON D. SMITH, *Georgia Institute of Technology*—When trying to remember a specific detail about a prior event, people frequently recollect other, often irrelevant details. Memory of these details, dubbed noncritical recollection

(ncR), elevates familiarity estimates and may operate automatically and independently of criterial recollection (Yonelinas & Jacoby, 1996). To date, ncR has been considered unique to the process dissociation procedure and has been found only in young adults (Toth & Parks, submitted). The remember-know and dual-process signal detection procedures were used to address these issues. Familiarity estimates were elevated by ncR in all the groups but were greater for those with optimal levels of criterial recollection (e.g., young > old). This pattern, along with receiver operating characteristic evidence, suggests that ncR may operate more similarly to criterial recollection than to familiarity. Overall, the findings demonstrate that ncR is likely to elevate familiarity estimates when operational definitions of recollection are both specific and difficult, regardless of the method.

(4026)

**Reducing Imagination Inflation in Older Adults by Increasing Access to Veridical Memories.** AYANNA K. THOMAS & JOHN B. BULEVICH, *Washington University* (sponsored by Henry L. Roediger III)—When compared with younger adults, older adults typically demonstrate higher levels of false memories. To investigate the nature of this age deficit, older and younger adults were compared within the imagination inflation paradigm. Our primary interest was to examine whether encoding deficits accounted for the age differences in this paradigm. Three experiments examined whether older adults could reduce susceptibility to false memories by increasing access to veridical memories. Retention interval and type of instructions were varied to test this hypothesis. Results suggest that older adults do encode contextual cues useful in reducing susceptibility to false memories. However, older adults have difficulty accessing and using those cues. Access is gained only when the retention interval is dramatically reduced or when older adults are reminded that contextual cues are useful indicators of veridical and false memories.

(4027)

**Memory for General and Specific Value Information in Younger and Older Adults.** ALAN D. CASTEL & NORMAN FARB, *University of Toronto*, & FERGUS I. M. CRAIK, *Rotman Research Institute & University of Toronto*—The ability to selectively encode and retrieve important units of information is a critical function of memory. Although previous research has shown that older adults are impaired in a variety of episodic memory tasks, more recent work demonstrates that older adults are capable of selectively remembering information designated as being of high value. The present research examined how younger and older adults remembered words with assigned point values, to see whether younger adults could remember more specific value information than older adults, given comparable abilities to selectively attend to high value words. Both age groups were equally good at recalling point values when asked to remember approximate values, but younger adults outperformed older adults when asked to recall specific values. The findings suggest that although both groups retain value information, older adults rely more on gist-based encoding and retrieval operations, whereas younger adults are able to retain more specific representations.

(4028)

**Strong Right-Handers Exhibit Decreased Stroop Interference and Poorer Explicit Memory: Interhemispheric Mechanisms.** STEPHEN D. CHRISTMAN, *University of Toledo*—Past research has shown that strong right-handedness is associated with decreased Stroop interference (Christman, 2001) and decreased explicit memory performance (Propper, Christman, & Phaneuf, in press). These results were interpreted in terms of decreased interaction between the left and the right cerebral hemispheres in strong right-handers, relative to mixed-handers, presumably arising from the presence of a smaller corpus callosum in strong right-handers (e.g., Witelson, 1985). In the present study, strong right- ( $n = 75$ ) and mixed-handers ( $n = 75$ ) were administered tests of both Stroop interference and episodic recall. Replicating prior results, strong right-handedness was again associated with decreased

Stroop interference ( $p < .006$ ) and poorer recall ( $p < .002$ ). However, performance on these two tasks was uncorrelated ( $r = .004$ ). This suggests that, although strong right-handedness is associated with lesser overall interhemispheric interaction, individual differences in functional interhemispheric connectivity may vary from task to task (perhaps due to regional variations in corpus callosum size).

(4029)

**Bilingual Source Monitoring.** SUSAN G. ROBISON & KRISTI S. MULTHAUP, *Davidson College*—This study investigated source monitoring in balanced and unbalanced French–English bilingual participants. In the control condition, participants watched four scenes of a movie in English. In the alternating condition, participants watched four scenes of a different movie that alternated between French and English presentation. After a 30-min delay, participants completed a source-monitoring task identifying the origin of idea units as Person A, Person B, Person C, or new and answered perceptual memory questions. Bilingual group, condition, and question type (source, perception) significantly interacted, with unbalanced bilinguals' source memory adversely affected in the alternating condition. The data challenge comprehension explanations for unbalanced bilingual performance, since unbalanced bilinguals performed above chance on the French-referent items in the alternating condition. The results are consistent with the hypothesis that unbalanced bilinguals engage in L1 (primary language) mediation when processing information in L2 (secondary language); alternative interpretations (e.g., task-switching costs) are considered.

(4030)

**Memory Under Divided Attention: Effects of Semantic Relatedness, Bilingualism, and Aging.** MYRA A. FERNANDES, *University of Waterloo*, ELLEN BIALYSTOK, *York University*, & FERGUS I. M. CRAIK, *Rotman Research Institute & University of Toronto*—We examined how aging and bilingualism affected memory interference from divided attention (DA) at encoding and at retrieval and whether the degree of semantic relatedness between items in the concurrent tasks modulated their effects. Monolingual and bilingual young and old adults studied a list of related words presented auditorily and later recalled them aloud. During either study or retrieval, they concurrently performed a distracting task requiring semantic decisions to words either related or unrelated to the list of studied words. DA significantly disrupted recall, although more so at encoding than at retrieval and when distracting task words were related, rather than unrelated, to the memory task. Aging and bilingualism did not alter this pattern, although both factors were associated with lower overall levels of recall. Results showing a bilingual disadvantage are in contrast to those in other studies that show a bilingual advantage in performing nonverbal executive function tasks.

(4031)

**Evidence for an Own-Age Bias in Children.** FIONA QUINLAN, SHENA L. SCOTT, & JEFFREY S. ANASTASI, *Arizona State University West*—Previous research has shown that an own-age bias exists for younger and older adults. The purpose of the present study was to determine whether an own-age bias exists in children. Children 5–8 years of age were shown photographs of young children, young adults, middle-aged adults, and older adults. Participants were instructed to rate the ages of the individuals in the photographs. This rating task allowed us to examine an own-age bias utilizing both the chronological age of the individuals in the photographs and the participants' subjective age estimates. Results verified an own-age bias in children.

• RECOGNITION •

(4032)

**Hit Me With Your Best Shot: Action as a Cue for Object Recognition.** JASON S. AUGUSTYN, JEANINE K. STEFANUCCI, & DENNIS R. PROFFITT, *University of Virginia* (sponsored by William

Epstein)—This research explored the influence of action on memory for object orientation. In the first experiment, pictures of two objects were projected onto a screen. Participants threw darts at one of the two pictures (i.e., the target). On a subsequent memory test, recognition of the target's orientation was worse than recognition of the nontarget's orientation. A second experiment tested whether throwing interfered with encoding details of the target that were necessary for recognizing orientation. Two groups of participants aimed a laser pointer either at the entire target or at a specific part of the target. Participants who pointed at part of the target were better at recognizing target orientation than nontarget orientation. Participants who aimed at the entire target were at chance level for recognizing both target and nontarget orientation. The data suggest that acting on an object interferes with encoding object-specific information that is irrelevant for guiding action.

(4033)

**When Describing Differences is More Important Than Describing Similarities for Remembering Faces.** CHARITY BROWN & TOBY J. LLOYD-JONES, *University of Kent*—We examined the potential benefits of verbally recoding faces upon their visual memory, in a multiple-face presentation paradigm. Participants were presented with pairs of faces and described (or not, in the control condition) the differences or similarities between face pairs. The faces were subsequently discriminated from distractors in a yes/no recognition task. Both types of descriptions elicited verbal facilitation; however, recoding effects were stronger for describing differences between the faces. Post hoc correlations revealed that descriptions of face differences contained more descriptors and more holistic descriptors (e.g., of personality or attractiveness) than did descriptions of face similarities. In a subsequent experiment, participants generated either holistic or featural descriptors. Verbal facilitation was equivalent for both descriptor types. We argue that quantity, rather than quality, of descriptors determines verbal facilitation of face recognition.

(4034)

**The Effects of Repetitions and Study Time on Associative Recognition of Verbal and Nonverbal Stimuli.** JING XU & KENNETH J. MALMBERG, *Iowa State University*—This research investigates the nature of associative recognition. Prior findings (Kelley & Wixted, 2001) have shown that repetitions of studied word pairs have little or no effect on the false alarm rate for intact–rearranged pair discrimination. Simple single-process familiarity and recollection models are rejected by this finding, because they predict increases and decreases, respectively, in false alarm rates with increases in target repetitions. A dual-process account that is consistent with this finding is that repetitions enhance the effectiveness of a recall-to-reject process that works in opposition to the expected rise in familiarity (Malmberg, Holden, & Shiffrin, 2004). This research further tests the dual-process account by using nonverbal stimuli (Chinese characters) that were hypothesized to be difficult or impossible to recollect. The findings from these experiments confirm this hypothesis, but only when items were studied for relatively brief periods of time (1.5 sec). Implications of associative encoding on recollection are discussed.

(4035)

**Do You Recall Where You Were When . . . ? Support for Automatic Encoding of One's Location.** KRISTEN L. NEAL & STEVEN P. MEWALDT, *Marshall University*—Twenty-one groups of students were given a tour of the Marshall University campus. At each of 10 locations, participants were told an interesting fact about the university. Participants were informed they would be tested following the tour, to assess recall of the facts. In addition, half of the groups were told that they would be tested for recall of the location at which each fact was presented, whereas the remaining groups were not. After the tour, participants completed a questionnaire which evaluated their (1) recognition of having heard a particular fact, (2) recall of the fact, and (3) recall of the location at which the fact was presented. Partic-

ipants were also tested 2 weeks later with the same instrument. In immediate and delayed recall, if participants correctly recalled the fact, the probability of recalling the location was high regardless of whether they were or were not instructed to remember the location.

(4036)

**Your Face Looks Really Familiar and I Still Can't Remember Your Name . . .** DAVID I. DONALDSON, GRAHAM MACKENZIE, & ALANA DAVIS, *University of Stirling*—George Mandler captured the intuitive essence of dual-process models of recognition memory with the seminal title *Your Face Looks Familiar but I Can't Remember Your Name*. Here, we revisit this scenario, introducing a novel manipulation of how familiar a face looks, by using computer morphing technology to morph faces to look more or less average in shape. Behavioral data from a familiarity rating task show that morphing faces toward average shape does indeed make them look increasingly familiar. Regardless, data from recognition testing show that this does not influence remembering *per se*; increasing the perceived familiarity of faces presented at test does not increase hit rates but does increase false alarms. Moreover, making a face look really familiar has no effect on how well participants are able to remember associated names. Data are discussed in relation to dual-process models, asking exactly what is meant by the term *familiarity*.

(4037)

**The Other-Race Effect: How Do Processing Time and Distracting Contexts Influence Recognition of Faces?** RACHEL A. DIANA & LYNNE M. REDER, *Carnegie Mellon University*—The goal of this research is to determine how processing resources at encoding are involved in producing the other-race effect of face recognition. Typically, a more unique association will improve recognition memory, because it provides a cue for retrieval. However, when other-race faces are recognized, we have found that more unique associations/contextes may also be more distracting during encoding, leading to an advantage for less unique contexts. Participants were asked to study pictures of people wearing accessories. Some of these accessories were unique to one person, whereas others were presented with five different people. We manipulated processing time at study in order to examine the influence of contextual cues at encoding. We also manipulated whether the context matched at test, in order to examine the influence of contextual cues at retrieval. The results show interactions between processing time, uniqueness of the accessory, and other-race versus same-race faces.

(4038)

**Signal Detection Analysis of Recognition and Identification in Episodic Visual Memory.** YUKO YOTSUMOTO, CHRISTOPHER M. McLAUGHLIN, MICHAEL J. KAHANA, & ROBERT SEKULER, *Brandeis University*—The relationship between two aspects of memory judgments, recognition and identification, was examined with compound gratings as study and probe items. Subjects judged whether the probe had or had not been presented in the study series (a recognition judgment) and, also, which of three study items had been matched by the probe (identification judgment). On each trial, subjects used an analogue rating scale to communicate their responses. Correct response rates for recognitions and identifications were consistent with the notion that both judgments depend on a common source of memory information. The relatively few misidentifications were controlled by two factors: perceptual similarity and adjacency of serial position among study items. ROC curves generated from recognition and identification responses were highly similar to one another. In all three experiments, the slopes of *z*-transformed ROCs were >1, probably because of variability among items used as lures.

(4039)

**Another Look at Recognition in the Distractor Paradigm: PI Build-Up and Release Mediated by Operation Span.** VINCENT R. BROWN, *Hofstra University*, & DAVID S. GORFEIN, *University of*

*Texas, Arlington*—Brown and Gorfein (2004) have recently developed an instructional procedure that ensures sufficient degree of freedom to apply multinomial models such as Brainerd, Reyna, and Mojarin's (1999) conjoint recognition model and Batchelder and Riefer's (1990) source-monitoring model to the STM task. We report an attempt to extend this procedure to PI build-up and release in a recognition memory version of the distractor task. Operation span is examined as a potential mediator of performance.

• CONTROL OF WORKING MEMORY •

(4040)

**Executive Control Operations for Updating Verbal Working Memory.** ADAM KRAWITZ, SHANE T. MUELLER, DAVID E. KIERAS, & DAVID E. MEYER, *University of Michigan*—The maintenance and updating of temporary stored information in verbal working memory has typically been studied through popular procedures, such as the immediate serial recall and *N*-back recognition tasks. However, these procedures are problematic because they confound memory-updating operations with other processes, such as encoding, rehearsal, and retrieval. To help solve this problem, we have developed new procedures that enable various types of updating (e.g., appending and deleting ordered items in working memory) to be isolated and characterized through analytical measurements of “cumulative” and “rolling” forward or backward overt rehearsal. Mean response latencies, durations, and error rates based on these measurements reveal that simple “append” operations are relatively easy and invariant with changes in memory load, whereas memory load strongly affects more difficult combinations of “delete” and “append” operations. Our findings have potentially significant implications for theoretical modeling of updating and other related executive control operations in verbal working memory.

(4041)

**The Role of the Executive Functions of Working Memory in Metaphor Comprehension.** DAN L. CHIAPPE, JULIA CHANES, ERIKA OCHOA, & KELLY McCULLOCH, *California State University, Long Beach*, & JENNIFER KOONTZ, *Pepperdine University*—We examine the role of working memory (WM) in metaphor comprehension. WM includes executive functions that activate relevant representations and inhibit potentially distracting ones. These are crucial for higher level reasoning. Are they involved in metaphor? Understanding metaphors, such as *rumors are weeds*, involves identifying features associated with the source that can be attributed to the target. Many features strongly associated with the source cannot be attributed. The property *plant*, although salient for *weeds*, cannot be attributed to rumors. This means that we often have to ignore features strongly associated with the source and that we have to activate properties that are sometimes secondary. This study assessed the WM of 163 subjects, using a listening span task, an OSPAN task, and a Stroop interference task. These measures predicted RT for subjects to construct interpretations of metaphors, as well as the probability that an interpretation would be arrived at.

(4042)

**Working Memory Retrieval Takes Attention: Effects of Distraction Under Time Pressure.** MICHAEL F. BUNTING & NELSON COWAN, *University of Missouri, Columbia*—Typical working memory measures impose a processing difficulty at encoding, thereby making it unclear whether its attentional demands disrupt maintenance or impair memory as a result of distraction or interference. We document in a series of experiments that attention and storage seem inextricably linked when an attentional demand occurs at retrieval, not at encoding. Distraction modeled after the prosaccade/antisaccade paradigm was presented between onset of a recall cue and the opportunity to recall in two short-term memory procedures (conceptual span, running span). Participants made a keypress response to the same side as a flashing box (prosaccade) or to the opposite side (antisaccade). The

latter task disrupted short-term memory for the cued items only when participants were under time pressure. Time pressure was less critical when the duration of the distraction task was unpredictable (required vigilance) or was especially difficult (flashed from side to side, not always on one side).

(4043)

**The Costs of Switching Items Stored in Working Memory in and Out of the Focus of Attention: The Role of Sequence Encoding.** LESLIE VAUGHAN, *University of North Carolina, Chapel Hill*, CHANDRA-MALLIKA BASAK & PAUL VERHAEGHEN, *Syracuse University*, & MARILYN HARTMAN, *University of North Carolina, Chapel Hill*—Older and younger adults performed a self-paced identity-judgment *N*-back task (*N* ranging from 1 to 4); difficulty of encoding the position of items in the sequence was manipulated. In the easy condition, accuracy decreased and RT abruptly increased (a *focus-switch cost*) in passing from *N* = 1 to *N* = 2, suggesting a focus of attention of size 1. For *N* > 1, accuracy decreased with increasing *N*, and a small significant RT slope was obtained, indicating search through working memory. Increasing encoding difficulty led to decreased accuracy outside the focus of attention, an increased focus-switch cost, but no change in WM search efficiency. Age had differential effects on accuracy and RT. We conclude that (1) part of the focus-switch cost is due to encoding into WM, (2) focus switching is independent of WM search, and (3) accessibility of items (RT) in WM is functionally independent of item availability (accuracy).

(4044)

**Assessment of Working Memory and Strategy Prevention.** KANDI JO TURLEY-AMES & HEATHER M. THOMPSON, *Idaho State University*—Turley-Ames and Whitfield (2003) found that controlling for strategy use on the operation span (OSPAN) yielded a purer measure of the relationship between working memory (WM) and higher cognitive functioning (HCF). Variation in strategy use suppressed the relationship between WM and HCF. To examine further how strategies influence processing efficiency, we prevented strategy use, rather than controlling for strategy use via training. In Experiment 1, after the presentation of each operation–word string, a three-digit number was presented, and participants counted backward by twos. WM span scores of high spans decreased significantly as a result of distraction, and the correlation between WM and reading ability was no longer significant. The extent to which the distractor task increased cognitive demands and/or prevented strategy use was examined in Experiment 2 by using a less resource-demanding distractor task. Differences between controlling for strategy use and preventing strategy implementation on the OSPAN are discussed.

(4045)

**Fundamental Working Memory Processes Predicting Inhibitory Errors.** DANIEL L. TRAUGHER, TRAVIS R. RICKS, & KANDI JO TURLEY-AMES, *Idaho State University* (sponsored by John M. Hinson)—The ability to inhibit irrelevant information is essential for efficient working memory (WM) functioning (Engle, 1996). Traugher and Turley-Ames (2002) found that WM span predicts the frequency of different types of inhibition errors (i.e., access and deletion; Hasher, May, & Zacks, 1999) on a paired-associates task. In the present research, the relative contributions of pure processing, pure storage, and the interrelated aspects of processing and storage (three components of WM span tasks) in committing inhibition errors were assessed. Pure processing was not predictive of inhibitory errors. Pure storage partially mediated the relationship between WM span and inhibitory errors. When the combined aspect of storage and processing was added to the regression model, the relationship between WM span and inhibitory errors was completely mediated with the exception of access errors. These findings suggest that pure storage and the interrelated aspects of processing and storage in a WM task appear to be responsible for the relationship between WM span and inhibitory functioning.

(4046)

**Feature Binding Creates Inhibition of Return.** TATJANA FEINSTEIN & DAVID L. GILDEN, *University of Texas, Austin*—Inhibition of return (IOR) refers to the finding that, after a short period of initial facilitation, responses to targets at cued locations are slowed, as compared with responses to targets at noncued locations (Posner & Cohen, 1984). IOR has been interpreted primarily in terms of mechanisms that prevent the return of attention to locations where it has recently been allocated. We propose a new account of the classic IOR data pattern that is based not on properties of attention but, rather, on the ways in which object features are integrated in short-term implicit memory. The IOR pattern appears to be a special case of a larger set of interactions that are generic to reaction time sequences where stimulus features change from trial to trial.

• SELECTIVE ATTENTION •

(4047)

**Attentional Priority Maps in Human Cortex.** JOHN T. SERENCES & STEVEN YANTIS, *Johns Hopkins University*—Vision is active, requiring the adoption of a constrained attentional set to select behaviorally relevant visual targets. The locus of attention is thought to be indexed by a topographical map representing the priority of objects at different locations in the scene; high priority is assigned to locations containing objects that fully or partially match the current attentional set. During fMRI scanning, subjects searched for a central target-colored letter in an RSVP stream; one or four target-colored distractors could appear simultaneously. Increasing the number of target-colored distractors impaired target identification accuracy and modulated activity in the frontal eye fields and the posterior parietal cortex, regions that have been implicated as possible attentional priority maps in recent studies of monkey neurophysiology. The activation patterns reveal that attentional priority maps are an emergent property of anatomically distributed visual representations; attentional selectivity increases as information is passed from the extrastriate visual cortex to the parietal and frontal regions.

(4048)

**Negative Priming and Stimulus–Response Compatibility: Implications for Control of Action.** LENORE E. READ & ROBERT W. PROCTOR, *Purdue University*—Neill, Valdes, and Kennedy (1994) investigated the interaction of negative priming (NP) and stimulus–response compatibility (SRC) with a four-choice task in which a target stimulus occurred in one of four positions and a distractor in another. SRC was manipulated within blocks and was cued by target form. NP occurred when the stimulus–response mapping was the same for the prime and the probe trials, but not when it switched. We replicated this finding, using a method similar to that of Neill et al. However, this finding is likely due to the fact that on 1/3 of the trials for which the mapping switched, the probe target occupied the prime distractor position but required the same response as the prime target. When these trials were excluded in a second experiment, a small NP effect was evident for all combinations of prime–probe mappings.

(4049)

**Deployment of Attention Can Be Controlled Through Operant Conditioning.** CHIARA DELLA LIBERA & LEONARDO CHELAZZI, *University of Verona* (sponsored by Leonardo Chelazzi)—By learning the relationship between our actions and their consequences, we are able to shape behavior in order to maximize its efficiency. Successful behaviors, leading to rewarding outcomes, are strengthened at the expense of competing behaviors, following the law of effect. It remains unknown whether similar mechanisms also shape covert mental processes including selective attention. Visual selective attention (VSA) underlies goal-directed behavior by selecting relevant visual inputs while inhibiting distracting items, allowing the allocation of processing resources to selected information. Using variable monetary rewards as (arbitrary) feedbacks of performance in VSA tasks, we

assessed whether attentional deployment was modulated by its consequences. The results showed that VSA could be sensibly adjusted depending on the feedback received. Lingering inhibition of distractors was robust after successfully rewarded responses, whereas it was eliminated after inefficient selections. This powerful feature of VSA seems fundamental in providing attentive processes with both flexibility and self-regulation properties.

(4050)

**Stroop Dilution Depends on the Role of the Color Word.** YANG SEOK CHO, *Purdue University*, MEI-CHING LIEN, *Oregon State University*, & ROBERT W. PROCTOR, *Purdue University* (sponsored by Robert W. Proctor)—The Stroop effect obtained when a target color bar is flanked by an irrelevant color word decreases when an irrelevant neutral word is also presented as a flanker. Four experiments examined this Stroop-dilution effect with a procedure in which the stimuli were exposed briefly, preceded and followed by masks. In Experiments 1 and 2, the target stimulus was a color bar or a colored color word and the flanker a neutral word. The color word produced a Stroop effect on color naming that was not diluted by the neutral word. In Experiments 3 and 4, the target stimulus was a color bar or a colored neutral word and the flanker a color word. The Stroop dilution effect occurred regardless of the target location. These results suggest that when attention is directed to a target that includes an irrelevant word dimension, that word takes precedence in processing over a flanking word.

(4051)

**Spatial Effects in a Nonspatial Task-Switching Paradigm.** TIZIANA GIANESINI, CHIARA DELLA LIBERA, & LEONARDO CHELAZZI, *University of Verona*—Switching between different tasks results in a deterioration of performance, as compared with when the same task is repeatedly executed. It is proposed that task-relevant stimulus properties may trigger an automatic tendency to repeat the recently performed task, causing both task repetition benefits and task-switching costs. We used a task-switching paradigm with a non-task-relevant spatial manipulation to investigate the possible interactions between stimulus location and task-switching costs. The results showed that location plays a role even in a nonspatial task, since it was more difficult to perform a task where a different task had recently been performed. Specifically we found an increased task-switching cost when the target on trial  $n$  was presented at the same location as that on trial  $n-1$ . The present findings suggest that within a task-switching paradigm, even an irrelevant stimulus property can influence task-switching costs, depending on its recent history of co-occurrence with task-relevant properties.

(4052)

**Disjunction Dysfunction: A Funny Thing Happened on the Way to Awareness.** BRUCE W. A. WHITTLESEA, *Simon Fraser University*, JASON P. LEOBE, *University of Manitoba*, & ANDREA D. HUGHES, *Simon Fraser University*—Treisman and Gelade (1980) observed that disjunctive search (“look for blue or S”) was as fast with many distractors (brown Ts and green Xs) as with fewer. They interpreted this observation as revealing a parallel search, in which one could (1) simultaneously look for two target features and (2) compare those targets simultaneously to multiple stimuli in the visual field. We observed two phenomena that modify that conclusion. We observed that subjects performed single feature search (“look for O”) about 100 msec faster than disjunctive search, contradicting the first sense of parallel search. We also observed that search speed for disjunctions was affected by number of distractors when sets were small but was less affected as number of distractors increased. That is, the second sense of parallel search was also violated when few distractors were presented. We hope to have an explanation for these findings by the time of the present meeting.

(4053)

**Attention and Working Memory: Results From an Illusory Conjunctions Paradigm.** BEATRIZ GIL GÓMEZ DE LIAÑO & JUAN

BOTELLA, *Autónoma University, Madrid* (sponsored by Juan Botella)—The relationship between working memory (WM) and attention has usually been studied with the idea that attention filters information for the WM. Recently, it has also been studied how WM can influence attention (e.g., Fockert et al., 2001; Downing, 2000). We have studied that relation by using an RSVP paradigm within the framework of the formation of illusory conjunctions in the time domain (Botella, Barriopedro, & Suero, 2001). We manipulated some variables related with the focalization mechanism described in the model and with storage processes related with WM. The results show strong effects on the focalization mechanism when WM is manipulated, indicating that attention can filter information from WM but that WM can also have an influence (even stronger) on the attentional processes.

(4054)

**Features and Dimensions Are Inherently Inseparable.** TAL MAKOVSKI & YEHOASHA TSAL, *Tel Aviv University* (sponsored by Yonatan Goshen-Gottstein)—Subjects performed either a feature match or a dimension match of two targets differing in either color or orientation from a background of homogeneous distractors. “Different feature” responses were faster when the dimension was also different (e.g., red–diagonal faster than red–green). “Same dimension” responses were faster when the feature was also the same (e.g., red–red faster than red–green). Additional experiments showed that in the Garner speeded classification task, dimensional variability interfered with feature classification, and feature variability interfered with dimension classification. The feature–dimension bidirectional influence observed in both sets of experiments suggest neither feature precedence nor dimension precedence. Instead, this pattern demonstrates that features and dimensions are strictly inseparable, since they cannot be processed independently.

(4055)

**Flow, Psychophysiology, and Performance.** ALVINA KITTUR & PAUL VERHAEGHEN, *Syracuse University* (sponsored by Paul Verhaeghen)—Flow is the state of being in the zone, experienced when engaged in an activity that requires skill in response to a challenge (Csikszentmihalyi). Twenty-two participants completed eight levels of a spatial-cognitive task similar to the computer game Tetris, while pulse, skin conductance, and respiratory rate were measured. On the basis of their responses on a skill/challenge questionnaire, participants’ psychological states were classified as boredom, apathy, flow, or anxiety. First, performance was better in the game in flow than in anxiety (but not different from performance in boredom or apathy). Second, the flow state was found to be relatively rare and unstable. Third, flow did not differ from the other states in terms of mean arousal/activation, but people in flow were more variable in the amplitude of breathing, in heart rate, and in the amplitude of skin conductance. This variability may be associated with increased responsiveness.

• INDIVIDUAL DIFFERENCES IN COGNITIVE CONTROL •

(4056)

**The Unitary/Nonunitary Nature of Executive Control.** RICHARD J. HOLDEN & BRADLEY R. POSTLE, *University of Wisconsin, Madison* (sponsored by Morton A. Gernsbacher)—Several theories propose that cognitive performance is mediated by a unitary control mechanism (e.g., executive attention, guided activation, central executive) that is indexed by working memory (WM) span tasks. To evaluate these theories, it is necessary to (1) illustrate an association between the putative unitary mechanism and a number of established executive control processes and (2) present evidence for the direction of causality: Is this mechanism truly a unitary cognitive primitive or, rather, a composite of more basic elements of executive control? Our individual differences study addressed (1) and provides a framework for investigating (2): We observed moderate-to-large correlations between WM span and measures of executive control function (e.g., mediation of interference and attention shifting), and a combination of

measures of executive control and short-term memory span accounted for 55% of variance in WM span. Regarding (2), tetrad analyses offer a means of assessing causal models of executive control.

(4057)

**Effects of Bilingualism and Aging on Task Switching.** ELLEN BIALYSTOK & MYTHILI VISWANATHAN, *York University*—Previous research has shown that bilingualism helps to offset age-related losses in certain executive processes (Bialystok et al., 2004). The present study investigated the role of bilingualism in younger and older adults in a task-switching paradigm. Monolingual and bilingual participants who were younger (20–30) or older (60–70) adults named a picture of an animal or the color of the animal in response to a cue. Switch costs were analyzed as the RT difference between consecutive trials (local switches) or blocks of trials (global switches). Monolinguals and bilinguals performed the same on local switches in both age groups. Bilinguals, however, were more efficient than monolinguals in handling global switches in both age groups. This is consistent with evidence that global switching, but not local switching, declines with age (Mayr & Liebscher, 2001). This bilingual advantage in global switching is attributed to the ongoing bilingual experience of switching between languages.

(4058)

**The Stroop Effect: Patterns of Change Over the Life Span.** MICHELLE M. MARTIN & ELLEN BIALYSTOK, *York University* (sponsored by Ellen Bialystok)—Children (5 years old), young adults (20–25 years old), middle adults (40–45 years old), and older adults (60–65 years old) completed three conditions of a Stroop task (Salt-house & Meinz, 1996): counting asterisks, naming digits, and counting how many digits. In the control conditions, the young adults were fastest, the children and older adults slowest, and the middle adults fell between the younger and the older adults. For all groups, the Stroop condition was slower and elicited more errors than did the two control conditions, indicating that all groups experience difficulty with conflict. Within the Stroop condition, all three adult groups were faster on congruent trials (25%) than on incongruent trials (75%); the children did not show this pattern. Finally, in spite of speed differences in the control conditions, all the adults were the same on the Stroop condition. This pattern shows an effect of inhibitory control on performance, irrespective of speed.

(4059)

**Factors Affecting Antisaccade Performance in 10-Year-Olds Versus Young Adults.** CANAN KARATEKIN, *University of Minnesota*—The antisaccade task requires participants to look away from a visible stimulus. Performance on this task continues to improve through adolescence. The purpose of this study was to test several hypotheses regarding these age-related changes. Young adults and 10-year-olds were administered the standard antisaccade task and manipulations designed to improve performance. Most conditions included three levels of time between the manipulation and the stimulus (200, 600 or 1,000 msec). An eye monitor recorded response times and landing positions of saccades. Among the main findings are that (1) a 1,000-msec overlap improved children's accuracy just as much as knowing the stimulus location 1,000 msec beforehand and (2) the overlap conditions and a centrally presented attention-demanding task improved children's accuracy to a greater extent than that of adults. Results help clarify effects of preparatory set, working memory, and inhibition of reflexive orienting of overt and covert attention on age-related changes in antisaccade performance.

(4060)

**Do Children's Switch Costs Scale Up to More Difficult Tasks?** MICHELLE R. ELLEFSON, NICK CHATER, & LAURA R. SHAPIRO, *University of Warwick*—The cost of switching between tasks has been explored extensively in adults, yet few studies have investigated these costs in children. Switch costs are defined as decreased performance

after switching between two tasks, as compared with repeating the same task. Adults elicit task asymmetries with greater switch costs when switching to an easy task than when switching to a more difficult task. The results of four experiments suggested that children elicit asymmetrical switch costs to simple categorization tasks and to some arithmetic equations. However, these cost asymmetries do not scale up to complex arithmetical equations. Four additional experiments conducted with adults suggested that switch cost asymmetries persist when adults complete these same tasks, further supporting a link between asymmetrical switch costs and task complexity.

• WORD PROCESSING IN VARIOUS LANGUAGES •

(4061)

**Serial Assembly of Phonology From Print in Transparent Orthography.** JELENA HAVELKA, *University of Kent*, & KATHLEEN RASTLE, *University of London*—In this study, we used the special properties of the Serbian writing system to investigate whether a serial procedure is implicated in print-to-sound translation. In mixed-alphabet and pure-alphabet lists, participants read aloud phonologically bivalent words (i.e., words that have one pronunciation in Cyrillic and a different pronunciation in Roman, only one of which corresponds to a word) comprising bivalent (i.e., ambiguous) letters in initial or final positions. Words with bivalent letters in initial positions were disadvantaged, relative to nonbivalent controls, to a greater degree than were words with bivalent letters in final positions. On the basis of these data, we propose a dual-route theory of bi-alphabetic reading aloud in which the nonlexical procedure operates serially and in which nonlexical spelling–sound correspondences for each script can be strategically emphasized or deemphasized. Implications for models of bilingual reading aloud are also discussed.

(4062)

**The Homophone Effect in Semantic Access Tasks of Kanji Words.** AIKO MORITA & SATORU SAITO, *Kyoto University* (sponsored by John Nicholas Towse)—The present study examined whether articulatory suppression influences homophone effects in Japanese kanji word recognition tasks. In Experiment 1, participants were required to decide whether visually presented word pairs were synonyms. Experiment 1 replicated previous findings that more false positive errors are made to nonsynonym homophone pairs than to controls. This homophone effect was also obtained under articulatory suppression conditions. In Experiment 2, participants performed a semantic decision task, in which they had to judge whether a visually presented target word was an exemplar of a definition that had been presented immediately before presentation of the target word. Longer response times and more false positive errors were associated with homophones of correct exemplars than with nonhomophone control words in both silent control and articulatory suppression conditions. These results suggest that phonological processing, which produces the homophone effects in semantic access tasks of Japanese kanji words, does not include articulatory mechanisms.

(4063)

**Hemispheric Differences During Reading in Urdu.** MAHEEN M. ADAMSON & JOSEPH B. HELLIGE, *University of Southern California*—The Urdu language provides a unique opportunity to test hemispheric differences in reading, since it can be written in two forms, one that joins letters together into a pronounceable unit and one that represents the same sequence of letters unjoined. The present visual half-field study investigates hemispheric differences in overall performance and processing strategy during reading of words and nonwords, using these two forms of Urdu in Urdu–English bilinguals. Analysis of error types indicates that the unjoined form of Urdu is processed in a slower, more sequential fashion than the more linguistic joined form and that hemispheric differences in processing strategy differ from what is found in English. However, both forms of Urdu words and nonwords produce an RVF/LH advantage, consistent with

the view that the left hemisphere is dominant for reading across a variety of specific languages.

(4064)

**Semantic Priming Effects in a Second Language: An Event-Related Potential Study.** GEORG STENBERG, *Kristianstad University*, & MIKAEL JOHANSSON & INGMAR ROSÉN, *Lund University*—This study addressed the question of whether the second language (L2) of bilinguals can access conceptual memory as directly as their first language (L1). Swedish undergraduates, with English as their second language, performed two tasks in both L1 and L2. Experiment 1 used a picture–name verification task, where pictures induced automatic semantic priming. Experiment 2 used a category–exemplar verification task, where pictures induced strategic priming. The primary measure was reduction of the N400 amplitude in the ERP. Experiment 1 showed a fronto-central priming effect that did not differ between L1 and L2 in amplitude, topographical distribution, or peak latency. Experiment 2 showed a different, centro-parietal priming effect that was similar in amplitude between L1 and L2 but differed in peak latency and lateral distribution. The study indicates that L2 provides direct automatic access to conceptual memory, although strategic use may recruit partly different neuronal resources in L2 than in L1.

(4065)

**Constraints on Cross-Language Semantic and Translation Priming in Spanish–English Bilinguals.** JEANETTE ALTARRIBA & DANA M. BASNIGHT-BROWN, *SUNY, Albany*—Cross-language semantic and translation priming effects were examined in Spanish–English bilinguals. Participants engaged in a lexical decision task, and prime–target presentation was constrained in terms of relatedness proportion, nonword ratio, SOA length, cognateness, word frequency, and word length. Two important conclusions emerged: (1) Priming under constrained conditions occurs only from a dominant language prime to a subordinate language target, and (2) dominance should not be defined by order of acquisition but, rather, by language usage and preference. An investigation including visual masking of the prime is also discussed. The implications of these experiments, which have direct bearing upon models of bilingual language processing and bilingual memory to date, will also be discussed.

(4066)

**Does Prior Orthographic Experience Influence L1 and L2 Word Segmentation?** JYOTSNA VAID, HSIN-CHIN CHEN, FRANCISCO E. MARTINEZ, & CHAITRA RAO, *Texas A&M University*—The influence of initial written language experience on segmentation of words was examined in English monoliterate adults and in Spanish-, Hindi-, and Kannada–English biliterates. Segmentation of spoken words was assessed in all languages using a task in which participants were to delete “the first sound” in the word and say what was left. Written word segmentation was examined in English in all four groups and in Spanish (for Spanish readers), using a split word lexical decision task with words divided according to sound-based or visual/morphological principles. On the spoken task, English L1 readers were expected to show phoneme-based segmentation, whereas Spanish readers were expected to show syllable-based segmentation. Indic readers were expected to show a phoneme-based preference only for items with initial consonant clusters. On the visual task, a visual/morphological (max coda) preference was expected for English mono- and biliterate readers, but a phonological preference was expected for Spanish.

(4067)

**A 200-msec Phonological ERP Component in Reading Chinese for Meaning.** YING LIU & CHARLES A. PERFETTI, *University of Pittsburgh*, & DANLING PENG & LUN XU, *Beijing Normal University*—Although reading Chinese logically allows by-passing phonology, behavioral experiments show evidence for lexical-level phonological processes during word recognition. However, there is no direct evidence for such processes in reading sentences, as opposed

to single words. Is it possible that in sentences read for meaning, Chinese reading exploits its direct orthography-to-meaning connection? We measured ERPs on the final word (a single character) of a written Chinese sentence. When the final word caused the sentence to be anomalous, an N400 was observed, replicating the standard result in English. When the anomalous sentence had a final word that was a homophone of a word that would have made sense, there was a slight reduction in the N400. But the important results for the homophone were a reduced P200 and an enhanced P600. The 200-msec component reflects a lexical phonological process that precedes the standard meaning-based N400, whereas the later component reflects postlexical process.

## • SENTENCE PROCESSING •

(4068)

**Garden Path Recovery and Cognitive Control: The Role of Conflict Resolution in Parsing.** JARED M. NOVICK, JOHN C. TRUESWELL, DAVID JANUARY, & SHARON L. THOMPSON-SCHILL, *University of Pennsylvania*—Most research on individual differences in sentence processing has focused on the role of working memory capacity in syntactic ambiguity resolution. We explore here whether individual differences in cognitive control—specifically, general conflict resolution abilities—account for differences in garden path recovery. Normal college-age adults participated in a battery of syntactic and non-syntactic tasks, including eyegaze during listening of prepositional phrase attachment ambiguity (*Put the frog on the napkin into the box*), whole-sentence reading of direct-object/sentence-complement ambiguity (*The man accepted the prize would not go to him*); delayed letter verification (DLV), and reading span. Individual differences in garden path recovery were significantly correlated between these syntactic tasks, which differed in modality and even in ambiguity type. These differences correlated with DLV interference scores but, crucially, not with reading span. Alongside previous child and patient research from our group, the findings implicate a general ability to recover from garden paths, perhaps arising from frontal lobe systems responsible for conflict resolution.

(4069)

**Garden Pathing or Syntactic Priming: A Closer Look at the Visual World Paradigm.** PAUL E. ENGELHARDT, KARL G. D. BAILEY, & FERNANDA FERREIRA, *Michigan State University* (sponsored by Fernanda Ferreira)—Recent work indicates that when participants hear *Put the apple on the towel in the box* while examining a display containing a single apple, they make immediate looks to an empty towel location. This result is consistent with both a garden path and a syntactic priming explanation, because in all previous studies, participants have heard sentences with the same verb (*put*) and the same syntactic form on every experimental and filler trial. Therefore, syntactic structures may simply be reused. To reduce the opportunities for syntactic priming, we conducted an experiment using coordination ambiguities in which the spoken utterances and the required hand movements were made complex and unpredictable. The results were consistent with a garden path explanation and with the principle of minimal attachment specifically. These results suggest that even in real-world situations and with natural prosody, coordination ambiguities are initially processed by building the simplest syntactic structure possible.

(4070)

**Evidence for Competition During the Processing of Relative Quantifier Scope.** KEVIN B. PATERSON, *University of Leicester*, SIMON P. LIVERSEDGE, *University of Durham*, & RUTH FILIK, *University of Derby* (sponsored by Susan Elizabeth Gathercole)—We report two eye-tracking experiments that investigate the on-line processing of quantifier scope ambiguity, which can occur whenever a sentence contains two or more quantifiers—for example, *Kelly showed a photo to every critic*. For the sentence to be interpreted unambiguously, the reader must establish the relative scope of the two quanti-

fiers, with one taking wide scope over the other. We manipulated three factors believed to influence relative quantifier scope: the relative linear order of quantifiers, the grammatical function of the quantified noun phrases, and individual quantifier characteristics. First-pass reading times showed interactive effects of grammatical function and quantifier characteristics. Total reading times showed that linear order had a late effect on processing and modulated the interaction between grammatical function and quantifier characteristics. We interpret our results as providing evidence for competition between the alternative possible analyses of a quantifier scope ambiguity, with multiple factors interacting to determine its resolution.

(4071)

**Literal Plausibility, But Not Decomposability, Affects the Immediate Retrieval of Idiomatic Meaning.** MAYA LIBBEN, CAROLINA ROMERO, & DEBRA A. TITONE, *McGill University* (sponsored by Debra A. Titone)—Models of idiom processing (Cacciari & Glucksberg, 1991; Cacciari & Tabossi, 1988; Titone & Connine, 1999) suggest that immediate retrieval of idiomatic meaning is enhanced by factors that render idiomatic configurations recognizable. We tested whether literal plausibility and semantic decomposability are two such factors. Idioms varying in these dimensions were embedded in sentences (*He was on cloud nine*) and presented auditorily to participants. In Experiment 1, idiom-related (ELATED) or literal-related (ELEVEN) visual targets were presented at sentence offset; in Experiment 2, idiom-related targets were presented at offset and preoffset; in Experiment 3, idiom-related targets were presented at offset and 1,000 msec later. In all experiments, literally implausible idioms generally induced significantly more idiom priming than did literally plausible idioms. Decomposability did not systematically influence idiom priming. Thus, idiom-processing models should incorporate literal plausibility as an important determinant of immediate idiom retrieval, whereas decomposability likely affects comprehension at a later stage.

(4072)

**Conventionalization of Metaphors and the Scope of Semantic Priming.** MICHAEL T. MCKAY, *Randolph-Macon Woman's College*, & IRA S. FISCHLER, *University of Florida*—The career of metaphor hypothesis (Gentner & Bowdle, 2001) holds that conventional metaphors (e.g., *Bob is a pig*) are comprehended through a categorization process (X is an instance of Y), whereas novel metaphors (e.g., *Fred is an armadillo*) are understood by means of an extended comparison process (X is like Y). In Experiment 1, metaphors that had been rated as more conventional (e.g., *pig*, above) were comprehended more quickly and showed greater scope of priming for words related to the metaphorical meaning of the vehicle shown immediately after the metaphor had been seen. In Experiment 2, novel metaphor vehicles were presented in three different sentence frames or in the same frame three times. Experience with varied frames led to greater conventionality judgments, faster meaningfulness decisions, and greater scope of priming, for those vehicles in new frames. The results provided some support for the career of metaphor hypothesis.

(4073)

**Idiom Syntax: Is It Learned?** KINO WOLF & FRANCESCA VIGNOLA, *University of Trieste* (sponsored by Lucia Colombo)—Typically, idiomatic expressions cannot enter all the syntactic constructions that are allowed by literal strings. *The bucked was kicked by the man*, for example, is not understood figuratively by most English speakers. What determines people's syntactic use of idioms? In this study, we explored the hypothesis that idiom syntax is not learned. Rather, one's linguistic competence, along with the knowledge of the stipulated meaning of an expression, is sufficient to restrict the syntactic use of the expression. Real and invented Italian idioms in different syntactic constructions were rated for acceptability by Italian speakers and by Slovenian speakers with a good knowledge of Italian. The results showed that for both real and invented idioms, the ratings

of Italian speakers were highly consistent, whereas Slovenians' agreement with Italian speakers was not different from chance. The findings are discussed with respect to current models of idiom processing.

(4074)

**Causal Relations: Conceptual Determinants.** MOHAMED TAHA MOHAMED, *Ain Shams University*, & CHARLES CLIFTON, JR., *University of Massachusetts*—Traxler et al. (1997) found that evidential causal relations (the "because" clause is evidence for belief in the main clause) are harder than iconic ones (the "because" clause causes the main clause event). We replicated this phenomenon and extended it to deductive causal relations (the "because" clause provides an enabling condition supporting belief in the main clause). Deductive relations were intermediate in difficulty and, like evidential relations, were facilitated by embedding the main clause under "I think." We also compared evidential and iconic causal statements with action versus psychological state main clause verbs and found that psychological verbs facilitated evidential, but impaired iconic, statements. This suggests that the consequence in an evidential relation is an unobservable mental state, whereas in an iconic relation it is an observable event. Finally, we explored the effects of presenting causal sentences in contexts making either the "because" clause or the matrix clause the given information.

(4075)

**The Role of Semantic Short-Term Memory in Filler Gap Processing.** HENK J. HAARMANN, *University of Maryland*, & EDDY J. DAVELAAR, *University of London*—We examined whether or not the meaning of a filler is active during the filler gap interval prior to its structural integration into the sentence context. Participants were grouped into those with high and low semantic short-term memory capacity on the basis of their performance on the conceptual span task. They performed a self-paced reading task containing control and filler gap sentences, in which a sentence-initial *Wh*-phrase had to be integrated with the main verb after an intervening subject noun and relative clause. The subject and object nouns, which were either semantically related or unrelated, appeared within the filler gap interval. Reading times at the object noun were longer in filler gap than in control sentences, but only in the related condition for high-span readers. These results suggest that high, but not low, conceptual span readers actively maintain the filler meaning during the filler gap interval when processing circumstances are favorable (i.e., presence of semantically related words).

(4076)

**Phonological Interference in Working Memory and Sentence Comprehension.** DANIEL J. ACHESON & MARYELLEN C. MACDONALD, *University of Wisconsin, Madison*—The role of phonological (sound-based) interference was examined in verbal working memory and sentence comprehension. Participants ( $n = 100$ ) performed a serial word recall task in both a phonological overlap (phonologically similar words) and a nonoverlap condition. The same participants also read sentences containing object-relative clauses with and without phonological overlap and answered comprehension questions about the sentences. Overlap sentences had two phonologically similar nouns and two similar verbs; nonoverlap items differed by two words, as in the overlap/nonoverlap pair: "The player/coach that the mayor met/aided bet the editor." Sentences were matched for length, frequency, and plausibility. Phonological overlap reduced both serial recall in the memory task and accuracy in sentence comprehension. Overlap sentences also yielded longer reading times than did nonoverlap controls. Individual differences are examined, and the relationship between phonological working memory and sentence processing is discussed.

(4077)

**The Role of Working Memory in Relative Clause Attachment Preferences.** BENJAMIN SWETS, *Michigan State University*, TIMOTHY DESMET, *Ghent University*, & ZACHARY HAMBRICK & FERNANDA FERREIRA, *Michigan State University*—The present study measured verbal working memory (WM), spatial WM, and rel-

ative clause (RC) ambiguity attachment preferences, using a questionnaire to show that individual differences in WM capacity predict attachment preferences. Both languages that were tested showed a negative correlation between reading span and NP1 attachments (English:  $-.29, p < .01$ ; Dutch:  $-.36, p < .01$ ) such that high-span participants displayed an NP2 preference, whereas low-span participants displayed an NP1 preference. Prosodic parceling (implicit prosody hypothesis; Fodor, 1998) was hypothesized to cause the cross-linguistic differences, as well as the individual differences. If different chunking strategies underlie the individual differences, forcing participants to chunk in a specific way should eliminate the differences between high- and low-span readers. We tested this possibility by presenting the sentences in chunks: the complex NP, the RC, and the matrix VP. Preliminary results show that breaking the sentences up forces NP1 attachment regardless of WM span.

(4078)

**The Repeated-Name Penalty in Self-Paced Reading.** GLORIA S. WATERS, *Boston University*, DAVID CAPLAN, *Massachusetts General Hospital*, & JOHN GOULD & LOUISE STANCZAK, *Boston University*—We examined the repeated-name penalty, comparing reading times for pronouns versus names in two experiments, following from work by Gordon et al. (1993). Both experiments presented participants with three-sentence passages in which subject and object repeated-names were contrasted with pronouns in the same positions. The first experiment ( $N = 52$ ) used a whole-sentence presentation, whereas the second experiment ( $N = 36$ ) used a self-paced word-by-word paradigm. In the first experiment, we found a significant repeated-name penalty when comparing name–name and name–pronoun sentences with pronoun–name sentences. In the second experiment, we found significantly increased reading times for the first NP in name–pronoun sentences, as compared with pronoun–pronoun and pronoun–name sentences. This experiment shows for the first time that the locus of the repeated-name penalty is directly on the first NP in sentences of this type.

## • BILINGUALISM •

(4079)

**Cross-Language Transfer of Word- and Text-Level Information in Fluent Reading.** DEANNA FRIESEN & DEBRA JARED, *University of Western Ontario*—A bilingual's reading opportunities are often divided between his or her languages. A question of interest is whether reading experiences in one language benefit reading processes in the other language. This study examines the transfer of word- and text-level information between languages, using a rereading paradigm. English–French bilinguals' eye movements were tracked while they read five pairs of passages. Passages overlapped either completely (language, story, words), in story and some target words (cognates), in story only, in target cognates only, or not at all. Second passages that were identical to the first, shared story and target cognates, and shared story only were all read significantly more quickly than second passages that were unrelated to the first. There were no transfer gains for shared words across languages. The same pattern of results was observed when second passages were in English and when they were in French. Implications of the results for current theories of text representation will be discussed.

(4080)

**Translating Words in Two Directions: When Order Matters.** ERICA B. MICHAEL, *Carnegie Mellon University*, NATASHA TOKOWICZ, *University of Pittsburgh*, & WENDY S. FRANCIS, *University of Texas, El Paso*—Green's (1998) inhibitory control model proposes that translation requires suppression of the input language to achieve production in the target language. Translation from the dominant language (L1) to the nondominant language (L2) is posited to be more difficult than the reverse, because the dominant L1 is harder to suppress than the weaker L2. Support for this model comes from language-switching

studies showing a higher cost for switching production from L2 to L1 than vice versa. We investigated whether this phenomenon persists when language switches occur at a blocked rather than a trial-by-trial level. Dutch–English, Spanish–English, and English–Spanish bilinguals translated words in both directions, with direction of translation blocked; block order was counterbalanced across participants. In two experiments, L2–L1 translation was indeed more sensitive to order than L1–L2 translation. A third set of data suggests that this effect is minimized when other bilingual tasks occur between the two blocks of translation.

(4081)

**Modulating Cross-Language Activation in Spoken Production: Evidence From Primed Picture Naming.** ZOFIA WODNIECKA, *Jagiellonian University*, SUSAN BOBB & JUDITH F. KROLL, *Pennsylvania State University*, & DAVID W. GREEN, *University College London*—When bilinguals prepare to speak in one language, alternatives in the other language appear to be active and to compete for selection. Models of lexical access in bilingual production differ in the hypothesized level of parallel activity in the first (L1) and second (L2) languages and in the requirement to actively suppress the more active language to enable production of the less active language. We report two experiments using a primed picture-naming paradigm in which pictures were repeated from study to test. In both experiments, the language congruency of picture naming varied from study to test, but in Experiment 1 the test was blocked by language, whereas in Experiment 2 it was mixed. The results indicate that the level of cross-language activation is modulated by priming, but also by the nature of language experience, by the requirement to activate both language alternatives, and by the dominance of the L1.

(4082)

**Sentence Recognition in Native and Foreign Languages.** SARA E. SEPANSKI, MEGAN KUHN, & PING LI, *University of Richmond* (sponsored by Ping Li)—The goal of language comprehension is to retrieve and retain the meaning of speech or text. Research with monolinguals has shown that participants' ability to detect structural changes in sentences decreases with time, whereas their ability to detect meaning changes remains accurate (Sachs, 1967). In this study, we examined whether this monolingual pattern holds for bilingual speakers in a second language. English–French and English–Spanish bilinguals at two different proficiency levels participated in a reading task in which L1 and L2 sentences were presented. Participants read both L1 and L2 sentences and were then tested for their recognition of the sentences. The test sentences either were identical to the original sentences or were altered in meaning or in form from the originals. Significant main effects of types of change were found, along with other interaction effects. Implications of the results are discussed in light of recent models of bilingual language processing.

(4083)

**Bilingual Digit Span in Language Pure and Mixed Conditions.** ANA I. SCHWARTZ & DAVID B. PISONI, *Indiana University* (sponsored by Judith Kroll)—Measures of verbal working memory, such as digit span, have been found to be strong predictors of second language (L2) acquisition. Performance on such tasks reflects the efficiency of verbal rehearsal information within the phonological loop. Increased efficiency is associated with better learning of novel phonological sequences, a critical component of L2 vocabulary acquisition. In the present study, we examined the effects of language mixing on immediate memory span. English–Spanish bilinguals performed digit span tasks in their native language (L1), in L2, and in language-mixed blocks. Digit span was greater in L1-pure blocks than in L2-pure blocks. Under language-mixed conditions, a cost was observed for L1 digits, but not for L2. This pattern is compatible with studies of bilingual language processing demonstrating an asymmetrical language switch cost, such that switching from the L2 into L1 is more costly than vice versa. Theoretical implications for models of working memory are discussed.

(4084)

**Bilingual Figurative Language Processing: Comprehension of Idiomatic Expressions.** ROBERTO R. HEREDIA, ELENI ATHANATOU, & STEPHANIE TUTTLE, *Texas A&M International University*—This study explores the comprehension of idiomatic expressions (KICK THE BUCKET) by Spanish–English bilinguals. Participants read idiomatic expressions classified as different, similar, or identical across Spanish and English (Irujo, 1986). Idiomatic expressions were biased toward either the literal meaning (INJURE FOOT + IDIOM) or the figurative meaning (ATTEND FUNERAL + IDIOM), and there was a no biasing context condition (ONE’S FRIEND + IDIOM). The experiment was self-paced, and we only measured the time taken (in milliseconds) to comprehend the idiomatic expression. For the different idiomatic expressions, bilinguals were slower to read the literal-biased than the figurative-biased and nonbiased idiomatic expressions. There were no differences between the figurative-biased and the nonbiased conditions. The exact opposite was true for the identical idiomatic expressions. No differences were observed for the similar idiomatic expressions in terms of the biasing context. The results are discussed in terms of transfer theory and bilingual models of figurative language processing.

## • WORD PRODUCTION •

(4085)

**Categorical and Gradient Representations and Processes in Spoken Word Production.** ADAM B. BUCHWALD & BRENDA C. RAPP, *Johns Hopkins University*—In spoken language production, speakers must access relatively abstract and categorical representations of sound structure, which are later elaborated to interface with gradient systems involved in speech. This work seeks to further our understanding of representations and processes involved in the transition from categorical to gradient systems, using performance from a brain-damaged individual with a speech production deficit. First, performance on repetition and naming tasks is used to broadly identify the locus of the deficit. Subsequently, we investigate factors affecting the individual’s poor production of consonant clusters, by identifying several contrasting predictions made by categorical constraints (e.g., markedness/sonority) and gradient constraints (e.g., sublexical frequency of consonant clusters) regarding production difficulty and errors. Information regarding the locus of impairment, coupled with an understanding of the constraints operational at that level, will inform our understanding of processes and representations involved in the interface between categorical and gradient components of spoken word production.

(4086)

**Computational Models of Homophone Production.** AUSTIN F. FRANK & MICHELE MIOZZO, *Columbia University* (sponsored by Michele Miozzo)—All current theories of language production agree that high-frequency words with a homophone mate (e.g., *light*) should behave like high-frequency words that lack a homophone (e.g., *lamp*). We tested the ability of a family of computational models of word production to simulate this outcome. We examined models that processed homophones and included either a single lexical node or both lemmas and lexemes. We also varied patterns of interactivity, resulting in feedforward, fully interactive, and mixed interactive models. For each model, we systematically varied several functional parameters (e.g., spread and decay rates). Our simulations showed that feedforward models are able to successfully reproduce the expected pattern of results across a wide range of parameter settings. By contrast, models that include either complete or partial feedback rarely generate this pattern. Tests of the behavior of homophones can thus be used to reveal parameter settings that yield psychologically plausible results.

(4087)

**Priming and Proper Name Retrieval in Young and Older Adults.** LORI E. JAMES, LESLIE L. DRAGE, SARA BEAVERS, & BRAN- DON McCLURE, *University of Colorado*—In this experiment, young and older participants attempted to name pictured celebrities. When a

participant suffered a tip-of-the-tongue (TOT) state for a name or did not know the name, they were given an ostensibly unrelated task in which they rated the pleasantness of six words. On half of the trials, four words were phonologically related to the name and two were unrelated (the phonologically primed condition), and on the other half, all six words were unrelated (the unprimed condition). Immediately following this, participants were given another opportunity to name the celebrity. As in previous studies, older adults reported more TOTs than did young adults. Both age groups resolved more TOTs in the phonologically primed than in the unprimed condition, with no age difference in the size of the priming effect and no effect of priming on don’t-know responses. Results increase our understanding of the causes underlying age-related declines in the ability to retrieve proper names.

(4088)

**Word Retrieval in a Stem Completion Task: Influence of Number of Potential Responses.** CHRISTINE CHIARELLO, LAURA K. HALDERMAN, & CATHY S. ROBINSON, *University of California, Riverside*, & NATALIE A. KACINIK, *University of California, Davis*—We examined word retrieval, using a stem completion task that varied the number of potential responses. Stems had one prepotent response, two competing dominant responses, or many potential responses with none being prepotent. Across three experiments, three-letter stems were presented centrally or to the LVF/RVF. Across all visual field conditions, accuracy was poorest when there were two dominant responses, suggesting that strong response competition may inhibit accurate word retrieval. However, the longest latencies were observed when there were many potential responses, implying a selection cost that increases with the number of viable responses. However, only stems presented centrally or to the LVF showed a reliable slowing between the two- versus many-response conditions. This may suggest a right-hemisphere role for the activation of a wide set of potential responses during language production.

(4089)

**Phonological and Orthographic Effects on Picture Naming.** GABRIELLE OSBORNE, *Claremont Graduate University*, KATHLEEN RASTLE, *University of London*, & DEBORAH BURKE, *Pomona College*—Previous results show that pictures are named more quickly when accompanied by an orthographically related, as compared with an unrelated, word. These orthographic effects can be attributed to phonological retrieval because orthographic similarity and phonological similarity are confounded in these studies. Using a picture–word interference task, we disentangled phonological and orthographic facilitation of picture naming. Related distractor words shared with the name of the target picture the initial phoneme and the initial letter (+P+O; e.g., *raid*–ROACH), the initial phoneme but not the initial letter (+P–O; e.g., *phase*–FOOT), or the initial letter but not the initial phoneme (–P+O; e.g., *germ*–GOAT). Picture naming was faster in the P+O+ condition, as compared with an unrelated condition, but not in the –P+O and +P–O conditions. The results suggest that both orthography and phonology contribute to name retrieval. The implications for models of language production are discussed.

(4090)

**Compound Elicitation in Finnish: The Case of Writing.** RAYMOND BERTRAM & JUKKA HYÖNÄ, *Turku University*, FINN-EGIL TOEN- NEN, *Stavanger Center for Reading Research*, SVEN STRÖM- QVIST, *Lund University*, & PEKKA NIEMI, *Turku University*—This study investigated the writing process of compound words in Finnish. A writing elicitation tool, Scriptlog, was employed to investigate whether compounds are retrieved holistically or are decomposed before writing onset. We found that writing onset time (WOT) is a function of whole-word frequency. Thus, in the case of LUMI/UKKO (“snowman”), WOT depends on the frequency of LUMIUKKO, but not on the frequency of LUMI or UKKO. This implies that initially, written word production is triggered by the whole concept. In order to check whether syllables or morphemes are also used as planning units in written word pro-

duction, we analyzed whether they affect pause durations between two subsequent letters (cf. Weingarten, 2001). Very systematically, pauses were much longer at sublexical boundaries than at nonboundaries. This implies that words are not fully planned before initial writing but that, instead, for every sublexical boundary, writers need additional planning/preparation time for retrieving graphemes.

• CATEGORIZATION AND UNDERSTANDING •

(4091)

**Adaptation Effects on Lexical Decision Times: Evidence for Perceptual Representation.** KATJA WIEMER-HASTINGS & CHRISTOPHER A. KURBY, *Northern Illinois University*—Evidence is provided that feature detector cells for primitive visual features (here, orientation) are involved in the initial stages of conceptual access. Participants performed lexical decision tasks on names of objects with standard vertical or horizontal orientations (e.g., lamp or airplane) after visual adaptation to horizontal or vertical gratings. Adaptation to a pattern slows response times to same-patterned visual stimuli by elevating the neural threshold. If oriented object concepts are represented perceptually, then response times to object names should be slower after adaptation to matching orientations, relative to adaptation to nonmatching orientations. Indeed, this is what was found. Adaptation effects were moderated by variables that affect the clarity with which an object's orientation is perceived in the world, such as the height/width ratio and the view invariance of the orientation. The data are inconsistent with the view that perceptual representations are epiphenomenal to amodal processing.

(4092)

**Semantic Property Activation During the Interpretation of Combined Concepts.** THOMAS L. SPALDING & CHRISTINA L. GAGNE, *University of Alberta*—Two experiments investigated whether relation selection during conceptual combination is influenced by recent activation of a property that is semantically compatible with a particular relation. Wool basket could be a basket for wool (dominant relation) or a basket made of wool (subdominant relation). Participants verified one of these definitions. Prior to verification, they viewed a statement containing a property compatible with the dominant or the subdominant relation (*Some baskets are used by shepherds/are knitted*) or a neutral property (*have handles*). Presentation of a compatible property speeded the verification of the corresponding relational definition, relative to the neutral property. The verification of the less compatible relational definition was not differentially affected by the preceding property statement.

(4093)

**The Interplay Between Distinctiveness and Intercorrelation in the Automatic Activation of Word Meaning.** KIRSTEN I. TAYLOR, HELEN MOSS, BILLI RANDALL, & LORRAINE K. TYLER, *University of Cambridge* (sponsored by Deborah Burke)—Does the structure of a word's meaning affect the activation of its semantic features during on-line language comprehension? We predicted that both feature distinctiveness (D) and intercorrelation (I) with other features would modulate the time course and strength of activation. We employed a semantic priming task with 0- and 300-msec ISIs and visual concept–feature pairs (McRae & Cree, 2002) factorially divided into low and high D and I groups. Although no interactions with ISI reached significance, both the main effects of priming and distinctiveness and the  $I \times D$  interaction did: High-D features primed more than low-D and high-I features more than low-I with constant low-I and low-D, respectively. Surprisingly, priming was absent in the high-D–high-I condition. Further analyses revealed that these concepts had more features (NOF) than did other groups. These findings demonstrate that both I and D influence automatic meaning activation and suggest that NOF may also modulate these semantic processes.

(4094)

**The Nature and Influence of Statistical Feature Correlations and**

**Explicit Feature Relations.** KEN MCRAE & CHRIS MCNORGAN, *University of Western Ontario*—The goal of this research is to understand more deeply the nature of explicit feature relations and statistically based feature correlations and their influence on various tasks. Experiment 1 used an interview format to elucidate theories that link two features. The stimuli were 65 feature pairs that span a range of correlational strength. At least 1 participant provided an a priori theory for 39 of the 65 pairs. For only two pairs did at least half the participants provide a priori theories. In Experiment 2, participants rated feature relatedness. Correlational strength and feature relations predicted ratings. In Experiment 3, both correlational strength and feature relations were significant but weak predictors of speeded feature relatedness judgments. The number of concepts in which the first, but not the second, feature occurred accounted for order effects, but direction of causal relation did not. We conclude that both feature correlations and relations influence conceptual computations.

(4095)

**Screening Training Techniques in the Screener Task.** JOSHUA S. REDFORD, *SUNY, Buffalo*, PAMELA WICKHAM, *University of California, San Diego*, & LAUREN GENT & J. DAVID SMITH, *SUNY, Buffalo* (sponsored by J. David Smith)—Baggage screeners perform an important categorization task in which they are required to identify members of threat object categories (e.g., guns, knives, etc.). Despite the serious consequences of overlooking a threat object, our previous research has found low threat detection performance in numerous circumstances. In particular, we observed poor performance when repeated dot distortion patterns (Posner, Goldsmith, & Welton, 1967; Posner & Keele, 1968) were replaced with new members of the same threat categories. This effect was found for real threat images as well. The present research reflects an initial attempt to improve screening performance through various training regimes involving distortion level (i.e., the distance a target is from its prototype) and display complexity (i.e., the total number of objects presented on screen). In all conditions, final performance was approximately equivalent; however, distortion level was more detrimental to performance than was set size. Implications for the screener task are discussed.

(4096)

**Do You Look Like a Bob or a Tim? The Possible Existence of Facial Prototypes.** ROBIN D. THOMAS, MELISSA A. LEA, KATE KARELINA, REBEKAH MILONE, & JEFF SHOLL, *Miami University*—Face-processing models assume that names are meaningless labels, accessed only after all perceptual processing and identity-specific semantic information retrieval is complete. The present experiments examine whether representations of faces are influenced by their names. In the first experiment, participants used a continuous magnitude scale to rate second-order relationships between features (e.g., distance between eyes) for a given name. These ratings were then analyzed using recent developments in principle component analysis (i.e., CPC). The results suggest that faces differ according to their names and that these reside in a common face space. In a second experiment, ratings from the previous study were translated into verbal descriptions, and an illustrator created sketches for each name. Participants then matched names to these face sketches. The frequencies of matches indicate that names that sound alike also look alike. The results suggest that individuals may consider certain features as belonging to specific names.

(4097)

**Nonstationary Response Distribution: A Telltale Sign of the Dynamics of Category Rating.** ALEXANDER A. PETROV, *University of California, Irvine*—A category-rating experiment reveals a markedly nonstationary response distribution: The average response gradually increases and the response variance decreases in the course of 450 trials even though the stimulus distribution remains fixed and uniform throughout. These dynamic effects constrain the theories of judgment and category rating. In particular, they invalidate the widespread assumption of static response policy and suggest a dynamic categoriza-

tion system driven jointly by environmental statistics and explicit strategies. ANCHOR—a memory-based model of category rating and absolute identification—accounts quantitatively for these and various other results (Petrov & Anderson, 2000, 2003, in press). A small set of anchors stored in memory compete to match the target stimulus magnitude. Two incremental learning mechanisms update the locations and base-level activations of these anchors, thereby changing the stimulus–response mapping continuously. A slight asymmetry in an explicit correction strategy explains the upward drift in the average response levels.

(4098)

**The Science of Cycology: How Little Do We Understand About How Everyday Objects Work?** REBECCA LAWSON, *University of Liverpool*—Rozenblit and Keil (2002) found that people overrated their understanding of complex phenomena. This illusion of explanatory depth was not simply due to general overconfidence: It was specific to causally complicated systems (e.g., crossbows, earthquakes) relative to other knowledge domains (e.g., baking cakes, movie plots). The present experiments objectively assessed people's understanding of how bicycles and other familiar, everyday objects work by having people draw these objects and answer multiple-choice questions. Serious errors of functional understanding were common, even for experts (e.g., experienced cyclists drawing bicycles). In contrast, non-cyclists were accurate if they could look at a real bicycle while doing the task. The results confirm Rozenblit and Keil's hypothesis that people have a sketchy, shallow understanding of how things work. People may overestimate their understanding because they do not realize how reliant they are on extracting perceptual information on line from the world in order to understand how objects work.

(4099)

**The Role of Experience in the Development of Biological Reasoning in Children.** ANNA VITKIN, ROBIN KANE, & JOHN D. COLEY,

*Northeastern University* (sponsored by John D. Coley)—Previous research suggests that adult novices utilize taxonomic relations to guide biological inferences, whereas experts augment these with ecological relations. In this study, we ask what factors contribute to the salience of ecological relations for biological induction in children. Children (K–6th grade) were taught about a disease or stuff inside a target species and were asked whether that property was more likely to be shared by a taxonomically matched species (same superordinate) or an ecologically matched species (different superordinate, shared habitat or predator–prey relation). Children were asked about either local or exotic species and were drawn from communities varying widely in population density. Relatively frequent ecological responses were associated with lower population density, local species, higher grade level, and reasoning about disease, thus suggesting that these factors contribute to the development of expert-like reasoning in children.

(4100)

**The Malleability of Lay Explanatory Theories for Mental Disorders.** NANCY S. KIM, *Rochester Institute of Technology*—The theory-based model of categorization suggests that our concepts are represented as theories (Murphy & Medin, 1985). Past studies measuring lay and expert theories of various concepts, including mental disorders (Furnham, 1995; Kim & Ahn, 2002; Lunt, 1991; Sloman, Love, & Ahn, 1998), have assumed that explanatory theories are relatively stable. Two experiments were performed to scrutinize that assumption, observing the effects of such influences as the order in which symptoms are noticed and the passage of time. In concert with previous evidence showing that people's theories for everyday concepts are more fragmented than they think (Rozenblit & Keil, 2002), the present experiments show that lay people's mental disorder theories are, in fact, easily malleable. Potential implications of these findings for models of categorization are discussed. Preliminary data on expert clinicians, who presumably think more frequently and in more depth about the causes of disorders, are also considered.

## POSTER SESSION V

Exhibit Hall, Saturday Evening, 6:00–7:30

## • EVENT COGNITION •

(5001)

**Distance Effects in a Sequencing Task.** MICHAEL S. FRANKLIN, ED E. SMITH, & JOHN JONIDES, *University of Michigan*—This study investigated the processes involved in sequencing information in a familiar routine. Subjects were presented with the title of a routine (e.g., going to a restaurant), were shown two actions from that routine, and determined whether they were in the correct order. Using a similar paradigm, Galambos and Rips (1982) had found a distance effect, in which subjects were faster when the actions were farther apart within the sequence. The present study suggests that the distance effect depends on the specific routine used and the location of actions within the routine. We found that pairs of actions containing an endpoint in the routine showed a distance effect, whereas other pairs showed the reverse of this (i.e., quicker reaction times when actions are closer together). These results suggest that subjects are scanning through the actions within the routine.

(5002)

**The Impact of Gender and Emotional Sensitivity on Memory for Emotional and Factual Information.** SUZANNE M. BLOISE & MARCIA K. JOHNSON, *Yale University*—Gender differences in autobiographical memories suggest that women remember more emotional information from their experiences than do men. The present study evaluated whether women recall more emotional information than do men when the content of an event is controlled. Participants read a script containing emotional and factual/neutral information with instructions to prepare advice for the characters by addressing their interpersonal issues or providing concrete plans or with no particular topic suggested. After writing out advice, on a surprise memory test, women recalled more emotional information than did men in all focus conditions and recalled more factual information than did men in the factual focus condition. A measure of emotional sensitivity mediated the gender difference in emotional recall, suggesting that memory for emotional information is not a function of gender per se. Gender differences in remembering emotional information may contribute to gender differences in coping styles (e.g., rumination) and the development of mental disorders (e.g., depression).

(5003)

**Representational Momentum Effects for Human Versus Nonhuman Objects: Man, Rod, and Ball.** MARGARET P. MUNGER, ALIA ANTONUCCI-ALTER, MATTHEW DELLINGER, ERIK HEIDEFORS, TIMOTHY FRIZZELL, & JUSTIN PORTER, *Davidson College*—Representational momentum (RM) was used to examine how the identity of an object impacts perception of movement. Animations depicted a man waving or taking a drink, a rod undergoing the identical motion as his forearm, or a ball following the same trajectory as the man's hand. Significant RM occurred for all objects, with significantly larger distortions for the ball. Previous work (e.g., Reed & Vinson, 2002) suggested that objects known to move (here, the man) would lead to larger RM, not smaller, as was found in the present experiment. The context of the motion (man vs. ball) altered how the movement was remembered, with smaller distortions occurring for the human form. In addition, there is some evidence that the movement of the man was actually misunderstood for a particular view, resulting in negative RM.

(5004)

**Effect of Awareness and Crime Seriousness on Eyewitness Identification Accuracy.** TERRI S. KRANGEL, LISA M. SHIN, RICHARD A. CHECHILE, & SAMUEL R. SOMMERS, *Tufts University*, & MICHAEL P. TOGLIA, *SUNY, Cortland*—An eyewitness investigation was conducted to determine the influence of awareness and crime

severity on identification. Experiment 1 witnesses were instructed to attend equally to a customer and a clerk in a video, one of whom was suspected of either highway littering or murder. In a surprise sequential lineup, participants who learned prior to watching the video that someone was a suspect (knowledge-before condition) did not differ in recognition accuracy from participants who learned about the crime after watching the video (knowledge-after condition). Crime severity was also not influential. Experiment 2 witnesses were instructed to attend to the customer only. Combined correct identification and correct rejection rates were higher in the knowledge-before condition than in the knowledge-after condition, irrespective of crime severity. Directed attention, coupled with purpose to attend to an individual, produced the best recognition accuracy, a finding reviewed in terms of levels-of-processing, transfer-appropriate processing, and fuzzy-trace theory.

(5005)

**Are Imagination Inflation Effects Due to Imagination?** DIANNE LEARNED & MARIA S. ZARAGOZA, *Kent State University*—Imagination inflation (e.g., Garry, Manning, Loftus, & Sherman, 1996) is the finding that imagining counterfactual autobiographical events from childhood increases participants' confidence that the counterfactual events actually transpired. The present study examined whether other manipulations that increase the familiarity of the counterfactual events (in this case, watching clips from movies where the counterfactual events happen to other children) might similarly inflate confidence. The results show that simply exposing participants to counterfactual events produces confidence inflation effects that are comparable in magnitude to those that result from imagination.

(5006)

**Confidence Inflation and Event Recognition With Young and Older Adult Eyewitnesses.** JEFFREY S. NEUSCHATZ, *University of Alabama, Huntsville*, MICHAEL P. TOGLIA, *SUNY, Cortland*, ELIZABETH L. PRESTON, *University of Alabama, Huntsville*, JAMES M. LAMPINEN, *University of Arkansas*, JOSEPH S. NEUSCHATZ, *Roger Williams University*, & CHARLES A. GOODSSELL, ANDREW H. FAIRLESS, & DEAH S. LAWSON, *University of Alabama, Huntsville*—Retrospective confidence was examined in two experiments employing Wells and Bradfield's (1998) postidentification feedback paradigm. College students and older adults watched a surveillance camera video of people shopping, focusing on someone they subsequently discovered shot a store security guard. The gunman was "identified" from a target-absent lineup followed by no feedback or confirming feedback. In both experiments, the subjects then answered 16 questions concerning identification certainty and memory for the gunman. Positive feedback produced confidence inflation on almost all questions, an outcome not moderated by age or by a week delay in Experiment 2. Following these questions, Experiment 2 subjects completed a recognition test probing overall memory for the video. Recognition accuracy decreased over the delay, and young adults exhibited superior retention. Results are discussed in terms of memory trace strength and the accessibility hypothesis, which posits that eyewitnesses possess little or no recollection of their confidence at the time of identification.

(5007)

**An Eye-Tracking Study of Describing Event Temporal Relations.** SHULAN LU, *Texas A&M University, Commerce*, & JAMES WALLACE, ARTHUR C. GRAESSER, & BARRY GHOLSON, *University of Memphis*—Temporal relations between events are one of the fundamental properties of event representations. The question arises as to where we look during the perceiving and describing of abstract temporal relations. Theories of plans and goals suggest that people focus on the end points of events that mark the achievement of goals, as opposed to the beginning points. Participants viewed animations of fish swimming events that systematically varied the temporal relations between events and described each corresponding temporal relation whenever they were ready. Eye movements were recorded while per-

forming this task. Participants linguistically marked the beginning and ending of events by using verbs such as *start* and *stop*. Right before saying the verb *start*, participants tended to fixate on the end points of events if they did not overlap in time. The eye movements while describing abstract relations showed some interactions between perception, conception, and mental animations of events.

(5008)

**Body Sway Supports Affordance Learning.** THOMAS A. STOFF-REGEN & CHIH-MEI YANG, *University of Minnesota*, & BENOIT G. BARDY, *University of Paris XI*—Standing people accurately judge their maximum sitting height (SH-max)—the tallest chair on which they can sit. They can adapt their judgments to changes in SH-max, as when wearing blocks on their feet that increase SH-max (even without practice or feedback). Previous research has shown that ordinary body sway is sufficient for retuning of judgments. We measured sway as subjects made a series of 24 SH-max judgments, while wearing blocks and without blocks. Learning was observed while they were wearing the blocks, but also without blocks (the latter result is consistent with several other findings). We contrasted sway during judgments with sway between judgments. In initial trials, sway during and between judgments did not differ. Among subjects who retuned their SH-max judgments, sway between judgments increased over time, but sway during judgments was constant. Sway was functionally related to the momentary task (judging vs. not judging).

• SPATIAL COGNITION •

(5009)

**Remembering Places in Spaces: Memory Load, Retention Interval, and Environmental Cues.** GARY L. ALLEN & SYLVIA FITTING, *University of South Carolina*—We conducted two experiments demonstrating the impact of three factors on human place learning and memory: memory load, retention interval, and peripheral environmental cues. In Experiment 1, we found that the number of remembered locations and the spatial relation of cues to remembered places influenced performance but that memory was stable over a 2-week retention interval. Results from Experiment 2 replicated these findings and further showed that number of cues influenced performance. There was some evidence that memory was biased toward alignment with peripheral cues. Overall, our results were consistent with the theoretical view of place memory as a temporally robust phenomenon that is based on geometric relations between remembered locations and peripheral environmental cues.

(5010)

**The Role of Haptic Information in Mental Rotation of Handheld Objects.** MARYJANE WRAGA & MONIQUE SWABY, *Smith College*—Mental rotation of objects improves when haptic information for the rotating object accompanies the imagined rotation (Wraga et al., 2000). We examined this phenomenon further using a within-subjects paradigm involving handheld puzzle pieces. In Experiment 1, participants imagined rotating the stimuli placed on their upturned palms. Participants were faster at updating parts of the stimuli when the stimuli were rotated than when they were not. In Experiment 2, we tested whether the advantage would occur when the participant experienced only the start- and endpoints of the rotation. We found that haptic information specifying start- and endpoints actually hindered updating performance, relative to a stationary control. A third experiment contrasted continuous haptic rotation paralleling participants' imagined movement with continuous rotation that was discrepant from imagined movement. The latter condition again hindered performance. The findings suggest a tight coupling between the parameters specifying haptic information and the representation of corresponding imagined movement.

(5011)

**Movement Facilitates Spatial Updating Within Imagined Environments.** UYEN T. LE & BARBARA LANDAU, *Johns Hopkins Univer-*

*sity* (sponsored by Barbara Landau)—Even in the absence of vision, people easily update their bearings with respect to their local environment as they move through space. However, updating to novel perspectives without movement is difficult. The present experiments examine the effect of movement on subjects' ability to adopt novel perspectives within imagined environments learned from maps and direct observation. Subjects were familiarized with a room's layout either by directly viewing the room from one perspective or by viewing a map of a room in one orientation. In a separate room, subjects imagined being in the studied room at a novel perspective and were tested on their ability to orient toward objects. Movement facilitated performance, both for subjects who had direct experience with the room and for subjects whose only exposure to the room was through a map. These results have implications for our understanding of the representations available to automatic spatial updating mechanisms.

(5012)

**Influences of Global and Local Orientations of Line Segments on Perceived Eye Level.** ADAM Y. SHAVIT, WENXUN LI, & LEONARD MATIN, *Columbia University*—In two experiments, the physical elevation of a visual target that appears to lie at eye level (VPEL) is shown to be systematically influenced by the global orientation of two linearly arranged, 64° long arrays of short parallel line segments, with only small influences due to the local orientation corresponding to the independently manipulated roll-tilt of the line segments. The two linear arrays were presented on a frontoparallel plane at bilaterally symmetric locations 25° distant from the median plane in otherwise total darkness. The elevation of a small target set by the subject was employed to measure VPEL. We suggest that the pattern of location information from the line segments is combined to yield the global orientation that influences VPEL and interpret this by introducing changes in the first stage of a neural model (Vision Research, 2001) that accounts well for the previous experiments regarding the visual influence on VPEL.

• MUSIC COGNITION •

(5013)

**Prosodic Persistence in Music and Speech Production: The Role of Structure.** MELISSA K. JUNGERS, *Ohio State University*—Previous research suggests that listeners persist in the tempo of a previously heard melody or sentence when they produce similar melodies or sentences. Is this prosodic persistence limited to rate, or does persistence reflect a broader set of acoustic cues that may be related to the melody or sentence structure? In the present study, pianists listened to melodies containing intensity and articulation cues and performed similar metrically ambiguous melodies. Pianists' performances persisted only in the metrically unrelated articulation cues, but in a metrically related manner. In a parallel speech experiment, speakers heard sentences containing prosodic phrase breaks and tonal patterns and produced similar syntactically ambiguous sentences. Their productions reflected syntactically related prosodic phrase breaks and some evidence of unrelated tonal (pitch) accents. The results suggest that prosodic persistence is not limited to rate and that productions include both structurally related and structurally unrelated prosodic cues.

(5014)

**Memory Improvement for Popular Music With Wide-Awake Listeners.** W. J. DOWLING, *University of Texas, Dallas*, & BARBARA TILLMANN, *CNRS-UMR 5020, Lyon*—We earlier found improvement in memory for phrases of classical minuets over filled delays of up to 30 sec (*Music Perception*, 2001). Here, we replicate that study, using Ottmar Liebert's guitar music. On each trial, listeners heard the beginning of a piece, with a target phrase near its start. The piece continued for 3, 6, 12, or 24 sec, after which there was a "beep" and a test item: a copy of the target (T), a similar lure (S) sharing the target's melodic contour, or a different phrase (D). We assessed memory in terms of both fine T/S discrimination and grosser T/D discrimination. As before, T/S discrimination improved with increasing delay. This

improvement was stronger and occurred over a longer time period near the peak of listeners' circadian rhythm (vs. far from the peak). These results contrast in detail with the pattern of improvement found with poetry.

(5015)

**Skilled Memory in Cello Performance: A Case Study.** ROGER CHAFFIN & TOPHER LOGAN, *University of Connecticut*, & TANIA LISBOA, *Royal College of Music*—Skilled memorists use familiar structures to organize memory for new material. For musicians, these structures include mappings of harmonic relationships onto the spatial layout of notes on a key- or fingerboard and onto patterns of movement involved in playing. We observed the practice of an experienced cellist (the third author) learning the Prelude from J. S. Bach's Suite No. 6 for solo cello. The cellist recorded her practice, commenting on the process as she played, and gave detailed reports of decisions about technique (e.g., bowing, fingering) and interpretation (e.g., phrasing, dynamics). In sessions in which the location of starts and stops during practice indicated that fingering and bowing were an important focus, the cellist's comments revealed that she organized her conceptual memory for the music in terms of repeated patterns of fingering and bowing. These kinesthetic/visual/spatial patterns provided the chunks from which memory for the piece was built.

(5016)

**Specifying the Flexible Mental Representation Used in Jazz Improvisation.** HELGA NOICE, *Elmhurst College*, ROGER CHAFFIN, *University of Connecticut*, TONY NOICE, *Indiana State University*, JOHN M. JEFFREY, *Elmhurst College*, & JAMES PELLETIER, *University of Connecticut*—We report a study of a jazz pianist learning a new piece for subsequent improvisation. The pianist recorded the two sessions during which he practiced the piece while concurrently generating think-aloud protocols. Subsequently, he was provided with an analysis framework previously used for classical music. This called for written reports of decisions made and features attended to during practice (e.g., fingering, rhythm, phrasing). Regression analyses, relating these features to starts, stops, and repetitions during practice, indicated the aspects of the piece to which he had devoted attention. Content analysis indicated which aspects had been the focus of problem-solving efforts. Guided by his knowledge of structurally similar tunes, the pianist focused on basic aspects (e.g., rhythm) in Session 1 and interpretation (e.g., phrasing) in Session 2. The resulting mental representation was malleable, allowing for both the inspiration of the moment and the use of favorite types of variations (the pianist's bag of tricks).

• ASSOCIATIVE LEARNING •

(5017)

**Implicit Mediation in Rote Rehearsal Learning.** ROBERT J. CRUTCHER, *University of Dayton*—When asked to learn unfamiliar material, using rote rehearsal, can learners employ implicit mediation techniques? Previous research (Crutcher, 2002) comparing keyword method instructed subjects (e.g., learning *cabra*–*goat* using the keyword *cab*) with free strategy controls showed that control subjects frequently reported the use of keyword mediators in learning Spanish–English vocabulary pairs. The present study sought to extend this work by comparing keyword-instructed subjects with subjects required to learn vocabulary pairs by using rote rehearsal. The keyword method group recalled significantly more pairs than did the rote rehearsal group. However, for correctly recalled items, both groups relied on keyword-mediated retrieval, as evidenced by an interference paradigm. Vocabulary items for which new associations to previously supplied (or implicitly accessed) mediators (e.g., *cab*–*flower*) were learned produced longer recall latencies than did control items for which no new keyword associations were learned. These results strongly suggest that rote rehearsal subjects can employ implicit mediation techniques while rehearsing.

(5018)

**Retrieval-Induced Forgetting as a Function of Intermediate Retrieval Task.** DAVID P. YELLS, *Utah Valley State College*, & KENNETH A. DEFFENBACHER, *University of Nebraska*—Retrieval-induced forgetting (RIF) was investigated in three experiments using a recognition memory task and a variety of intermediate retrieval tasks. Participants were presented with a 15-item study list composed of unrelated concrete nouns. This was followed either by a distractor task or by a task that required participants to retrieve a subset of study list items. RIF was observed for participants who had retrieved a subset of study list items on the basis of their ink color. RIF was not observed for participants who had retrieved a subset of study list items with a particular initial letter or who had retrieved items that completed particular sentences. These results amplify our contention that occurrence of RIF in an episodic memory paradigm depends on the nature of the study items, the intermediate retrieval task, and the final memory test.

(5019)

**Episodic Word List Recall in Normal Aging.** JONATHAN E. PEELLE, JULIE D. GOLOMB, KELLY M. ADDIS, MICHAEL J. KAHANA, & ARTHUR WINGFIELD, *Volen National Center for Complex Systems, Brandeis University*—Episodic memory research has long involved participants recalling random word lists either in any order (free recall) or in the order presented (serial recall). The contrast between the effects of free recall and those of temporal order requirements of serial recall has not been fully investigated in older adults, a population known to exhibit decreased memory performance. Young and older (>65 years old) adults were presented with random lists of 10 nouns with instructions for either free or serial recall. Overall, recall levels and output patterns were similar for young and older adults. However, for the serial recall task, older adults were less likely than young adults to make correct forward transitions. In addition, older adults were more likely to include intrusions in their recall. Taken together, the results suggest that older adults' overall organization is similar to that of young adults but that they are less effective at preserving temporal order.

(5020)

**Investigating Semantic Inhibition Using a Modified Independent Cue Task.** KENNETH L. CARTER, *University of Southern Indiana*, & GEORGE KELLAS, *University of Kansas* (sponsored by George Kellas)—The present research extends the work of Anderson and Spellman (1995). We modified the independent cue technique and adopted the use of meaningfully related pairs selected from associative norms, instead of category cue/exemplar sets. Experiment 1 minimized episodic competition and established that preexisting or semantic competition is sufficient to initiate semantic inhibition. Experiment 2 sought to minimize episodic activation of to-be-inhibited items in general. Results of Experiment 2 successfully established semantic inhibition of meaningfully related associates in memory in the absence of previous episodic activation. Overall results indicate that, under appropriate conditions, semantically related information in long-term memory that has the potential to compete for recall processes is subject to inhibition, even if it has not recently been episodically activated.

(5021)

**Does Exposure to Information That is Known as False Impede Correct Knowledge?** PIERRE PERRUCHET, ARNAUD REY, & EIMERIC HIVERT, *LEAD-CNRS, Université de Bourgogne*, & SÉBASTIEN PACTON, *Université René Descartes, Paris*—To assess whether exposure to potentially interfering information generates interference even if this information is known to be false, we looked at the effect of lures in a yes/no recognition test for previously learned paired associates. In Experiment 1, the lures had a deleterious impact on the accuracy and the speed of responses to previously learned arbitrary associations between visual symbols and auditory syllables. This effect was found to be identical for the three levels of training that were explored, and furthermore, in Experiment 2, the same effect

was observed for overlearned small multiplication facts. These results are discussed in the context of research on the role of error in learning, on the one hand, and studies on false memories, on the other hand.

(5022)

**All or None: The Effect of Serial Repetition on False Recognition.** JOHN P. TAYLOR, SARA HABER, JESS REIS, & WILLIAM P. WALLACE, *University of Nevada, Reno* (sponsored by William P. Wallace)—The DRM false recognition effect (study lists consisting of the words THREAD, EYE, HAYSTACK, etc. lead to high false recognition of NEEDLE) is a robust phenomenon. The present experiment sought to diminish this effect by using one, three, or eight serial repetitions of study lists. At test, participants rated number of times they saw the word (0 corresponded to a response of *new*). Results indicated that after eight presentations, the false recognition effect persisted, although at a significantly reduced level, and that the effect may be all or none. That is, when participants judged that a critical lure for an eight-repetition list was old, the frequency rating to the lure was higher, as compared with one- and three-repetition lists. However, the proportion of old judgments to eight-repetition lures was above those to weak associate lures and unrelated controls but substantially lower than old responses to critical lures for one- and three-repetition lists.

(5023)

**Piece-Wise Repeated Measures Poisson Regression Illuminates Time Course of Differential Outcomes Effect in Adult Humans.** LEH WOON MOK, *Nanyang Technological University* (sponsored by J. Bruce Overmier)—When outcomes/feedback are uniquely correlated with each type of correct choices in the conditional discrimination choice task, animals, children and mentally challenged adults have been found to learn better, faster, and/or to a higher asymptote than when outcomes are nonspecific to correct choice responses. This is the differential outcomes effect (DOE). Here, the DOE was demonstrated in normal human adults, using a novel concurrent-task within-subjects design and biologically neutral rewards. Demonstrating the DOE in normal adults posed a set of peculiar challenges, because the benefit afforded by outcome-specific expectancies peaked early in training. In addition, the anticipated faster learning by application of differential outcomes, rather than a single common outcome, was most evident at the very beginning of training. These significant results were obtained only when trials were grouped into small sequential time blocks giving number correct nonnormal count data that were piece-wise modeled using repeated measures longitudinal Poisson regression.

• FALSE MEMORIES •

(5024)

**Encoding Context Effects on False Memories: Deep Versus Generative Processing.** MICHAEL T. CARLIN, *University of Massachusetts Medical School*, MICHAEL P. TOGLIA, *SUNY, Cortland*, YVONNE WAKEFORD, *Tufts University*, CHARLES A. GOODSSELL, *University of Alabama*, & LISA E. HASEL, *Iowa State University*—With the DRM false memory paradigm, previous research has indicated that deeper processing leads to increased memory for old items and increased false memories, whereas generative encoding contexts lead to higher true memory rates without increases in false memories. Comparisons of deep and generative encoding are problematic, however, because the two effects are based on comparisons with differing control conditions (shallow vs. read). This study compared true and false recognition across deep, shallow, generate, and read encoding contexts. Results replicated the “no-cost” pattern for generate versus read conditions. For levels of processing, deeper processing led to increased recognition of old items, without an increase in false memories. Direct comparison of deep and generate conditions indicated that deep processing led to greater recognition of targets, with only a slight increase in false memories. Distinctions between deep and generative processing and the implications for theories of false memory will be discussed.

(5025)

**The Modality Effect on False Memory: Now You See It, Now You Don't.** REBEKAH E. SMITH, *University of North Carolina, Chapel Hill*, R. REED HUNT, *University of North Carolina, Greensboro*, & PATRICK GALLAGHER, *Wake Forest University*—High levels of memory errors can be produced in a paradigm in which participants study a list of words—e.g., *candy, sugar, bitter*—that are all highly associated with nonpresented critical words—for example, *sweet* (Deese, 1959; Read, 1996; Roediger & McDermott, 1995). Participants often falsely recall or recognize the nonpresented critical items. Smith and Hunt (1998) found that visual presentation of the study list reduced, relative to auditory presentation, the likelihood of false remembering in this paradigm. The effect of modality on false memory has been replicated by other researchers (e.g., Cleary & Greene, 2002; Gallo, McDermott, Percer, & Roediger, 2001; Kellogg, 2001). However, the size of the modality effect can vary (e.g., Gallo, et al., 2001), and in one experiment, visual presentation did not reduce false recognition, relative to auditory presentation (Maylor & Mo, 1999). The present experiments investigated possible boundary conditions of the modality effect in false memory.

(5026)

**The Role of Encoding in False Memories With the Misinformation Paradigm.** YOKO OKADO & CRAIG E. L. STARK, *Johns Hopkins University*—False memories are frequently demonstrated using the misinformation paradigm, in which a person's recollection of a witnessed event is altered after exposure to misinformation about the event. Here, five behavioral experiments using this paradigm with varying retrieval cues (original, misinformation, or novel item) on recognition/cued recall memory tests showed that a simple model based on the probability of encoding predicted the distribution of responses across experiments, regardless of the different retrieval cues. In addition, encoding the original and the misinformation events in separate experimental contexts had no effect on false memory rates. Furthermore, fMRI results showed that the strength of neural activity during encoding, particularly in the left hippocampus, predicted subsequent true and false memories. Together, these results suggest that the strength of encoding of the original and the misinformation events together predict what is later remembered, and it is during the retrieval process that distortions and misattributions of memories occur.

(5027)

**Imagery, Pictures, or Rehearsal: The Interplay of Encoding Processes in Determining False Recall.** DESIREE BUDD, MICHAEL DONNELLY, KIMBERLY SCHULTZ, KRISTIE LONSDORF, ROB SCHWEISTHAL, & PETE ZIOLKOWSKI, *University of Wisconsin, Stout*—The effect of type of encoding process on false recall of theme-related associates was examined. Participants were shown two lists of words, each containing items associated with a theme (e.g., kitchen), but in which words highly related to the theme (e.g., stove) were not present. Either participants were given rehearsal instructions (repeat each word until the next word appears) or imagery instructions (create a mental image of each word), or they were shown a picture of the item named by the word. Preliminary analyses (15 participants per group) indicate that the imagery group recalled more words from the memory list than did the rehearsal and the picture groups and that participants in the rehearsal group were more likely to falsely recall theme-related words not on the memory list than were either the imagery or the picture group. We believe that these results can be accounted for by item-specific versus relational encoding processes.

(5028)

**False Memories and Level of Processing: Effect of Personally Relevant Processing on the Development of Illusory Memories.** JENNIFER L. TOMES, *Mount Allison University*—This study explored the effect of level of processing on the generation of false memories, using DRM word lists. The “more is less effect” suggests that processing that leads to better retention of words from the lists also leads to in-

creases in false memories for nonpresented critical lures. In the present study, participants were asked to make different types of judgments about words presented to them. Specifically, they either were asked to count the number of vowels in each word (shallow processing) or to decide whether the words were personally meaningful (deep processing) or were not given any instructions about the manner in which they should process the words on the list. As was expected, deep processing led to greater memory for words. However, counter to the predictions of the “more is less” effect, deep processing that involved judgments with respect to the self, rather than a more semantically oriented task, did not increase the number of false memories generated.

(5029)

**Self-Generation Improves Memory Accuracy in a False Recognition Paradigm.** RAYMOND W. GUNTER & GLEN E. BODNER, *University of Calgary*—We examined whether self-generation at study and/or at test can increase correct recognition while decreasing false recognition in the Deese/Roediger–McDermott paradigm. Correct recognition was enhanced by generating list words at study from anagram cues, relative to simply reading list words, under some conditions. False recognition was substantially reduced by generation at study; generating again at test produced only a modest additional reduction in false recognition. In a within-subjects experiment, participants indicated their basis for making recognition decisions. Participants appear to have used a distinctiveness heuristic in which they attempted to recollect solving an anagram for each word on the test to guide their recognition decisions.

(5030)

**Aging Effects on Source- and Gist-Based False Recognition.** BEN-TON H. PIERCE, DAVID A. GALLO, & DANIEL L. SCHACTER, *Harvard University*—Prior research indicates that aging impairs source memory, leading to greater source-based false recognition, relative to younger adults. Aging also leads to greater false recognition based on semantic similarity or gist information. In this study, we examined age differences in both types of false recognition. Younger and older participants studied several lists of associated words printed in blue, along with several lists of unrelated words printed in either red or blue. They were then given an exclusion memory test in which they accepted only words studied in blue. Even though our groups were equated on source discrimination, older adults made substantially more gist-based errors than did younger adults. In a second experiment, we examined whether source monitoring makes older adults more susceptible to gist-based false recognition or makes younger adults less susceptible.

(5031)

**Activating the Critical Lure During Study Is Unnecessary for False Recognition.** RENÉ ZEELENBERG, *Erasmus University, Rotterdam*, INGE BOOT, *University of Leiden*, & DIANE PECHER, *Erasmus University, Rotterdam*—Subjects studied lists of nonwords (e.g., *froost*, *floost*, *stoost*) that were orthographically–phonologically similar to a nonpresented critical lure, which was also a nonword (e.g., *ploost*). Experiment 1 showed a high level of false recognition for the critical lure. Experiment 2 showed that the false recognition effect was also present for forewarned subjects who were informed about the nature of the false recognition effect and were told to avoid making false recognition judgments. The present results show that false recognition effects can be obtained even when the critical lure itself is not stored during study. This finding raises problems for accounts that attribute false memories to implicit associative responses or spreading activation but is easily explained by global familiarity models of recognition memory.

(5032)

**Distinctive Information and False Recognition: The Contribution of Encoding and Retrieval Factors.** JASON ARNDT & JACOB CARNEY, *Middlebury College*—Two experiments evaluated the influence

of encoding-based and retrieval-based factors in the production of false recognition. The contribution of these factors was evaluated by varying both the presentation characteristics of items at study (i.e., the association of unusual fonts with study items) and the presentation characteristics of test items (both studied and unstudied). The results of both experiments suggest that the effects of presenting study items in unusual fonts are largely due to encoding factors, but also suggest a smaller influence of retrieval-based factors in the production of false recognition. Retrieval-based factors, however, do not appear to moderate the effects of distinctive visual presentation, again supporting the primacy of encoding-based factors over retrieval-based factors in producing false recognition.

• METAMEMORY •

(5033)

**Use of Inferences in Source Monitoring.** JESSICA L. KLUG & NANCY FRANKLIN, *SUNY, Stony Brook*—People often encode inferences along with information that is explicitly presented to them, and this information can later be retrieved along with the presented information. The present work examines the role that inferences of this sort may play in source monitoring. Traditional studies in the literature have directly manipulated similarity between sources and have shown that such similarity impairs people’s ability to determine which source had previously been associated with a message or action. We examine whether self-generated inferences are used in source monitoring, by capitalizing on the social psychological phenomenon known as the out-group homogeneity effect. Members of one’s in-group are viewed as more diverse, whereas members of a given out-group are viewed as more homogeneous. Sources were presented as either two 20-year-olds (in-group members) or two 80-year-olds (out-group members). Source monitoring was worse for the out-group sources, supporting the hypothesis that inferred similarity increases source-monitoring difficulty.

(5034)

**Limiting Attentional Resource Influences Performance and Output Monitoring of an Event-Based Prospective Memory Task.** ERIKO SUGIMORI & TAKASHI KUSUMI, *Kyoto University*—We investigated how limiting attentional resources would influence event-based prospective memory (PM) performance and output monitoring of performing the task. In Experiment 1, participants performed a high- or low-demand secondary task while performing a PM task. The high-demand task lowered PM performance. Also, the high and low conditions showed different biases in output monitoring. In the high condition, participants were more likely to say that they did not respond toward the targets even though they did. In the low condition, participants were more likely to say that they did respond toward the targets even though they did not. In Experiment 2, participants practiced responding toward targets before a PM task. The practice did not affect PM performance; however, it affected output monitoring. In the low condition, participants increased the tendency to say that they did respond as the amount of practice increased. These results were discussed on the basis of metamemory and working memory capacity.

(5035)

**Monitoring False Recognition on Criterial Recollection Tests: Distinctiveness Heuristic Versus Criterion Shifts.** DAVID A. GALLO, JONATHAN A. WEISS, & DANIEL L. SCHACTER, *Harvard University*—Across several tasks, studying pictures elicits lower false recognition than does studying words. We devised criterial-recollection tests to understand why. Subjects studied unrelated words in black letters, paired with the same word in red letters, a picture, or both. Black words were presented at test, and subjects decided whether they had studied a corresponding red word (the red word test) or a picture (the picture test). This design preempted a recall-to-reject exclusion strategy, so that subjects had to rely on memory for the criterial format. We found that, regardless of whether red words were made more or less familiar than pictures (via repetition), false recog-

niton was lower on the picture test. This pattern cannot be explained easily by familiarity-based criterion shifts. More likely, subjects reduced false recognition by expecting more detailed recollections for pictures (a distinctiveness heuristic). We propose that, in addition to recall-to-reject and familiarity criteria, recollective expectations contribute to recognition memory decisions.

(5036)

**Confidence and Accuracy for Deceptive and Nondeceptive Semantic Information.** WILLIAM F. BREWER & CRISTINA SAMPAIO, *University of Illinois, Urbana-Champaign*, & M. ROSE BARLOW, *University of Oregon*—In previous research, we have examined the relation of confidence and accuracy for nondeceptive and deceptive information in a variety of episodic sentence memory tasks. The present experiment extends our approach to the study of semantic memory. Deceptive items made use of mental map distortions. A deceptive item was “Venice, Italy is south of Toronto, Canada” (false). A nondeceptive item was “Baghdad, Iraq is south of Kiev, Ukraine” (true). Participants made true/false and confidence judgments. Participants were well calibrated for nondeceptive items, with high correlations between mean item accuracy and mean item confidence. For deceptive items, the confidence accuracy relationship actually reversed, with a high negative correlation between mean item accuracy and mean item confidence. The data support our hypothesis that, for nondeceptive items, confidence is typically well calibrated but that, for deceptive items, the confidence accuracy relation is disrupted and may even reverse, as in the present experiment.

(5037)

**Illusions of Knowing: Dissociating Metamemory and Memory Under Conditions of Retroactive Interference.** DEBORAH K. EAKIN, *Georgia Institute of Technology*, & THOMAS A. SCHREIBER & SUSAN J. KEMPER, *University of Kansas*—In the typical retroactive interference (RI) paradigm, people study a list of cue–target pairs and then are presented with the cue and asked to recall the target with which it was paired. Prior to recall, people study a second list on which either the cue is re-paired with another target (interference) or a completely new cue–target pair (control) is presented. The finding that recall is lower for the interference, relative to the control, condition is known as the RI effect. Both memory and metamemory were examined using the RI paradigm in two experiments. The findings indicate that RI effects were obtained even when retrieval blocking was isolated. In addition, memory and metamemory were dissociated. People gave more positive predictions in the interference condition, particularly when they could not recall the target, thereby evidencing an illusion of knowing. Three competing hypotheses concerning the source of metamemory predictions will be discussed.

(5038)

**Genes and Cognitive Strategies: A Think-Aloud Study of Strategy Use in Identical and Fraternal Twins.** ROY W. RORING, KIRUTHIGA NANDAGOPAL, ANDERS K. ERICSSON, & JEANETTE E. TAYLOR, *Florida State University*—In many cognitive tasks, such as sentence–picture verification, individual differences in strategies explain a large portion of the variability in performance. Our ongoing study instructs identical and fraternal twins (around 50 tested individuals by November 2004) to think aloud while solving tasks from four different domains measuring short-term memory, long-term memory, estimation, and linguistic processing, to assess processes involved in strategy selection and strategy use and to estimate the respective heritabilities. We also administer tests of general knowledge, spatial ability, and speed of processing and interview each twin participant separately to describe the development of skilled performance in school and in other domains of activity. We propose tentative statistical models to account for preliminary estimates of heritabilities of strategy selection and of overall task performance. The heritabilities for the four task domains are related to jointly acquired skills due to shared developmental history and similarity in more basic cognitive capacities.

(5039)

**Metamemory in Adulthood as a Function of the Memory Demands Required in the Profession.** ELISABETH A. M. BACON, *INSERM, Strasbourg*, & NATHALIE HUET, *CNRS-UMR 5551, Toulouse*—The effects of a high memory due to professional activity on the relationship between age and metamemory knowledge and beliefs were analyzed. Two groups of high memory demand professions, actors and teachers, were compared with control participants on scores obtained from the Metamemory Inventory in Adulthood (Dixon et al., 1988). Participants’ ages ranged from 20 to 73. Results showed that regardless of profession, advancing age was associated with lower estimations of self-efficacy but that actors scored higher than the other two groups on the self-efficacy dimension throughout the age range. Furthermore, with advancing age, actors perceived both stability of memory capacity and a higher controllability of their memory, and advancing age, in actors, was associated with a high use of internal strategies. Thus, the intensive use of memory seems to have a specific effect on metamemory knowledge only in the actors’ group.

(5040)

**Intact Metamemory in People With Alzheimer’s Disease.** AYANNA K. THOMAS & DAVID A. BALOTA, *Washington University*—Metamemory is a multifaceted concept that focuses on the interplay between processes of monitoring (evaluation of the cognitive system) and control (selection and execution of cognitive mechanisms). To investigate metamemory in people with Alzheimer’s disease (AD), we compared them with nondemented older adults and younger adults, using an item-by-item judgment-of-learning (JOL) methodology. The focus of this study was to examine whether younger adults, nondemented older adults, and people with AD were similarly sensitive to manipulations of intrinsic factors, such as associative strength between word pairs. We also examined whether all groups would be susceptible to overconfidence, on the basis of a perceived relationship in word pairs. Finally, this study investigated the role of executive function by correlating performance on psychometric batteries with absolute and relative cue recall to JOL calibration. The results suggest that people in the early stages of AD are able to use intrinsic factors to predict future performance.

(5041)

**Aging and Memory Accuracy: Neuropsychological Functioning and Memory Monitoring.** MATTHEW G. RHODES & COLLEEN M. KELLEY, *Florida State University*—Older adults who score low on neuropsychological tests of frontal functioning are often more susceptible to false memories than are younger adults. We examined the role of memory and memory monitoring in this relationship. Older and younger adults were tested in a paradigm (Koriat & Goldsmith, 1996) that permits separate assessments of the quantity of correct responses that can be retrieved, the effectiveness of memory monitoring, and final memory accuracy in free report. Participants were also assessed on measures of executive functioning, working memory, and processing speed. Several models were tested to determine whether executive processes predict individual differences in memory monitoring and memory accuracy. We also assessed whether this relationship is mediated by overall level of memory.

• WORKING MEMORY •

(5042)

**Overcoming the Task Specificity Problem in Pigeon Directed Forgetting.** KAREN L. ROPER & DEVINEY M. CHAPONIS, *Wake Forest University*, & AARON P. BLAISDELL, *UCLA*—Directed forgetting (impaired memory for information designated as to-be-forgotten) using the delayed matching-to-sample (DMTS) memory task with animals has come under significant criticism, largely for failures to equivalently model the phenomenon shown in humans. One problem involves evidence (Grant, 1988) that delay interval forgetting cues are less generalizable or may be very sample specific. When Grant trained pigeons on two DMTS tasks (red and green samples with forget and

remember cues, and blue and yellow samples without delay interval cues), the forget cue did not reduce matching accuracy when transferred to the blue/yellow task. The present study replicated Grant's procedure but trained pigeons with different remember and forget cues for each of the two matching tasks. Significant transfer (directed forgetting) on the alternative task was then shown. This finding parallels the failure of occasion setters to transfer to conditioned stimuli that were not themselves targets of occasion-setting training.

(5043)

**Asymmetrical Sample Training and Retention in Pigeons.** DOUGLAS S. GRANT, *University of Alberta*—Two groups of pigeons were trained in a matching task in which samples involved either colors or lines. After asymmetrical training in which pigeons were initially trained with only one of the two samples, marked retention asymmetries were obtained. Specifically, accuracy dropped precipitously on trials involving the initially trained sample and remained high 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. The same pigeons were then trained with the alternate set of samples mapped to the same comparisons as the original set of samples. Both color and line samples produced retention asymmetries in the color-first group, whereas neither set of samples produced retention asymmetries in the line-first group. Hence, sample salience and rate of acquisition appeared to influence whether the second set of samples was asymmetrically coded.

(5044)

**List Length Effects in Free Recall: A Reexamination of Shiffrin (1970) Using Overt Rehearsal.** LYDIA TAN & GEOFF WARD, *University of Essex* (sponsored by Debi Roberson)—Three experiments investigated the effect of the length of to-be-remembered (TBR) and intervening lists on free recall. Of interest was whether selective rehearsal could account for the previous finding that recall was affected only by TBR list length (Shiffrin, 1970). In Experiments 1 (covert rehearsal) and 2 (overt rehearsal), participants saw 5- and 20-word lists and had to recall the list prior to that which was last presented. In Experiment 3, either one or two lists were presented, and participants were postcued as to which to recall. The proportion of words recalled decreased with increased TBR list length. In addition, extended recency effects were found when recall was replotted by when words were last rehearsed (Experiments 2 and 3), and an effect of intervening list length was found when rehearsal was effectively eliminated (Experiment 3). (Shiffrin, R. M. [1970]. Forgetting: Trace erosion or retrieval failure? *Science*, 168, 1601-1603.)

(5045)

**What's Color Got to Do With It? How Word Color Affects Working Memory.** JULIE B. MORRISON & SCOTT A. WOOD, *Bryant University*—Can color be used as an effective working memory cue? If so, are some colors better cues than others? Previous research has investigated the role of object color on memory; however, the relationship between word memory and color is unclear. Certain colors are used to draw our attention—for example, the color red as used on Web pages, graded papers, and so on. Other colors are ubiquitous and unlikely to stand out (e.g., black). In this experiment, participants studied 15 concrete nouns presented at 5-sec intervals. Word color (black, red, yellow, green, blue) was counterbalanced. After a math filler task, participants recalled the words and their colors. Words colored black were recalled most frequently, followed by words colored red, whereas those colored yellow, green, and blue were recalled the least often. Ongoing research is investigating the role of study instructions (study words vs. words and colors) on recall.

(5046)

**Cognitive Analysis of the Implicit Association Test.** SHAWN R. SINGER, SCOTT D. GRONLUND, & ROBERT A. TERRY, *University of Oklahoma* (sponsored by Scott D. Gronlund)—The Implicit As-

sociation Test (IAT) measures the extent to which an individual subscribes to a given stereotype. Much controversy has surfaced as to the validity of the IAT as a measure of prejudice, attributing IAT scores to a multitude of additional theoretical explanations with moderate success. Two experiments examined the hypotheses (1) that the IAT effect is a result of two, rather than one, processes or psychological constructs, which was revealed by an analysis of RT distribution shapes and (2) that one of these constructs is cognitive ability. The IAT is a cognitively demanding paradigm requiring complex response mappings and, therefore, should correlate with measures of working memory capacity and fluid intelligence.

(5047)

**Repetition, Proactive Interference, and Temporal Order in Prefrontal Cortex.** LAUREN N. BRUSH & BRADLEY R. POSTLE, *University of Wisconsin, Madison* (sponsored by Keith Kluender)—A critical contribution of the prefrontal cortex (PFC) to working memory function is the evaluation of memory probes on tests of recognition. Although the magnitude of the release from proactive interference (PI) on the Brown–Peterson task is insensitive to whether there was repetition of individual items among prerelease memoranda, delayed recognition performance of patients with PFC lesions can depend upon whether or not items are recycled as memoranda. We will use functional magnetic resonance imaging (fMRI) to examine the effects of item repetition across trials, in order to assess whether the PFC's role in detecting and mediating the effects of such item repetition is the same as or different from that region's role in the mediation of PI.

(5048)

**Neural Correlates of Prospective and Working Memory.** ROBERT WEST & RITVIJ BOWRY, *University of Notre Dame*, & JASON KROMPINGER, *University of Pennsylvania*—Event-related brain potentials (ERPs) were used to examine the costs of working and prospective memory load on the neural correlates of prospective memory and working memory. The ERP data revealed several interesting results: Distinct modulations of the ERPs were elicited by *N*-back targets and prospective cues, *N*-back load modulated the amplitude of the N300 elicited by prospective cues, prospective load was associated with a broadly distributed sustained modulation that began shortly after stimulus onset, and brain–behavior correlations between the neural correlates of prospective memory and working memory varied with the working memory demands of the ongoing activity. These findings indicate that increasing the working memory demands of the ongoing activity disrupts attentional processes that support cue detection and that the prospective interference effect arises from the need to maintain the intention over the course of task performance.

(5049)

**Aging, Interhemispheric Collaboration, and Individual Differences.** ERIN ANDERSON, CHRIS BARRETT, & MARIANA YAMASHIRO, *California State University, Fullerton*, MAHEEN M. ADAMSON, *University of Southern California*, BARBARA J. CHERRY, *California State University, Fullerton*, & JOSEPH B. HELLIGE, *University of Southern California*—Evidence suggests that corpus callosum function diminishes with old age and may have consequences for the ability of the left and right cerebral hemispheres to collaborate with each other. In a visual half-field experiment that compared letter matching within and across hemispheres, Cherry et al. (in press) found less efficient across-hemisphere processing in elderly adults than in young adults. At the same time, in the elderly group, the benefit of spreading processing across both hemispheres increased with decreases in the length of an individual's backward digit span. A new experiment was designed both to replicate the group-level age effects and to extend the investigation of individual differences by incorporating a wider range of neuropsychological tests. The pooled results from both experiments are used to clarify the nature of group-level age differences, to examine the robustness of individual differences within both age groups, and to examine the relationship to gender.

(5050)

**Spatial Memory in FEF Visual, Visuomovement, and Movement Neurons.** BONNIE M. LAWRENCE & LAWRENCE H. SNYDER, *Washington University School of Medicine*—The frontal eye field (FEF) is a cortical area involved in the transformation of sensory signals into saccadic commands. Previous research has implicated FEF visual and visuomovement, but not movement, neurons, in spatial memory. We revisited the role of FEF cell types in spatial memory, recording from 87 neurons in a delayed saccade paradigm. Significant delay period activity was found in the population of visual and visuomovement neurons, but not in the population of movement neurons. Paradoxically, however, the incidence of significant delay activity in individual movement neurons was equal to or greater than that in individual visual and visuomovement neurons. This paradox was reconciled by the finding that individual movement neurons consisted of excitatory and inhibitory subtypes, the combination of which resulted in the near cancellation of delay activity across the population of movement neurons. This cancellation of activity may be an important mechanism by which planned saccades are inhibited in FEF.

• INHIBITORY PROCESSES IN ATTENTION •

(5051)

**Attentional Blink Induces Order Illusion.** HIROYUKI TSUBOMI & NAUYUKI OSAKA, *Kyoto University*—When four letters are repeatedly presented by RSVP procedure with decelerating manner (gradually increasing duration of exposure), observers often make order errors despite intactness of letter identification (Holcombe, Kanwisher, & Treisman, 2001). It has been argued that the order illusion is caused by failure to direct attention to an arbitrary initial item that bears no saliency. However, in Experiment 1, we found a robust order illusion in the condition where one of four letters involved high saliency. In Experiment 2, we found that identification of a letter during deceleration impaired order perception within about 500 msec. These results suggest that the order illusion is caused by temporal limits of visual attention, the same underlying mechanism as an attentional blink.

(5052)

**High Overlap Between T1 and T2 Reduces the Attentional Blink Effect.** DOMINIC CHARBONNEAU & DENIS COUSINEAU, *Université de Montréal* (sponsored by Michèle Robert)—In a rapid serial visual presentation task, the accuracy for detecting a second target when a first one is correctly reported is lower for lags of 200–500 msec between the targets. This effect is called attentional blink (AB). Jolicœur (1998) postulated a bottleneck model in which the encoding of each target in memory is serial. This causes a slack in the processing of the second target while the first is being processed. During this delay, the second target decays. Decreasing this slack should reduce the AB effect. We show that increasing the overlap between the pixels of the two targets reduces the AB effect. Yet, in a perceptual identification task, targets overlapping with foils are more difficult to identify. This paradoxical effect is explained by the bottleneck model.

(5053)

**Performance Feedback Can Attenuate the Attentional Blink.** PAUL HAERICH, *Loma Linda University*—In two experiments using a standard attentional blink paradigm, subjects identified the white letter and indicated whether an X had been presented among a stream of black letters (16-msec duration, 66-msec SOA). Trial-by-trial feedback on performance was provided to (or withheld from) subjects as an independent variable. If information is available from perceptual analyzers for stimuli presented during the blink, it was expected that it could be used to improve performance. In the first experiment, the attentional blink (appearing as a lag  $\times$  single-/dual-task interaction) was observed in the group receiving no feedback. However, although performance was reduced during dual-task, as compared with single-task, trials, the feedback group did not produce an observable attentional blink. In the second experiment, the effect of feedback was

replicated in a within-groups design. These experiments demonstrate that subjects can learn to use information from stimuli presented during the attentional blink for valid response selection.

(5054)

**Exogenous Setting of Target Filters in the Attentional Blink Paradigm.** ILSE M. VERSTIJNEN, *University of Utrecht*, ADDIE JOHNSON & SANDER MARTENS, *University of Groningen*, & VANESSA DE GRAAF, *University of Utrecht* (sponsored by Addie Johnson)—Attentional set models propose that the deficit in reporting the second of two targets presented about 200–500 msec apart in a stream of distractors can be attributed to the need to reset an endogenous control mechanism when a distractor intervenes between the two targets. A critical assumption of at least one such model is that the system can be held in the appropriate state for processing the first target (T1). We present evidence from experiments in which target and distractor orientations were varied that shows that leading distractors do affect the attentional set for T1, as does T2 when T2 directly follows T1. Moreover, the improvement in T2 identification that was found when both targets had the same orientation did not interact with lag, as had been predicted. That is, the effect of congruency between T1 and T2 was not always greater when there were no intervening distractors than when there were.

(5055)

**The Effects of Inhibition of Return on the Information-Processing Dynamics of “What” and “Where.”** JASON IVANOFF, *Vanderbilt University*, & RAYMOND M. KLEIN & TRACY L. TAYLOR, *Dalhousie University*—Inhibition of return (IOR) is characterized by slowed responses to targets presented at peripherally cued locations. IOR is believed to function to facilitate search to new locations by inhibiting locations that had once been attended. At present, very little is known about the underlying dynamics of IOR’s negative effect upon target processing. Using a response signal speed–accuracy tradeoff methodology—in the context of go/no-go, discrimination and localization tasks—we unveiled multiple effects of IOR: (1) reduced sensitivity to the task-relevant feature of the target, especially prominent with relatively prolonged viewing of the target; (2) raised criterion for cued targets when little target information was available; (3) increased sensitivity to the task-irrelevant spatial feature of the target; and (4) decreased anticipatory responding. We suggest that an early bias component to IOR may underlie the sensitivity decrease at the cued location by diverting attention toward novel locations.

(5056)

**Object- and Location-Based Inhibition of Return in Younger and Older Adults.** JIM MCAULIFFE, *Lakehead University*, & ALISON L. CHASTEEN & JAY PRATT, *University of Toronto*—Location-based inhibition of return (IOR), with cues and targets occurring in static placeholders, has been found with approximately equal magnitude in both younger and older adults. However, unlike younger adults, older adults do not show object-based IOR with dynamic placeholders, possibly due to processing costs associated with tracking moving objects. In the present experiment, location- and object-based IOR was examined between age groups, using static displays. This was done by using displays in which the placeholders were either present (location + object) or absent (location only). Both younger and older adults showed location-based IOR, but the older adults failed to show object-based effects, thus indicating that changes in object-based IOR with age cannot be due solely to age-related deficits in processing motion.

(5057)

**Inattention Blindness to Changed Objects and New Objects.** YU-CHIN CHAI, *University of Texas, Arlington*, & ANNE P. HILLSTROM, *George Mason University*—It can be difficult to detect a change to an object. It depends in part on whether the change is large enough to be interpreted as the appearance of a new object (Rauschenberger, 2003). Our research used a different methodology, the inattention blindness paradigm, to look for converging evidence. People looked for a transient tar-

get change (in most experiments, a luminance change) in a single rotating object. After practice, an unexpected event, either another change to the existing object or the appearance of a new object, was introduced on a single trial. Factors that affected detection of the unexpected change were (1) whether it was the appearance of a new object or a change to the existing object, (2) similarity of the unexpected change to the target change, and (3) distinctiveness of the unexpected change. This is discussed in relation to perceptual constancy and attentional capture.

(5058)

**Cognitive Control and Personality in Emotion-Induced Blindness.** STEVEN B. MOST & MARVIN M. CHUN, *Yale University*, & DAVID H. ZALD, *Vanderbilt University*—Preferential attention to irrelevant emotional stimuli can cause temporary blindness even for targets that people search for (Most et al., 2003). Does this reflect an automatic tendency, or can people exercise control over such emotion-induced blindness, and could personality modulate such cognitive control? We hypothesized that specific knowledge about target-identity would aid in ignoring emotional stimuli, thus reducing emotion-induced blindness. People searched for a specific (building) or nonspecific (building or landscape) RSVP target, which followed an irrelevant neutral or negative picture. Consistent with our hypothesis, people were less susceptible to emotion-induced blindness in the specific-target than in the nonspecific-target condition, but this reduction occurred only in people scoring low in harm avoidance. Indeed, a strong inverse correlation emerged between individuals' levels of harm avoidance and the degree to which they could override emotion-induced blindness when given a specific target. Thus, personality and attentional strategy interact to modulate emotion-induced blindness.

• PHONOLOGY IN WORD PROCESSING •

(5059)

**Minimality Principle Reconsidered: Evidence for the Early Use of Elaborated Phonological Representations During Silent Reading.** JANE ASHBY, *University of Massachusetts*, REBECCA TREIMAN & BRETT KESSLER, *Washington University*, ANDREA MARTIN, *Hampshire College*, & KEITH RAYNER, *University of Massachusetts*—The minimality principle (Frost, 1998) claims that readers only use a sketch of assembled phonological information in the process of recognizing written words. Alternatively, readers might construct more complete representations en route to lexical access, including the information that English orthography makes available about a word's likely phonological form. Four studies examined what phonological information is represented in the course of lexical access. Experiments 1 and 2 recorded event-related potentials during a masked priming paradigm to demonstrate effects of syllable congruency in early word recognition that had been shown previously in an eye movement experiment (Ashby & Rayner, 2004). Experiments 3 and 4 used a parafoveal preview eye movement technique to gauge the processing of rime information. Results disconfirm the minimality principle, since they demonstrate that skilled readers use the available information to construct a phonological representation that is as complete as possible in the course of word recognition.

(5060)

**The Effect of Spoken Word Context on Visual Word Recognition.** BRIANNA M. EITER & ALBRECHT W. INHOFF, *SUNY, Binghamton*—The purpose of the study was to demonstrate the independent operation of two functionally distinct phonological codes. The phonological environment in which a lexical decision task (LDT) was performed was manipulated to determine the effects of a spoken word on target processing. The spoken companion was identical, phonologically similar, or dissimilar to the phonological form of the visual target. LDTs were performed more slowly when an irrelevant spoken companion word was phonologically similar to a to-be-classified visual word, and this similarity effect was independent of list composition. However, articulatory suppression eliminated phonological in-

terference, but not semantic interference. Similar results were found using a reading task. Together, the results provide converging evidence for the existence of two independent phonological codes—one used during recognition of a visual target during silent reading, which is followed by the second code, its inner articulation. We propose that one purpose of inner articulation is to help establish word order.

(5061)

**Letter-by-Letter Processing in the Phonological Conversion of Multi-letter Graphemes.** RONALD PEEREMAN, MURIELE BRAND, & ARNAUD REY, *LEAD-CNRS, Université de Bourgogne* (sponsored by Arnaud Rey)—Current models of word reading differ in their descriptions of how print-to-sound conversion is performed. Whereas a parallel procedure is generally assumed, the DRC model developed by Coltheart and colleagues (Coltheart et al., 2001) holds that phonological conversion operates letter by letter, serially from left to right. An interesting aspect of the hypothesized serial procedure is that only the first letter of two-letter graphemes is thought to cause activation of its corresponding phonological code, the second letter of multiletter graphemes being directly merged with the preceding letter to form a complex grapheme. This hypothesis was examined in a task in which participants had to detect target phonemes in visually presented pseudowords. The data suggest that phonological codes associated with all the letters of the multiletter graphemes are activated.

(5062)

**The Time Course of Phonological Interference and Facilitation Effects.** PENNY M. PEXMAN & JENNIFER L. TREW, *University of Calgary*—The process of naming an exception word prime (e.g., PINT) has been shown to delay subsequent naming of a regular word body neighbor target (e.g., TINT). Both an activation account (Taraban & McClelland, 1987) and a learning account (Burt & Humphreys, 1993) have been offered to explain this phonological interference effect. We investigated how long phonological interference effects last (Experiments 1, 2, and 4), using prime–target intervals of 3, 5, 6, 9, 27, and 51 sec. We also explored whether exception word primes can produce facilitation for rhyming exception word targets (e.g., FOOT–SOOT, Experiment 3). We addressed potential problems with control conditions used in previous studies and found that phonological facilitation and interference effects in naming tasks were quite short-lived. Finally, we investigated whether phonological interference and facilitation effects last longer in a more difficult task (phonological lexical decision [does it sound like a word?]; Experiments 5 and 6).

(5063)

**Early Time Course Hemisphere Differences in Phonological and Orthographic Processes.** LAURA K. HALDERMAN & CHRISTINE CHIARELLO, *University of California, Riverside*, & NATALIE A. KACINIK, *University of California, Davis*—A lateralized backward-masking paradigm was used to examine hemisphere differences in orthographic and phonological processes at an early time course of word recognition. Targets (e.g., *rain*) were presented and backward masked by pseudohomophones of the target word (orthographically and phonologically related; e.g., RANE), orthographically related (little phonological similarity; e.g., RAND) or unrelated (e.g., LOKE) nonwords. Participants made two-alternative forced choice responses to a centrally presented target and foil. The foil differed from the target by only one letter. Stimuli were presented to the left visual field/right hemisphere (RH) or the right visual field/left hemisphere (LH), using target/mask durations of 30 or 50 msec. Results revealed that the LH is capable of accessing phonology at the earliest moments of word recognition. The RH, however, showed orthographic access only and showed a greater degree of facilitation, compared with the LH, when nonword masks were orthographically similar to the target.

(5064)

**Phonological Codes Assessed Via Acronym Reading: Evidence From Eye Movements.** TIMOTHY J. SLATTERY, ALEXANDER POLLAT-

SEK, & KEITH RAYNER, *University of Massachusetts*—We examined the effect of acronyms on eye movements in reading. When such acronyms are read, there is a one-to-one correspondence between orthography and phonology not found elsewhere in English. In addition, some acronyms, such as FBI, begin with an orthographic consonant that has a vowel pronunciation. Should *a* or *an* precede such an acronym? If integration of the article with the acronym proceeds phonetically, the acronym FBI should be read more quickly when preceded by *an*. However, the letter F is typically preceded by the article *a*, so if orthography is driving the integration, this should be the more quickly read of the two articles. Participants read sentences such as *He had a meeting with a/an FBI agent yesterday* while their eye movements were recorded. First-fixation durations for the combined article/acronym region were shorter when the article agreed with the pronunciation of the first letter of the acronym.

(5065)

**Nonword Recognition: Orthographic and Phonological Neighborhoods' Density Effects.** CLAUDIO MULATTI & REMO JOB, *Università di Trento*, & DEREK BESNER, *University of Waterloo* (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 slower the nonwords are rejected in an LD task. It is assumed that this effect is orthographic in nature, but this conclusion is premature given that orthography and phonology are correlated. The present work manipulates nonword orthographic and phonological neighborhood density in an LD task. The results are discussed in the context of an interactive activation framework.

(5066)

**Phonological Neighborhood Facilitates Written Word Processing.** MARK YATES, *University of South Alabama*, & LAWRENCE LOCKER, JR. & GREG B. SIMPSON, *University of Kansas*—The investigation of how phonology influences written word processing has received considerable attention but remains equivocal. The research reported here used phonological neighborhood to investigate the impact of phonology on visual word processing. Phonological neighborhood has been used extensively in the area of spoken word processing but has been relatively ignored in terms of written word processing. A phonological neighbor was defined as a word that had the same number of phonemes as the target word but differed by one phoneme substitution. The results of three experiments show that words with many phonological neighbors were processed more rapidly in the lexical decision, naming, and semantic categorization tasks than were words with only a few phonological neighbors. This facilitative effect of phonological neighborhood on written word processing will be discussed in terms of current models of visual word recognition.

• SEMANTIC PROCESSING OF WORDS •

(5067)

**Behavioral and Electrophysiological Effects of Relatedness Proportion on Masked Associative Priming.** GIORDANA GROSSI, TERESSA DEL SANTO, JOANNA DOERFER, JENNIFER EARLE, & AMERTAH PERMAN, *SUNY, New Paltz* (sponsored by William Prinzmetal)—The effect of relatedness proportion (RP; percentage of related words in a list) on associative priming was investigated in two masked priming experiments. In Experiment 1 (lexical decision), 40 subjects were randomly assigned to either a high (80%) or a low (20%) RP condition. Semantically related and unrelated primes were briefly flashed (50 msec) before the targets (500 msec) and were preceded by a mask that prevented their overt identification. In Experiment 2, twenty subjects were tested in both RP conditions in a categorization task; the N400, an electrophysiological index of lexical integration, was measured in trials that did not require a buttonpress. The results show that the priming effect was not modulated by RP in terms of reaction times or N400 amplitude. The results are discussed in terms of current theories of associative priming.

(5068)

**Investigating the Nature of Stimuli Differences in Mediated Priming.** KAY L. LIVESAY, *Linfield College*—Mediated priming (MP) is a reliable effect that is sensitive to a range of experimental conditions (Balota & Lorch, 1986). Livesay and Burgess (1998) showed the MP effect to be carried by mediated prime–target pairs that are likely to be experienced in a common context (CC). Context inconsistent (CI) pairs, pairs that are not as likely to be experienced in a CC, show no reliable MP. The categorization of the mediated pairs into CC and CI is both methodologically and theoretically important. The present experiment attempts to further validate the CC/CI stimuli separation. Participants were given mediated prime–target pairs and were asked to produce a word that would connect the two words (e.g., LION \_\_\_\_\_ STRIPES; the answer is TIGER). Correct item production frequency was found to be negatively correlated to reaction time to mediated prime–target pairs. Furthermore, CC items maintained this strong negative correlation, whereas CI items showed no reliable correlation. These results reaffirm the separation of the CC/CI pairs.

(5069)

**Semantic Inhibition of Return.** ULRICH W. WEGER & ALBRECHT W. INHOFF, *SUNY, Binghamton*—Inhibition of return (IOR) denotes the phenomenon that uncued targets are identified more quickly than cued ones. IOR is commonly defined as a spatial phenomenon, but recent evidence suggests that it occurs in other domains as well, such as lexical and semantic processing (Fuentes, Vivas, & Humphreys, 1999). Studies investigating semantic IOR (according to which related words are processed more slowly than unrelated ones) have used only a small number of categories and often have varied a spatial dimension along with a semantic one. The present research follows up on those previous experiments but varies the semantic and spatial dimensions independently. Three experiments show that semantic IOR is a robust phenomenon even under conditions where no spatial variation occurs. However, the results also show that semantic IOR occurs only when there is considerable repetition of a small set of stimuli and that there is robust *semantic facilitation of return* in the absence of item repetition.

(5070)

**A Comparison of Semantic, Nonsemantic, and Production Effects in Auditory Word Naming.** SEAN R. SEAMAN & LEE H. WURM, *Wayne State University* (sponsored by Lee H. Wurm)—Several semantic variables have been found to influence response times in word naming, including concreteness, animacy, polysemy, danger, and usefulness. These variables appear to have relationships with reaction times similar to those of nonsemantic variables, such as frequency and neighborhood density, as well as those of production variables, such as place of articulation. Although the naming task is often considered a measure of recognition latency, it contains two components: recognition and response. The delayed naming task, in which subjects are presented a word stimulus and then instructed to wait until a signal before pronouncing the presented word, has been used with visually presented words, with the intention of teasing apart perception and production. We used the task with auditory stimuli and assessed the contributions of several semantic and nonsemantic variables to naming reaction times at several delays; we predicted that only production variables would consistently predict reaction times at long delays.

(5071)

**To Go or Not to Go: The Influence of Task Demands on Semantic Processing.** PAUL D. SIAKALUK, *University of Northern British Columbia*, & SETH BASSETT, *University of Southern Mississippi*—We examined semantic distance effects in yes/no and go/no-go lexical decision with nonwords (LD-nw), lexical decision with pseudohomophones (LD-ps), and phonological lexical decision (PLD) tasks. In the yes/no condition of each experiment, responses were made to all stimuli. In the go/no-go conditions, responses were made to either the words only (LD-nw and LD-ps) or the stimuli that sounded like real words (i.e., words and pseudohomophones, but not nonwords in PLD). Of par-

ticular interest to the present study, there was a main effect of condition and a semantic distance  $\times$  condition interaction in the LD-ps and PLD tasks (i.e., longer response latencies and larger effects of semantic distance in the go/no-go conditions). These effects were not observed in the LD-nw task, since response latencies and the effects of semantic distance were similar in both conditions. These findings are accounted for using a cross-module activation framework of visual lexical processing.

(5072)

**Morphological Processes in Children's Word Reading.** DEBORAH McCUTCHEN & ULRIKE BIANGARDI, *University of Washington*—In this study, we examined whether morphological information aided normally achieving English-speaking 4th graders in word recognition in a lexical decision priming task. Each target word was immediately preceded by a word that was morphologically related, orthographically similar, or unrelated to the target word, with all words appearing in all conditions across children. All priming words were equated in terms of frequency, and morphological and orthographic primes were equated in terms of orthographic overlap and phonological transparency/opacity with the target. Furthermore, morphological primes were balanced across inflections and derivatives. Results indicated that morphologically primed base words were recognized more quickly than orthographically primed and control primed base words, which did not differ, implicating children's use of morphological information in word reading.

(5073)

**Semantic and Associative Relationships: By-Products of the Statistics of Learning Environments?** JOHN WILLITS & CURT BURGESS, *University of California, Riverside*, & PATRICK CONLEY, *University of Western Ontario*—A word's semantic relatedness to another word (categorical relationship) and associative strength to another word (word association production frequency) have been found to be predictive of priming and reaction time in many studies (Lund, Burgess, & Audet, 1996; McRae & Boisvert, 1998). Both are post hoc measures of relatedness. Are there statistical factors in the learning environment that could account for these differences, predicting both reaction time and semantic and associative classifications? The hyperspace analog to language model (HAL; Burgess & Lund, 2000) measures global co-occurrence (contextual similarity), conditional probability, and local co-occurrence in a large corpus of text. These statistics are used to predict reaction time in a priming paradigm, as well as in a more explicit semantic judgment task. It is suggested that internal representations of concepts and language may be functions of these and other statistics of the learning environment.

(5074)

**Associative and Semantic Neighborhoods for 66,000 English Words.** JON CASEY, LORI BUCHANAN, & RICK CARON, *University of Windsor*—Borrowing heavily from Lund and Burgess (1996), we have developed a database containing both associative and semantic neighbors for 66,000 English words. These neighborhoods were established through an optimized search through approximately 300 million words of text, including newspapers, examples from the Gutenberg online library, government reports, and various other sources of clean electronic text. The optimization was based on the ability of the neighborhood size values to predict lexical decision RTs, and the resulting neighborhoods show a clear relationship to the target items. We will provide evidence from a series of experiments that these values capture the meaning of the individual words in such a way as to be applicable across a range of psycholinguistic experiments and text analysis applications.

• PSYCHOLINGUISTICS •

(5075)

**A Turkey Is a Bird: Semantic Markedness and the Role of Context.** KYMBERLIE D. SCHELLIN, CURT BURGESS, & JOHN WILLITS, *University of California, Riverside*, & CATHERINE H. DECKER,

*Chaffey College*—Current models of semantic markedness note that word frequency is associated with the phenomena—the less frequent a word is, the more semantically marked or inherently meaningful it is. In Experiment 1, human ratings of markedness were collected for a set of antonymous word pairs. An analysis of markedness ratings, pleasantness, negativity ratings, and various HAL memory model metrics of contextuality was conducted. The frequency–markedness relationship was found. However, it contributes very little variance in predicting markedness beyond negativity ratings. The second experiment investigated the role of age of acquisition in word negativity and subsequent markedness. The relationship of these results from the perspective of high-dimensional memory theory will be presented.

(5076)

**Lexical Decision and Semantic Categorization: Age-of-Acquisition Effects With Students and Elderly Participants.** SIMON DE DEYNE & GERT STORMS, *University of Leuven*—One of the ongoing discussions about the role of age of acquisition (AoA) in word processing remains the confound with word frequency. In this study, we removed possible frequency confounds by comparing AoA and word familiarity differences with young (18–23 years) and older (52–56 years) participants. Unlike previous studies with elderly persons, age-specific AoA word familiarity ratings were gathered for both the students and the older participants. Furthermore, care was taken to include words only recently acquired (e.g., *modem*) by the older persons to provide a full range of AoA values. A lexical decision task and a semantic categorization task were conducted to investigate the effects of AoA. Results of both experiments showed that there was an effect of difference in AoA, but not of word familiarity, when RT differences for the young and older participants were predicted. These results confirm the important role of AoA in different word-processing tasks.

(5077)

**Lexical Effects on the Perception of Assimilated Segments.** REBECCA L. PIORKOWSKI & WILLIAM BADECKER, *Johns Hopkins University*—Recent evidence (Gow, 2003, *P&P*) suggests that the mechanism underlying the perception of assimilated segments operates without reference to phonological or lexical knowledge by applying general perceptual grouping principles to the auditory form of the signal. Our study examines whether lexical access for a word such as *hen* is influenced by lexical competition with its assimilated form (*hem*). We used a cross-modal priming paradigm to compare the priming effect of words that assimilate to nonwords in a labial context (*brown pea*) with the priming effect of words that assimilate to other words in a labial context (*hen best*). We observed a facilitative priming effect for words that assimilate to nonwords, but not for words that assimilate to other words. Because the existence of a lexical competitor eliminates the priming effect of an assimilated word, lexical knowledge appears to play some role in the perception of assimilated segments.

(5078)

**The Effects of Vowel and Consonant Length in Silent Reading.** MARIANNE ABRAMSON, SHERYL METHENEY, & CARRIE DEURMIER, *California State University, Bakersfield*—In an effort to generalize vowel and consonant length effects to silent reading, participants determined the sensibility of sentences containing words varying in vowel length, consonant length, word frequency, number of words, and sensibility. Unlike previous studies in visual word recognition, the effects of vowel and consonant lengths were not reliable; however, vowel and consonant length did reliably interact with word frequency. Consonant length also reliably interacted with number of words and sensibility of the sentence. Such interactions with word frequency and sensibility most strongly suggest either a phonologic or a phonetic component to silent reading similar to that found in visual word recognition.

(5079)

**Comparing Who-Questions' Interpretation in Italian Sentences.** MARICA DE VINCENZI & ROSALIA DI MATTEO, *University of*

Chieti, & REMO JOB, *University of Padua*—Italian *Wh*-questions hold a temporary ambiguity, since the *Wh* can be the subject or object of (at least) the following verb. According to the minimal chain principle (De Vincenzi, 1991), the parser interprets the *wh* element by constructing the most economical structural representation—that is, the subject representation. In a self-paced procedure, Italian participants read sentences in which the *who* element was either the subject or the object of the following verb: (1A) *Chi insegue i cavalli?/Who is following the horses?* (1B) *Chi inseguono i cavalli?/Who are following the horses?* As is predicted by the minimal chain principle, reading times on the verb were longer in 1B than in 1A.

(5080)

**Developmental Changes in Grammaticality Judgment Performance.** JANET L. McDONALD, *Louisiana State University*—Elementary-school-aged children and adults judged sentences for grammaticality and completed a working memory span task. Performance on grammatical sentences was high for all ages, whereas performance on ungrammatical sentences showed drastic improvement with age. Errors involving word order changes were mastered early; errors involving morphology were mastered later. For morphological omission errors, the youngest children were more likely to err on words where the unmarked word ended in a phoneme similar to the missing morphological marker. Working memory span also increased with age. Correlations between grammatical judgment performance and working memory span are discussed.

(5081)

**Chinese Speakers Rely More Heavily on Shape When Classifying Objects.** MARIA D. SERA, *University of Minnesota*, & YI-CHUN KUO, *National Chiayi University*—Classifier languages, such as Yucatec Maya, Japanese, and Chinese, vary with respect to the categories in which they group nouns for quantification. Chinese is a language that classifies nouns into groups on the basis of shape, material, and size. We asked whether the classification of nouns by shape affects the degree to which Chinese speakers rely on shape when classifying objects. Three experiments examined the degree to which Chinese- and English-speaking adults rely on shape versus taxonomic similarity in a classification task. Participants were shown one target picture and were asked to choose whether a picture that was similar to the target in shape or in taxonomic kind was more similar to the target. Across all three experiments, Chinese speakers made significantly more shape choices than did English speakers, although speakers of both languages classified objects together mostly on the basis of taxonomic similarity. The results illustrate how language influences categorization.

(5082)

**Perception of Motion Affects Language Processing.** MICHAEL P. KASCHAK, CAROL J. MADDEN, DAVID J. THERIAULT, RICHARD H. YAXLEY, MARK E. AVEYARD, & ROLF A. ZWAAN, *Florida State University*—Participants listened to (and made judgments on) sentences that described motion in a particular direction (e.g., *The car approached you* describes motion toward you). They simultaneously viewed dynamic black-and-white stimuli that produced the perception of movement in the same direction as the action specified in the sentence (i.e., toward you) or in the opposite direction as the action specified in the sentence (i.e., away from you). Participants were faster to respond to the sentences when they viewed a percept that depicted motion in the direction opposite to the direction of the action described in the sentence. This result suggests that the neural mechanisms recruited to construct simulations during language processing are also used during visual perception and that these mechanisms can be quite specific.

(5083)

**Response Latencies and Social Impression Formation.** MARILYN G. BOLTZ, *Haverford College*—Four experiments examined whether variations in response latencies to a speaker's query can be used to

infer certain characteristics of a respondent. Across all experiments, subjects listened to a set of monologues that varied in terms of their underlying speech act (honesty, confidence, certainty, compliance). In Experiment 1, subjects were asked to produce a designated one-word response to each monologue with the latency that resulted in the most favorable or unfavorable impression. Experiment 2 confirmed that those latencies produced to convey the most positive and negative impressions were, in fact, perceived as such by an independent sample of subjects. Experiments 3 and 4 extended these findings by revealing that the duration of intersentence pauses of a speaker's monologue predict both the produced latencies and the perceptual ratings of respondents. This set of results demonstrates the use of certain temporal judgment skills in conversational interaction that may be mediated by processes of speaker accommodation and expectancy generation.

(5084)

**Semantic Satiation in Aging and Dementia.** JULIET E. BAYSA, TAMIKO AZUMA, & STEPHEN D. GOLDINGER, *Arizona State University*, DONALD J. CONNOR & MARWAN N. SABBAGH, *Sun-Health Research Institute*, & RICHARD J. CASELLI, *Mayo Clinic of Scottsdale*—The semantic satiation hypothesis proposes that continued repetition of a word leads to a temporary reduction in its meaning, since the neural representation of the concept is fatigued. This effect may extend to subordinate associates of a repeated concept. Young adults, healthy older adults, and individuals with Alzheimer's disease made relatedness decisions to prime–target word pairs after repeating the prime 2 or 22 times. Related stimulus pairs were of the form category–exemplar (*fruit–apple*) or exemplar–category (*robin–bird*). Young adults demonstrated a decreased relatedness effect after 22 repetitions, indicating satiation; however, older adults did not. The results are extended to individuals with AD with respect to impaired retrieval of subordinate terms from semantic memory.

## • DISCOURSE PROCESSING •

(5085)

**Suppression and Excitation Effects on Reading Multiple Lexically Ambiguous Words.** BRIAN D. LEANY & GRETCHEN KAMBE, *University of Nevada, Las Vegas*—When we encounter a lexically ambiguous word, we must decide which of its possible meanings is appropriate for the context in which we find it. Several models explain how the appropriate meaning is selected, but few focus on the fate of the unselected meaning. Of the few theories that describe the selection mechanism in any great detail, fewer describe the effects (additive, decay, etc.) of this mechanism over subsequent encounters of a lexically ambiguous word. This study attempts to further investigate the mechanisms involved in lexical ambiguity resolution, with a particular emphasis on the fate of the unselected meaning within the context of suppression and excitation, as described by Gernsbacher (1990). Reading times on texts containing multiple encounters of ambiguous words, along with working memory and suppression ability, were measured. Results are discussed within the framework of the comprehension as a structure building model.

(5086)

**The Effects of Audience Awareness and Interactivity on Referential Communication Tasks.** MIJA M. VAN DER WEGE & BRANDON TEARSE, *Carleton College*—Researchers have recently debated the extent to which speakers and listeners take their discourse partners into account when processing language (Schober & Brennan, 2003). A partner's effect on an interlocutor could be due to the interaction between the speaker and the listener, it could be due solely to the awareness of the other's presence, or it could be due to a combination of two separate processes. To help distinguish between these processes, participants completed a series of referential communication tasks. These tasks varied in how aware of the listener the speaker was and in how much interactivity was allowed between the two participants. Results indicate that both factors effect language processing independently,

with interactivity playing a larger role than simple awareness. Implications for models of language processing are discussed.

(5087)

**Older Adults' Proofreading Ability Varies by Error Type and Difficulty.** MEREDITH A. SHAFTO, *University of Cambridge*—Previous research indicates that older adults are as good as younger adults at detecting misspelled words, despite an age-related increase in the production of misspellings. The research reported here tests the boundaries of age-invariant error detection by embedding the errors in a prose context and varying the types of errors to be detected. Older and younger adults performed a proofreading task, detecting and correcting errors in short prose passages. Errors included misspellings (e.g., *verbbal*), grammatical errors (e.g., incorrect subject–verb agreement), or meaning errors (e.g., substituting *sunrise* for *sunset*). Results replicated age equivalence in proofreading spelling errors. However, older adults were worse than younger adults at proofreading grammatical errors. Older adults were also less accurate at proofreading meaning errors, and this age difference increased with more difficult text. These results are discussed in terms of theories of language and aging and in terms of previous research on aging and spelling error monitoring.

(5088)

**Age-Related Changes in Reading Comprehension.** BRENDA HANNON, *University of Texas, San Antonio*, & MEREDYTH DANEMAN, *University of Toronto, Mississauga*—Although it is well documented that older adults have more difficulty comprehending written text than do their younger counterparts, the source of their difficulty is not well understood. Using a task developed by Hannon and Daneman (2001), we investigated four possible sources of age-related declines in reading comprehension performance: the ability to access knowledge from long-term memory, the ability to integrate the accessed knowledge with new text information, the ability to make inferences about the new text information, and the ability to remember the new text. By comparing younger and older readers' performance on Hannon and Daneman's component processes task and on a test of reading comprehension ability, we were able to determine that knowledge access is the component of comprehension that is least susceptible to declines with aging and that age-related declines in text comprehension are more quantitative than qualitative in nature.

(5089)

**Older Adults' Processing of Bridging and Predictive Inferences During Reading.** TRACY LINDERHOLM, LISE ABRAMS, & VANESSA ROBINSON, *University of Florida*—Older adults' processing of bridging and predictive inferences was examined as a function of causal text constraint (low vs. high) and the linguistic form of verification statements (negated vs. nonnegated). After reading short stories that elicited low and high causally constrained bridging and predictive inferences, participants, 60–90 years of age, verified negated and nonnegated statements that summarized target inferences. The results showed that older adults were more accurate at verifying statements that pertained to high-constraint than to low-constraint bridging and predictive inferences. However, older adults were least accurate at verifying statements that pertained to low-constraint bridging inferences. Finally, older adults' accuracy at verifying statements was similar for negated and nonnegated forms. Results are interpreted in light of current theories of language processing and cognitive aging.

(5090)

**Ha Ha as Aha: Lateralization of Insight in Joke Processing.** HSIN-CHIN CHEN & JYOTSNA VAID, *Texas A&M University* (sponsored by Jyotsna Vaid)—Both insight problem solving and humor comprehension involve similar cognitive processes, including fixation on an initial representation, overcoming an impasse, frame-shifting, and having an Aha! experience. The right hemisphere has been claimed to maintain a weaker but broader ranging activation of possible solutions, whereas the left hemisphere is thought to show stronger but restricted activation;

as a result, left-hemisphere presentation may block the opportunity for frame shifting needed to solve an insight problem (Beeman, Bowden, & Gernsbacher, 2000). In the present study, we applied a lateralized rapid serial visual presentation procedure to examine the time course of hemispheric involvement in joke comprehension as a specific example of linguistic insight problems. By comparing insight responses (getting the joke) with noninsight responses (not getting the joke), our results extend insight problems to the case of joke problems and offer a test of laterality claims advanced in the insight problem-solving field.

• CONCEPT LEARNING •

(5091)

**Simultaneous and Sequential Abstract Concept Learning by Pigeons.** JEFFREY S. KATZ, BRADLEY R. STURZ, KENT D. BODILY, & MICHELLE HERNANDEZ, *Auburn University*, & ANTHONY A. WRIGHT, *University of Texas Medical School*—Pigeons trained in a simultaneous same/different task to discriminate pairs of pictures as same or different showed complete transfer to novel stimuli, indicating abstract concept learning. Features based upon simultaneous presentations of identical items (e.g., symmetry in form and color of two identical pictures) could conceivably be the basis of accurate performance, rather than identity of the pictures themselves. To test this possibility, the pigeons were tested with sequential stimulus presentations (ISIs of 0, 1, 2, 6, 10, 20, or 30 sec) of the pictures. By separating the two pictures in time, the types of emergent features that are present in simultaneous presentations would be minimized. In the sequential task, the pigeons showed rapid relearning and complete concept learning, indicating that the controlling variable was identity (or nonidentity) of the two pictures in both tasks, and not some special property of a display of two simultaneously presented identical pictures.

(5092)

**The Effects of Subtyping Exception Items on Category Learning.** LEWIS A. BOTT & GREGORY L. MURPHY, *New York University*—Negative stereotypes are frequently maintained despite contradictory evidence, provided that the counterstereotypical examples can be subtyped into another group. Such subtyping takes place with the aid of a feature that covaries with the congruency of the examples of the stereotype. We carried out two experiments investigating whether subtyping can facilitate category learning when exceptions to a general theme are present in the training examples. We hypothesized that segregating the exceptions would prevent prior knowledge mappings from being broken in the face of the exceptions, thus facilitating overall learning of the concept. Our first experiment confirmed that a category with exception items is learned more quickly in the presence of a subtyping feature than without this feature. The second experiment demonstrated that participants gated their use of the knowledge mapping as a function of the subtyping feature. We interpret our results in terms of theories explaining knowledge effects on categorization.

(5093)

**Integrating Novel Dimensions to Eliminate Category Exceptions: When More Is Less.** MARK R. BLAIR, *Indiana University*, & DONALD L. HOMA, *Arizona State University* (sponsored by Donald L. Homa)—Category learning can be characterized as a process of discovering the dimensions that represent stimuli efficiently and effectively. Categories that are overlapping when represented in one dimensionality may be separate in a higher dimensional cue set. Two experiments are reported in which participants were shown an additional cue after learning to use two imperfect cues. The results reveal that participants can integrate new information into their categorization cue set. Wide individual differences are discovered, however, with many participants favoring simpler but less accurate cue sets. Some participants demonstrated the ability to discard information previously used when new, more accurate information was introduced. Current theories of categorization that posit rapid shifts of learned attention offer promising accounts of these data.

(5094)

**Learning Categories Really Fast: Evidence for Multiple Category Representations.** JOHN PAUL MINDA, *University of Western Ontario*—Some theories of categorization suggest that people learn categories by storing exemplars, whereas other theories suggest that people learn both rules and exceptions. The present research evaluates both kinds of theories and finds more support for the latter. Several experiments examined artificial category learning with or without a response deadline. In the initial stages of learning and when learning under a deadline, participants seemed to rely on abstractions (rules or prototypes) when making classifications. The deadline also increased dependence on single-feature rules and prohibited participants from learning exceptions. With no deadline, however, participants were also able to learn specific exemplars and exceptions. These results offer evidence against an exemplar-only account of category learning and in favor of a rule-and-exception account. These results also suggest that once specific exemplars are learned, categorization tends to be based on a mixture of abstract information and exemplars, even under a deadline.

(5095)

**The Effect of the Cross-Classification of Items on Category Knowledge.** SETH CHIN-PARKER, *Denison University*—Many items belong to multiple categories. Thus, to understand category representations, we need to consider how knowledge of different categories might influence each other. In these experiments, participants learned to classify items (fictional creatures) into two categories and then learned to classify the same items into an orthogonal pair of categories. Last year, I provided some evidence that learning a cross-classification for an item can lead to an exclusion effect: Some initially learned information about the items was excluded from later category-based judgments when it was learned to be associated to the cross-classification of the item. The present study examines the processes involved in the modification of category knowledge to more fully specify the effect of cross-classifying items.

(5096)

**Dimensional Structure, Alignability, and Unsupervised Categorization.** JOHN P. CLAPPER, *California State University, San Bernardino*—It is generally assumed that natural categories are based on correlational structure. In research on unsupervised category learning, this means that different categories are defined by different clusters of correlated values within a common set of attribute dimensions. However, another possibility is that dimensional alignability, rather than correlational structure, is the primary basis by which people partition stimuli into categories. In this experiment, participants were presented with instances of two categories in a sequential unsupervised learning task. In the alignable condition, categories were distinguished in terms of different values within a common set of dimensions. In the non-alignable condition, categories were composed of entirely different dimensions. The consistent features within each category were learned much better in the nonalignable condition. This is consistent with the suggestion that people automatically segregate categories that differ in dimensional structure and that dimensional alignability/nonalignability may be the default basis for unsupervised categorization.

(5097)

**Proper Names, Common Nouns, and Category Learning.** HARLAN HARRIS & JAMES S. MAGNUSON, *University of Connecticut*—We examined whether category learning is affected by linguistic context—specifically, whether subjects attend to different features when learning proper name categories, as is predicted by some lexical semantic theories. Subjects learned to categorize line drawings of “aliens,” either with proper name instructions (“choose Pibo”) or common noun instructions (“choose the pibo”). If proper name categories require exhaustive feature lists, subjects should attend to more features and learn more slowly in that condition. We found no differences in learning rate, but subjects in the proper name condition reported that significantly more features were relevant for categorization, despite the fact that the stimuli were identical. We also manipulated variation within

each category. Subjects found it initially easier to learn when variation matched linguistic context (one variant and proper name context, or multiple variants and common noun context). These results challenge existing categorization models and pose questions about the semantics of proper names.

(5098)

**The Role of Relational Information in Similarity and Semantic Representations.** MATT JONES & BRADLEY C. LOVE, *University of Texas, Austin* (sponsored by Bradley C. Love)—The study of similarity and category learning has focused largely on the intrinsic features of objects. However, recent research suggests many natural objects and categories (e.g., *carnivore*) are represented in terms of their relationships to other objects. This hypothesis is tested directly, using an incidental learning task followed by similarity comparisons. Results show that participation in the same relationship increases the similarity between objects; furthermore, this effect is enhanced when both objects play the same role within the relation. For example, people who read about a dog chasing a cat and a polar bear chasing a seal view the seal as more similar to the cat than to the dog, whereas people who read about a seal chasing a fish show the opposite preference. The results are captured by extending approaches to word learning that exploit co-occurrence statistics (e.g., LSA) to incorporate a richer notion of context that includes role information.

(5099)

**Contrasting Force Dynamic and Probabilistic Approaches to Causation.** PHILLIP M. WOLFF, *Emory University*—Most psychological theories of causation specify how causal relations may be induced from multiple examples. In contrast, the vector model (Wolff & Song, 2003), based on Talmy’s (1988) theory of force dynamics, proposes that causal relations can be induced from single events. In a series of naming experiments, I show that people regularly distinguish causal categories that are not readily specified by probabilistic accounts of causation. In particular, people are careful to distinguish CAUSE from ENABLE and PREVENT from DESPITE. However, as is shown in a series of simulations, probabilistic information does not allow these distinctions to be easily made. The results suggest that the concepts of facilitative and inhibitory causation, as defined by probabilistic models, are coarser than those captured by such common terms as cause, enable, and prevent. The results also explain some of the incongruities between general and specific causation that have been noted in the philosophical literature.

(5100)

**Approach and Avoidance in Category Learning: Merging Research on Motivation and Category Learning.** GRANT C. BALDWIN, ARTHUR B. MARKMAN, & W. TODD MADDOX, *University of Texas, Austin*—Usually, payoffs in perceptual categorization tasks involve either all gains or a mixture of gains and losses. The motivation literature suggests that gains and losses are treated differently because they engage the anatomically distinct approach and avoidance motivational systems. To explore this issue, observers completed perceptual categorization tasks in which the payoffs consisted of all gains, a mixture of gains and losses, or all losses. Tasks were constructed such that optimal performance was identical for all conditions. Nonetheless, people’s performance (as measured by points earned and accuracy) were further from optimal when payoffs consisted of all losses, as compared with the other payoff conditions. One possible explanation is that participants are more strongly influenced by the magnitude of payoffs than by their direction, resulting in performance favoring the lower-payoff category. Another explanation is that participants are not familiar with situations that involve only losses and this inexperience leads to poorer performance.

(5101)

**A Dynamic Hebbian Model of Perceptual Learning.** LESLIE M. BLAHA & JAMES T. TOWNSEND, *Indiana University* (sponsored by

Jerome Busemeyer)—Current research in holistic perceptual processing lacks a rigorous description of how people develop Gestalt representations of visual images. This study begins developing a neurologically motivated model of configural learning, with particular attention to how the learning affects or is affected by the underlying information-processing system. We constructed a linear stochastic dynamic model of parallel processing to examine how channel interactions develop over the course of learning, particularly those interactions associated with the Townsend and Wenger (2001) working definition of Gestalt. In a series of category-learning tasks that encouraged participants to unitize object features, we uncovered the characteristics of this perceptual-learning processing system. Applying the dynamic model to these data supports the hypothesis that the development of a holistic perceptual representation creates facilitatory interactions among the processing channels, which results in the processing characteristics, such as supercapacity, often observed in Gestalt processing.

(5102)

**Are 2-D Spatial Categories Induced From Category Exemplars?**

DALE S. KLOPFER, *Bowling Green State University*—When a dot is shown briefly in a frontal circular field, people remember the quadrant in which the dot was shown but misremember the dot as being closer to the geometric center of the quadrant than it was: There is a bias in memory for locations away from the horizontal and vertical (HV) axes and toward the diagonal axes. Huttenlocher and colleagues (e.g., Engebretson & Huttenlocher, 1996) have claimed that spatial categories are derived from the perceptual system, rather than being induced from category members. Spencer and Hunt (2002) reported that the bias in memory of locations of objects placed on a table was influenced by the spatial distribution of exemplars. We found that the spatial distribution of exemplars in a frontal circular field yields biases in memory for locations toward the HV axes and away from the diagonals. The nature of perceptually derived categories is discussed.