Papers and Posters Presented at the 32nd Annual Meeting of the Psychonomic Society
The Hyatt Regency San Francisco, San Francisco, California
November 22-24, 1991

ATTENTION I
Embarcadero AB, Friday Morning, 8:00-9:40

Chaired by James C. Johnston, NASA-Ames Research Center

8:00-8:20 (1)
Selective Attention to an Item Is Stored as a Feature of the Item. GEORGE SPERLING, *New York University*, & STEPHEN A. WURST, *SUNY at Oswego*—Subjects must detect a repetition in a stream of 30 characters flashed at 10 per second. Items alternate in either color (black/white), size, orientation, or spatial frequency. Selectively attending a feature (e.g., black) never improves detection of repeated attended (black) versus unattended (white) items. Many counterintuitive results are explained by assuming (1) all items are stored in short-term memory (there is no perceptual filtering) and (2) attention to an item is itself stored as a feature of that item.

8:25-8:40 (2)
Why Is There a Set-Size Effect in Visual Search? JOHN PALMER & CYNTHIA T. AMES, *University of Washington*—Set-size effects in visual search may be due to attentional effects on perception or to effects of sensation, decision, or memory. In simple search tasks such as detecting a long line among short lines, we have previously found the modest set-size effect predicted by an attentional effect on only decision and not perception. To pursue this result, we investigated several more complex search tasks that have larger set-size effects.

8:45-8:55 (3)
The Stroop Effect: Incorporating Noncolor Words into the Response Set. COLIN M. MACLEOD & STUART A. GRANT, *University of Toronto, Scarborough Campus*—In the classic Stroop effect, incompatible color words interfere with naming the ink colors in which they are printed (e.g., the word "red" in green ink, say "green"). Ordinarily, noncolor words (e.g., "horse") interfere virtually not at all with color naming because they are not possible responses. We describe a situation wherein noncolor words interfere as much as color words, we investigate its parameters, and we consider its implications for interpretations of the Stroop effect.

9:00-9:10 (4)
Beyond Reaction Time: A Forced-Choice Procedure for Studying Visual Search. JAMES L. ZACKS & ROSE T. ZACKS, *Michigan State University*—Investigation of visual search processes has relied heavily on RT procedures. We will describe a forced-choice procedure with limited duration displays that can be used to provide converging evidence of a serial search process, and estimates of the parameters that characterize the search process. The estimates are based on both the changes in the threshold duration as a function of array size and on the shape of the psychometric functions relating accuracy to presentation duration.

9:15-9:35 (5)
Asymmetries in Visual Search for Conjunctively Defined Targets. ASHER COHEN, *Indiana University*—This study demonstrates asymmetry in visual search for conjunctively defined targets despite symmetry in search between the simple features that define these targets. For instance, search for a red X among red Os and blue Xs is faster under some circumstances than search for a red O among red Xs and blue Os, while there is symmetry in search between Xs and Os. An explanation of this phenomenon is proposed and supported by several experiments.

ASSOCIATIVE LEARNING: ANIMAL I
Embarcadero CD, Friday Morning, 8:00-9:50

Chaired by Lorraine G. Allan, McMaster University

8:00-8:15 (6)
Incentive Shifts in Pavlovian Fear Conditioning: A US Modulation View. MICHAEL S. FANSELOW & STACEY L. YOUNG, *UCLA*—CSs associated with painful USs produce a naloxone reversible analgesia which acts as negative feedback, reducing the impact of predicted USs. Accordingly, naloxone "disregulated" conditioning; learning curves went to the same asymptote regardless of US intensity. Shifting drug treatment during acquisition had effects that paralleled US intensity shifts. Naloxone blocks the retarded acquisition found when strong shock experience follows mild shock. These data indicate that US intensity effects can be explained by conditional analgesic processes.

8:20-8:35 (7)
Behavioral, Vocal, and Hormonal Relationships in Five Captive African Elephants. MELISSA R. SHYAN, ROBERT H. I. DALE, *Butler University*, JOHN K. CRITSER, ESTHER NOILES, *Methodist Hospital of Indiana, Inc.*, & DEBORAH J. OLSON, *Indianapolis Zoo*—Five captive African elephants were studied to compare behaviors and vocal activities to their estrous cycles. Their behaviors were observed over a two-year period. Vocalizations were recorded and analyzed to determine whether an estrogen-related vocalization used to attract mates (the "estrous song") was being produced. These data are being analyzed to determine whether these vocalizations and any associated behaviors could be used as noninvasive behavioral markers for peak fertility during the estrous cycles.

8:40-8:55 (8)
Modulation of Ethanol Reinforcement by Pavlovian Conditioned Tolerance. CHRISTOPHER L. CUNNINGHAM, *Oregon Health Sciences University*—Previous studies show that stimuli correlated with ethanol injections come to elicit a hyperthermic response which interferes with the drug's unconditioned hypothermic effect, thereby producing tolerance. The present study shows development of a similar conditioned response to a stimulus that signals availability of orally self-administered ethanol in a discrete-trial operant task. Responding for ethanol was greater on signaled than on unsignaled trials, suggesting conditioned tolerance to ethanol's thermal effect altered its reinforcing efficacy.

9:00-9:15 (9)
Flavor-Drug Associations Produced by Positively Reinforcing Drugs: A Dose-Response Analysis. LINDA A. PARKER, *Wilfrid Laurier University*—Drugs which are positively reinforcing in a place conditioning or self-administration paradigm have also been shown to have aversive properties at equivalent doses in a conditioned taste aversion (CTA) paradigm. A series of experiments with Sprague-Dawley rats investigated this paradox using the taste reactivity and CTA paradigms. Taste reactivity responses elicited by sucrose, which was paired on five occasions with various doses of D-amphetamine (0, 2, 3, 5, 10 mg/kg, i.p.), nicotine (0, .4, .8, 1.2, 2.0 mg/kg, s.c.), or morphine (0, 2, 8, 20, 80 mg/kp, i.p.), were measured. The only doses of these drugs which effectively conditioned rejection taste reactivity responses were those that are higher than those capable of producing a place preference. However, lower doses, which were within the range capable of producing a place preference, produced a CTA.

9:20-9:30 (10)
Specificify of Pavlovian Drug Conditioning Effects on Drug-Taking Behavior. MARVIN D. KRANK, *Mount Allison University*—Pavlovian theories of addiction postulate that conditional stimuli (CSs) for drug effects exert motivational control over drug-taking behavior. I tested the nature and specificity of drug CS effects on operant behavior for ethanol, using the transfer of training design. The results indicate that a discrete cue light CS trained with response-independent ethanol has an incentive effect on ethanol-reinforced behavior. The incentive effects influence both general appetitive behavior (e.g., approach) and reinforcer specific choice behavior.

9:35-9:45 (11)
The Comparator Ratio: Stimulus Control of the Numerator. T. JAMES MATTHEWS, ORN BRAGASON, & BENETTA YEE, *New York University*—Pigeons were tested on two random time schedules of food reinforcement in which a response key was transilluminated throughout the trial by yellow light which increased at either a fixed rate or at a variable rate that was proportional to the trial duration. On the fixed-rate procedure, subjects initiated autoshaped pecking at a fixed time before the reinforcer. On the longer trials of the variable-rate procedure, subjects responded at the midpoint of the trial.

HUMAN LEARNING/MEMORY I
Pacific West DE, Friday Morning, 8:00-10:50

Chaired by Denise C. Park, University of Georgia

8:00-8:15 (12)
The Effect of Cue and Retrieval Strategy Compatibility in Part-List Cuing Inhibition. DAVID R. BASDEN & BARBARA H. BASDEN, *California State University, Fresno* (read by Barbara H. Basden)—Providing some of the study-list members at recall is inhibitory. Perhaps part-list cues alter memory traces in a way that favors retrieval of cue over noncue words. Alternatively, the presence of cues may encourage the use of a less effective retrieval strategy. Several experiments are described in which inhibition was reduced or eliminated when subjects organized the study list in a way that was compatible with the presence of cues at recall.

8:20-8:40 (13)
Adaptation-Level Coding and Isolation Effects in Serial Learning. G. J. JOHNSON, *University of British Columbia* (sponsored by F. P. Valle)—The distinctiveness model of serial learning is extended to the von Restorff effect. Predictions are generated with respect to relative performance on an isolated item, presence or absence of a spread of effect, number of isolates, and serial position of an isolate. Other derivations concern the frequency with which the serial position of an isolated item is involved in intralist generalization errors.

8:45-9:05 (14)
Memory for Bizarre Imagery: A Multinomial Modeling Analysis. DAVID M. RIEFER, *California State University, San Bernardino*, & JEFFREY N. ROUDER, *University of California, Irvine*—A new multinomial model is presented that separately measures storage and retrieval factors in memory by examining free followed by cued recall of paired associates. The model is used to explore the storage-retrieval basis behind the bizarreness effect, the finding that bizarre imagery is remembered better than common imagery. The model suggests that bizarre images are better retrieved but not better stored than common images, a finding that is consistent with current theories.

9:10-9:25 (15)
The Hidden Power of Tests: Control of the Ultimate Acquisition Level. CHIZUKO IZAWA, *Tulane University*—Two experiments, utilizing constant study time, unveiled previously unknown facilitating effects of unreinforced test (T) trials administered successively with the traditional list-repetition (as opposed to the novel item-repetition) technique in cued recall; total T-time was held constant. Rapid successive Ts uncovered long-term memory retrieval facilitation effects. Data did not support the total T-time, the T-frequency, or the T-exposure dura-

tion hypotheses, but findings are in line with the T-trial programming hypothesis.

9:30-9:45 (16)
Pavlovian Principles in Human Parallel Distributed Processing. ROBERT FRANK WEISS, NICHOLAS B. McDONALD, CHRISTINE LITTLE, & ROBERT D. SHULL, *University of Oklahoma*—The least-mean-squares solution for parallel distributed processing is mathematically identical to the Rescorla-Wagner equation for Pavlovian conditioning. This unexpected confluence of cognition and conditioning is sparking interest among cognitive psychologists in the strange new laws of Pavlovian conditioning successfully predicted by Rescorla-Wagner theory. In experiments that make full use of the techniques of modern conditioning research, we demonstrate a human analog of Pavlovian blocking.

9:50-10:05 (17)
Memory for Fractal Textures. KEITH CLAYTON & DAVID L. GILDEN, *Vanderbilt University*—Ecological surveys of natural textures that were measured on the fractal dimension reveal a greater frequency of textures with beta near 2. Recent psychophysical research shows maximal sensitivity to fractal contours with beta near 2. In the present study, images varying in fractal dimension (five levels of beta from .8 to 4) were presented to subjects followed by a forced-choice recognition test. Memory was poorest for images with beta near 2.

10:10-10:20 (18)
Prospective Memory: The Effects of Cue Familiarity and Cue Distinctiveness. MARK A. McDANIEL, *Purdue University*, & GILLES O. EINSTEIN, *Furman University*—Apparent similarities between cued retrospective memory tasks and event-based prospective memory tasks prompted the hypothesis that the familiarity and the distinctiveness of the target event (cue) would influence prospective memory performance. The data confirmed that unfamiliar target events and target events that were distinctive relative to the local context benefited prospective memory. Also, prospective memory performance correlated with performance on an indirect retrospective task but did not generally correlate with recall and recognition performance. Several frameworks of retrospective memory are applied to the present effects.

10:25-10:45 (19)
Learned Covariation: Conscious or Unconscious Representation? DON E. DULANY & RUSSELL POLDRACK, *University of Illinois*—After viewing pictures of persons with physical traits revealed and psychological traits described, subjects judged whether other persons with the same physical traits would have the associated psychological traits. We were able to reproduce Lewicki's (*JEP: LMC*, 1986) two positive effects only under these conditions: on latency of judgment by introducing a sequence bias consistent with reported sequence constraints and on correctness of judgment by introducing awareness of covariation with instructional hints.

RECOGNITION/RECALL I
Pacific West FG, Friday Morning, 8:00-10:35

Chaired by Richard Schweickert, Purdue University

8:00-8:20 (20)
The List-Strength Effect (LSE) and Global Matching Models. BENNET B. MURDOCK, *University of Toronto*—It has been claimed that the LSE is counter to all the current global matching models (SAM, MINERVA, CHARM, TODAM, and matrix models). Whether or not this is true depends on the underlying assumptions. If memory is continuous, then most, if not all, of the current global matching models would seem to predict not only the absence of an LSE, but also the presence of a list-length effect in recognition memory.

8:25-8:45 (21)
Interference and Forgetting in Recognition Memory. RICHARD M. SHIFFRIN & KIM MARINELLI, *Indiana University*—The causes of interference and forgetting are examined in a study presenting a mixed list of exemplars (but not prototypes) from 16 semantic categories (e.g., words related to "butterfly") and 8 orthographic/phonemic categories

(e.g., words sharing the vowel sound, number of letters, and one consonant with "cat"). Recognition tests were carried out immediately and after one week for exemplars, prototypes, and other types of distractors. The results rule out a wide class of models.

8:50-9:00 (22)
Reorganized Memory Lists, Expanded Memory Lists, and Retrieval. DAVID BURROWS, *Skidmore College*—Subjects determined whether test words belong to expanded memory lists. Test cycles alternated with presentation cycles. In the standard condition, presentation cycles consisted of 12 words to be added to the list. In the reorganization condition, presentation cycles consisted of 12 words, 9 to be added to the list, and 3 to be deleted. Accuracy declined gradually with list length, and was equivalent for the two conditions. Latencies were 670 msec greater for reorganized lists.

9:05-9:15 (23)
A Context-Dependent Stimulus Suffix Effect. AIMEE M. SURPRENANT, IAN NEATH, & ROBERT G. CROWDER, *Yale University* (read by Robert G. Crowder)—Precategorical acoustic store (PAS) explains stimulus suffix effects by assuming that the suffix enters into an acoustic store on physical criteria and interferes with earlier list items contained therein. One line of evidence incompatible with this explanation, a context-dependent suffix effect, has been demonstrated only once (Ayres, Jonides, Reitman, Egan, & Howard, 1979). The two experiments reported here replicate and extend the finding that a clearly nonacoustic factor can determine whether the suffix effect obtains.

9:20-9:40 (24)
Understanding Human Memory. MICHAEL S. HUMPHREYS, JANET WILES, & SIMON DENNIS, *University of Queensland*—Marr's (1980) framework for understanding an information processing device is applied to cued recall with an extralist associate. Our computational theory specifies that pairwise information is used and that the goal is to find the intersection of the items related to the cue and the items in the list. We then show how this characterization of the computation constrains theories at the next level, which may also be constrained by the hardware implementation level.

9:45-10:05 (25)
Implicit Memory: Effects of Associative Set Size, Connectivity, and Network Intersection. DOUGLAS L. NELSON, NANCY GEE, & THOMAS SCHREIBER, *University of South Florida*—By collecting discrete word associations for a very large sample of words, $n \times n$ associative matrices were constructed for over 1,500 items. Associative structures vary naturally in size and connectivity, and the networks for any two words intersect to different degrees. In several experiments, subjects studied words whose associates varied in set size and connectivity, with recall cued by related words sharing differing numbers of intersecting associates. Each variable independently affected recall.

10:10-10:30 (26)
An Acquisition, Loss, and Decision Model of Retrieval from STM. BARBARA ANNE DOSHER, *Columbia University*—A forgetting model of STM, including acquisition, loss, and decision components, was applied to reaction time and error data in speeded item recognition. Each serial position of STM lists (lengths 2-5) of digits, discriminable and confusable letters, trigram syllables, and novel pictographs were tested. The model is applied to differences in recency profiles across materials, allowing the estimation of acquisition, interference-decay loss, immediate match, and encoding contributions.

CATEGORIZATION
Golden Gate A, Friday Morning, 8:00-10:05

Chaired by Roger Chaffin, Trenton State College

8:00-8:15 (27)
Learning Event Categories: Effects of Correlational Structure. DORRIT BILLMAN & ALAN KERSTEN, *Georgia Institute of Technology*—Event categories are central to cognition and language but have been little studied relative to object categories. We analyzed verb and syntactic features to design the event attributes for our experiments. Subjects watched animated events showing two characters interacting. We

varied the correlational structure organizing possible events and the particular attributes that correlated. Subjects were tested for knowledge of individual correlations among event attributes. Individual correlations were learned more easily when part of a coherent system of correlations.

8:20-8:35 (28)
The Role of Attentional Resources in Suggestibility and Source Monitoring. MARIA S. ZARAGOZA & SEAN LANE, *Kent State University*—Subjects who are exposed to misleading suggestions about an event they have witnessed sometimes come to believe they remember seeing items that were merely suggested to them, an error we refer to as source misattribution errors. An experiment was conducted to test the hypothesis that source misattribution errors are a function of the attentional resources available at test. The results show that retrieval conditions play an important role in the prevalence of source misattribution errors.

8:40-8:55 (29)
Topography Facilitates Symptom-Fault Learning during Troubleshooting by Restricting Search. LAWRENCE W. BARSALOU, *University of Chicago*, & CHRISTOPHER R. HALE, *Georgia Institute of Technology*—Knowing a system's topography during troubleshooting facilitates identifying the faults that produce symptoms. Of interest is whether such effects reflect intelligent guessing versus learning. We report results from four experiments showing that topography facilitates both. Unexpectedly, topography does not facilitate learning through mnemonic elaboration but through restricting search. When subjects who do not know topography can restrict search similarly, they learn at the same rate. The max rule, the Luce rule, and search probability constitute possible mechanisms.

9:00-9:15 (30)
Primary and Secondary Generalization in Categorization and Typicality of Well-Defined Concepts. ANDRÉ VANDIERENDONCK, *University of Ghent*—According to exemplar models of categorization, primary generalization is the only principle needed to explain categorization performance and typicality. Other views support the idea that in addition to primary generalization, subjects use some form of secondary generalization. Experimental results are discussed which test the hypothesis that a decrease in interexemplar similarity results in increased opportunities for secondary generalization changing the form of the categorization and typicality gradients.

9:20-9:35 (31)
Inferring Sex and Age from Handwriting. WILLIAM N. HAYES, *Albion College*—Handwriting samples were collected from 30 people aged 60+ (15 female and 15 male) and 30 college students (15 female and 15 male). Another group of students, half female, half male, rated the samples on two categories, sex and age. Accuracy for the sex ratings was well above chance, and for the age ratings was slightly above chance. Handwriting apparently conveys information about sex and, to a lesser extent, age.

9:40-10:00 (32)
ALCOVE: An Exemplar-Based Connectionist Model of Category Learning. JOHN K. KRUSCHKE & ROBERT M. NOSOFSKY, *Indiana University* (read by Robert M. Nosofsky)—Kruschke's (1990) ALCOVE model implements key features of the exemplar-based generalized context model (GCM) (Nosofsky, 1986) within a multilayered connectionist network. The model provides excellent quantitative fits to category learning data and accounts for fundamental phenomena such as prototype effects, effects of specific exemplars, sensitivity to correlated dimensions, attentional learning, and base-rate neglect. Unlike standard backpropagation models, ALCOVE does not suffer catastrophic interference, and learns as people do.

INFORMATION PROCESSING I
Golden Gate B, Friday Morning, 8:00-9:40

Chaired by Alinda Friedman, University of Alberta

8:00-8:10 (33)
Visual Stimulus Intensity Does Not Influence Response Force. JEFF MILLER, *University of California, San Diego*, ROLF ULRICH, *Univer-*

sity of Tubingen, & KERRY PFAFF, University of California, San Diego—The forcefulness of a keypress response did not depend on stimulus intensity in experiments using simple, go/no-go, and choice RT tasks with visual stimuli. Subjects responded with index finger flexions, and force was measured. Task-irrelevant increases in stimulus intensity reduced RT by approximately 100 msec but did not affect response force. This finding supports models with discrete stimulus coding and is consistent with the "constant stage output" assumption of the Additive Factor Method.

8:15-8:30 (34)
Mental Chronometry: Further Beyond Reaction Time. DAVID A. BALOTA & RICHARD A. ABRAMS, Washington University—Last year, we presented evidence that factors (word frequency and memory set size) that affect onset latencies in two classic response-latency paradigms (lexical decision and memory scanning) also influence response dynamics after response initiation. This year, we provide evidence regarding word-frequency effects in a manual and vocal lexical decision task. These data eliminate a response-completion account of our previous findings and extend these findings to speech production.

8:35-8:50 (35)
Effects of Response Uncertainty on Semantic Retrieval. JAMES M. CLARK, University of Winnipeg—Selected RT effects of response uncertainty (i.e., number of alternative responses) are reported for such semantic retrieval tasks as picture naming, free association, synonym production, and generation of translation equivalents. Reported findings include: increased RTs with response uncertainty, independence from familiarity and other item attributes, and unique uncertainty effects for different operations (e.g., generation of instance vs. superordinate names for same pictures). Possible explanations are described, including mutual inhibition among competing alternatives.

8:55-9:10 (36)
Independence of Form and Color in Perception and Memory. JOHN CERASO, Rutgers at Newark—Whether presented as units or as separate entities, forms and colors tend to be independently perceived and independently recalled. Yet, on other measures, there are differences between unitary and separate stimuli: Units show better associative recall; perceptual identification of unitary form and color is not disrupted by divided attention, whereas separate form and color is disrupted. These findings suggest that the independence measure is not diagnostic of unitariness.

9:15-9:35 (37)
A Backwardly Masked Stimulus Is Not Subliminal. JOHN THEIOS & GLORIA MARMOLEJO, University of Wisconsin-Madison—Critics of unconscious priming have erroneously assumed that stimuli backwardly masked by a pattern are subliminal. In fact, masked stimuli are superthreshold and activate the visual system all the way up to the semantic level. The mask has been chosen so that it captures the observer's attention, diverting it away from the stimulus. Thus, the observer has no conscious experience of the stimulus, but it does automatically activate the perceptual and semantic systems enough to associatively prime related stimuli.

AUDITORY PERCEPTION
Embarcadero AB, Friday Morning, 9:50-12:15

Chaired by Cynthia H. Null, NASA-Ames Research Center

9:50-10:00 (38)
Auditory Intensity Changes Can Cue Perception of Transformation, Accompaniment, or Replacement. ALBERT S. BREGMAN, McGill University, & LUC ROUSSEAU, Laval University—Amplitude change can cue the number of sounds in a mixture. When part of a spectrum increases in intensity, listeners hear either that a first sound has "transformed" in intensity or that a second sound has begun, and either "accompanies" or "replaces" it. We presented a pure tone which underwent an intensity increment, then returned to the lower value. Shorter

increments favored accompaniment. With longer increments, fast rise/falls favored replacement; slower ones cued transformation.

10:05-10:20 (39)
Prosodic Organization in Song Composition and Performance. MICHAEL H. KELLY, University of Pennsylvania, & CAROLINE PALMER, Ohio State University (read by Caroline Palmer)—We examined the alignment of phrasal stress patterns with musical meter in song. Analyses of song compositions showed adjective-noun phrases aligned with musical meter, as predicted by clitic rules of stress assignment. Vocalists' performances of songs containing adjective-noun phrases indicated that sung durations of adjectives and nouns varied according to principles of clitic group formation. Prosodic stress and musical meter had independent effects on sung durations, suggesting separate but similar organizational principles.

10:25-10:40 (40)
General Principles of Musical Expectancy in the Implication-Realization Model. CAROL L. KRUMHANSL & E. GLENN SCHELLENBERG, Cornell University—The implication-realization model (Narmour, The analysis and cognition of basic melodic structures) specifies basic perceptual principles governing expectancies in music. The first test of the model found strong support for the model using Western folk tunes (Psychonomic meeting, 1990). Recent experiments have found additional support using atonal music and Chinese folk tunes; effects of musical training and acculturation are minimal. Affective responses to melodic patterns have also been explored within the context of the model.

10:45-11:00 (41)
Neural Self-Organization of Auditory Categories. JAMSHED J. BHARUCHA & W. EINAR MENCL, Dartmouth College—Auditory categories can be learned passively by neural self-organizing mechanisms. A network presented with a tonotopic representation of tone spectra discovers similarities between tones and learns to classify them by forming specialized detectors. The learned categories include octaves and timbres. Following learning, the network generalizes its categorization to degraded spectra that are missing the very cues (e.g., octave harmonics) that led to the learning of those categories.

11:05-11:25 (42)
Perceiving Implied Harmony. MARI RIESS JONES, SUSAN HOLLERAN, & DAVID BUTLER, Ohio State University—Listeners (musically trained and untrained) heard standard-comparison pairs of novel tonal melodies. Melodies were accompanied by: (1) no chords, (2) key-consistent chords, or (3) key-inconsistent chords in certain measures. A target tone occurred in one unaccompanied measure of the comparison; its pitch could change (relative to the standard) to become consistent or inconsistent with the chord implied locally. All listeners were less likely to notice target changes consistent with local implied harmony.

11:30-11:45 (43)
Melody Is Separable from Rhythm in Music Discrimination: Evidence from Neuropsychology. ISABELLE PERETZ, University of Montreal, & RÉGINE KOLINSKY, Free University of Brussels—The study of a brain-damaged patient who suffered from a severe disturbance in the processing of pitch patterns without accompanying disorder in the processing of temporal patterns will be presented. This selective deficit was (a) replicated across different sets of material, (b) supported by a reversed association, and (c) maintained in conditions that promote integration in a normal brain. The results argue against the view that melody and rhythm are treated as a unique dimension.

11:50-12:10 (44)
Selective Attention in Auditory Detection. ERVIN HAFTER, KOUROSH SABERI, LYNE PLAMONDON, & ERIC JENSEN, University of California, Berkeley—In a masking experiment, listeners detected tones, sets of tones, or harmonic complexes, whose frequencies varied randomly from trial to trial. Uncertainty was reduced by various stimulus cues, each directed at a different level of auditory processing, levels that ranged from auditory filters to pitch to musical relations to auditory memory. Results show that auditory attention could be focused downward in the processing chain but not upward.

3-D/MOVEMENT PERCEPTION I
Embarcadero CD, Friday Morning, 10:00-12:35

Chaired by Philip J. Kellman, Swarthmore College

10:00-10:15 (45)

Perception of Relative Depth from Translation and Rotation.
MYRON L. BRAUNSTEIN, JEFFREY C. LITER, & JAMES S. TIT-
TLE, *University of California, Irvine*—Random-dot displays with similar
velocity gradients can simulate orthographic projections of rotating sur-
faces or polar projections of translating surfaces. Using polar projec-
tions of dihedral angles oscillating along a horizontal axis and compress-
ing the image in phase with the oscillation to simulate rotation, we found
that perceived depth for a constant velocity gradient varied inversely
with the amount of compression. Compression allows subjects to respond
differentially to velocity gradients produced by translation and rotation.

10:20-10:35 (46)

Detection of 3-D Surfaces from Optic Flow. GEORGE J. ANDER-
SEN, *University of California, Riverside*—Subjects discriminated be-
tween translating corrugated 3-D surfaces and random volume displays
with minimal texture density. Discrimination accuracy increased with
the number of texture elements and decreased with an increase in the
number of corrugations. Similar results were obtained when the cor-
rugated surface was positioned between two transparent moving sur-
faces. The results indicate that 3-D surfaces can be detected with minimal
texture density in the presence of other overlapping surfaces.

10:40-10:55 (47)

**Perceptual Consequences of the Filtering Characteristics of the
Pursuit System.** JULIE MAPES LINDHOLM, *University of Dayton
Research Institute*—In multisegment stroboscopic-motion sequences, tar-
get displacements within and between segments were given by a local
and global velocity, respectively. For a wide range of velocities and
segment durations, pursuit eye movements were in accord with the global
velocity. The spatial percept corresponded to the retinal image that would
have been painted during each segment if global velocity tracking were
perfect. These results are discussed in terms of the Fourier transforms
of the time-space contrast distributions.

11:00-11:15 (48)

**Accurate Distance Perception Assessed by Two Triangulation
Methods.** SERGIO S. FUKUSIMA, JACK M. LOOMIS, *University
of California, Santa Barbara,* & JOSÉ A. DA SILVA, *University of
São Paulo* (read by Jack M. Loomis)—We studied distance perception
in a large open field using two methods. In the pointing method, the
subject viewed the target and then, with eyes closed, attempted to point
toward the target while walking along an oblique path. In the other,
the subject viewed the target and then, with eyes closed, walked along
an oblique path until commanded to turn and walk towards the target.
The directional responses indicated accurate perception of initial target
distance.

11:20-11:35 (49)

**Where Did the Time Go? Temporal Factors in Apparent Motion Path
Choice.** MAGGIE SHIFFRAR, *Rutgers University,* & JENNIFER J.
FREYD, *University of Oregon* (read by Jennifer J. Freyd)—Observers
viewed photographs of a human body alternating between two positions.
We previously reported that at long SOAs perceptual knowledge of bi-
ological motion overrides the shortest path constraint in apparent mo-
tion. We now show that half-cycle presentations with short SOAs are
sufficient for the perception of long, anatomically "correct" paths. We
also manipulate correct path length. Is additional processing necessary
to access "higher level" information for correct paths? Or does path
interpolation require time proportional to length?

11:40-11:55 (50)

Time to Passage: The Forgotten Tau. MARY K. KAISER & LYN
MOWAFY, *NASA-Ames Research Center*—Despite its general mathe-
matical formulation, empirical work on the perception of tau (defined
as a quantity divided by its temporal derivative) has focused on the case
of direct approach, with tau defined as image angle/rate of expansion.
Empirical investigators tend to generalize image-size analyses to off-
axis approaches; this is inappropriate for most object classes. We reestab-

lish the appropriate optical cues specifying time-to-passage for non-
collision cases and present data on observers' relative and absolute pas-
sage judgments.

12:00-12:10 (51)

Scene Perception under Dynamic Occlusion. PETER M. VISHTON,
PHILIP J. KELLMAN, & THOMAS F. SHIPLEY, *Swarthmore Col-
lege* (read by Philip J. Kellman)—Scene perception under dynamic oc-
clusion was studied in two experiments. Subjects viewed real scenes
through moving occluding surfaces with multiple apertures; each ex-
posure was followed by a forced-choice presence/absence judgment about
an object in the scene. Speed, aperture size, and number were manipu-
lated. Results indicated that, above a threshold speed, accuracy was a
logarithmic function of spacetime duration (area × time). Two models
of spatiotemporal integration underlying coherent scene perception are
considered.

12:15-12:30 (52)

Postural Adjustments to Optical Oscillation during Walking. WIL-
LIAM H. WARREN, BRUCE A. KAY, & EMRE YILMAZ, *Brown
University*—Do humans use optical flow to control balance during loco-
motion, as they do for standing posture? Large-screen displays simulating
movement down a random-texture hallway were presented to participants
walking on a treadmill. Superimposed optical oscillations specified
horizontal translation or pitch/roll about different axes. We found
differential responses to optical translation (side-stepping) and pitch/roll
(body tilt), and an anisotropy in directional responses, with large lateral
sway (>20-cm excursion) but little anterior-posterior sway.

ANIMAL MEMORY
Pacific West DE, Friday Morning, 11:00-12:25

Chaired by Rita E. Anderson, Memorial University of Newfoundland

11:00-11:10 (53)

**More Evidence That Discrimination Training Facilitates Spatial
Matching to Sample.** DONALD M. WILKIE & ROBERT J. WILL-
SON, *University of British Columbia*—Pigeons received delayed
matching-of-location training on a 3×3 matrix of keys. During the 10-
min study phase of each trial both the sample and distractor were pre-
sented; pecks to the sample, but not the distractor, were rewarded. This
phase was followed by a retention interval (5 sec to 40 min), after which
subjects chose between the sample and distractor. Accurate responding
after long retention intervals depends on sample-distractor discrimina-
tion training.

11:15-11:25 (54)

Drug State and Context Dependent Memory Interactions. DENNIS
C. WRIGHT, *University of Missouri-Columbia,* & KIMBERLY E.
VANOVER, *University of Chicago*—Apparatus context change resulted
in one-way avoidance deficits in undrugged (ND) rats, but not in rats
trained and tested drugged (D) with pentobarbital (drug state overshadows
context cues?). However, drugged rats were sensitive to context change
when given initial ND training followed by D training and D context
shift testing (acquired distinctiveness of context cues?). Undrugged rats
were insensitive to context change when ND training and test followed
initial D training.

11:30-11:45 (55)

Alleviation of Forgetting in the Infant Rat. NORMAN E. SPEAR,
SUNY at Binghamton, JAMES S. MILLER, *Edinboro University,* &
H. MOORE ARNOLD, *SUNY at Binghamton*—The younger the
preweanling rat, the more rapid is its retention loss over short inter-
vals. This forgetting can be alleviated with brief cuing treatments pre-
sented just prior to the retention test. The prior cuing treatments
strengthen the memory as well as alleviating its forgetting, but seem
not to induce new learning. Separable events of conditioning differ in
their effectiveness as prior cuing treatments, allowing inferences about
the necessary and sufficient conditions for alleviation of forgetting.

11:50-12:05 (56)

Tuning Curves for Reinforcement. PETER R. KILLEEN, *Arizona
State University*—We know that reinforcement controls more than the
most recent response; it affects the trace or memory of responding,

weighting the most recent events more heavily. Contingencies of reinforcement should be maximally effective if they match the animal's memory. I measure the effectiveness of contingencies with differing windows, and find optimal control for windows with half-lives of three responses. This resonance identifies the animal's memory window, and tells us how to optimize reinforcement.

12:10-12:20 (57)
Reality Versus the Statistical Rat: Empirical Modeling of Object Investigation. MICHAEL J. RENNER & CHARLES P. SELTZER, *Memphis State University*—Over four nights, 12 male rats were individually videotaped in a large arena containing objects; component behaviors of object investigation (1,125 bouts) were coded. Each rat's behavior sequences were condensed to a behavioral "grammar," a template describing bouts via individual transitions between contiguous acts. Many bouts allowed by the grammars, however, did not actually occur. Each real rat's behavior was compared to its grammar-generated "statistical rat." Compliance and omission patterns illuminate the organization of investigatory behavior.

LETTER/WORD PROCESSING I
Pacific West FG, Friday Morning, 10:45-12:10

Chaired by Nancy B. Marshall, University of Alabama at Birmingham

10:45-11:05 (58)
Interpretations of the Frequency Effect in Word Recognition. KENNETH I. FORSTER, *University of Arizona*—Word-frequency effects in tasks such as lexical decision place powerful constraints on models of word recognition, provided they operate during lexical access and not at some postaccess stage. Recent work has raised doubts about this assumption. This work is briefly reviewed, and new studies are described dealing with familiarity, repetition effects, and tasks that show lexical effects without frequency effects.

11:10-11:30 (59)
Naming Reaction Times to Braille Words: Effects of Lexicality, Frequency, and Uniqueness Point. PAUL BERTELSON, PHILIPPE MOUSTY, RONALD PEEREMAN, & MONIQUE RADEAU, *Université Libre de Bruxelles*—The latencies of naming responses to high- and low-frequency words and to pseudowords presented in braille were measured in blind readers. The effects of lexicality and of frequency showed the pattern generally obtained with printed material. The location of the uniqueness point influenced RTs to high-frequency words, not to low-frequency ones. The results are consistent with a two-process interpretation of the pronunciation of braille words.

11:35-12:05 (60)
Lexical Ambiguity and Eye Fixations: Frequency and Familiarity Effects. KEITH RAYNER, JEREMY M. PACHT, SARA C. SERENO, *University of Massachusetts*, & SUSAN A. DUFFY, *Amherst College*—Readers look longer at biased ambiguous words when context instantiates the subordinate meaning compared to unambiguous control words. In the present studies, we examined fixation times on ambiguous words and control words to determine if the effect is due to subjects (1) treating the subordinate sense of a biased word as a low-frequency word or (2) lacking familiarity with the subordinate sense. Implications for models of lexical ambiguity resolution will be discussed.

COGNITION
Golden Gate A, Friday Morning, 10:15-12:30

Chaired by Margaret Jean Intons-Peterson, Indiana University

10:15-10:25 (61)
Serial Position Effects in Numerical Comparisons: Magnitude Versus Order Judgments. DANIEL B. BERCH & ANGELA BIRKHEAD-FLIGHT, *University of Cincinnati*—Subjects were given either a standard, numerical magnitude comparison task or an "ordinal" numerical comparison task involving the same digits pairs, but for which the correct numerical (left-to-right) order of the two digits had

to be judged. Group differences emerged with regard to the shapes of the serial position functions, with these curves flattening less for the ordinal condition as distance level increased. Implications for the positional discriminability model will be discussed.

10:30-10:40 (62)
Speech-Controlled Motor Behavior and Problem Solutions: What Is Relevant? ELIZABETH F. SHIPLEY, *University of Pennsylvania*—In a follow-the-leader game, 3-year-olds produced either one of two incompatible solutions (match color or block number) or repetitive motor behavior (play all blocks). Models' verbalizations relevant to the solutions ("blue, blue," "one, two") decreased repetitive motor behavior but did not determine specific solutions. Neither nonsense nor irrelevant familiar words facilitated solutions. These results refine prior findings on the irrelevance of semantic factors in speech controlled motor behavior.

10:45-11:00 (63)
The Conceptual Organization of Mental Verbs. PAULA J. SCHWANENFLUGEL, *University of Georgia*, WILLIAM V. FABRICIUS, *Arizona State University*, KELLY BIGLER, *University of Michigan*, & JOYCE ALEXANDER, *University of Georgia*—Major organizational features underlying naive adults' concepts of mental verbs were examined. The 30 mental verbs used represented early acquired verbs designated by experts as ways to know or come to know something. Subjects rated pairs of verbs in terms of the similarity of the mental processes involved. Multidimensional scaling, additive similarity trees, and Pathfinder network techniques yielded three organizing dimensions, three major verb clusters, and three central mental verbs ("think," "examine," and "observe").

11:05-11:20 (64)
Individual Differences in Working Memory. RANDALL W. ENGLE, JUDY CANTOR, & JULIE CARULLO, *University of South Carolina*—Does the correlation between tests of working memory and comprehension occur because of differences in processing, not storage? A moving-window version of the reading span task was used to measure the time to read the words in the sentence and the time spent processing the to-be-remembered word. When the time to process the sentence and the span words was partialed out, the correlation between reading span and comprehension was undiminished.

11:25-11:40 (65)
Learning and Performing Fluent Cognitive Sequences. RICHARD A. CARLSON, *Pennsylvania State University*—Fluent performance of routine cognitive activities such as skilled problem solving requires rapid selection and integration of procedural subsequences. Recent research has examined roles of acquisition context, consistency, goal structures, and metacognition (awareness of repeated sequences) in the development of fluent cognitive sequences. Learning data from problem solving, attention switching, and motor sequence paradigms are reviewed. Two learning processes—learning by restructuring, and explicit sequence learning—are proposed to integrate findings from these diverse paradigms.

11:45-12:00 (66)
Aesthetics, Laterality and Visual Scanning. JOHN P. McLAUGHLIN & ANDREW M. MEAD, *University of Delaware*—Lateral differences contribute to evaluations of art. Paintings preferred by dextrals elicited fixations farther to the right in the picture space, indicating that the amount of a picture in the right visual field determines preference. For paintings producing the strongest effect, mirror reversals produced differences in the frequency, distance, and direction of saccades. This sensitivity to compositional change reveals a type of intersubject consistency in scanning patterns. Sinistrals, however, showed these effects less consistently.

12:05-12:25 (67)
Incubation Effects in a Multisolution Anagram Task. CATHERINE G. PENNEY, *Memorial University of Newfoundland*—Four experiments investigated incubation effects in a multisolution anagram task in which subjects produced five-letter words from the letters in a ten-letter starter word. Subjects worked as long as they were being productive before taking a break. After the break, subjects produced new solutions not generated before the break. The number of new solutions depended on

the length of the break and whether subjects were exposed to solution words during the break.

COMPREHENSION/REASONING
Golden Gate B, Friday Morning, 9:50-12:20

Chaired by Arthur C. Graesser, Memphis State University

9:50-10:05 (68)
Hypothesis-Testing Goals and Strategies: Two Rules Are Better than One. CHARLES M. WHARTON, THOMAS D. WICKENS, & PATRICIA W. CHENG, *UCLA* (read by Thomas D. Wickens)—An effective strategy to recover from an erroneous inference in hypothesis testing is to examine both what is the correct hypothesis and what is not. The efficiency of dual hypotheses relative to a single hypothesis has been attributed both to task difficulty and to problem representation. Subjects in three experiments performed isomorphs of Wason's (1960) 2-4-6 task with instructions for single-rule or dual-rule testing. Results and models support problem-representation theories.

10:10-10:25 (69)
If Saddam Is Hitler Then Who Is George Bush? Coherence in Analogical Mapping. BARBARA A. SPELLMAN & KEITH J. HOLYOAK, *UCLA* (read by Keith J. Holyoak)—Naturalistic analogical mapping between the Persian Gulf War and World War II revealed that the analogy is bistable—an "analogical Necker cube." When Saddam was presumed to map to Hitler, subjects mapped Bush and the United States *either* to Churchill and England *or* to Roosevelt and the United States of World War II; in addition, Saudi Arabia mapped to England only if the United States did not. These patterns, simulated using Holyoak and Thagard's (1989) ACME model, reflect multiple constraints that determine analogical coherence.

10:30-10:45 (70)
Validation of Motive Bridging Inferences in Brief Texts. MURRAY SINGER, *University of Manitoba*—The *validation model* states that the motive bridging inference that links the sentences *Joan wanted to rent a modern house, She bought the newspaper*, must be validated against pertinent knowledge. Subjects read motive and control temporal sequences. As predicted, answer times for subsequent questions about pertinent knowledge, such as *Do newspapers advertise houses?*, were faster in the motive condition. This outcome obtained both for adjacent and separated goal and action sentences.

10:50-11:05 (71)
The Role of Pretests in Predictions of Performance on Text. RUTH H. MAKI, *North Dakota State University*, & MATT SERRA, *Purdue University*—Two experiments were conducted in which subjects answered multiple-choice pretest questions before predicting performance on multiple-choice tests. Although subjects could predict their performance with greater-than-chance accuracy, subjects who had pretest questions that were either identical to or similar to final test questions did not predict more accurately than subjects who saw no pretest questions. Apparently, pretests without feedback do not help subjects to predict test performance more accurately.

11:10-11:25 (72)
Early Learning of Mathematical Concepts. PATRICIA BAGGETT, *University of Michigan*, & ANDRZEJ EHRENFEUCHT, *University of Colorado*—Arithmetic is currently taught in an inconsistent fashion. We are developing and testing a curriculum based on the arithmetic of real numbers (rather than positive integers). This approach stresses a verbal component of mathematics and the use of manipulatives and calculators. It introduces all four arithmetical operations in the first grade. Some lessons have been tested in kindergarten, first, and second grade classrooms.

11:30-11:50 (73)
A Comparison Between Children's and Parents' Memory for Emotional Events. NANCY L. STEIN & MARIA LIWAG, *University of Chicago*—Our study compared the correspondence between parent-child memory for emotional events experienced by children. Parents accurately identified events that caused their children to experience emotional reactions. However, children frequently disagreed with their parents as to which emotion they had experienced, especially when parents reported anger and fear reactions. Parents' skill in predicting accurately their children's emotional response was directly related to the amount of content overlap found in the two accounts of the same event.

11:55-12:15 (74)
Concepts in Situated Reasoning. JAMES G. GREENO & JOYCE L. MOORE, *Stanford University and Institute for Research on Learning*—We view reasoning as interactive activities of agents in situations that generate information. Concepts, in this view, correspond to bundles of constraints on physical and social activities. Reasoning in accord with a concept can be analyzed to show which constituent constraints result from affordances of situations and which result from agent(s)' abilities. These analyses support attributions of understanding to the agent(s). We present an analysis and data involving the concept *linear function*.

HUMAN PERFORMANCE
Embarcadero AB, Friday Afternoon, 1:00-4:00

Chaired by Stephen R. Ellis, NASA-Ames Research Center

1:00-1:10 (75)
No Influence of Music on Maximal Performance and Fatigue. JOHAN HUETING, ERIC SOETENS, & ILSE CAUWENBERGHS, *University of Brussels*—The question of whether music enhances performance, mood, sales, and so forth has long been a much-debated topic. Straightforward experiments with clear data are scarce, however. The influence of music was investigated during an exhaustive task on a bicycle ergometer. Music was presented with a Walkman, and effects were compared to a control session. No differences were found, neither between maximal performances nor between continuously self-rated feelings of fatigue and recovery. Apart from the music, striking differences were found between the course of fatigue and of lactic acid curves.

1:15-1:30 (76)
Verbal Protocols and Complicated Performance. PAT-ANTHONY FEDERICO, *Navy Personnel Research and Development Center*—In order to determine the impact of different verbal protocol procedures on complex task performance (i.e., tactical decision making), subjects were randomly assigned to one of three conditions: experimental concurrent or retrospective protocols or control no protocol, and administered 256 simulated scenarios. Obtaining verbal protocols from the subjects did not have any significant impact upon their complex task performance.

1:35-1:50 (77)
Using Attention Operating Characteristics to Calibrate Inferences about Performance Operating Characteristics. BARRY H. KANTOWITZ, *Battelle Human Affairs Research Centers*, GREG C. ELVERS, *University of Dayton*, & JOHN PALMER, *University of Washington*—Performance on dual tasks can be represented as attention operating characteristics (AOCs: same tasks on both axes) or performance operating characteristics (POCs: different tasks on each axis). There are serious problems in interpreting POCs arising from combining two different dependent variables. A new methodology is presented to mitigate such difficulties by testing for consistency between AOCs and POCs. Initial results for two perceptual tasks showed predicted consistency.

1:55-2:15 (78)
The Ubiquitous Congruity Effects. DANIEL HOLENDER, *Free University of Brussels*—A general theory based on the concept of congruity is proposed of the effects observed in Stroop-like and priming tasks, and in some serial tasks. Congruity effects arise from the fact that irrelevant aspects of the situation may be related to the responses according to the same descriptors as those used for mapping the relevant aspects into the responses. Hence, the locus of the effects is in late decisional processes dealing with conscious mental contents.

2:20-2:40 (79)
Dimensional Overlap and Population Stereotype as Joint Predictors of Stimulus-Response Compatibility. LINDSAY M. OLIVER & SYLVAN KORNBLUM, *University of Michigan* (read by Sylvan Kornblum)—Stimulus-response compatibility has recently been attributed

to two separate factors: one factor, at the set level, is based on the similarity, or dimensional overlap, between the stimulus and response sets; the other, at the element level, is based on the pairing, or mapping, between the individual stimulus and response elements. Independent measures of these two factors, and data showing their joint effects on RT in stimulus–response compatibility tasks will be presented.

2:45-3:05 (80)
A Cognitive Task Analysis of Intelligent Vehicle/Highway Navigation Systems. RALPH NORMAN HABER & LYN R. HABER, *University of Illinois at Chicago*—Intelligent vehicle/highway systems are becoming available for automobiles. Display of navigational information is standard, while dynamic systems provide on-line updated route guidance alternatives based on traffic density, accidents, and construction, using information from roadway sensors and probe and other vehicles, processed by a traffic control center and transmitted back to vehicles. A task analysis of the use of such standard and dynamic systems by drivers is presented, focusing on attentional demands, safety, and driver ability to benefit from the information presented.

3:10-3:30 (81)
Components of Orientation Ability in Blind Travelers. LYN R. HABER & RALPH NORMAN HABER, *University of Illinois at Chicago*—Research publications reveal a variety of definitions of orientation ability underlying travel by the blind. We present a systematic analysis of these components, which include: knowing the locations of objects, knowing one's location, knowing how these change with self-motion, knowing stimuli that provide orientation information, knowing how to make oriented psychomotor responses, and knowing the sequence of route segments and choice points. The analysis is applied to current research with blind travelers, and extensions to navigation, map reading, and visual guidance by the sighted are examined.

3:35-3:55 (82)
Why Humans Get Hot. DAVID L. GILDEN & KERSTIN MAC-DONALD, *Vanderbilt University*—In a variety of tasks ranging from putting golf balls to signal detection, we have shown that performance is streaky; success tends to segregate from failure. Why is this? We consider three classes of models to account for our data: stochastic fluctuations in effort, effort contingent upon prior outcome, and wave modulation of ability. The wave modulation model not only is able to generate streaky sequences, it reproduces the exact statistical structure of observed sequences.

PATTERN RECOGNITION
Embarcadero CD, Friday Afternoon, 1:00-3:30

Chaired by Mario Zanforlin, University of Padova

1:00-1:15 (83)
Infant Perception of Illusory Contours in Apparent Motion Displays. ALBERT YONAS, DOUG A. GENTILE, & KIRSTEN CONDRY, *University of Minnesota*—In a series of experiments, we have investigated 4- and 7-month-old infants' abilities to perceive illusory contours using kinetic displays. Seven-month-old infants do pay attention to illusory contours. The data on the 4-month-old infants are not as clear. Methodological issues regarding luminance, spatial frequency, and d_{MAX} will be discussed.

1:20-1:35 (84)
Effects of Hierarchical Structure and Spatial Frequency on Global/Local Analysis. MARVIN R. LAMB & E. WILLIAM YUND, *VAMC, Martinez*—Recent studies have shown that reaction times to local and global targets depend on the activity of several dissociable mechanisms. A series of experiments will be presented examining the extent to which the operation of these different mechanisms depends on the hierarchical structure of the stimulus or on its spatial frequency content.

1:40-1:55 (85)
Size Effects in Recognition Memory Are Based on Perceived Size. BRUCE MILLIKEN & PIERRE JOLICOEUR, *University of Waterloo* (read by Pierre Jolicoeur)—The present research considers the size-congruency effect in recognition memory (Jolicoeur, 1987) in light of

the distinction that can be made between "perceived" size and "retinal" size. The results suggest that the size-congruency effect in memory for visual shape occurs as a result of changes in the perceived size of shapes between the encoding and the testing phases, with little or no contribution of retinal size.

2:00-2:15 (86)
Visual Orientation and Symmetry Detection under Affine Transformations. WALTER GERBINO, *University of Trieste*, & LING ZHANG, *ISAS, Trieste*—In normal mirror symmetry, the axis is vertical and the virtual lines connecting corresponding points are horizontal. We studied affine transformed dot patterns to separate the contribution of these two properties to symmetry detection. Results indicate that matching along the horizontal dimension is more important than the vertical axis. A 3-D frame, either preceding or simultaneous, was presented. A simultaneous frame facilitates symmetry detection, but does not eliminate the orientation bias intrinsic to the matching process.

2:20-2:40 (87)
Prevailing Lightness and Texture Segregation. JACOB BECK & WILLIAM GOODWIN, *University of Oregon*—Perceived segregation was investigated in displays in which the elements in one quadrant differed from those in other quadrants by interchanging light and dark areas. The light and dark areas composing an element were equal. Interchanging figure–ground lightnesses failed to yield strong texture segregation. This is consistent with previous findings that shape differences fail to predict perceived segregation. Perceived segregation appears to occur in terms of differences in the prevailing lightnesses of the texture elements. The experimental results will be compared to predictions from computational models.

2:45-3:00 (88)
An Attribute Integration Model of Image Segmentation. WILLIAM R. UTTAL, ROBB LOVELL, SRIRAM DAYANAND, & TOM SHEPHERD, *Arizona State University*—We present a computational model of image analysis which results in the segmentation of objects in a scene. The significant aspect of this model of this important aspect of human visual perception is that it is based upon the integration of a number of weak and fallible analyzers, each sensitive to a different attribute (e.g., texture, brightness, color, and depth) rather than on the performance of a single algorithm especially tuned to respond to a single attribute. By a process of spatial averaging, the variable and inaccurate outputs of the several weak analyzers are pooled to segment objects in a powerful and accurate manner. This procedure is consistent with contemporary views of both neuroanatomy and psychophysical function.

3:05-3:25 (89)
Multiple Mechanisms for Detection of Reflection Symmetry in Brief Exposures. C. W. TYLER, L. HARDAGE, & R. MILLER, *Smith-Kettlewell Institute*—Reflection symmetry (a "pop-out" feature which receives preferential visual processing compared with repetition or rotation symmetry) was imposed on a field of either static or dynamic noise, with same or opposite luminance contrast in the two half fields. Profound differences in symmetry detection with duration, eccentricity, and the width of a masking strip around the symmetry axis implied the existence of three separate mechanisms mediating static, dynamic, and opposite contrast symmetry perception.

PSYCHOLINGUISTICS I
Pacific West DE, Friday Afternoon, 1:00-2:30

Chaired by Marilyn Shatz, University of Michigan

1:00-1:15 (90)
Action Plans for the Production of Word Sequences. CHRISTINE A. SEVALD & GARY S. DELL, *University of Illinois* (read by Gary S. Dell)—What units of speech must be mentally represented to correctly specify a sequence of syllables for production? We used a parameter remapping rationale to determine what units are present in the speech plan. We found that units corresponding to syllables and rimes can be "reused" during the execution of a sequence, resulting in a repetition benefit. This was not true for either onset or CV units.

(91)
Withdrawn
1:20-1:35 (92)
Plausibility and Argument Structure in Sentence Comprehension.
SHARI R. SPEER, *Northeastern University*, & CHARLES E.
CLIFTON, JR., *University of Massachusetts at Amherst* (read by Charles E.
Clifton, Jr.)—Subjects read sentences of the form NP V NP PP. Plau-
sibility (determined in a previous norming experiment) and argument
versus adjunct status of the PP were manipulated factorially. Thus, sen-
tences were either highly plausible or implausible, and PPs were either
verb arguments or VP adjuncts. Reading times showed an early, short-
lived advantage for arguments over adjuncts and an independent, longer
lived processing advantage for plausible over implausible conditions.

1:40-2:00 (93)
A Reaction Time Study of Sentence Processing in Chinese. PING
LI, *University of California, San Diego*, BRIAN MacWHINNEY,
Carnegie-Mellon University, & ELIZABETH BATES, *University of
California, San Diego* (read by Brian MacWhinney)—Chinese is often
described as a language that uses word order and no inflectional devices
for marking grammatical relations. However, research by Miao has
shown that Chinese speakers do not make consistent use of word-order
cues. But then how can Chinese speakers understand sentences if they
have no cues to rely on? This study measured reaction times in a com-
puterized picture-choice task to study the utilization of a wider variety
of cues. Evidence was found for a more subtle set of integrations of
word-order patterns with markings for indefiniteness, preverbal objects,
and passivized subjects. The results are discussed within the framework
of the competition model.

2:05-2:25 (94)
Verb-Based Lexical Information and Parsing. MICHAEL K.
TANENHAUS, JOHN C. TRUESWELL, & CORNELL JULIANO,
University of Rochester—We report a series of experiments using several
response measures, including self-paced reading, cross-modal naming
and eye-tracking that support two conclusions: (1) Contrary to recent
claims in the literature, subcategorization information is used immedi-
ately in parsing and (2) a complexity difference between two structures
can easily be mistaken for a temporary syntactic garden-path, particularly
when eye-movement data are parsed into first and second pass fixations.

ANIMAL LEARNING/BEHAVIOR I
Pacific West FG, Friday Afternoon, 1:00-2:50

Chaired by Linda A. Parker, Wilfrid Laurier University

1:00-1:10 (95)
The Role of Vasopressin in Stress-Induced Analgesia. HELEN M.
MURPHY & CYRILLA H. WIDEMAN, *John Carroll University*—
Tail-flick latencies were measured in vasopressin-containing (LE) and
vasopressin-deficient (DI) rats under ad-lib and food-restricted condi-
tions. On the first day of the ad-lib phase, LE rats showed a longer latency
than did DI rats. On all of the other ad-lib days, no significant differ-
ences were noted between the two groups. With the introduction of food-
restriction stress, significant differences were again noted, with LE
animals exhibiting a longer latency. It appears that vasopressin plays
a modulatory role in the stress phenomenon.

1:15-1:30 (96)
**Effects of Repeated Sessions of Intruder Defeat on Hypoalgesia
and Freezing.** JON L. WILLIAMS, PAUL D. WORLAND, & JONA-
THAN M. JUST, *Kenyon College*—Rats exposed to one session of defeat
as colony intruders by dominant (alpha) male conspecifics were found
to show partially opioid-mediated hypoalgesia and freezing when for-
malin tested 24 h later with alpha-colony odors present. Recently, we
found that four sessions of intruder defeat, given on two consecutive
days, resulted in naltrexone-reversible hypoalgesia during later tests when
alpha-colony odors were either present or absent, but freezing only oc-
curred when these odors were present.

1:35-1:50 (97)
A Simple Dynamic Model for Recurrent Choice. DERICK G. S.
DAVIS & J. E. R. STADDON, *Duke University* (read by J. E. R.
Staddon)—The dominant process theories of recurrent choice are all based
on a simplified version of the law of effect which assumes that prefer-
ence now is determined solely by reinforcement conditions in the re-
cent past. We term these *Markovian* models. Data from experiments
on successive discrimination reversal show that Markovian models cannot
be correct. We propose a simple non-Markovian alternative that can
account for these and other transitional effects as well as standard match-
ing relations.

1:55-2:10 (98)
Dynamics of Temporal Learning. JENNIFER J. HIGA, *Duke
University*—Temporal learning is generally thought to be a slow process
(e.g., standard temporal schedules such as fixed-interval usually require
hundreds of cycles for complete learning). Yet under some conditions
it is rapid, and dynamic properties can be studied. I will present results
from experiments investigating such conditions, showing that pigeons
can quickly learn a series of short interfood intervals (IFIs) and how
this ability depends on the number and separation of these IFIs.

2:15-2:30 (99)
Inhibitory Learning in the Lesser Octopus (*Eledone cirrhosa*). W. F.
ANGERMEIER, *University of Cologne*—Octopi (*Eledone cirrhosa*) were
trained to approach a model of a crab attached to the outside wall of
their living tanks. After this response was inhibited, a live crab was
presented to the animals to see whether this inhibition would transfer
to the natural feeding situation. The results indicate transfer of inhibi-
tion and long-term memory of the learned inhibition. Findings are dis-
cussed in terms of evolutionary significance.

2:35-2:45 (100)
Dissociation of Contingency and Blocking Effects. BEN A. WIL-
LIAMS, *University of California, San Diego*—Contingency and block-
ing effects were dissociated by changing the identity of the reinforcer.
In the contingency procedure, freely presented reinforcers suppressed
operant behavior more when the free reinforcers were the same as the
contingent reinforcer than when they were different. In the blocking
procedure, changes in the identity of the reinforcer from single-element
pretraining to compound-element training did not attenuate the degree
of blocking.

REPETITION/PRIMING EFFECTS I
Golden Gate A, Friday Afternoon, 1:00-2:20

Chaired by J. W. Whitlow, Jr., Rutgers University

1:00-1:15 (101)
**A Computer Simulation of Priming Effects in Simple Multiplica-
tion.** JAMIE CAMPBELL & PAUL MEAGHER, *University of
Saskatchewan*—We present a computer model of a network-interference
theory of memory for simple multiplication and addition facts. In the
model, representations of numerical facts that are related to the pre-
sented problem receive continuous activation and compete by way of
mutual inhibition. Numerical primes preactivate components of the net-
work, biasing the tradeoff between excitation and inhibition. Different
degrees of interference or facilitation are observed as a function of prime
type and problem difficulty.

1:20-1:35 (102)
**Controlled and Automatic Retrieval: Influence of Relational and
Distinctive Processing.** R. REED HUNT, *University of North Caro-
lina at Greensboro*—Organization and distinctiveness independently affect
cued recall. These influences were analyzed in terms of controlled and
automatic retrieval processes using Jacoby's opposition logic. Subjects
sorted or rated the pleasantness of words from natural or ad hoc cate-
gories. Tests were either direct cued recall, indirect category produc-
tion, or category production with direct instructions to exclude list words.
Distinctive processing had little effect on automatic generation but sub-

stantially influenced conscious recollection. Relational processing primarily affected automatic generation.

(103)
(withdrawn)
1:40-1:55 (104)

Perceptual Fluency and Recognition Memory—What's the Connection? JOAN GAY SNODGRASS, *New York University*—Two processes—fluency and explicit retrieval—are often implicated in recognition memory judgments. Because fluency also supports priming in fragment completion, we asked whether level of fragmentation at study accounted for performance on both fragment completion and speeded recognition. Across four experiments, there was no connection between successful fragment completion and successful recognition memory. Moderately fragmented pictures at study were best for fragment completion while complete pictures at study were best for recognition memory.

2:00-2:15 (105)

Mood Congruent Memories: Explicitly Remembered, Implicitly Forgotten. SUSAN T. BLAZ, TARA C. RANKIN, & DAVID B. MITCHELL, *Southern Methodist University* (read by David B. Mitchell)—We investigated the influence of experimentally induced positive mood states on memory for self-referent personality trait adjectives. Across three experiments, we systematically varied the amount of perceptual information available at test. The implicit tests were free association, word-stem completion, and "know" judgments; free recall, cued recall, and recognition served as parallel episodic tests. Both data-driven and conceptually driven tests revealed mood congruency in episodic memory but not in implicit memory.

SYMPOSIUM I:
SHORT-TERM MEMORY: WHERE DO WE STAND?
Golden Gate B, Friday Afternoon, 1:00-3:30

Chaired by Robert G. Crowder, Yale University

1:00-1:20 (106)

Introductory Remarks. ROBERT G. CROWDER, *Yale University*—The identification of a separate short-term memory system was among the proudest accomplishments of early work in cognitive psychology. Now, a quarter-century afterwards, the evidential basis for such a system is in dispute. New experimental settings and new theoretical contexts are being suggested for this concept. We should ask: To what extent do these suggestions serve either (1) James's intuitive definition or (2) Hebb's reasoning about memory?

1:25-1:45 (107)

Activation, Attention, and Short-Term Memory. NELSON COWAN, *University of Missouri*—I argue that the term "short-term memory" (STM) is vague because it is used to refer to either (1) the set of representations from long-term memory currently in a state of heightened activation or (2) the focus of attention or content of awareness. A more coherent representation of STM depicts (2) as a subset of (1). Research to be discussed helps to isolate and characterize the activation component and also to assess the modifying effects of attention.

1:50-2:10 (108)

Short-Term Memory and Sentence Processing: Evidence from Neuropsychology. RANDI C. MARTIN, *Rice University*—Theories of sentence comprehension typically assume a working memory system used to hold the results of phonological, syntactic, and semantic analyses. Several proposals are considered about the possible overlap between the short-term memory revealed by traditional span tasks and the working memory involved in sentence processing. Evidence is brought to bear from studies of the sentence-processing abilities of brain-damaged patients who have severely restricted memory spans.

2:15-2:35 (109)

Varieties of Short-Term Memory in a Connectionist/Control Architecture for Working Memory. WALTER SCHNEIDER, *University of Pittsburgh*, & MARK DETWEILER, *Pennsylvania State University*—The nature of working memory in a connectionist control architecture takes on a variety of forms not present in modal box models of the 60s and 70s. The forms include data and control memory in feed-forward and recurrent networks with multiple time constraints and learning rates. This variety provides a far more robust processing system than box models, and can interpret such memory phenomena as episodic and procedural memory, the role of context storage, buffering and workload effects, and stages of skill acquisition.

2:40-3:00 (110)

Very Short-Term Conceptual Memory. MARY C. POTTER, *MIT*—Is short-term memory (STM) for conceptual information missing from current models of short-term memory? Several phenomena will be discussed that give evidence for fleeting conceptual representations. I argue that these representations are fundamental to cognitive processing and the form that long-term memory takes, but they do not surface readily with many of the standard methods for studying and testing STM.

3:05-3:25 (111)

Discussion. RICHARD M. SHIFFRIN, *Indiana University*—In one guise or another, the concept of short-term memory has survived numerous empirical and theoretical attacks since the 1960s, perhaps for utilitarian rather than fundamental reasons. We look at the key issues from the perspective of 25 years of research.

SPEECH PERCEPTION
Embarcadero AB, Friday Afternoon, 4:10-5:30

Chaired by Beatrice de Gelder, Tilburg University

4:10-4:25 (112)

Segmenting Speech by Recognizing Words. ANNE HENLY & HOWARD NUSBAUM, *University of Chicago* (read by Howard Nusbaum)—According to most theories, listeners recognize words in the order by which they are spoken. Recognizing one word locates automatically the beginning of the next, eliminating an explicit segmentation mechanism. To test the predictions of segmentation by recognition, subjects identified target words in the context of preceding and succeeding monosyllabic words and nonwords. The results indicate that listeners can use lexical status in recognition, but it is not done the way most theories would predict.

4:30-4:45 (113)

Migration of Speech Units in an Illusory Word Detection Task. JOSÉ MORAIS & RÉGINE KOLINSKY, *Université Libre de Bruxelles*—Evidence concerning the units of speech processing was obtained by using tasks that do not require attention to these units. We created conditions such that illusory perceptions of a word or a pseudoword target could occur through the extraction and subsequent recombination of parts of two dichotically presented items. The aptitude of phonetic features, phonemes (consonants and vowels) and syllables to cross from one ear to the other and elicit such illusions was compared.

4:50-5:05 (114)

Making the (Auditory) Scene with Speech. ROBERT E. REMEZ, JENNIFER S. NUTTER, *Barnard College*, & PHILIP E. RUBIN, *Haskins Laboratories*—Our studies of sine-wave sentences frustrate the attempt to characterize perceptual organization in a few rules derived from Gestalt principles. In such sentences, phonetic perception survives multiple violations of grouping principles and concurrent impressions of sinusoidal pitch and timbre. Does this mean that phonetic perception is independent of auditory scene analysis? We report experiments to assess the extent to which the perceiver experiences divergent perceptual effects of the phonetic and auditory aspects of sine-wave sentences.

5:10-5:25 (115)

Perceptual Restoration, Perceptual Bias, Priming, and Pseudowords: Insights from a Newer Methodology. ARTHUR G. SAMUEL, *SUNY at Stony Brook*—Samuel (*JEP: General*, 1981) reported that perceptual restoration of missing phonemes was stronger in real words than in pseudowords and stronger in primed words than in unprimed. These effects did not appear in Samuel (*J. Memory & Language*, 1987). A new method is reported that clarifies when such lexical effects will and will not appear. The method and results will be used to address the idea

of "perceptual bias," a concept that has not received adequate attention in recent years.

ATTENTION II
Embarcadero CD, Friday Afternoon, 3:40-5:45

Chaired by Raymond M. Klein, Dalhousie University

3:40-4:00 (116)
Brightness Perception: Automatic Detection Versus Controlled Identification in Concurrent Tasks. ANNE-MARIE BONNEL & PIERRE BERTUCCI, *CNRS-LNF, Marseille* (sponsored by Ervin Hafter)—Is there a qualitative difference between "automatic" or "capacity-free" detection and "controlled" or "capacity-limited" identification? A series of dual-task experiments on brightness perception showed that different kinds of information are required for detection and for identification. It may be that transient channels mediate global detection and behave essentially as "change detectors," which detect signal onsets. In contrast, sustained channels mediate focal identification of the direction of change and behave as "integrative detectors."

4:05-4:25 (117)
Dimensions of Experience: What's Important for Perception? ROBERT D. MELARA, *Purdue University*—Cognitive psychologists distinguish between integral and separable experiences. "Integral" is often meant to convey that perceivers have limited access to the constituents of the experience. For example, two dimensions of color—saturation and brightness—are called integral because color stimuli are thought to be coded initially as unanalyzed points in color space. In this talk, I discuss the difficulties—both logically and empirically—in maintaining the traditional view of integral experiences. I argue instead that certain dimensions are *primary* in experience. I report supporting evidence from color, sound, and touch perception.

4:30-4:45 (118)
Is There a Color Advantage in Visual Search? DAVID W. MARTIN & ALAN E. BENSON, *New Mexico State University*—Jonides and Yantis (1988) reported that, in contrast to abrupt-onset targets, detection of uniquely colored targets in visual search was not enhanced when the cue was randomly predictive of target identity. However, we have consistently found a color-advantage effect with 5-character displays when subjects are required to identify rather than detect a target. In an identification experiment, display size was manipulated and these results were replicated. Explanations are offered for the detection/identification difference.

4:50-5:05 (119)
Attentional Capture by Equiluminant Objects. STEVEN YANTIS & ANNE P. HILLSTROM, *Johns Hopkins University*—Abrupt visual onsets capture attention. Possible mechanisms include (a) the activation of low-level visual channels that are sensitive to luminance increments and (b) a higher level mechanism that orients attention to newly presented objects even without a luminance increment. Observers visually searched for a prespecified target in an array of objects defined by discontinuities in luminance, motion, texture, or binocular disparity. The abrupt appearance of an equiluminant object tended to capture attention, supporting mechanism (b).

5:10-5:25 (120)
Novel Visual Shapes in Negative Priming. BRETT DE SCHEPPER & ANNE TREISMAN, *University of California, Berkeley* (read by Anne Treisman)—We report a series of experiments on priming by novel visual shapes, exploring the memory traces left by a single exposure, either attended or unattended, and how they change over 30 successive presentations. Whereas no explicit memory seems to be available for the unattended shapes in a superimposed pair (Rock & Gutman, 1981), we do find negative priming when the novel unattended shape on one trial becomes the attended shape on the next.

5:30-5:40 (121)
Attentional Modulation of Size Contrast. GORDON L. SHULMAN, *Washington University Medical School*—The perceived size of an object depends on the size of surrounding context objects. This illusion depends on whether subjects attend to the context circles. Subjects saw a briefly (150 msec) presented test circle surrounded by small and large context circles of different colors. After judging test circle size, subjects judged the color of either the small or large context circles. Perceived test size depends on which context circles were task relevant.

3-D/MOVEMENT PERCEPTION II
Pacific West DE, Friday Afternoon, 2:40-4:50

Chaired by Maggie Shiffrar, NASA-Ames Research Center

2:40-2:55 (122)
Orientation Affects Both Structural and Episodic Representations of 3-D Objects. LYNN A. COOPER, *Columbia University*, DANIEL L. SCHACTER, *Harvard University*, & CASSANDRA MOORE, *Columbia University*—Previous work has demonstrated functional dissociation between structural and episodic representations of unfamiliar, 3-D objects, and invariance of structural representations over changes in object size and parity. The present experiments examine the effects of manipulation of an object's orientation in the picture plane on priming and recognition. Unlike reflection, rotation in the plane significantly reduces the magnitude of object-decision priming, suggesting that structural representations of objects are axis and reference-frame based.

3:00-3:15 (123)
Lateral Asymmetries in Representational Momentum. ANDREA R. HALPERN, *Bucknell University*, & MICHAEL H. KELLY, *University of Pennsylvania*—Is representational momentum (RM) solely an internalization of environmental properties? Five experiments demonstrate one aspect of RM that cannot have been learned from the environment. For our sample of right-handed subjects, objects apparently moving to the right engender a larger RM effect than those moving to the left. This effect is insensitive to changes in apparent velocity, type of object, and retention interval, and it may be confined to objects in the left half of visual space.

3:20-3:35 (124)
Stereokinetic Phenomena with Rotating Ellipses Follow a Minimum Principle. MARIO ZANFORLIN, *University of Padova*—A rotating ellipse gives rise to three different percepts: an elastic figure, a rigid tilting disc, and a solid ellipsoid. Minimizing relative velocity differences among all the points of the configuration yields three mathematically possible minimal solutions corresponding to the three percepts. The hypothesis predicts: (1) the precise size of the perceived "objects" in depth and (2) what stimuli should be added to obtain a unique minimal solution and a unique percept. Theoretical predictions are supported by experimental results.

3:40-3:55 (125)
Do Moving Observers Decompose Retinal Flow? JAMES E. CUTTING, *Cornell University*—Moving observers find their way through cluttered environments with ease and without injury. Most approaches to wayfinding consider this feat to be done on the basis of information in optical flow. Thus, they insist that retinal flow be decomposed into its component flow fields, one of which is the familiar radial expansion pattern of optical flow. I will present several lines of evidence, however, that suggest decomposition is not performed by human observers.

4:00-4:15 (126)
Perceptual-Motor Organization and the Calibration of Biomechanical Information for Locomotion. JOHN J. RIESER, DANIEL A. ASHMEAD, *Vanderbilt University*, HERBERT L. PICK, JR., *University of Minnesota*, & ANNE GARING, *Vanderbilt University*—People coordinate the force and direction of locomotion with the distance and direction of surrounding objects. To test coordination, people view a target, close their eyes, and attempt to walk to its location (or turn to face it). Precise walking depends on the calibration of vision and action, that is, on knowing how far to walk or turn. We induce recalibration when people walk at one rate while seeing a different rate of optical flow. Transfer of the recalibration effects, at the level of specific muscles or limbs or directions, is used to probe the organization of the underlying system.

4:20-4:30 (127)
Increases in IPD Reduces Perceived Depth in Stereograms.
ROBERT FOX & DEBORAH L. MAUK, *Vanderbilt University*—
Increasing interpupillary distance (IPD) increases retinal disparity when
3-D space is viewed, but increases in IPD do not change the simulated
disparity built into stereograms. If depth constancy is operative, inverse
linear relationships will obtain between IPD and perceived depth inter-
vals even when disparity remains constant. Results from a factorial ex-
periment (3 IPDs, three viewing distances) conform to such relation-
ships, albeit with a small systematic underestimation of perceived depth
(i.e., constancy prevails).

4:35-4:45 (128)
Misdirected Visual Motion: Mae and Phi. ERIC J. HIRIS, *Vander-
bilt University*, ROBERT H. CORMACK, *New Mexico Tech*, & RAN-
DOLPH BLAKE, *Vanderbilt University* (read by Robert H. Cormack)—
A peripherally viewed rectangle moving across a grating can appear
to deviate 90° from its true path. A model providing the requisite stimulus
energy underlying this illusion makes predictions relative to motion after-
effects and apparent motion. Aftereffects should be opposite the illu-
sory direction of motion; they are. Two-point phi-motion should fail
to elicit the illusion under relevant conditions; it so fails. Why there
is no illusion with foveal viewing remains unknown.

ANIMAL LEARNING/BEHAVIOR II
Pacific West FG, Friday Afternoon, 3:00-5:00

Chaired by Helen M. Murphy, John Carroll University

3:00-3:15 (129)
Learned Industriousness. ROBERT EISENBERGER, FRED A.
MASTERSON, & FRANCES WEIER, *University of Delaware*—
Extensive research with lower animals and humans indicates that re-
warded effort contributes to durable individual differences in industri-
ousness. It is proposed that reinforcement for increased physical or cog-
nitive performance, or for the toleration of aversive stimulation,
conditions reward value to the sensation of high effort and thereby reduces
effort's aversiveness. The conditioning of secondary reward value to
the sensation of effort provides a dynamic mechanism by which rein-
forced high performance generalizes across behaviors.

3:20-3:35 (130)
**Context Specificity of Operant Discrimination Performance in
Pigeons.** DAVID R. THOMAS, *University of Colorado at Boulder*—
Pigeons learned a key color discrimination in two similar chambers while
a particular odor was present. Then they learned the reversal in one
of these chambers with a different odor present. The reversal did not
transfer to the alternative chamber. Subsequent experiments revealed
that visual contextual cues played an important role and that the use
of a discrimination and its reversal (rather than single-stimulus train-
ing) was essential. Furthermore, the use of different odors potentiated
the acquisition of control by visual contextual cues.

3:40-3:50 (131)
**Opioid Versus Nonopioid Proactive Effects of Shocks on Gastric
Ulcers.** J. BRUCE OVERMIER, *University of Minnesota*, & ROBERT
MURISON, *University of Bergen*—Rats exposed to either intermittent
5-sec shocks or to a single long shock show dramatically increased ulcer-
ation induced 72 h later by exposure to restraint-in-water stress (at 19° C).
A subcutaneous injection of naltrexone 20 min prior to the shock ses-
sion blocked the proactive effects of intermittent shock but not the long
shock. This suggests there are two types of proactively induced vulner-
ability to ulceration; one is opioid mediated and the other is not.

3:55-4:10 (132)
Body Weight Set-Point and Muscular Exercise in Rats. MICHEL
CABANAC & JULIE MORRISSETTE, *Laval University*—Rats' body-
weight set-point was measured with the hoarding method to be 497 ± 18 g.
Then the rats were trained to run 1 h every day. Mean body weight
set-point was 433 ± 9 g ($p < .05$) when training took place just before
hoarding session, and 504 ± 21 g (n.s.) when training took place after
hoarding session. This suggests that body weight set-point is acutely
lowered by muscular exercise but not by chronic training.

4:15-4:25 (133)
**Length of Exposure to Sucrose and Negative Consummatory Con-
trast Effects in Rats.** FRED VALLE, *University of British Columbia*—
Rats given alternating daily 2-h exposure to 16% and 4% sucrose solu-
tions prior to their daily meal of Purina Chow show negative consum-
matory contrast effects to both the sucrose solution and the Purina Chow
on 4% days (Valle & Valle, *AL&B*, 1991). The present experiments
investigated the length of daily sucrose exposure required to engender
the secondary contrast effect to Purina Chow: neither 15- nor 60-min
exposure is sufficient.

4:30-4:40 (134)
Selective Breeding for Negative Contrast. CHARLES FLAHERTY
& KATHLEEN KRAUSS, *Rutgers University*—Degree of decrement
in lick frequency following a shift from 32% to 4% sucrose was used
as the criterion for a selective breeding program using Sprague-Dawley
derived rats. Reliable differences between the large and small contrast
lines appeared by the fourth generation and have been maintained through
the seventh generation. Behavior of the two lines in the open field, in
other contrast procedures, and in response to selected drugs will be
reported.

4:45-4:55 (135)
Simultaneous Conditioning in Honeybees. JOHN D. BATSON, *Fur-
man University*, JAMES S. HOBAN, & M. E. BITTERMAN, *University
of Hawaii* (read by M. E. Bitterman) (sponsored by M. E. Bitterman)—
Proboscis extension was classically conditioned in two experiments
designed to explicate the role of amount of reward in the development
of odor preferences by honeybees. The results contradict the long-
standing assumption that honeybees learn nothing about odors present
during feeding.

RECOGNITION/RECALL II
Golden Gate A, Friday Afternoon, 2:55-5:30

Chaired by Robert A. Bjork, University of California, Los Angeles

2:55-3:15 (136)
The Regularities of Recognition Memory. MURRAY GLANZER,
New York University, JOHN K. ADAMS, *Montclair State College*, &
KISOK KIM, *New York University*—Three regularities in recognition
memory are presented: (1) the mirror effect, (2) the order of receiver
operating characteristic slopes, and (3) the symmetry of movement of
underlying distributions. Sets of data are presented that demonstrate these
regularities. These regularities are related to attention/likelihood the-
ory and to signal detection theory.

3:20-3:40 (137)
**Do Deliberate, Metamemorial Judgments Underlie the Mirror Ef-
fect?** DOUGLAS L. HINTZMAN, DAVID CAULTON, & TIMOTHY
CURRAN, *University of Oregon*—In the mirror effect, categorization
of both old and new recognition items is better for one stimulus type
(e.g., concrete words) than for another (abstract words). One hypothe-
sis is that this reflects a postretrieval judgment of the memorability of
the test item rather than a fundamental aspect of the recognition process
itself. To test this hypothesis, we examined recognition judgments using
two paradigms: divided versus undivided attention and the response-
signal method of speed-accuracy tradeoff.

3:45-4:00 (138)
Recognition, Recall, and Episodic Information. DAVID L. HORTON
& TIMOTHY J. PAVLICK, *University of Maryland*—Further evidence
will be presented for two kinds of recognition memory that depend on
qualitatively different underlying processes. It will be shown that im-
provements in performance in these two kinds of recognition memory
are often inversely related to one another. Some implications of this
interpretation will be discussed, particularly as it pertains to the dis-
tinction between episodic and semantic memory.

4:05-4:20 (139)
On the Reality of the Tulving-Wiseman Function. ENDEL TULV-
ING, *University of Toronto*, & ARTHUR J. FLEXSER, *Florida Inter-
national University*—Hintzman's (1991) recent claim that the Tulving-
Wiseman (1975) function is a mathematical artifact is wrong. Data from

a large number of experiments and experimental conditions in which recognition hit rate is equal to or exceeds probability of cued recall—and therefore not subject to any mathematical constraints—adhere closely to the Tulving-Wiseman function. These empirical facts attest to the reality of the function.

4:25-4:45 (140)
Recognition Failure in a Composite Holographic Associative Recall Model (CHARM). JANET METCALFE, *Dartmouth College*—The relation between recognition and the recognizability of recallable words in human memory is an orderly function, but one that has resisted theoretical interpretation. A composite, holographic, associative recall and recognition model—CHARM—is applied to this situation. It is shown that because of the interactive nature of the composite memory trace in the model, a relation like that found in the data provided by human subjects is automatically produced.

4:50-5:05 (141)
Knowing Who's New: The Phenomenon of Jamais Vu. J. DON READ, JOHN R. VOKEY, & MATTHEW DAVIDSON, *University of Lethbridge*—Subjects sometimes less frequently recognize a person that they have seen than they falsely recognize a person not previously seen. Such "negative recognition" or "jamais vu" occurs when a person's appearance in photos and video clips has changed from study to test and when episodic familiarity for the person is perhaps discounted because specific retrieval is lacking.

5:10-5:25 (142)
Cognitive Resources and Retrieval Interference Effects in Normal People: The Role of the Frontal Lobes and Hippocampus. MORRIS MOSCOVITCH, *University of Toronto, Erindale Campus*—Four experiments are presented that show that a secondary concurrent interfering task (sequential finger tapping) at study and test impairs performance in normal people only on memory tests sensitive to frontal lobe damage (memory for categorized lists, memory for temporal order, release from PI, and phonemic/fluency) but not on tests sensitive to hippocampal damage (memory for random lists, cumulative learning, memory on prerelease trials in PI test, and category fluency). These studies support the more general hypothesis that the hippocampus acts like a module in which cues elicit memories mandatorily, effortlessly, and automatically and the frontal lobes act like central systems that require cognitive resources for their operation.

PSYCHOLINGUISTICS II
Golden Gate B, Friday Afternoon, 3:40-5:45

Chaired by Laurie B. Feldman, SUNY at Albany

3:40-3:55 (143)
Word Recognition and Ambiguity in Meaning and Syntactic Function. LEONARD KATZ, *Haskins Laboratories*, MIRA PETER, & KARL REXER, *University of Connecticut*—The effects of polysemy and functional ambiguity on lexical decision were examined, factorially, in Serbo-Croatian and English. A polysemous word was recognized faster than a semantically unambiguous word. In contrast, ambiguity in a word's case role (its functional role in its phrase) had the opposite effect: recognition was slowed. Apparently, the resolutions of

lexical meaning and functional syntactic role involve different processing mechanisms.

4:00-4:20 (144)
Prosodic Information for Syntactic Structure in Parental Speech. ANNE LEDERER & MICHAEL H. KELLY, *University of Pennsylvania* (read by Michael H. Kelly)—Thirty-six mothers read one of six phrase structurally ambiguous sentences to their infants (mean age = 10 months), with a prior story context indicating the intended interpretation. Analysis of the two interpretations revealed that syllable durations and F0 at prosodic boundaries are strongly correlated with the number of syntactic boundaries crossed. This is the first demonstration that the hierarchical syntactic structure of an utterance is recoverable from the prosodic structure of parental speech.

4:25-4:40 (145)
The Tip-of-the-Tongue (TOT) Experience: The Effects of Recency, Frequency, and Aging. DEBORAH M. BURKE, KATHLEEN RASTLE, *Pomona College*, & CARRIE MARINER, *University of Virginia*—We induced TOT states in young and older adults and found that probability of a TOT increased with subject age but decreased by about one half for target words presented earlier in a pronunciation task. Recency effects were comparable across age, suggesting that age-related increases in spontaneous TOTs are not because of age differences in word recency. A model is presented in which TOT probability is affected by word recency and frequency and by subject age.

4:45-5:00 (146)
Toddlers' Understanding of the Normative Concepts of Color and Number. MARILYN SHATZ & ANDREA BACKSCHEIDER, *University of Michigan*—We propose that children's earliest understandings about the normative concepts of color and number come from discourse with parents and that these understandings are top-down, concerning lexical categories, not word-to-world mappings. Our study examined how toddlers under the age of two use color and number terms. Virtually none could consistently map color or number terms to the world correctly. However, even toddlers unable to use them appropriately knew that color and number terms belonged to separate lexical categories.

5:05-5:15 (147)
Repair Maneuvers. SAMUEL FILLENBAUM, *University of North Carolina at Chapel Hill*—If a cooperative speaker says what should not need saying, then maybe it really did need saying, and normal assumptions about reality may be revised. But what if the speaker asserts what has been presupposed immediately before? People recognize that something is amiss and will reverse the order of presupposed and asserted materials or delete the latter, responding very differently than when the assertion conflicts with previously presupposed material or when normal assertion-presupposition order obtains.

5:20-5:40 (148)
Spelling Ability and Word Recognition Strategies. VIRGINIA M. HOLMES, *University of Melbourne* (sponsored by Edward J. Shoben)—Knowledge of how to spell long words with idiosyncratic spelling patterns most strongly discriminates poor from good adult spellers. Thus, poor spellers make more errors than good spellers in resolving the lexical status of long, irregular words. Poor spellers also have greater difficulty classifying nonwords based on long, regular words with pairs of medial letters transposed. Further, the idea that poor spellers process words in a rapid, cursory fashion is not substantiated.

POSTER SESSION I
Pacific Concourse East, Friday Evening, 5:45-7:15

(149)

Prerecognition Pattern Processing by Left and Right Hemispheres. LLOYD L. AVANT, ALICE A. THIEMAN, & MICHAEL B. TEPIN, *Iowa State University*—Good and poor gestalt dot patterns were presented in paired pre- and postmasked 10-msec presentations to the RVF/LH or LVF/RH, and patterns were not recognized. Subjects judged which of the paired flashes appeared to last longer. Duration judgments showed differences between LH and RH prerecognition processing of these patterns. Implications for earliest hemispheric visual processing are discussed.

(150)

Effects of Blurring on Hemispheric Asymmetry for Processing Spatial Information. ELIZABETH L. COWIN & JOSEPH B. HELLIGE, *University of Southern California* (presented by Joseph B. Hellige)—Subjects indicated whether a dot was presented above or below a line or whether the dot was within 3 mm of the line. Stimuli were projected to the LVF or RVF on each trial and were presented clearly or blurred. Clear stimuli produced a task × visual field interaction that changed with practice. Blurring disrupted performance and eliminated the task × visual field interaction found with clear stimuli at early stages of practice.

(151)

Perception of Conspecific Faces by a Bird. SUSAN D. BROWN & ROBERT J. DOOLING, *University of Maryland* (presented by Robert J. Dooling)—The perception of conspecific faces by budgerigars was assessed by analyzing reaction times to discriminate between faces. Budgerigars discriminate among other budgerigar faces more efficiently than among the faces of other avian species. The salient features of conspecific faces were confirmed using computer-generated synthetic models of natural faces. These models were further modified to demonstrate that efficient processing (discrimination) of faces in this species depends on a normal configuration of features.

(152)

Palatability Differentially Affects Aversive Conditioning of Gustatory and Nongustatory Food Cues. STUART R. ELLINS, CHRISTINE L. ROBERTS, & DAVID K. KENNEDY, *California State University, San Bernardino*—Varying contributions of saccharin produce tastes ranging from sweet (palatable) to bitter (unpalatable). In a series of experiments, we found that although unpalatable tastes followed by LiCl-induced illness produce stronger conditioned taste aversions, palatable tastes potentiate stronger conditioned aversions for auditory cues that are spatially contiguous with ingesta. The results are discussed in terms of attentional differences in the aversive conditioning of gustatory and nongustatory food cues.

(153)

Shock Avoidance Via Learned Orientation by Individual *Drosophila melanogaster*. KATHARINE L. LOFDAHL & JERRY HIRSCH, *University of Illinois at Urbana-Champaign* (presented by Jerry Hirsch)—We report rapid shock avoidance learning (and more rapid relearning) of an orientational response accompanied by inhibition of locomotion by individual Drosophila using a direct current voltage source to establish an optimal shock intensity.

(154)

The Effects of Medial Frontal and Orbitofrontal Lesions on Timing Performance in the Rat. DAVID L. FREDERICK & JOSEPH D. ALLEN, *University of Georgia* (presented by Joseph D. Allen)—Timing shifts produced by medial frontal or orbitofrontal cortex aspirations were examined in 18 80-day-old male rats. Trained to estimate a 40-sec interval using the peak procedure, they received a 14-session retest following surgery. Individual, mean peak time, and distribution curves showed timing behavior unaffected by either lesion. Results are inconsistent with those of Meck et al. (1987) and imply that the frontal lobe is not involved with timing behavior in the rat.

(155)

Complex Conditional Relationships Learned by a Language-Trained Sea Lion. ROBERT C. GISINER, *Naval Ocean Systems Center, Hawaii Laboratory*, & RONALD J. SCHUSTERMAN, *California State University, Hayward* (sponsored by Paul E. Nachtigall)—A sea lion was trained to respond appropriately to instructions conveyed by two to seven signs. She was then presented with probe trials containing missing, added, or disordered signs. The sea lion's responses showed that she had learned more than the specifically trained paired-associate relationships between signs and referents. Signs were also treated as cues about the next sign in sequence (sequential conditional relationships) and as cues for response organization (hierarchical conditional relationships).

(156)

Retroactive Interference of Delayed "Symbolic" Matching to Sample in California Sea Lions. RONALD J. SCHUSTERMAN, BRIGIT GRIMM, *University of California, Santa Cruz*, ROBERT C. GISINER, *Naval Ocean Systems Center, Hawaii Laboratory*, & EVELYN HANGGI, *University of California, Santa Cruz*—Two female California sea lions were trained on two-choice delayed conditional discrimination tasks. Delays were gradually extended for both sea lions, and although Rocky showed little or no forgetting over delay intervals of from 1 sec to 2 min, Rio showed some forgetting over delay intervals of from 1 sec to 45 sec. In retroactive interference experiments, both sea lions showed nearly complete forgetting when irrelevant comparison stimuli were shown during the delay intervals.

(157)

A Cognitive Perspective on Parent–Young Recognition in Kittiwakes (*Rissa tridactyla*). RITA E. ANDERSON, *Memorial University of Newfoundland*, JULIE M. PORTER, *Fisheries and Oceans Canada*, & ANNE E. STOREY, *Memorial University of Newfoundland*—A cognitive analysis of memory-related behaviors challenges the standard behavioral ecology claim that black-legged kittiwake (*Rissa tridactyla*) parents do not recognize their chicks. Results of four experiments suggest that the lack of recognition reflects both lowered chick vocal identifiability and reduced differential responding by chicks and parents to each other, relative to ground-nesting gulls. Kittiwake memory-related behavior is discussed in terms of decision rules versus adaptation of memory systems.

(158)

Context Value Modulates Levels of Response Recovery after Random Control Training. LYNN ARONSON, *Columbia University*, PETER D. BALSAM, *Barnard College, Columbia University*, & JOHN GIBBON, *New York State Psychiatric Institute and Columbia University* (presented by John Gibbon)—Pigeons exposed to autoshaping procedures followed by response elimination using random control show response recovery in extinction (Lindblom & Jenkins, 1981). In Experiment 1, subjects receiving intervening context extinction before testing showed stronger recovery. In Experiment 2, subjects tested in a context not present during random training also showed stronger recovery. Levels of recovery may depend on a comparator-like performance rule, sensitive to context value (i.e., Gibbon & Balsam, 1981).

(159)

Conditioning Flavor–Flavor Associations Via Opponent Processes of Sickness/Wellness. LEWIS M. BARKER, MARK BOWMAN, & LAURA HERBERT, *Baylor University*—Aversions to flavor A and preferences for flavor B can be conditioned concurrently in rats when A precedes and B follows lithium injections. A also becomes associated with B. When, following conditioning, A is extinguished, reconditioned, and reextinguished, preference for B tracks the aversion to A. If A is aversive, B is preferred, and, alternatively, when aversion to A is extinguished, preference for B is correspondingly diminished. Association via opponent processes of sickness–wellness is hypothesized.

(160)

Heptophysostigmine Attenuates the Effects of Scopolamine in a 14-Unit T-Maze. SETSU IIJIMA, DONALD K. INGRAM, EDWARD

L. SPANGLER, BRETT HELLER, & PAOLO GAROFALO, *National Institute on Aging* (sponsored by Donald K. Ingram)—Heptophysostigmine (1.0, 1.5, 2.0 mg/kg i.p.), a long-acting form of the indirect cholinergic agonist physostigmine, was administered prior to injection of the muscarinic cholinergic antagonist scopolamine (0.75 mg/kg i.p.) in 3-month-old F-344 rats. All rats were subsequently tested in a complex, shock-motivated 14-unit T-maze, known to be sensitive to cholinergic antagonism and demonstrating robust age-related effects in rats. Heptophysostigmine attenuated the effects of scopolamine in a dose-related manner.

(161)

Stimulus Control of Pavlovian Inhibition. B. KENT PARKER, SHERRY L. SERDIKOFF, & THOMAS J. SPENCER, *West Virginia University*—The present study examined stimulus control of Pavlovian inhibition. Training consisted of the presentation of a *B* stimulus in a feature-negative discrimination in which the *A* stimulus was followed by grain presentation only if *not* preceded by *B* ($B{\to}A-/A+$). Control by the *B* stimulus was assessed using generalization training. The results are compared with those obtained in studies examining (a) stimulus control of Pavlovian facilitation and (b) operant feature-negative discrimination training.

(162)

Landmark Learning in Honeybees. P. A. COUVILLON & M. E. BITTERMAN, *University of Hawaii*—The performance of foraging honeybees trained to discriminate between two feeding places, one of which was distinguished by a pair of landmarks 30 cm to either side of it, was impaired by removal of the landmarks after feeding began. The results are compatible with accumulating evidence of excitatory "backward" conditioning in vertebrates.

(163)

Differences in Affiliative Behavior among Voles (*Microtus*). ALLEN L. SALO, *University of Florida*, LAWRENCE E. SHAPIRO, *National Institute of Mental Health*, & DONALD A. DEWSBURY, *University of Florida* (presented by Donald A. Dewsbury)—We are working to characterize traits that lead prairie and pine voles to be generally monogamous and meadow and montane voles to be generally polygamous. We have previously shown that prairie voles are more contact prone, that is, huddle more when in male-female pairs in 1-h tests, than are montane voles. We now show that pine voles huddle more than meadow voles. These data suggest that contact proneness may be a factor engendering monogamy.

(164)

Attenuation of the Habituation of Neophobia by Swim Stress. T. R. SCHACHTMAN, B. R. BUTCHART, J. L. CALTON, *University of Missouri–Columbia*, & S. REILLY, *Pennsylvania State University Medical School*—Previous reports found that external stressors during classical conditioning of a taste aversion can produce poor conditioned responding at test. The present experiments tested one theory of such effects: that external stressors inhibit learning about internal events as claimed by the gut-defense/skin-defense systems theory. Supporting this view, it was found that swim stress disrupted processing during simple flavor preexposure and maintained a neophobic response at test relative to a nonstressed control condition.

(165)

Intrasession Dynamics of Waiting in Pigeons. CLIVE D. L. WYNNE & J. E. R. STADDON, *Duke University* (sponsored by J. E. R. Staddon)—Pigeons were exposed to series of interfood intervals that varied within a session. In different conditions, the frequency (number of sine-wave cycles per session) and noise content (amount of random noise added into a sine wave) of variation were changed. With time to first peck as dependent variable, the results showed that adaptation to temporal contingencies was very rapid, but not solely based on the immediately preceding interfood interval.

(166)

Distortions in the Perception of Spatial Axes. URS J. BUCHER, *University of Zurich and NASA-Ames Research Center*, FRED W. MAST, & NORBERT BISCHOF, *University of Zurich* (sponsored by Malcolm M. Cohen)—To perceive a stable visual environment and preserve space constancy, the CNS performs complex transformations of continually changing retinal signals. Four subjects were tilted to 62 different body positions (pitch and roll combined) and set visual targets to their apparent vertical and horizontal. No visual direction cues were provided. Angular distortions as large as 40° were found when the body was tilted more than 90°; a mathematical description of this nonorthogonality is presented.

(167)

Task Dependence in the Global Effect for Saccadic Eye Movements. CLARA CASCO & GABRIELLA LUPI, *University of Padua* (sponsored by Lucia Colombo)—We recorded saccade amplitude while subjects performed either a "physical" or a "name" letter-matching task on peripherally presented letter pairs. Saccades landed closer to one of the two letters in the name-letter-matching task. In the physical letter matching, however, saccades fell to an intermediate position between the two targets. This is called global effect, and it is stronger with physically identical than with physically different letters. Our results indicate that the activation of an automatic subsystem with low resolution, underlying the global effect, is task dependent and is more likely to occur with tasks involving sensory codes.

(168)

The Detection of Texture Density: Evidence from Adaptation. FRANK H. DURGIN & DENNIS R. PROFFITT, *University of Virginia* (presented by Dennis R. Proffitt)—The perception of texture density is susceptible to powerful adaptation effects amounting to a retinally localized response suppression of about 50%, measured by a staircase method. The visual registration of texture density appears to be accomplished by a detection system specifically sensitive to the density or clustering of elements. This detection system may be locally distorted by exposure to high-density stimuli. The effects cannot be explained by luminance, contrast, spatial frequency, or size information.

(169)

Rapid Discrimination of Textures Comprising Isospectrum Micropatterns. RICK GURNSEY & PAULINE PEARSON, *University of Western Ontario* (sponsored by Mel Goodale)—Several recent theories assume that texture discrimination involves localizing energy gradients within spatially restricted regions of "neural images," each of which represents the convolution of the input image with an orientation and scale selective filter. This assumption was tested using textures comprising L- and X-type micropatterns that had identical amplitude spectra but different phase spectra. The resultant textures were easily discriminable at brief exposures and discrimination showed an interesting dependence on eccentricity of presentation.

(170)

Magnitude Estimations of Reflex-Eliciting Stimuli: (Non)Contribution of the Reflex. CHARLES B. WOODS, *University of Florida*, & P. HAERICH, *La Sierra University* (presented by P. Haerich) (sponsored by W. Keith Berg)—Magnitude estimations and electrophysiological measurements of the reflex blink were collected from subjects presented with acoustic (white noise) and tactile (periocular air puff), reflex-eliciting stimuli of various intensities. Results indicated that (1) perceptions of intensity changes were consistent across subjects (with the power function for air puffs being greater than that for noise), (2) reflex probability (but neither amplitude nor latency) was significantly associated with increasing intensity, and (3) magnitude estimations were independent of the elicited reflex.

(171)

Color Discrimination and Color-Opponent Strength in Normal and Defective Color Vision. CHARLES B. WOODS & KEITH D. WHITE, *University of Florida* (sponsored by Robert D. Sorkin)—Color-normal, dichromatic, and anomalous observers were tested at five different field sizes with Rayleigh matches to measure color discrimination and bichromatic mixture thresholds to measure luminance additivity. These measures were compared within and between observers to determine how well the luminance additivity index of color opponent strength predicts color discrimination. Luminance additivity could predict color discrimination among normals (high and low discriminators) and among dichromats but not among simple or extreme anomalous trichromats.

(172)

The Effect of Target Position in a Visual Search Task. MARISA CARRASCO & DENISE EVERT, *Wesleyan University* (sponsored by R. A. Kinchla)—Two experiments, involving an orientation × color conjunction visual search task, examined the effect of target position under free and fixed viewing conditions (eye movements possible and impossible, respectively). Both experiments found an asymmetry: the tilted target was processed faster and better than the vertical one. Reaction time and errors increased with increasing eccentricity. The effect was more pronounced as more stimuli were displayed. The results seem to support the "zoom lens" hypothesis of covert attention.

(173)

Localization Illusion in Taste. L. BARTOSHUK, L. GREEN, C. LEHMAN, S. MARINO, *Yale University School of Medicine*, & J. TODRANK, *University of Pennsylvania*—When a taste solution was "painted" from an area with many taste receptors into an area with few, the initial strong taste filled the tactile path and produced the illusion of strong taste from the receptor-poor area. Similarly, when touch was spared but taste was locally damaged or anesthetized, painting a solution from the intact into the impaired area produced sensations "from" the impaired area. However, anesthetizing touch and taste caused this illusion to disintegrate.

(174)

Generalization between Sensorimotor Maps. HELEN A. CUNNINGHAM & ROBERT B. WELCH, *NASA-Ames Research Center* (sponsored by Robert B. Welch)—In the first of two experiments, subjects alternately practiced (1) a visual tracking task involving 108° clockwise rotation of hand relative to visual space and (2) the normal hand-eye mapping. Eventually, subjects performed both tasks with little mutual interference. Positive transfer was found to a 72° clockwise rotation and negative transfer to a 72° counterclockwise rotation. The second experiment extended these results to reflection transformations. These results support the existence and generalizability of "multiple adaptations."

(175)

The Influence of Visual Pitch on Visually Perceived Eye Level Is Spatiopic. WENXUN LI & LEONARD MATIN, *Columbia University* (sponsored by Leonard Matin)—The elevation of visually perceived eye level (VPEL) is systematically influenced by the pitch of a visual field consisting of a single vertical line in darkness. The effect is essentially spatiotopic with the VPEL-versus-pitch function nearly invariant with variation of horizontal gaze direction. However, with gaze directed within the median plane, change in horizontal eccentricity of the line produced systematic change in the slope of the VPEL-versus-pitch function.

(176)

Perception of Shrinking in Apparent Motion. MAURICE HERSHENSON, *Brandeis University*—Apparent motion was produced by exposing triangles of different sizes for 100 msec with 50 msec ISI and 200 msec recycle interval. Triangles with one colinear side appeared to shrink and expand in a fixed depth plane. Concentric triangles were perceived as constant-sized objects moving in depth. Type of pattern (dots, outline, or filled), background (blank; horizontal, perspective, or full texture), and orientation of base had no effect.

(177)

Influence of Depth Cues on Velocity of Apparent Motion. MICHAEL K. McBEATH, *NASA-Ames Research Center* (sponsored by Roger N. Shepard)—A new objective technique was used to measure experienced velocity of 3-D apparent motion with displays that varied consistency of depth cues. Subjects discriminated between tilted, maximally fast clockwise and counterclockwise stimulus sequences. Temporal variance was better accounted for by 3-D spatial separation than by 2-D retinal separation, and the influence of each depth cue was additive. When all cues specified tilt in depth, velocity of apparent motion remained relatively constant over separation in 3-D space.

(178)

Cooperative Self-Organization in the Perception of Apparent Motion. HOWARD S. HOCK & GUNTHER W. BALZ, *Florida Atlantic University*—A row of dots is presented in a series of alternating frames; dots in each frame are located at the midpoints between dots of the preceding frame. Although the perceived frame-to-frame direction of motion could vary randomly, cooperativity is indicated by the emergence of two temporally coherent motion patterns, one unidirectional (small dot separations), the other oscillatory (larger dot separations), and a third perceptual state in which the dots appear to be stationary.

(179)

Early Vision Detects Differential Structure Prior to Stereopsis. JOSEPH S. LAPPIN & WARREN D. CRAFT, *Vanderbilt University*—Spatial derivatives of optical images constitute potentially visible information about the structure of surfaces in 3D. Is early vision sensitive to differential structure prior to binocular combination of the two monocular half-images? Evidently so: Stereoacuity (< 10 sec arc) remains invariant under dichoptic transformations that alter correspondences between pairwise spatial relations in the two monocular half-images but do not change their second-order differential structure.

(180)

3-D Bilateral Symmetry Assumed in Judging Figural Identity and Orientation. DIANE J. SCHIANO, MICHAEL K. McBEATH, *NRC/NASA-Ames Research Center*, & BARBARA TVERSKY, *Stanford University* (sponsored by Mary Kaiser)—Subjects viewed symmetric and asymmetric random polygons and described "what the figure looks like" and its orientation. The findings demonstrate that viewers tend to interpret indeterminate shapes as silhouettes of 3-D bilaterally symmetric objects. Symmetric shapes are interpreted as front or top views and asymmetric shapes as profile or oblique views. The assumption that indeterminate stimuli depict symmetric, 3-D objects appears to be a frequently used pattern-recognition heuristic.

(181)

Effects of Temporal Recruitment on Perceived Direction of Moving Stimuli. BENNETT I. BERTENTHAL & TOM BANTON, *University of Virginia*—The perceived direction of a moving stimulus is biased by its past stimulation. In a series of experiments, we show that this bias is mediated by the velocity, and not merely the direction of the past stimulation. Moreover, this bias is offset by contradictory depth information but not by contradictory form information. These results are most compatible with a global cooperative model (composed of velocity-tuned local operators) that is modulated by higher level heuristics.

(182)

Motor Coactivation and Response Force in Bimodal Stimulation Paradigms. ROLF ULRICH & MARKUS GIRAY, *University of Tubingen* (sponsored by Jeff Miller)—Response force and RT were measured in two experiments using visual, auditory, and bimodal stimuli. Responses were faster to bimodal than unimodal stimuli, both when responses were made to any stimulus (Experiment 1, redundant targets effect) and when responses were made only to the visual stimulus (Experiment 2, intersensory facilitation effect). Response force was also greater for bimodal than unimodal stimuli, suggesting that part of each effect occurs in the motor system.

(183)

Mental Rotation and the Gravitational Upright. ALINDA FRIEDMAN & DANIEL PILON, *University of Alberta*—We independently varied the angular disparity between two 3-D elongated shapes and the angular distance between the top of one shape and the gravitational upright. Both factors accounted for a significant proportion of the variance in response times for identity judgments. In general, the effect of angular disparity between the shapes increased as the top of the leftmost stimulus was increasingly farther from the upright. Results are discussed in terms of their implications for shape recognition.

(184)

Vigilance for Real and Subjective Contours. W. TODD NELSON, JOEL S. WARM, WILLIAM N. DEMBER, *University of Cincinnati*, & RAJA PARASURAMAN, *Catholic University of America* (presented by Joel S. Warm)—Signal detection for real and subjective contour targets in a vigilance task varied inversely with increments in event rate and event synchrony, providing further evidence for functional equivalence in the perception of real and subjective contours. Work-load rat-

ings (NASA-TLX) varied directly with increments in task difficulty only in conjunction with the subjective targets, a result which supports the notion that the perception of subjective contours drains more attentional capacity than that of real contours.

(185)

Preattentive and Attentive Processes in Enumeration: Color Versus Brightness Contrast. LANA TRICK, *University of British Columbia* (sponsored by Jim Enns)—*Subitizing* is the rapid (40-100 msec/item) apprehension of number in the 1-4 range. *Counting* is the slower (250-350 msec/item) process of enumeration when there are larger numbers of items. Trick and Pylyshyn (1991) found that subjects can subitize target items in a background of distractor items, but only if the targets and distractors differ by a feature. This suggests that there may be a limited capacity preattentive individuation mechanism at work in subitizing, because enumeration by its nature requires individuation to prevent targets from being recounted or missed. The counting process seemed to require spatial attention. In addition, contrast between targets and the background affect the subitizing slope but not the counting slope. The relative contributions of the color and brightness channels to this effect are examined.

(186)

Dividing Attention between Color and Shape: Extensions to the Interactive Race Model. J. TOBY MORDKOFF, *University of California, San Diego,* & STEVEN YANTIS, *Johns Hopkins University* (sponsored by Steven Yantis)—Previous work has shown that the performance of tasks requiring divided attention across spatial locations is well described by an interactive race model. Under this model, only one target on redundant-target trials directly activates the response. Three new experiments demonstrate that dividing attention between featural dimensions—color and shape—is best explained in terms of coactivation with both target features activating the response on redundant-target trials.

(187)

Early Perception: Searching for Textures and Single Elements. TARA C. CALLAGHAN, *St. Francis Xavier University* (sponsored by C. Ann Cameron)—This experiment bridges the gap between visual search for single elements and texture segregation for groups of elements (orientation and luminance) using a single vsearch task. Number of target elements (1, 2, 6), variation in background (constant, variback), and similarity of elements within target (high, low) varied. Results indicate lowering similarity of elements within target impairs ability to find target but the particular effect depends on dimension varied and whether one or both regions (target, background) contain variation.

(188)

An Interpretation of the Role of Attention in Location Cuing. M. L. CHEAL & D. R. LYON, *University of Dayton Research Institute*—In order to better understand the attention mechanisms that occur during a trial in the location-cuing task, a framework was developed within which a proposed temporal sequence of events is specified. This theoretical framework helps explain several puzzling aspects of location-cuing data, such as (1) some of the temporal differences between central and peripheral precuing and (2) the effect of invalid cuing on feature discrimination.

(189)

Attending to Objects or Their Locations. KEVIN A. BRIAND, *SUNY at Albany* (sponsored by Robert Rosellini)—Covert visual attention has been postulated to occur through either attention to objects or the locations they occupy. The present experiment induced either an object-based or a location-based mode of attention and confirmed that making simultaneous judgments about two separated objects was difficult only when in a location-based mode. When presumably in an object-based mode, distance between objects had no effect on performance.

(190)

Inhibition of Return to Locations and to Features. HO-WAN KWAK & HOWARD EGETH, *Johns Hopkins University* (presented by Howard Egeth)—Inhibition of return refers to a detrimental consequence of orienting attention to a specific spatial location. Would a similar effect occur in a nonspatial task? For example, would the response to a red stimulus be slower if the preceding stimulus were red rather than

blue? Our results suggest not. We found a consistent failure of inhibition of return in several nonspatial domains (viz., color, orientation, and form). Implications of these findings are discussed.

(191)

The Effect of Relative Probe Position on a Dual Target RSVP Task. SANDRA DRAKE & KIMRON SHAPIRO, *University of Calgary* (presented by Kimron Shapiro)—Using rapid serial visual presentation (RSVP), subjects are required to identify a target letter from among a stream of nontarget letters and indicate if a subsequent probe occurs. When the probe is followed by other letters, identifying the target results in a probe-detection decrement of about 450 msec. The probe-detection decrement is attenuated, however, when the probe is the last letter stimulus, even when it is masked by a random-dot pattern.

(192)

Spatial Distribution of Attention in Detection and Identification Tasks. STEPHEN D. RADER & FRANCES J. FRIEDRICH, *University of Utah* (presented by Frances J. Friedrich)—Evidence exists in support of several models describing the allocation of spatial attention, including spotlight, zoom lens, and gradient. However, the tasks used have varied widely across models. This series of experiments explores how the distribution of attention differs for detection and identification and as a function of cue size. The results suggest that the nature of the task places strong constraints on attention distribution and the effectiveness of different cue types.

(193)

Movement Preprogramming: When RT Does Not Increase with Movement Complexity. IAN M. FRANKS, *University of British Columbia*—Reaction time increases as the movement becomes more complex. Three experiments are described that investigated several situations where RT did not increase across levels of complexity. Two simple movements were compared. When subjects were asked to extend and flex in a continuous movement, the RT to complete this movement was significantly greater than the RT to complete the extension movement. However, when subjects were asked to extend, pause, and flex, there was no comparative increase in RT.

(194)

Adaptive Coordination and Recalibration of the Eye-Hand System Under Optical Misalignment. GORDON M. REDDING, *Illinois State University,* & BENJAMIN WALLACE, *Cleveland State University*—Direct-effect measures of terminal error in target pointing observed under optical displacement with visual feedback showed complete adaptation in about 30 trials of paced (3-sec rate) sagittal pointing and overcompensation for the remaining 30 trials. Aftereffect measures observed with the optical misalignment removed and without visual feedback showed slower adaptation, which was only about 40% complete after 60 trials. These differences suggest a strategic coordination component of direct-effect measures beyond the automatic recalibration reflected by after-effect measures.

(195)

Tendency or Pattern? The Nature of Veering among Blind Pedestrians. DAVID GUTH, *Western Michigan University* (sponsored by John Rieser)—The ability of blind ($n=18$) and blindfolded-sighted ($n=7$) pedestrians to establish and to maintain a 25-m straight-line trajectory in the absence of auditory and underfoot cues was assessed across 3 to 14 15-trial test sessions. In agreement with previous research, most subjects exhibited a clear "veering tendency" across the 15 trials of individual test sessions. Across sessions, however, the characteristics of the tendency tended to vary. Implications of these findings for explaining and reducing veering will be presented.

(196)

Does Vision Guide the Hand or Update Knowledge of Target Location? LINDA L. LAGASSE & DAVID A. ROSENBAUM, *University of Massachusetts* (sponsored by David A. Rosenbaum)—Traditionally, vision has been thought to guide aiming movements by allowing on-line comparisons of hand and target locations. An alternative view, proposed here, suggests that vision merely helps update knowledge of target locations. We have tested this hypothesis by comparing aiming to externally held or subject-held targets in the light or in the dark.

(197)

Tapping Speed and Bimanual Coordination in Expert Versus Amateur Pianists: Talent or Practice? RALF TH. KRAMPE, *Max Planck Institute, Berlin,* & K. ANDERS ERICSSON, *University of Colorado at Boulder* (presented by K. Anders Ericsson)—Twelve expert pianists displayed higher speed than 12 age-matched amateur pianists for both simple finger tapping and series of fixed keystrokes with either or both hands. The magnitude of the skill differences increased as a function of coordination complexity. Amount of past and current deliberate practice assessed from diaries and retrospective estimates for each individual predicted the pattern of movement speed as well as asymmetries between left and right hands better than the expert–amateur distinction.

(198)

Age Differences in Serial Mental Rotation: Replication and Extension. CHRISTOPHER HERTZOG & BART RYPMA, *Georgia Institute of Technology*—Hertzog and Rypma's (1991) pattern of age differences in a serial mental rotation paradigm is problematic for inferences of age-related slowing in speed of mental rotation. We found relatively small differences in rotation RT slopes accompanied by larger differences in decision RT slopes. The present experiment, now in progress, replicates and extends these results by imposing a response deadline, minimizing opportunity for mental rotation to be deferred to the decision phase of the task.

(199)

Automaticity of Frequency and Spatial Encoding: Concurrent Processing, Practice, and Aging. JAMES M. PUCKETT, *Texas A&I University,* CONSTANCE E. TOFFLE, & LESLEE K. POLLINA, *West Virginia University*—In Experiment 1, spatial and frequency encoding tasks were given alone and in combination, and incidentally and intentionally (the latter manipulation both within- and between-subject in order to assess practice effects). Practice and concurrent processing effects were obtained. In Experiment 2, young and old adults were given the same conditions as in Experiment 1 except that only incidental conditions were used. Again, a concurrent processing effect was obtained but no age effect. Results suggest that these encoding tasks are nonoptimally automatic (Sanders et al., 1989).

(200)

Mental Rotation Ability as a Function of Age, Sex, and Handedness. STEPHANIE M. CLANCY & CAROL A. BONTEMPO, *Southern Illinois University* (sponsored by Dennis L. Molfese)—Mental rotation ability, as measured by the Vandenberg and Kuse Mental Rotations Test, was examined in a sample of young (18–22 years) and old (66–85 years) adults as a function of sex and handedness. The mental rotation scores of males were higher than females, independent of handedness. Right-handers, as assessed by the Edinburgh Handedness Inventory, had higher scores than left-handers. Young subjects exhibited superior performance relative to older adults. Several interactions involving age, sex, and handedness were also observed. The implications of the present findings for the study of spatial ability based on sex and handedness across the life span is considered.

(201)

Aging and the Inhibition of Spatial Location. S. LISA CONNELLY & LYNN HASHER, *Duke University* (presented by Lynn Hasher)—Younger and older adults indicated the location of a target that appeared on critical trials with a distractor. Across successive pairs of trials, both groups were slower to respond to the target when it appeared in a location previously occupied by the distractor than when it appeared in a new location. While older adults appear unable to inhibit identity, they seem as able as younger adults to inhibit spatial locations. Interference data are also presented.

(202)

Spatial Memory Changes in Adulthood. BOB UTTL & PETER GRAF, *University of British Columbia* (presented by Peter Graf)—Age-related changes in spatial memory were investigated as part of an exhibit on memory. The subjects were visitors to the exhibit. In an intentional condition, subjects were informed about an impending memory test before they entered the exhibit; in an incidental condition, they were not so informed. Memory performance was not affected by the incidental versus intentional manipulation. There was an age-related decline in memory, but only for subjects older than 65 years.

(203)

Organizational Signals Affect Text Recall. ROBERT F. LORCH, JR., & ELIZABETH PUGZLES LORCH, *University of Kentucky*—This study tested four models concerning how signals influence text recall. Subjects read and recalled a text in which all topics were signaled simultaneously by overviews, headings, and summaries (ALL); no topics were signaled (NONE); or half of the topics were signaled (HALF). The most important finding was that signaled topics were recalled better than unsignaled topics in the HALF condition. The results support the hypothesis that signals induce selective processing of text topics.

(204)

Organizational Signals and Reading Instructions Affect Text Processing. ELIZABETH PUGZLES LORCH, ROBERT F. LORCH, JR., & JONATHAN M. GOLDING, *University of Kentucky* (sponsored by Robert F. Lorch, Jr.)—Readers' text-processing strategies are constrained by the manner in which a text is written. Subjects read a computer-presented text under instructions to read for comprehension or to do a free recall. The text either did or did not contain organizational signals (overviews, headings, and summaries). When the text did not contain signals, reading speed was unaffected by instructions; when the text did contain signals, reading speed was faster under comprehension than under recall instructions.

(205)

The Effect of Purpose for Reading a Procedure on Performance Measures. VIRGINIA A. DIEHL, *Western Illinois University,* LIEN-CHONG MOU, *University of Maryland,* CAROL BERGFELD MILLS, *Goucher College and American Institute for Research,* & DEBORAH P. BIRKMIRE, *U.S. Army Human Engineering Laboratory* (sponsored by Carol Bergfeld Mills)—The effect of purpose for reading a procedure on task completion and text recall was investigated. Forty-eight subjects read one of two texts; half read to do the task and half read to recall the text. Condition did not affect task performance. However, subjects who read more naturally (Read to Do) recalled more active than static text, while subjects who read to recall did not. Thus, purpose for reading affected the type of information remembered.

(206)

Loci of Visual Areas Involved in Reading Filtered Words That Improve Reading Performance. TERI B. LAWTON, *University of Oregon* (sponsored by Michael I. Posner)—Image-enhancement filters boost the amplitude of spatial-frequency components that are less visible for the low-vision observer. Low-vision observers have experienced a two- to fourfold increase in reading speed at up to 70% less magnification when reading filtered text. I also report reading-speed changes for myopic viewers and discuss the neural systems involved in these improvements.

(207)

Lexical Guidance in Sentence Parsing. BEVERLY COLWELL ADAMS, CHARLES E. CLIFTON, JR., *University of Massachusetts at Amherst,* & DON C. MITCHELL, *University of Exeter* (sponsored by Charles Clifton, Jr.)—Eye movements were measured while subjects read sentences like "Although the audience yawned, the comedian continued telling very bad jokes." The intransitive verb (e.g., "yawned") was replaced half the time by an optionally transitive verb (e.g., "booed"), and each was followed half the time by a common. The pattern of fixation durations and regressive eye movements was interpreted in terms of how and when verb transitivity information is used.

(208)

Word Class Effects in Intrasentential Code-Switching. SHOJI AZUMA, *University of Utah,* & RICHARD P. MEIER, *University of Texas at Austin* (sponsored by Donald J. Foss)—Bilinguals frequently alternate, or "code-switch," between two languages within a single sentence. We report two sentence repetition experiments on Spanish/English and Japanese/English code-switching. Our results show that the switching of closed-class morphemes causes significantly longer reaction times and more errors than the switching of open-class morphemes. These results are interpreted to support the claim that open- and closed-class

morphemes are involved in distinct levels of processing in speech production.

(209)

The Independence of Thematic Role Information. SARAH D. BREEDIN & RANDI C. MARTIN, *Rice University* (presented by Randi C. Martin)—An aphasic patient is reported who shows disrupted knowledge of thematic role assignment for verbs yet otherwise shows preserved knowledge of semantic and syntactic structures. His defective knowledge of thematic roles affects both production and comprehension. The results suggest either an independent thematic role processor or lexical representations for thematic information that is separate from other types of lexical representations.

(210)

Tracking Sentence Topics in Speech and Writing. JEAN E. NEW-MAN, *University of New Mexico* (sponsored by Peder Johnson)—A discourse continuation task investigated the influences of stimulus modality, word order, and focus on the production of sentence starting points, their surface forms, and underlying topic relations. Starting points for speech depended on recency and focus, and repeated stimulus NPs. Writing used more pronominalization and was less influenced by focus and word order; topic relations did not differ between modalities. This pattern points to the importance of surface form in processing spoken discourse.

(211)

Depth of Interpretation in the Processing of Literary Discourse. PETER DIXON, MARISA BORTOLUSSI, LESLIE C. TWILLEY, & ALICE LEUNG, *University of Alberta*—Is the processing of literature different from that of other kinds of discourse? We propose that literary discourse is more likely to support depth of interpretation; that is, it provides a greater opportunity for elaboration and inferencing that goes beyond the propositional content of the text. In our research, depth of interpretation was measured by assessing how much readers' evaluations changed after rereading literary and nonliterary texts.

(212)

Working Memory Capacity Affects Use of Context in Parsing. JONATHAN KING, *University of California, San Diego* (sponsored by Patricia A. Carpenter)—The use of contextual information during parsing depends on available working memory capacity. Large differences between high- and low-capacity readers in their processing of object relative sentences in a "neutral" context collapse when the context provides thematic role assignment cues. But low-(unlike high-)capacity readers do not use presuppositional information to guide their initial processing of temporarily ambiguous sentences, and thus always behave in accordance with the memory-conserving principle of minimal attachment.

(213)

The Effect of Inferential Processes on Perceptual Identification. REBECCA FINCHER-KIEFER, *Gettysburg College* (sponsored by Paul R. D'Agostino)—Perceptual identification responses were collected for briefly presented target words that followed short texts. Results demonstrated that targets that had been explicitly presented were identified significantly better than targets not presented. Further, targets that had not been presented but were required for referential coherence (implicit targets) or were predictive in nature (predicted targets) were identified as well as explicit targets. This pattern was only obtained when the targets were related to the preceding text.

(214)

Comprehension Strategies during Reading. JASON E. ALBRECHT & EDWARD J. O'BRIEN, *University of New Hampshire* (presented by Edward J. O'Brien)—Four experiments examined the effect of presenting inconsistent location information concerning the location of the protagonist, or information inconsistent with the perspective of the protagonist, on the comprehension of short narratives. In Experiments 1 and 2, information that violated the location of the protagonist resulted in increased reading times and poorer recall. In Experiments 3 and 4, subject reading times were unaffected by violations of the protagonist's perspective unless they were explicitly instructed to read from that perspective.

(215)

Influence of Text and Feedback Variations on Discourse Processing. PHILIP LANGER, VERNE KEENAN, & KATE BLASH, *Univer-*sity of Colorado—Subjects read either of two 26-sentence versions of a small town. One description consisted of geographical relations (survey) while the other presented the same locations sequentially encountered (route). Sentences were presented one at a time on 3×5 cards. Feedback consisted of either (1) limited access to a map during reading, (2) limited referrals to previously presented sentences during reading, or (3) access to the entire text upon completion. There were significant differences in inferential reasoning but not propositional recall.

(216)

Semantic Interference and Orthographic Facilitation in Definition Naming. WIDO LA HEIJ, *University of Leiden* (sponsored by Judith F. Kroll)—Semantic interference and orthographic facilitation are common findings in Stroop-like naming tasks. We show that these context effects also obtain when, instead of colors or pictures, definitions are used as target stimuli. Furthermore, it is shown that the semantic interference effect (a) cannot be attributed to a strategic match/nonmatch decision and (b) only obtains when the context word follows the definition. These findings will be related to context effects in studies on word retrieval and the tip-of-the-tongue phenomenon.

(217)

Visual and Phonological Codes in Repetition Blindness. DAPHNE BAVELIER & MARY C. POTTER, *MIT* (presented by Mary C. Potter)—Repetition blindness (RB) is the inability to detect the second occurrence of a visual stimulus when repeated within a few hundred milliseconds. The role of visual versus phonological (name) similarity was examined. RB occurs between visually similar items, but also between phonologically identical items that are visually distinct. We propose that RB results when the codes used for initial registration of two targets in STM are similar or identical.

(218)

Repetition Priming Effects with Pseudohomophones. LAREE A. HUNTSMAN, *San Jose State University*, & SUSAN D. LIMA, *University of Wisconsin-Milwaukee* (sponsored by Susan D. Lima)—In a repetition priming experiment, orthographically similar word primes (e.g., DREAM), pseudohomophone primes (e.g., DREEM or DREME), and nonword primes (e.g., DROAM) were all found to facilitate lexical decision response latencies to high-frequency word targets (e.g., DREAM). However, only word and pseudohomophone primes reduced error rates on high-frequency word targets. Low-frequency word targets benefited from word primes only. The results suggest that both phonological and orthographic codes exert an influence on lexical access.

(219)

Inhibitory Phonological Priming in Auditory Word Recognition. LOUISA M. SLOWIACZEK & MARY BETH HAMBURGER, *SUNY at Albany* (sponsored by Donn Byrne)—Research in word recognition has suggested that lexical memory may be organized phonologically as well as semantically. In three experiments, subjects shadowed auditorily presented target items that were preceded by phonologically similar word and nonword prime items. Results revealed a complex pattern of inhibition and facilitation of target items preceded by word primes. However, a significant effect was not found for targets preceded by phonologically related nonword primes. The results provide evidence for a phonologically organized network in lexical memory.

(220)

Lexical Representation of Morphologically Complex Words. ETTA DREWS, *Technische Universität Braunschweig* (sponsored by Karl Friedrich Wender)—In a series of priming experiments, we tried to distinguish between the levels of lexical representation involved in processing of polymorphemic words. For this purpose, we used German and Dutch particle verbs, which can also differ in semantic complexity. Particle verbs sharing the same stem morpheme could be either semantically transparent or opaque. The results show strong stem morpheme priming effects. However, these effects are significantly influenced by semantic complexity and experimental task.

(221)

Developing Episodic Distinctiveness Via Retrieval Practice: Insulation from Associate Interference. TODD M. GROSS & ROBERT A. BJORK, *UCLA* (presented by Robert A. Bjork)—In an A-B, A-C paired-associates paradigm, retrieval practice on some of the A-B and A-C

pairings was provided after the A-B and A-C study episodes, respectively. Practiced items did not suffer proactive or retroactive interference from competing responses on a later MMFR test, whereas unpracticed items did suffer such interference. When study and retrieval-practice events were mixed in a single list, however, practiced as well as nonpracticed pairings exhibited associative interference.

(222)

Test Awareness and the Longevity of Associative Priming. JOHN M. RYBASH, *Hamilton College and Mohawk Valley Community College*, & ADEEL HASAN, *Hamilton College*—Three groups of college students performed an associative priming task either 10 min, 4 days, or 8 days after they generated sentences to pairs of semantically unrelated words (e.g., flannel-broccoli; apricot-surgeon). The associative priming task consisted of word fragments that appeared in the same (e.g., flannel-b_cc_i) or different (e.g., flannel-su_g_n) context relative to items on the sentence-generation task. Subjects who recognized that test items appeared on the sentence-generation task displayed associative priming at each time of testing. Subjects who failed to recognize that test items appeared on the sentence-generation task exhibited nonassociative priming, but not associative priming, at each time of testing.

(223)

Does the Surprise Response Mechanism Play a Role in the Bizarre-Imagery Effect? VIRGINIA A. LANG, *Wichita State University* (sponsored by David G. Payne)—Surprise response has been proposed as an underlying mechanism that can predict and explain the inconsistency of the bizarre-imagery effect (Hirshman, Whelley, & Palu, 1989). This set of experiments tests what, if any, role surprise response may have by manipulating the associate level of the to-be-remembered items. Memory performance is measured using both a free- and cued- (verb is the cue) recall test. Preliminary results indicate that the surprise response mechanism is not supported.

(224)

Unconscious Memory on a Conceptual Indirect Test. COLLEEN KELLEY, *Macalester College*, & D. STEPHEN LINDSAY, *University of Victoria*—Performance on implicit memory tests can be mediated by explicit memory. To rule that out, we placed the effects of conscious recollection and unconscious memory in opposition and then tested for unconscious memory on a conceptually driven test. Subjects were correctly informed that words on a list they had just studied were all wrong (but related) answers to questions on a general-knowledge test. When the subjects' attention was divided during study, unconscious memory effects occurred at test.

(225)

Individual Differences in Inhibition from Unattended Stimuli. JOSEPH S. BROWN, THOMAS C. LORSBACH, & GREG B. SIMPSON, *University of Nebraska at Omaha* (presented by Thomas C. Lorsbach)—We examine the extent to which inhibition by ignored stimuli (Tipper & Driver, 1988) is affected by spatial location. Learning-disabled (LD) and non-learning-disabled (NLD) children named one of two letters. On half the trials, a second pair containing the ignored letter from the previous trial was presented. For LD children, inhibition occurred only if the letter appeared in the same position as the previous trial. For NLD subjects, there was significant inhibition at both positions.

(226)

Implicit and Explicit Memory for Words and Voices. BARBARA CHURCH & DANIEL L. SCHACTER, *Harvard University* (sponsored by Daniel Schacter)—We examined priming effects on auditory identification and stem completion tests following semantic and nonsemantic encoding of target words. Speaker's voice was same or different at study and test. Overall level of priming was less affected by the encoding manipulation than was explicit memory; voice effects were observed only under circumscribed conditions and were unrelated to study tasks. Results were interpreted in the context of neuropsychological research on auditory processing and perceptual representation systems.

(227)

Context Change and Recognition of Repeated Words. AYDIN Y. DURGUNOGLU & BARBARA J. HANCIN, *University of Illinois* (sponsored by James H. Neely)—Masson and Freedman (*JEP: LMC*,

1990) reported that repetition effects on a homograph (e.g., BAR) were smaller if the semantic context accompanying each of the two presentations differed (steel vs. tavern) compared to repetition effects with contexts identical or similar in meaning. However, in our experiments, the repetition effects did not decrease as a function of the context differences during the two presentations. The role of the overall experimental conditions leading to such discrepancies is discussed.

(228)

Mechanisms of Visual Word Recognition in Fluent Dyslexic Readers. JAMES HODGSON, *Massachusetts General Hospital* (sponsored by David Swinney)—A plausible model of visual word recognition in dyslexia might propose that familiar words are recognized by logographic processes, resulting in strong frequency but weak regularity effects, whereas unfamiliar words are identified through prelexical recoding to phonology, implying strong regularity but weak frequency effects. The predicted interaction of these two factors was sought in naming experiments with 25 high school dyslexics. Strong regularity and frequency effects were found but no interaction. Possible explanations are explored.

(229)

Connectives Increase Word Activation and Clausal Integration. KEITH MILLIS, *Northern Illinois University*, & MARCEL JUST, *Carnegie-Mellon University* (sponsored by Marcel Just)—Three experiments investigated the effect of connectives on the modulation of word activations during reading. Subjects read pairs of clauses that were either joined or not joined by a connective (e.g., *because*). Immediately after reading the sentence(s), subjects performed a word-recognition task. The recognition time for the verb from the first clause (or sentence) was facilitated when a connective was present. Overall, the data indicate that connectives increase the activation of concepts and thus facilitate interclause integration.

(230)

Differences in Cohesiveness among Different Types of Word-Initial Consonant Clusters. REBECCA TREIMAN, *Wayne State University*, & CAROL A. FOWLER, *Dartmouth College and Haskins Laboratories*—In two experiments, subjects saw printed stimuli such as "gav" and "spem." They substituted either the first phoneme or the first and second phonemes of the second stimulus for the corresponding phonemes of the first stimulus and pronounced the result ("sav" or "spav") as quickly as possible. The results suggest that word-initial consonant clusters are cohesive units. Consistent with certain linguistic theories, /s/ clusters seem less cohesive than other clusters.

(231)

Does Perceptual Salience Influence "Pop-out" with Words and Nonwords? SAL A. SORACI, JR., *University of Alabama*, JEFFREY J. FRANKS, MICHAEL T. CARLIN, THEODORE P. HOEHN, & JAMES K. HARDY, *Vanderbilt University* (sponsored by Keith Clayton)—Previous research (Flowers & Lohr, 1985) has not found evidence for the "pop-out" phenomenon (e.g., Treisman, 1988) with word and nonword letter strings. Flowers and Lohr utilized a visual search task consisting of a circular arrangement of stimuli. This arrangement does not optimize interstimulus contiguity, which is critical in facilitating stimulus detection in certain contexts (Soraci, Carlin, Deckner, & Baumeister, 1990). The present study examines "pop-out" with words and nonwords on a same-different task, under conditions (i.e., high interstimulus contiguity) designed to enhance perceptual salience.

(232)

Word Onset Versus Word Specification in Spoken and Visual Word Recognition. SARAH C. WAYLAND, *Northeastern University*, & ARTHUR WINGFIELD, *Brandeis University* (sponsored by Arthur Wingfield)—We investigated the importance of word onsets in auditory and visual word recognition. Subjects identified gated auditory and visual stimuli that presented more and more of a word's beginning. For comparison, responses were collected for entire words presented with increasing S/N ratios and tachistoscopic durations. Analyses of stress patterns, phonemic overlap, and word frequencies of the responses indicated that the word-onset priority in recognition is due to increased efficacy in specifying the word.

(233)
The Effect of Word Frequency during Two Readings of a Text.
GARY E. RANEY & KEITH RAYNER, *University of Massachusetts at Amherst* (sponsored by Keith Rayner)—The effect of word frequency on reading time was examined during two readings of short passages. The frequency of target synonym pairs was varied between the first and second reading. Each synonym pair contained one high-frequency and one low-frequency word. Fixation times were shorter for high- than for low-frequency words during each reading. During the second reading, fixation times varied depending on whether a high- or low-frequency synonym was seen during the first reading.

(234)
ERP Evidence of Differences in the Processing of Concrete and Abstract Words. PHILLIP J. HOLCOMB & JOHN KOUNIOS, *Tufts University*—Event-related potentials were recorded to concrete and abstract words in a lexical decision and a concreteness judgment task. The N400 component was larger to concrete than to abstract words in both tasks. Also, the N400 produced a greater repetition effect for concrete than abstract words in the right hemisphere, but equal effects in the left hemisphere. These results support models that posit separate systems for imaginal and propositional representations of word information.

(235)
Individual Differences in Lexical Access. JANET L. McDONALD, *Louisiana State University*—Subjects of differing verbal ability as measured by English ACT scores performed a lexical decision task on non-words consisting of prefixes and nonprefixes combined with stems and nonstems. While subjects of average ability showed the reaction time pattern predicted by a serial prefix stripping model, subjects of very high or very low ability did not. In addition, very low-ability subjects showed a larger prefix effect than did other subjects. Implications for models of lexical access are discussed.

(236)
Memory for Interrupted Problems: The Zeigarnik Effect Revisited. COLLEEN M. SEIFERT & ANDREA L. PATALANO, *University of Michigan* (sponsored by Edward E. Smith)—Zeigarnik (1927) found better free-recall memory for interrupted tasks than for completed ones, despite shorter solution attempts. Following this methodology, one study showed completed tasks were better remembered; however, a second experiment replicated Zeigarnik when subjects could abandon problems they did not solve. Factors determining memory differences by solution status include interruption method, time on problem, and differential set size. Incomplete status can serve as a distinctive memory cue that aids free recall of past problems.

(237)
Automaticity of Information Extraction from Tachistoscopic Displays. ROBERT L. STEPHENS, JACQUELYN Y. PEARSON, & MICHAEL D. SISSON, *U.S. Army Aeromedical Research Laboratory* (sponsored by Kenneth B. Melvin)—This experiment provides evidence of differential levels of automaticity for processing information from tachistoscopic displays. Using three variations of the partial report procedure, processing of both spatial and identity information in letter displays was assessed simultaneously and then independently. Practice effects on the resulting three tasks indicate that feature extraction is a highly automated process, while spatial information extraction is a controlled process. Implications for separate processing streams in the visual system are discussed.

(238)
The Expanse of the Expanding Test Series Effect. JOHN J. SHAUGHNESSY, *Hope College*, EUGENE B. ZECHMEISTER, WILLIAM L. CULL, & HOLLY M. HART, *Loyola University of Chicago*—Landauer and Bjork (1978) demonstrated that an expanding test series (1-5-9) led to better cued recall than a uniform series (5-5-5) or a massed series (0-0-0). Using expanding test series has been referred to as "a new and powerful mnemonic strategy." Our series of laboratory experiments tested its generality over materials, pacing of study, modality, and the presence or absence of study opportunities following

tests. Our research represents a case study of the challenges of establishing external validity of memory phenomena.

(239)
Translation Problems in Causal Reasoning: Graphical Representation and Inference Strategy. EMILY DIBBLE, *University of Washington*, & HARRIET SHAKLEE, *Seattle University* (presented by Harriet Shaklee)—Previous work shows that people rely on cause-present outcomes in making causal inferences. We manipulated data presentation format to draw attention to cause-absent outcomes. Accuracy patterns across causal judgment problems suggest that incorporation of cause-absent outcomes was most likely with data in a pie chart, intermediate for bar charts, and least likely for tabled data. Results suggest that data representation format readily influences how people evaluate the relevance of statistical information for causal inference.

(240)
Age Changes in Handedness Are Task Specific. CLARE PORAC, *University of Victoria*—Published reports have shown that the incidence of left-handedness decreases among older individuals. In this study, respondents, ages 8 to 85 years ($N = 654$), described the degree of right-versus left-hand use using a 7-item inventory. Older individuals showed a lower incidence of left-handedness, but the magnitude of this trend differed for different handedness behaviors. These behavior-specific findings suggest that age-relatedness changes in handedness incidence involve an environmental adaptation component.

(241)
Local Versus Global Incoherence: Some Evidence from ERP Data. MARIE ST. GEORGE, SUZANNE MANNES, & JAMES E. HOFFMAN, *University of Delaware* (presented by Suzanne Mannes) (sponsored by Frances Graham)—Event-related potential research has demonstrated that the N400 component is sensitive to local semantic expectancy, with words less likely to occur within the context of a sentence being followed by N400s of greater amplitude. In the present experiment, more global, theme-related context effects were investigated by recording ERPs while subjects read titled and untitled paragraphs one word at a time. Data suggest that the N400 component is larger for untitled paragraphs, indicating sensitivity to global semantic incongruity.

(242)
Quality of Motivation Questionnaire Predicts Codependency. R. CHRIS MARTIN, BRAD RUTKOWSKI, & RAMA ESHELBRENNER, *University of Missouri-Kansas City*—The concept of codependency has been criticized extensively for lack of anchoring. The Friel questionnaire is one of the few objective tests but does not identify areas where behavior change is needed most. The Quality of Motivation Questionnaire does show such information, and 25 couples given both tests showed that the two tests equally predict codependency and the scores were significantly correlated ($p < .01$). A model for anchoring the concept is presented.

(243)
Attributions of Self-Esteem as a Function of Duration of Eye Contact. JOYLIN M. DRONEY & CHARLES I. BROOKS, *King's College* (presented by Charles I. Brooks)—Subjects viewed one of three videotapes in which a model maintained eye contact with an interviewer for 5, 30, or 50 sec of a 60-sec period. Subjects then completed the Multidimensional Self-Esteem Inventory, answering as they thought the model in the tape would answer. Results showed that, for all self-esteem scales, scores significantly increased as amount of eye contact increased. Thus, increased eye contact produced attributions of high self-esteem.

(244)
Developmental Correlates of Direct and Indirect Remembering. LINDA J. ANOOSHIAN & PENNIE S. SEIBERT, *Boise State University*—Two testing sessions for 48 children at each of two age levels (4-5 years and 8-9 years) and 96 parents provided measures of indirect memory (picture identification), direct memory (recognition, recall), typicality judgments, analytic and holistic processing (in classification), and theories of mind (4-5 year olds). Discussion of observed relations between memory measures and other task performances will focus on the

significance of indirect memory to understanding developmental change in other areas.

(245)

Relationships between Weight, Body-Esteem, and Parental Influence in Adolescents. MARY E. QUINLAN-HEINS & MARCIA Z. LIPPMAN, *Western Washington University* (presented by Marcia Z. Lippman)—The relationships between actual weight, body-esteem, self-esteem, and perceived parental evaluation of appearance were studied in a sample of 53 adolescent females. The Body-Esteem Scale, Piers-Harris Children's Self-Concept Scale, and a Believed-Parental-Evaluation Scale were administered to classroom groups. Perceived parental evaluation of appearance was found to be a better predictor of body-esteem and self-esteem than actual weight. Implications for intervention with adolescents were discussed.

(246)

Children's Inferences about the Health Consequences of Contact with Artifacts Versus Natural Kinds. KEN SPRINGER, *Southern Methodist University* (sponsored by Curtis W. McIntyre)—This study examined children's ability to infer the health consequences of contact with artifacts and natural kinds that have been altered in some way. By age 4, children drew domain-specific inferences about physical contact, asserting, for instance, that licking a clean spoon that had lain in the sun for a week would not make one sick, whereas licking a clean piece of apple under the same conditions would cause illness.

(247)

Serial and Parallel Processing in Japanese Kanji Recognition. CHISATO AOKI, MASAOMI ODA, *ATR Auditory and Visual Perception Research Laboratories, Japan,* & TOSHIO INUI, *Kyoto University* (sponsored by Thomas S. Aiba)—We examined whether Kanji (logographic) characters consisting of left (hen) and right (tsukuri) radicals are processed holistically or by constituent in parallel or sequentially. Comparing Kanji-radical, radical-Kanji, and pseudo-Kanji-radical pairs, hen and tsukuri reaction times were identical in a visual matching task, while tsukuri reaction time was faster than that of hen in a phonological task. The results suggest that radicals are parallel processed in the visual task and sequentially in the phonological task.

(248)

Computing Agreement in Sentence Production. GABRIELLA VIGLIOCCO, *University of Trieste,* BRIAN BUTTERWORTH, *University College of London,* & CARLO SEMENZA, *University of Padua* (presented by Brian Butterworth) (sponsored by Patrizia Bisiacchi)—In a series of experiments, speakers of Italian (whose morphology is richer than English, thus allowing more articulate experimental manipulations) completed sentence fragments designed to elicit erroneous subject-verb agreements. At variance with previous findings in English (Bock & Miller, 1991), broken agreement was shown to be affected reliably by both semantic and morphological features of sentences subjects. This result is discussed in light of current questions about the relative segregation of sentential constituents.

(249)

Effects of Instruction on Normal Listeners' Perception of Error. NANCY B. MARSHALL, LINDA WARREN DUKE, & AMANDA C. WALLEY, *University of Alabama at Birmingham* (sponsored by Linda W. Duke)—The effects of pause time and task instructions on the ability of college students to make judgments of appropriateness and correctness for different sentence types were investigated. Sentence sets included affirmative active, affirmative negative, passive active, and passive negative types. Each type sentence was presented containing no errors, semantic errors, syntactic errors, and semantic and syntactic errors. The results of statistical analyses will be discussed in terms of automatic versus effortful processing of language.

(250)

A Theory of Lemma Retrieval in Speaking. ARDI ROELOFS, *Nijmegen Institute for Cognition Research and Information Technology* (sponsored by Herbert H. Clark)—The paper reports a theory on conceptually driven word (i.e., lemma) retrieval. The mental lexicon is conceived as a network with concepts, lemmas, and word forms. Lemmas are retrieved via activation spreading from concepts towards lemmas, with the highest activated lemma being selected. A computer model implementing the theory simulates well-known data on the time course of object naming within the picture-word interference paradigm. Novel predictions were experimentally tested and validated.

(251)

Research Support from the National Science Foundation. FRED STOLLNITZ, *NSF Program Director for Animal Behavior,* & JOSEPH YOUNG, *NSF Program Director for Human Cognition and Perception.*

DEVELOPMENTAL PROCESSES I
Embarcadero AB, Saturday Morning, 8:00-9:45

Chaired by Susan Kemper, University of Kansas

8:00-8:15 (252)

Developmental Differences in Holistic Processing of Faces? SUSAN CAREY, *MIT*—A composite photo of the top half of one person's face and the bottom of another's fuses into a new person from which it is difficult to recover the identity of either half alone. This composite interference effect occurs only for upright faces, and is robust at ages 6, 10, and adult. Nonetheless, adults are markedly more affected by inversion overall than are children. Two senses of configural encoding of faces are distinguished, only one of which undergoes developmental change.

8:20-8:35 (253)

A Passover Effect in Children's Word Learning. WILLIAM E. MERRIMAN, JOHN MARAFITA, & LORNA H. JARVIS, *Kent State University*—Our goal was to determine whether young children who observed a speaker pass over an object while introducing a new name for similar objects would infer that the name did not apply to the passed-over object. Three-year-olds, but not 2-year-olds, tended to infer this. These results suggest that this inductive tendency is another source of preschoolers' remarkable skill in word meaning acquisition.

8:40-8:50 (254)

The Spacing Effect and Young Children's Implicit and Explicit Memory. MELINDA Y. SMALL & ANTOINETTE E. KAVANAUGH, *Bowdoin College*—Implicit (word production) and explicit (recall) memory were compared for preschoolers and first-graders. Recall improved with age. Implicit memory occurred at both ages, but without an age effect. Spacing of repeated items had an effect on recall for both ages. There was no spacing effect on the implicit memory task. Comparisons of incidental and intentional learning conditions indicated no effects on memory. Theoretical implications are discussed for memory development and the spacing effect.

8:55-9:15 (255)

Short-Term Memory for Item, Temporal, and Spatial Information in Young and Elderly. ROBERT E. TILL, *University of North Dakota*, ALICE F. HEALY, *University of Colorado*, THOMAS F. CUNNINGHAM, *St. Lawrence University*, & LYLE E. BOURNE, JR., *University of Colorado*—Short-term memory was examined for names, temporal order, and spatial location of letters. Subjects saw three letters displayed one at a time, followed by digits. Each appeared arbitrarily on the left, right, or center. Some subjects read aloud each letter; others announced the letter's location. Age differences appeared in all combinations of encoding and test except one: no age effect occurred when subjects had named items at encoding and recalled only letter names at test.

9:20-9:40 (256)

Fuzzy-Trace Theory and Developmental Stability of Reminiscence. CHARLES J. BRAINERD, *University of Arizona*—In long-term retention designs, three variables may exhibit development trends: acquisition rates, forgetting rates, and reminiscence rates. Developmental trends in acquisition rates have long been well established and, more recently, evidence of parallel trends in forgetting rates has become firm. As yet, little is known about the development of reminiscence, though fuzzy-trace theory anticipates that age changes should be minimal because reminiscence involves reconstruction from stored gist. We review evidence from several experiments which suggests that between early childhood and adolescence, at least, reminiscence rates are remarkably stable.

ASSOCIATIVE LEARNING: ANIMAL II
Embarcadero CD, Saturday Morning, 8:00-9:45

Chaired by T. James Matthews, New York University

8:00-8:15 (257)

Associative Structure of Negative Discriminative Stimuli. RUTH M. COLWILL, *Brown University*—Three experiments using rats showed that a stimulus (S−) that signals the nonreinforcement of an instrumental response provides information about the identity of the omitted outcome. An S− trained with one outcome preferentially transferred to a new response trained with the same outcome (Experiment 1) and was slower to develop discriminative control over a new response reinforced with the same outcome (Experiment 2). In Experiment 3, an S− elevated performance of a response trained with the same outcome when that outcome had been devalued.

8:20-8:35 (258)

Reversibility of Within-Incentive Selective Associations in Appetitive and in Aversive Situations. LEIGH V. PANLILIO & STANLEY J. WEISS, *American University, Washington, D.C.* (read by Stanley J. Weiss)—Barpressing in tone-plus-light (T+L) avoided shock for two groups of rats. When tone-and-light absence ($\overline{T}+\overline{L}$) was shock free, tone was selectively attended to during a stimulus-element test. However, when unpredictable unavoidable shocks and punishment was programmed in $\overline{T}+\overline{L}$, light controlled barpressing. Switching $\overline{T}+\overline{L}$ conditions over groups reversed modality control. When selective associations were produced solely with appetitive baselines, similar reversals occurred when contingencies were switched over groups. This within-incentive reversibility strengthens the position that selective associations are contingency rather than class-of-reinforcer determined.

8:40-9:00 (259)

Contextual Conditioning and Performance in Appetitive Conditioning. MARK E. BOUTON, CHARLES A. PECK, & DOUGLAS C. BROOKS, *University of Vermont*—Contextual conditioning promoted performance to an extinguished CS but had less effect when the CS was merely paired or unpaired with food. When USs were added to the ITIs of extinction, the effect was abolished. USs added to either conditioning or extinction could acquire the ability to cue the corresponding performance. Contextual conditioning has complex effects that are simplified by recognizing that it, and the USs that produce it, can acquire discriminative control over performance.

9:05-9:25 (260)

Separate Effects of Aversion to Visual and Taste Cues on Drinking Latencies: Belongingness Reconsidered. JOSEPH J. FRANCHINA, P. ANDREW LEYNES, & LERA JOYCE JOHNSON, *Virginia Polytechnic Institute and State University*—Presence of familiar visual cues during prior aversion conditioning to a novel-tasting solution reliably decreased the latency to start drinking, relative to that for conditioning to a familiar taste in the presence of novel visual cues. Latencies to complete nine subsequent drinking responses were similar for conditioning to novel visual or taste cues and were reliably shorter than those for conditioning to novel cues combined. Measures of intake and hedonic expression showed reliable conditioning effects.

9:30-9:40 (261)

Failure to Find Keypress Contrast for Milk Reinforcers. FRANCES K. McSWEENEY & CAM L. MELVILLE, *Washington State University*—No contrast occurred when rats pressed keys for milk reinforcers for five component durations and two baseline schedules. The failure was not caused by poor discrimination, a floor or ceiling, fatigue, satiation, insensitivity to reinforcement, or a change in response form. These results imply that differences in response rates and in the part of the body used did not produce differences in contrast among other responses, such as keypecking and treadle-pressing.

REPETITION/PRIMING EFFECTS II
San Francisco A, Saturday Morning, 8:00-9:40

Chaired by Joan Gay Snodgrass, New York University

8:00-8:20 (262)

Subliminal Semantic Activation between Objective and Subjective Thresholds. ANTHONY G. GREENWALD, *University of Washington*—Regression analysis was used to describe the relation between detectability of dichoptically masked priming stimuli and magnitude of their priming effects. Data from two experiments indicated that this regression function passes through the origin (i.e., no priming with no detec-

tion). These findings are consistent with the subjective threshold thesis of Cheesman and Merikle—that effective priming stimuli are detectable, even when subjects deny seeing them.

8:25-8:40 (263)
Suppression of Irrelevant Ambiguous Word Meanings in the Cerebral Hemispheres. CHRISTINE CHIARELLO, KIM CANNON, LORIE RICHARDS, & LISA MAXFIELD, *Syracuse University*—We investigated hemisphere-specific processes in the suppression of ambiguous word meanings. Homograph primes were shown twice using lags of 1 or 6 intervening trials. Second presentation targets were unique, being related to the same meaning as the first homograph-target pair, an alternate meaning, or unrelated. Target pronunciations were slowed when a new meaning was instantiated, and this suppression varied over visual fields and lag. Implications for hemisphere differences in ambiguity resolution are discussed.

8:45-9:00 (264)
Variation of Attention Predicts Repetition Blindness in Rapid Serial Visual Presentation. ELISABETH M. FINE & ADAM REEVES, *Northeastern University* (read by Adam Reeves)—Random high-frequency words were shown in RSVP to study repetition blindness (RB) (Kanwisher). We explain RB using the "attention gating model" (AGM) (Reeves & Sperling) of the perception of temporal order in RSVP. In AGM, RB occurs when two presentations of the same item enter visual short-term memory together. AGM predicted the amount of RB across the RSVP stream and also the effects on RB of an attention-grabbing cue.

9:05-9:15 (265)
Orthographic Versus Phonological Similarity in Repetition Blindness. NANCY KANWISHER, *UCLA*—Repetition blindness is the difficulty of reporting two items from a rapid display when they are similar in both orthography and phonology (Kanwisher, 1987) or just phonology (Bavelier & Potter, in press). Is all RB phonologically mediated? In the present experiment, RB occurred to the same extent for word pairs with primarily phonological (certify-sir) or primarily orthographic (right-rig) similarity. Apparently, either phonological or orthographic overlap alone is sufficient to produce the full effect.

9:20-9:35 (266)
Effects of Repeating the Same Relation on Relatedness Decision Times. ROGER CHAFFIN & ROBERTA KELLY, *Trenton State College*—Subjects decided if noun:noun pairs were related or not. We varied relational similarity of related pairs to related pairs that immediately preceded them. Response time increased with similarity of the relation of preceding pairs. The decision criterion for relatedness reflected expectations about the type of relation; decisions were faster when expectations were more accurate. Subjects spontaneously preferred to look for specific types of relation rather than for a general property of relatedness.

LANGUAGE/DISCOURSE PROCESSING II
San Francisco B, Saturday Morning, 8:00-9:40

Chaired by Sam Glucksberg, Princeton University

8:00-8:15 (267)
Message Level Influences on Lexical Access. SUSAN A. DUFFY, *Amherst College*—In research on the effect of sentence context on lexical access, a critical issue is whether the message level representation influences access. This issue was addressed using a naming task in which the target word was preceded by a sentence context. Within the contexts, critical lexical items were held constant while their role in the message was varied. Results will be discussed in terms of their implications for modular and interactive models of access.

8:20-8:30 (268)
Errors in Transcription. DANIEL C. O'CONNELL, *Georgetown University*, SABINE KOWAL, *Technische Universität Berlin*, ROBERT R. DORIN, *Gonzaga University*, & NATHALIE JAUMOUILLE, *Technische Universität Berlin*—Recent evidence points to limitations in transcribers' ability to accurately reproduce spoken discourse. Recordings of interviews of native speakers of German were transcribed (with unlimited access) by native speakers of German (untrained transcribers). Nearly half of the errors were omissions of noninformative material:

conjunctions, parenthetical remarks, and hesitation phenomena (filled pauses, repeats, and false starts). Other errors occurred with diminishing frequency: additions, substitutions, and sequence reversals. Sources of these systematic transcriptional errors are discussed.

8:35-8:50 (269)
Causal Inferences in Comprehension: Does Syntax Play a Role? MICHAEL E. YOUNG & CHARLES R. FLETCHER, *University of Minnesota* (read by Charles R. Fletcher)—Previous research suggests that causal inferences play a major role in story understanding. We present two experiments that evaluate the role of world knowledge and syntactic cues in readers' ability to make these inferences. Both experiments reveal that a reader's sensitivity to the causal structure of a text is diminished if that text is modified to remove the availability of *either* syntactic cues or appropriate world knowledge.

8:55-9:10 (270)
The Definite Article *the* Facilitates the Process of Mapping. MORTON ANN GERNSBACHER & RACHEL R. W. ROBERTSON, *University of Oregon*—The definite article *the* is one way to signal referential coherence in English. For example, compare the sentences *A man bought a dog* and *A boy was delighted with a gift* with the sentences *The man bought the dog* and *The boy was delighted with the gift*. Using a variety of laboratory tasks, we demonstrated that referential coherence—as signaled by the definite article *the*—facilitates the process we call "mapping" during discourse comprehension.

9:15-9:35 (271)
Context and the Resolution of Ambiguous Idioms. LUCIA COLOMBO, *University of Padua*—The influence of context on the resolution of ambiguous idiomatic expression was investigated in two experiments with the self-paced reading paradigm. The context was neutral, or biased the literal or the figurative interpretation of the idiom. The idiom was followed by a disambiguating clause that always referred to the literal interpretation of the idiomatic string. Reaction times to the idiom and the post-idiom regions indicated whether either one, or both interpretations, had been activated and constructed.

ATTENTION III
Golden Gate A, Saturday Morning, 8:00-9:50

Chaired by Colin M. MacLeod, University of Toronto

8:00-8:20 (272)
False Recognition, Attention, and Perception without Awareness. STEVE JOORDENS & PHILIP M. MERIKLE, *University of Waterloo* (read by Philip M. Merikle)—Jacoby and Whitehouse (1989) found that different patterns of false recognition occur following perception with and perception without awareness. We show that the "unaware" pattern of false recognition also occurs when attention is divided during the recognition test and that the "aware" pattern of false recognition occurs when attention is focused during the recognition test on the critical stimuli. These results provide evidence for a link between attention and awareness.

8:25-8:45 (273)
The Fate of Neglected Targets in the Callosotomized Brain: A Chronometric Analysis. PATRICIA A. REUTER-LORENZ, *Dartmouth College and Medical School*, GEORGE NOZAWA, *Dartmouth College*, & HOWARD C. HUGHES, *Dartmouth College and Medical School* (read by Howard C. Hughes)—The speaking left hemisphere of callosotomy patients can report the occurrence of a unilateral left or right visual field light. LVF report accuracy drops by 34% with bilateral presentations (simultaneous extinction). Paradoxically, simply unimanual or vocal reaction times to bilateral targets are significantly faster than unilateral target RTs, demonstrating a robust redundancy gain. We discuss the potential role of attention and response competition in mediating redundant target effects in callosotomized as compared to normal subjects.

8:50-9:10 (274)
Dual-Task Interference and the Cerebral Hemispheres. HAROLD PASHLER & SHANNON O'BRIEN, *University of California, San Diego*—Previous studies have suggested that the two cerebral

hemispheres constitute separate "resource pools," or that dual-task interference depends upon "cortical distance." However, these proposals were based on dual-task studies that did not require two separate response selections—the operation often found to constitute a processing bottleneck. We combined tasks requiring independent response selections, with lateralized stimuli and responses. There was no evidence that directing tasks to separate hemispheres allowed response selections to proceed simultaneously.

9:15-9:30 (275)
Failure to Find Generally Reduced Inhibition in Old Age. JAMES KIELEY, *Pitzer College*, & ALAN HARTLEY, *Scripps College* (read by Alan Hartley)—In testing the hypothesis that inhibitory functioning is generally impaired in old age, we found that inhibition of return and Stroop interference combined additively in young adults but subadditively in older adults: Stroop targets had a smaller effect at an inhibited than at an uninhibited location. At press time, we are not yet able to explain this, but we have ruled out eye-movement artifacts and the possibility that the inhibition particularly impacts semantic information.

9:35-9:45 (276)
"Effortless" Texture Segmentation and "Parallel" Visual Search Are *Not* the Same Thing. JEREMY M. WOLFE, *MIT*—If a texture-defined region is effortlessly perceived, the texture segmentation is labeled "preattentive." If search RT for a target among distractors is independent of set size, the search is labeled "parallel." Preattentive texture segmentation and parallel search have been assumed to be equivalent measures of the same parallel processing stage. I will demonstrate that this is not the case. Parallel search can occur with stimuli that do not support effortless texture segmentation and vice versa.

INFORMATION PROCESSING II
Golden Gate B, Saturday Morning, 8:00-9:40

Chaired by Jerome Busemeyer, Purdue University

8:00-8:20 (277)
Selective Attention under Speed Stress. ALLEN OSMAN & LIANGGANG LOU, *University of California, San Diego*—We examined the effects of speed stress on distractibility. Subjects made two-choice manual reactions in response to a target letter surrounded by irrelevant flankers. Flankers were either identical to the target or letters signaling the alternative response. Instructions emphasized either speed or accuracy. We measured reaction times, electromyographic activity, and event-related brain potentials. The results bear on the level to which unattended stimuli are processed and how speed is traded for accuracy.

8:25-8:45 (278)
A Response Time Theory of Separability and Integrality in Speeded Classification. F. GREGORY ASHBY & W. TODD MADDOX, *University of California, Santa Barbara*—A theoretical framework is developed for the speeded classification tests of perceptual separability and integrality, which were popularized by Garner (1974). We show that, if decisional separability holds, then the filtering and redundancy tasks provide good tests of separability and integrality. However, if the subject responds optimally, then redundancy gains and no interference effects are likely, regardless of whether the dimensions are integral or separable. Experimental evidence supporting these predictions is reported.

8:50-9:10 (279)
The Stop-Signal Paradigm: Old Models and New Data. HANS COLONIUS, *Universitaet Oldenburg*—Consider a simple reaction time experiment where, in a certain percentage of the trials, the subject is instructed (by presenting a *stop signal* after stimulus onset) to withhold the response. This stop-signal paradigm has been used to study basic issues in automaticity and control. We compare several early and more recent approaches to describe the underlying processing mechanisms (Colonius, 1990; Logan & Cowan, 1984; Ollman, 1973) and present some unpublished data from our lab.

9:15-9:35 (280)
Multiple Detector Models of Simple Reaction Time. PHILIP L. SMITH, *University of Otago*—A class of models of visual simple reaction time (SRT) is developed, in which the sensory processes are represented as diffusion processes with time-varying drifts. Within this framework, two current issues in SRT research are examined: namely, whether SRT is mediated by separate change and level detectors and how information is combined across redundant targets. Model fits favor an account in which information combines coactively across stimuli for independent parallel change and level detectors.

NEURAL NETWORK MODELING
Embarcadero AB, Saturday Morning, 9:55-11:40

Chaired by Martha J. Farah, Carnegie-Mellon University

9:55-10:10 (281)
Connectionist Modeling of Multidimensional Generalization. ROGER N. SHEPARD, *Stanford University*, & JOSHUA TENENBAUM, *Yale University*—We explore multidimensional extensions of the connectionist explorations of unidimensional generalization and classification begun by Shepard and Kannappan (Psychonomic meeting, 1990) and based on the theory of generalization proposed by Shepard (Psychonomic meeting, 1984; *Science*, 1987). The connectionist architectures we explore are chosen (a) to be neurophysiologically plausible and (b) to account for the functional form of generalization and classification in the contrasting cases of psychologically integral and separable stimulus dimensions.

10:15-10:30 (282)
Aperiodic Components Analysis of Evoked Potentials in Cognitive Tasks. BRUCE L. BROWN, DONOVAN E. FLEMING, MICHAEL J. ANDERSON, & ALLEN C. SCHOFIELD, *Brigham Young University*—Evoked potentials were obtained for four cognitive tasks (math, synonyms, figure discrimination, and lateral tone localization) for eight subjects. Raw waveforms were processed with aperiodic components analysis. Three components accounted for 75% and 79% in two replications of the study. The resultant components were analyzed with a five-way MANOVA (task type, hand of response, cerebral location, cerebral hemisphere, and individual subject). Significant differences were found for task type, subject, and task-by-subject interaction.

10:35-10:50 (283)
Interference and Generalization in Distributed Memory Models. STEPHAN LEWANDOWSKY, *University of Oklahoma*—An attractive property of distributed memory models, or neural networks, is their ability to generalize to new inputs. However, that capability also contributes to their tendency to show unreasonably fast unlearning, or "catastrophic interference." The relationship between generalization and unlearning is examined for a variety of network models, and it is shown that some solutions to the unlearning problem adversely affect generalization performance.

10:55-11:10 (284)
A Neural Network Approach to Cognitive Mapping. NESTOR A. SCHMAJUK & AARON THIEME, *Northwestern University*—We present a real-time neural network that builds a topological cognitive map. The network combines recurrent and nonrecurrent properties that allow the reading of the cognitive map without modifying it. The network generates fast-time predictions of the remote future and real-time predictions of the present that are used to update the cognitive map. Computer simulations portray latent learning and detour behavior in rats and problem-solving tasks in humans.

11:15-11:35 (285)
MATHNET: A Distributed Model of Arithmetic Fact Retrieval. MICHAEL McCLOSKEY & A. MARGRETHE LINDEMANN, *Johns Hopkins University*—We present a connectionist model of the retrieval of basic arithmetic facts (e.g., $8 \times 7 = 56$), showing that the model generates many of the phenomena observed in studies of normal and brain-

damaged subjects (e.g., problem-size effects, error patterns, nonuniform impairment). We also discuss some general issues arising in the context of the model (e.g., to what extent do models of this sort interpret or explain, as opposed to merely reproducing, the phenomena of interest?).

ANIMAL COGNITION I
Embarcadero CD, Saturday Morning, 9:55-11:35

Chaired by Ronald J. Schusterman, University of California, Santa Cruz

9:55-10:10 (286)
Knowledge of Ordinal Position by List-Sophisticated Rhesus Monkeys. KARYL B. SWARTZ, *Lehman College, CUNY*, SHAOFU CHEN, & H. S. TERRACE, *Columbia University*—Rhesus monkeys who had acquired at least 16 four-item lists (each consisting of novel items) were trained on four lists consisting of items from previous lists in which the ordinal position of each item, with respect to its original list, was maintained (2 lists) or violated (2 lists). Acquisition rates and error patterns supported the hypothesis that the original ordinal position of each item influenced responding on derived lists.

10:15-10:30 (287)
The Construction of Analogies by a Chimpanzee. DAVID L. ODEN, *La Salle University*, & ROGER K. R. THOMPSON, *Franklin and Marshall College* (read by Roger K. R. Thompson)—Analogical reasoning by an adult chimpanzee (*Pan troglodytes*) was studied by permitting her to construct analogies in whole rather than simply completing partial problems or judging those completed previously by an experimenter. She demonstrated her ability to produce analogies from a set of unarranged stimuli; the patterns of analogy construction and spontaneous corrections of errors imply that the chimpanzee planned her analogies with foresight.

10:35-10:50 (288)
Chimpanzee Communication II: Dr. Whitmer and Peter. DOUGLAS CANDLAND, *Bucknell University*—Among Lightner Whitmer's goals in founding the Psychological Clinic in Philadelphia at the turn of the century was to test the ability of "slum" children to determine the kind of education appropriate for them. While visiting Boston in 1908, he saw a performance by Peter, perhaps the first trained chimpanzee to be seen in the U.S. Whitmer tested Peter's intelligence and helped him learn the alphabet. This paper reviews the results of this early attempt at chimpanzee-human communication.

10:55-11:10 (289)
Pigeons' Cognitive Maps Represent Relative Metric Space. DONALD F. KENDRICK, *Middle Tennessee State University*—Pigeons were trained to discriminate between two sets of pictures of a natural location. One set (S+) included scenes from a field of view from 254° to 272°. The second set included scenes from 290° to 308° (magnetic north at 360°). Generalization testing included pictures from 200° to 360°. Gradients showed the traditional inverted U-shaped functions, demonstrating that the pigeon's cognitive map accurately represents spatial extent and relative metric space.

11:15-11:30 (290)
Landmark Use in Pigeons: Determining Direction by Global and Local Landmarks. KEN CHENG, *University of Toronto*—In one experiment, pigeons learned to go to one of four walls of a square arena for food. They continued to choose this location in the room after a number of manipulations, suggesting the use of global landmarks in determining which direction is which. In a second experiment, pigeons learned to find food at a constant location in a circular tray. Manipulations of large and small nearby objects showed that nearby landmarks influenced the calculation of direction as well.

DEVELOPMENTAL PROCESSES II
San Francisco A, Saturday Morning, 9:50-11:35

Chaired by Leslie B. Cohen, University of Texas at Austin

9:50-10:10 (291)
Visiting the Pediatrician: Long-Term Retention and Forgetting. BETTY N. GORDON, PETER A. ORNSTEIN, PATRICIA A. CLUBB, ROBERT E. NIDA, *University of North Carolina at Chapel Hill*, & LYNNE BAKER-WARD, *North Carolina State University* (read by Peter A. Ornstein)—Three- and 6-year-olds' long-term recall of the details of a physical examination was investigated. Children were interviewed after 12 weeks, with subgroups receiving zero, one, or two additional assessments during this interval. Although immediate and delayed recall of the older children was superior, performance was impressive at both age levels. The facilitative effects of repeated questioning and the contribution of prior knowledge about visits to the doctor are discussed.

10:15-10:30 (292)
Spilling the Beans on Children's Comprehension and Production of Idioms. CRISTINA CACCIARI, *University of Bologna*, & M. CHIARA LEVORATO, *University of Padua*—The effects of context, frequency of exposure, and semantic transparency on the comprehension and production of idioms in children (ages 7 to 11) are investigated in a set of experiments using different tasks (multiple choice, completion, and paraphrase). The results challenge current hypotheses on idioms acquisition. A tentative model is proposed in order to account for the factors allowing children to overcome a literal-referential strategy and to develop a figurative competence.

10:35-10:50 (293)
Aging and the Loss of Linguistic Complexity. SUSAN KEMPER, *University of Kansas*—Adults' language changes across the life span as a result of limitations on their production of complex forms such as multiple sentence embeddings and cohesive devices. A five-year longitudinal record of adults' language has now been analyzed using structural equation modeling with regards to identifying how age-related changes to verbal ability and working memory affect adults' language.

10:55-11:05 (294)
Adult Age Differences in Prospective Memory. TIMO MÄNTYLÄ, *University of Stockholm*—Adult age differences in prospective memory were examined in a laboratory paradigm, in which older and younger adults generated associations to a large number of words. Parallel with this task, subjects performed an action when a semantically or phonemically defined target word occurred. The results showed age-related differences both in retrospective and prospective remembering. The findings are discussed in terms of cue distinctiveness and self-initiated retrieval processes.

11:10-11:30 (295)
Standardizing a Psychomotor Test Battery for Assessing Aging in Mice. DONALD K. INGRAM, JOHN M. HENGEMIHLE, JEFFERY LONG, & PAOLO GAROFALO, *National Institute on Aging*—Our objective was to standardize a psychomotor battery that reflected aging in rodents. Using automated image analysis, we assessed motor performance across the life span (6–30 months) of male C57BL/6J mice as follows: open-field locomotion in several apparatus; inclined screen ambulation; ability to remain suspended from a taut string; falls from a rotarod; and swim vigor. Varying in degree of linearity, significant age-related decline in performance was observed in all tests except swim vigor.

TACTILE PERCEPTION
San Francisco B, Saturday Morning, 9:50-11:20

Chaired by Paul Bertelson, Universite Libre de Bruxelles

9:50-10:00 (296)
Stress-Induced Analgesia in Humans? GARY B. ROLLMAN, *University of Western Ontario*, & LISA M. CARSWELL, *University of Victoria*—Thirty subjects were exposed to one of three stress conditions: physical (vigorous exercise), cognitive (mental arithmetic, digit-symbol substitution), or emotional (scenes from an arousing film). Pain threshold and tolerance were determined with a constant pressure algometer. Results indicated significant stress effects for the three conditions but no analgesic effect. These data suggest that cognitive variables implicated in animal studies of SIA may also apply to humans. In particular, perceived controllability and self-efficacy may override stress per se in engaging endogenous analgesic systems.

10:05-10:20 (297)
Haptic and Cross-Modal Recognition in Children. EMILY W. BUSHNELL, *Tufts University*—Five-year-old children were given eight objects in succession to explore haptically. These were then mixed with eight distractor objects and recognition was tested. Objects were familiar or unfamiliar, and on the recognition test, they were presented haptically or visually. Haptic and cross-modal recognition with familiar objects were remarkably good, as was haptic recognition with unfamiliar objects (all > 90%). Cross-modal recognition with unfamiliar objects was not as good as in the other conditions (about 80%). The results suggest that haptic recognition may be mediated by vivid memory traces analogous to visual images and that cross-modal recognition may involve different cognitive processes than does within-mode recognition.

10:25-10:35 (298)
Remembering Braille: Cross-Modal and Intramodal Effects. SLATER E. NEWMAN, *North Carolina State University*, ANTHONY D. HALL, *IBM Corporation*, & SHARON M. PULLEN, *North Carolina State University*—Braille symbols were presented for haptic or visual examination on a single study trial along with auditory presentation of their letter names. All subjects were then tested haptically both immediately and 48 h later. Forgetting occurred in both conditions. Performance in the cross-modal condition exceeded that in the intramodal condition to about the same extent on each test. Some explanations for these results will be discussed.

10:40-10:55 (299)
Modeling Perception of Temperature Change Using the Generalized Additive Model. JOHN COTTON & ABDUL RAHMAN OTHMAN, *University of California, Santa Barbara*—Refinetti (1989) modeled the estimation of magnitude of thermal sensation as a power function $E = kS^B$, where E is the sensory estimate of warmth and S is the stimulus magnitude, using linear regression on 52 subjects. We believed that intrasubject variabilities could perhaps partially be accounted for by period and carryover from stimuli in previous periods. Data from 3 subjects in Refinetti's experiment were used. The generalized additive model was used to obtain a nonlinear equation of the form $Y = B_0 + B_1 f_1(X_1) + B_2 f_2(X_2) + B_3 f_3(X_3)$, where Y is the estimate of warmth and $f_1(X_1)$, $f_2(X_2)$, and $f_3(X_3)$ are nonlinear cubic spline functions of the period, stimulus, and carryover effects, respectively. Computations of the estimates of the coefficients and residuals were done on the GAIM computing package. When modeled on individuals, period effects were significant across all 3 subjects and carryovers were significant on 2 subjects.

11:00-11:15 (300)
Tactile Attention and Response Competition. PAUL M. EVANS, *Willamette University*, & JAMES C. CRAIG, *Indiana University* (read by James C. Craig)—Previous studies have demonstrated that the identification of a moving, tactile stimulus (target) can be interfered with by a second, equally intense tactile stimulus (distractor). The present study showed that target identification is interfered with only if the distractor has a different learned response from the target. These results provide evidence that tactile distractors are processed to the level of incipient response activation even when subjects are instructed to attend only to the target.

PICTURE MEMORY/PROCESSING
Golden Gate A, Saturday Morning, 10:00-11:45

Chaired by Irving Biederman, University of Southern California

10:00-10:15 (301)
Visual Object Representations: Holding on to an Old View. STEPHEN J. LUPKER & G. KEITH HUMPHREY, *University of Western Ontario*—Ellis and Allport (1986) proposed a model of object perception wherein successively more abstract descriptions are generated as a function of processing time. To test the model, our subjects decided whether successively presented pictures (identical, same name, or different) rotated in the frontoparallel plane had the same name. SOAs were short (600 msec) or long (2,500 msec). Inconsistent with this model

but consistent with other research on perception of rotated objects, representations remained viewpoint specific at both SOAs.

10:20-10:35 (302)
Implicit Processing of Faces by Prosopagnosic Patients. JUSTINE SERGENT, *Montreal Neurological Institute*—Prosopagnosia is an acquired inability to recognize known persons by their faces as a result of a breakdown at different levels within the face-recognition system. Yet operations on faces are still performed in prosopagnosics' brains whereby a perceived face activates pertinent memories, but either these operations cannot be completed or their outcome fails to reach consciousness. The functional locus at which faces are implicitly processed was examined in 3 prosopagnosics, and the results indicated a different pattern of performance depending on the nature of the prosopagnosic disturbance and on the processing requirements of the tasks.

10:40-10:55 (303)
Effects of Inversion on Configural Processing of Normal and Distorted Faces. JAMES C. BARTLETT & JEAN SEARCY, *University of Texas at Dallas*—If the mouth and eyes of a face are inverted, the altered construction appears grotesque when upright but not when upside-down. Several studies of this "Thatcher illusion" using three types of configurally distorted faces, along with grotesque-expression faces, revealed dissociations between simultaneous paired-comparisons and similarity-difference ratings, and between difference and similarity ratings, suggesting separate modes of face processing that are differentially sensitive to configural information, and differentially affected by stimulus inversion.

11:00-11:15 (304)
Imagery in Scientists: Galton's Breakfast Questionnaire Revisited. WILLIAM F. BREWER, *University of Illinois at Urbana-Champaign*, & MARLENE SCHOMMER, *Wichita State University*—In 1880 Galton gathered data on recollective autobiographical memory with the "breakfast questionnaire." He stated that scientists have "feeble powers of visual representation." We gathered contemporary data from scientists and nonscientists on Galton's task and found that both groups showed consistent imagery reports. A reanalysis of Galton's own data shows that his findings are consistent with our data in showing that scientists do not have a deficit in imagery during recollective memory tasks.

11:20-11:40 (305)
Evidence for Syntactic Analysis of Visual Patterns. RICHARD CHECHILE & JANE ANDERSON, *Tufts University*—Subjects in three experiments learned abstract visual patterns which differed in syntactic complexity. After learning the patterns (i.e., at least three perfect, consecutive, paired-associate trials), the subjects were placed in a speeded-recognition test. In each study, there was a large (approximately 200 msec) effect associated with increased syntactic complexity for targets and a larger (approximately 700 msec) effect for foils. These effects are taken as an indication of preaccess syntactic analysis for visual patterns.

HUMAN LEARNING/MEMORY II
Golden Gate B, Saturday Morning, 9:50-11:30

Chaired by Michael P. Toglia, SUNY at Cortland

9:50-10:10 (306)
Implicit Learning: Within- and Cross-Modality Transfer of Tacit Knowledge. LOUIS MANZA & ARTHUR S. REBER, *Brooklyn College and the Graduate Center, CUNY* (read by Arthur S. Reber)—Four transfer experiments were run using an artificial grammar learning task. The stimuli during training and testing differed in their surface forms but retained similar underlying structural commonalities. In Experiments 1 and 2, the letters used to instantiate the grammar changed; in Experiment 3, the modality of presentation changed; in Experiment 4, both physical form and modality changed. Subjects were able to transfer tacit knowledge in all cases, supporting the argument that tacit knowledge is likely represented in an abstract form.

10:15-10:30 (307)
Effects of Perceptual Interference on Explicit Memory. ELLIOT HIRSHMAN, *University of North Carolina at Chapel Hill*—Nairne

(1988) and Hirshman and Mulligan (1991) demonstrated that interfering with perceptual processes at study improves later memory. A plausible explanation of this finding is that interfering with an item's perception increases the elaborative rehearsal the item receives. We tested this explanation by varying presentation duration and, consequently, rehearsal time during study. The results of our experiments were not consistent with the elaborative-rehearsal explanation.

10:35-10:50 (308)
Contextual Support of Implicit and Explicit Memories in Older Adults. DENISE C. PARK, *University of Georgia*, RAYMOND J. SHAW, *West Virginia University*, & DAVID FRIESKE, *University of Georgia*—We examined the role of contextual support on implicit and explicit memory in young and old subjects. Despite a large N, no age effect occurred on the implicit task. The effect of contextual support (number of letters in stem at retrieval) was equivalent for young and old on implicit and explicit tasks. These findings suggest that data-driven context can support both implicit and explicit memory and also pose some difficulties for the environmental support hypothesis of aging.

10:55-11:10 (309)
Abstractness of Implicitly Versus Explicitly Acquired Knowledge of Artificial Grammars. ROBERT C. MATHEWS, FREDDA BLANCHARD-FIELDS, LISA NORRIS, & LEWIS G. ROUSSEL, *Louisiana State University*—Following implicit/explicit training, subjects performed a string discrimination test. The letter set was changed midway through test preserving grammatical structure. Some abstract knowledge was obtained when a finite-state grammar was learned implicitly or explicitly. Performance either stayed the same or improved when letter set was changed using biconditional grammar. Feedback during string discrimination was not critical for obtaining transfer to a new letter set, suggesting that an analogy mechanism was not necessary for transfer.

11:15-11:25 (310)
Restoration of the Incongruity Effect. THOMAS J. AYRES, *Failure Analysis Associates, Menlo Park*—Words generated in response to a negative cue are generally recalled better than those with a positive cue. A recent attempt to replicate this *incongruity effect* (Horton, 1987) may have failed because the cues were made irrelevant to the generation task. The incongruity effect is restored here in two experiments using task-relevant cues. The results are consistent with an account based on greater effort involved when generating in response to incongruous definitions.

POSTER SESSION II
Pacific Concourse East, Saturday Noon, 12:00-1:30

(311)

Perceptual Integration of Shape and Texture Dimensions during Haptic Processing. CATHERINE L. REED, *Carnegie-Mellon University* (sponsored by Roberta L. Klatzky)—Experiments investigated haptic integration of shape and texture at perceptual levels of processing. The haptic system combines tactile and kinesthetic information. Perceptual separability and independence were assessed for planar and 3-D stimuli using a speeded classification paradigm and quantitative tests developed by Ashby and Maddox (in press). Results indicated that shape and texture were perceptually separable yet highly dependent. Hand-movement analyses showed optimized exploration for the simultaneous apprehension of both dimensions.

(312)

Surface Filling-in Is Not Directly Related to Contrast Mechanisms. BIRGITTA DRESP, *Université Paris V-CNRS* (sponsored by Claude Bonnet)—Some theories relate surface brightness to antagonistic contrast mechanisms, assuming that they directly generate a summative filling-in process. We present psychophysical evidence that such a "filling-in" must occur at stages of processing which integrate more complex structural inputs than merely contrast. Increment thresholds, generally assumed to reflect the output of antagonistic contrast mechanisms, do not correlate with the intensity of surface brightness in the Kanizsa square measured with matching and rating procedures.

(313)

Lacunarity: Fractal Dimension Alone Is Not Sufficient for Texture Discrimination. FRANK M. MARCHAK, *TASC* (sponsored by George L. Wolford)—Marchak (1989, 1990) showed that fractal dimensionality accounted for subjects' ability to discriminate textures. Using higher resolution stimuli, it was found that fractal dimension alone is not sufficient to predict discrimination; it is possible to have textures with the same fractal dimension but different visual appearance. Lacunarity is a fractal parameter that describes the distribution of mass in a fractal set. Fractal dimension and lacunarity together provide a more accurate texture descriptor.

(314)

Laterality Effects in the Perception of Relative Frequency in Audition. RICHARD IVRY & PAUL LEBBY, *University of California, Berkeley*—Laterality effects in auditory perception were explored. Subjects were monaurally presented with two pure tones. The frequency of one of the two tones was varied. For decrements in frequency, performance was better when the stimuli were presented in the left ear/right hemisphere. Conversely, a right ear/left hemisphere advantage was found when the frequency was increased. The results converge with recent laterality findings in visual perception and account for disparate results in the study of music perception and language.

(315)

Assimilation, Contrast and Figure/Ground. SUSAN PETRY & ALAN COOPER, *Adelphi University*—While the mechanisms causing brightness contrast are relatively well understood, its converse, brightness assimilation, is rather poorly understood. We present experiments investigating the relationship of figure–ground to assimilation. Black/gray or white/gray square-wave gratings were manipulated by changing spatial parameters, surrounds, flickering, apparent motion, and eccentric viewing to alter the region seen as figure. The results suggest that contrast is a property of figure, assimilation of ground. Attentional and physiological models are discussed.

(316)

Optic Bias of Perceived Eye Level Depends on Structure of the Optic Array. KENNETH NEMIRE & STEPHEN R. ELLIS, *NASA-Ames Research Center* (sponsored by Arnold E. Stoper)—Head-relative visual direction is determined by a combination of retinal and extraretinal information. We manipulated visual information by presenting pitched virtual boxes, of different optical structures, in a head-mounted display. Perceived eye level was biased in the direction of box pitch; the magnitude of the bias depended on the pattern of optical structure of the box. Results are discussed in terms of an oculomotor theory of spatial stabilization.

(317)

Influences of Closure and Occlusion on the Perception of Fragmented Figures. JAMES M. BROWN & CHRISTOPHER KOCH, *University of Georgia* (sponsored by Milton H. Hodge)—Two experiments examined recognition of a repeated figure in stimuli where only fragments of the figures were available. Fragments were either closed or open regions presented either with or without an occluder filling the spaces between fragments. Recognition performance was superior for open fragment stimuli, with or without an occluder. Experiment 2 compared equiluminance and luminance open/occluded and open/unoccluded stimuli. Recognition times were faster with an occluder and slower for equiluminance stimuli.

(318)

Size Contrast as a Function of Conceptual Similarity. STANLEY COREN & JAMES T. ENNS, *University of British Columbia*—Magnitude of the Ebbinghaus illusion is known to vary as a function of the visual similarity between the central (test) element and surround (inducing) elements. Two experiments show that illusion magnitude also varies with conceptual similarity. Objects served as test stimuli, with larger or smaller objects as inducers. Illusion magnitude was greatest for visually identical inducers, next highest for same and similar conceptual class inducers, and least for inducers from a different conceptual category.

(319)

Perceptual Set and Neural Fatigue Effects on Two Reversible Figures. GERALD M. LONG, GREGORY W. MONDIN, & THOMAS C. TOPPINO, *Villanova University*—Observers reported the initial configuration and subsequent reversals of a reversible figure over a 30-sec testing interval following variable adaptation to an unambiguous version of the figure. For a rotating 3-D Necker cube and a 2-D cube drawing, observers were more likely to report the reversible figure in the same configuration as the adapted figure following brief adaptation periods and in the opposite configuration following long adaptation periods. Cognitive set and neural fatigue are implicated.

(320)

The Time Course of the Global Precedence and Consistency Effects. JAMES G. MAY, CAROLINA GUTIERREZ, & CHARLES A. HARSIN, *University of New Orleans*—The global precedence and consistency effects were examined with an RT paradigm which delayed the global information relative to the local information. With a delay of 80 msec, the global precedence effect was obliterated, but the consistency effect was still significant. This suggests that the two effects may derive from different neural loci.

(321)

Incompatible Eye Movements Disrupt Spatial Encoding. DALE S. KLOPFER, *Bowling Green State University* (sponsored by Michael E. Doherty)—Research indicates that eye position information is not needed for integration in spatial working memory to occur. Yet, with patterns shown sequentially so that the first piece is to be remembered to the left of the second piece, and so forth, pattern memory is better when the pieces are presented from left to right than when presented randomly. It appears that incompatible eye movements disrupt spatial encoding and that eye position information aids spatial integration.

(322)

The Relationship between Spatial Organization and the Perception of Rotational Motion. JOHN R. PANI & SUSAN J. HESPOS, *Emory University* (sponsored by Ulric Neisser)—We investigated perception of 3-D geometric forms undergoing various rotations. Basic implications are: (1) Comprehension of rotational motion can be conceived as the recognition of an implied spatial organization centered on the axis of rotation; when that organization is aligned with the object-centered or the environmental reference systems, the structure of the rotation

becomes apparent. (2) Type of rotation affects kinetic depth for spatial organization. (3) Rotations aligned with object-centered reference systems reinforce those systems.

(323)

Converging Evidence on Sex Differences in Spatial Ability.
THOMAS G. BEVER, *University of Rochester*—A series of new studies confirms and expands the hypothesis that men and women are generally equal in the ability to learn to negotiate new areas. The studies also show that the previously reported differences are a function of greater relative utilization by females of egocentric than geocentric cues: both kinds of cues require configurational and recognition computations. The spatial difference may underlie other kinds of cognitive sex differences that will be discussed.

(324)

The Geometrical Bases of Reasoning about an Object's Orientation. LAWRENCE M. PARSONS & CHARLES H. SCOTT, *University of Texas at Austin*—The geometrical bases of people's imagined spatial transformations is unknown. Our results indicate that even high-spatial ability individuals are generally quite poor at rotating an object about an arbitrary axis and at perceiving the unique axis and angle of rotation separating two orientations of an object. We suggest how this and other recent evidence weighs against the idea that people mentally represent minimum-length trajectories in the Cartesian space in which an object is oriented.

(325)

A Test for Models of Motion Processing: Nonrigidly Perceived Rotating Ellipses. MAGGIE SHIFFRAR & JEFFREY B. MULLIGAN, *NASA-Ames Research Center* (sponsored by Jennifer J. Freyd)—We investigated the perceived nonrigidity of rotating ellipses under a variety of conditions, following Wallach, Weisz, and Adams (1956). We measured the degree of perceived rigidity as a function of aspect ratio and found that a number of factors other than aspect ratio can profoundly affect the percept. We compare the results with the predictions of existing models of motion processing and examine how they might be extended to generate categorical judgments of rigidity.

(326)

The Illusions of the Veil. GLENN E. MEYER & JAMES McMULLEN, *Lewis and Clark College*—If an intermediate gray target moves along a ramp of light to dark, perceived lightness changes. However, motion causes this change to be interpreted as a change in a lighting source. As targets cross the isoluminant point, a veil of mist is perceived which the target must penetrate. If targets, which are also ramped in brightness, are moved across ramps, subjects perceive shadows and illumination changes sweeping across the targets' 3-D structure.

(327)

Dissociation and Self-Reports of Eating, Dieting, and Weight.
ELLEN F. ROSEN, *College of William and Mary*, & LINDA C. PETTY, *Hampton University*—Sanders (1986) defines dissociation as a personality trait which modifies links between affect, cognition, behavioral control, and perception. She found that bingeing college students score high on the Perceptual Alteration Scale (PAS). However, PAS only measures affect and control (Fischer & Elnitsky, 1990). In this study, college women responded to both the PAS and the Dissociative Experience Scale (Bernstein & Putnam, 1986), which measures the cognitive dimension, two standard measures of eating disorders and questions about dieting and weight.

(328)

Perception of Symmetry: The Role of Features. SEONGHEE HONG, *Stanford University*, & M. PAVEL, *New York University* (presented by M. Pavel)—Symmetry has been considered to be an important global feature facilitating object perception. Current models of symmetry perception are based on the symmetry of either individual points or higher level features, such as lines or corners. To evaluate these models, we compared judgment of 2-D stimuli defined by individual points or by patterns of points. Vertical symmetry perception, investigated by the 2AFC method, was better when the points formed simple features. We conclude that perception of symmetric features aids in the perception of object symmetry.

(329)

A Line Facilitates the Perception of a Second Line. DONALD L. KING, HESTER HICKS, & PAMELA D. BROWN, *Howard University*—The stimuli were a vertical line connected to a horizontal line (VH), a vertical line alone (V), a horizontal line alone (H), and a blank tachistoscope card. V was always 10 mm. Stimulus duration and then intensity were decreased progressively. When H was 2 mm, VH was identified more accurately than H, but when H was 10 mm, VH and H were identified equally accurately. Therefore, V facilitated the perception of the 2-mm H.

(330)

The Face-Detection Effect: Sensory and Cognitive Factors. DEAN G. PURCELL, *Oakland University*, ALAN L. STEWART, *Stevens Institute of Technology*, & ERIC J. HIRIS, *Vanderbilt University*—Normal faces have lower detection thresholds than either upside-down or rearranged faces. We show that both sensory and cognitive factors determine when this face-detection effect (FDE) will occur. The FDE is not found if the stimuli contain dark blobs or have a high contrast facial outline. Furthermore, the FDE is eliminated when thresholds are determined for both faces and objects. Although the FDE is eliminated, the object-detection effect is not.

(331)

Effects of Early Visual Features on Pattern and Object Perception. THOMAS SANOCKI, *University of South Florida* (sponsored by Douglas L. Nelson)—The idea that recognition involves a contingency, in which later processing is modified contingent on earlier analyses, was distinguished from bottom-up feature models. Common-feature shape primes were presented briefly, followed immediately by a target pattern, and then a mask and forced-choice alternatives. Primes facilitated choices between same-shape alternatives even though, according to feature models, the primes provided no discrimination-relevant information. Experiments with common objects will also be reported.

(332)

Is Auditory Word Recognition Serial or Interactive? MARK A. PITT, *Ohio State University*, & ARTHUR G. SAMUEL, *SUNY at Stony Brook* (sponsored by Neal Johnson)—Previous research examined this question by having subjects monitor for phonemes at locations surrounding a word's uniqueness point (phonetically unique measuring from word onset). When compared with a nonword control condition, the results favored serial models. However, the beginnings of the nonwords formed the beginnings of legal words, possibly diminishing any word advantage. We controlled for this problem by creating nonwords with early nonword points and found data in support of interactive models.

(333)

Extensions of a Within-Trials Manipulation of Visual Quality as a Means of Testing for Serial and Parallel Processing. DALE DAGENBACH, *Wake Forest University*, & HOWARD EGETH, *Johns Hopkins University* (sponsored by Howard Egeth)—The within-trials visual quality diagnostic for parallel and serial processing described previously by the authors is further developed to apply to varying display sizes and to target-present trials. These extensions provide a potential means of distinguishing between serial and at least some limited-capacity parallel models of visual search. The results of the application of the extended diagnostics to new experiments are then described.

(334)

Express Saccades during the Encoding of Text? ALBRECHT WERNER INHOFF & RICHARD TOPOLSKI, *SUNY at Binghamton*—Reading, letter detection during reading, and copytyping require the encoding of text via a sequence of saccades and fixations. Effects of task demands on fixation durations (saccade latency) were examined to determine whether visuospatial attention during the encoding of text affects the prevalence of short-duration fixations. The results showed unimodal distributions when fixation durations during reading and letter-detection tasks were analyzed. A bimodal distribution characterized oculomotor activity during copytyping.

(335)

Attentional Reduction of (Processing) Noise in Perceptual Encoding. PETER C. GORDON, *Harvard University* (sponsored by Kathryn

Bock)—Performance of a distractor task influences perception of a concurrent stimulus presented in a different modality by affecting the signal-to-noise ratio in the encoding of perceptual features as described by an additive cue model. The effect of reduced attention on different perceptual features closely follows the effect of adding white noise to the stimulus. This supports the conclusion that one role of attention in perception is to reduce processing noise in stimulus encoding.

(336)
The Serial and Parallel Nature of Attention Shifting: Biology and Behavior. WALTER SCHNEIDER, JUDITH SHEDDEN, *University of Pittsburgh*, & GREGORY McCARTHY, *VAMC, West Haven*—The nature of attention shifting was examined in a positional scanning experiment in which attention is attracted to one location and then scans to four other locations. Both reaction time and high-density evoked potential measurements were made. Attention shifting was examined in a serial character search and parallel color search. The biological basis of attention shifting is discussed.

(337)
The Distractor-Suppression Effect: Alternatives to Response Inhibition Theory. JIM CHEESMAN & MATTHEW POLLOCK, *University of Saskatchewan* (sponsored by James M. Clark)—In past studies, we have observed that the negative priming effect diminishes and even reverses to produce a facilitation effect as a function of practice. Two new experiments are reported that show that neither the speed-accuracy mechanism proposed by Neill and Westberry (1988) nor the argument that subjects were predicting the occurrence of suppression trials can be used to discount our results. We believe that the effects of practice are inconsistent with an attentional inhibition mechanism. An alternative mechanism involving the coordination of response codes is proposed to account for the patterns of observed results.

(338)
Right Hemisphere Lateralization of Arousal. ROGER WHITEHEAD & MARIO LIOTTI, *University of Oregon* (sponsored by Steven Keele)—Is there a specific cortical mechanism activated during sustained attention? Behavioral studies of neurological patients and blood flow data in normals suggest a right hemisphere lateralization of arousal. The current study used reaction time and electrophysiological measures to test the prediction that a right hemisphere superiority would emerge when normals are required to sustain attention over long delays. Both the anatomy and the time course of arousal will be considered.

(339)
Perceptual Processing and Recall for "Different" Items. RICHARD S. CIMBALO, *Daemen College*, & ROBIN J. BRICKLER, *SUNY at Brockport*—Three experiments are described wherein a consonant is distinctive (red against a black ground) in a Sperling-type tachistoscopic recall task. Overall recall advantages resulting from distinctiveness are difficult to explain using often-cited retrieval explanations. Our results extend earlier findings from short-term memory, where strategically based explanations are more possible, to even briefer tachistoscopic presentations, where these would seem to give way to more perceptual explanations.

(340)
Listening to the News: Knowledge Acquisition and Metamemory. SANDRA L. SCHNEIDER, *University of South Florida*, & SUZANNE K. LAURION, *University of Wisconsin-Madison* (sponsored by James J. Jenkins)—This study provides evidence that (1) knowledge acquired from a radio broadcast is affected by listener involvement (personal relevance) but not by news item format (editorial vs. informational) and (2) confidence ratings tend to be well calibrated with accuracy measures of listeners' newly gained knowledge. The confidence-accuracy relationship is moderated by listener involvement, question difficulty, and individual differences. Overall, categorical shifts from certainty to partial confidence are easier for listeners to discriminate than other gradations in confidence.

(341)
The Role of Viewing Perspective in the Orientation Specificity of Cognitive Maps. TINA NOLAN & JEANNE SHOLL, *Boston College* (presented by Jeanne Sholl)—A single look at a path that is entirely viewable from one perspective produces an orientation-free representation if the path is large, but an orientation-specific representation if the path is small (Presson, DeLange, & Hazelrigg, 1989). We show that the factor critical to orientation specificity is not path size but the perspective afforded by paths of different sizes. A horizontal perspective produces an orientation-free representation and a vertical perspective, an orientation-specific representation.

(342)
Category and Property Specificity in Category-Based Induction. SHARON LEE ARMSTRONG, *Central University of Iowa* (sponsored by Lloyd Avant)—Osherson et al. (1990) developed a model predicting strength of categorical arguments ("Robins have an ulnar artery"/ "Birds have an ulnar artery") based on similarity relations among the categories occurring in the premise(s) and conclusion. Their model was tested using biological categories and properties. Research here tested the model across different kinds of categories (artifacts) and properties (behaviors) with mixed results. Prospects for a general theory of induction are discussed.

(343)
Imagery and Creativity. MARGARET JEAN INTONS-PETERSON, *Indiana University*—To study if and how imagery contributes to creativity, we tested three conditions assumed to vary in their dependence upon imagery. In all three conditions, subjects were asked to combine four components (drawn from simple geometric forms and capital letters) into novel, but potentially useful, objects. The data supported the view that imagery contributes to creativity and identified some constraints.

(344)
Effects of Context on Representational Momentum. TIMOTHY L. HUBBARD, *Eastern Oregon State College* (sponsored by Alliston K. Reid)—The context surrounding a moving object influences judgment of that object's final position. A square frame context surrounded a rotating rectangle, and subjects judged final rectangle orientation. If the frame rotated in the direction opposite to the rectangle but vanished prior to judgment, direction of representational momentum was reversed. If a stationary frame was shown at judgment, direction of representational momentum was strongly biased toward the frame orientation, regardless of frame motion prior to judgment.

(345)
Languages of Number: Language, Orthography, and Developmental Changes in Number Similarity Judgments. KEVIN F. MILLER, *University of Illinois at Urbana-Champaign*—All mathematical ideas must be expressed in some notation, and the most basic notation of all is the system of number names a language uses. The structure of number-naming systems and the orthographies used to describe them will be discussed. Results of a recently completed study of effects of language and orthographic variation on number-similarity judgments by children in the U.S., Korea, and China will be presented.

(346)
Representational Transfer in Math and Logic Problem Solving. LAURA R. NOVICK & CINDY E. HMELO, *Vanderbilt University* (sponsored by James Pellegrino)—Previous research on transfer in problem solving has considered the transfer of a solution procedure (e.g., a sequence of mathematical operations) from a source problem to an analogous target problem. We report the results of several studies that document and explore solvers' ability to transfer a problem representation (e.g., a matrix, a hierarchy) from a source problem to a superficially dissimilar target problem that requires a very different procedure for solution.

(347)
External and Internal Instantiation of Abstract Principles Facilitates Analogical Transfer. ZHE CHEN, *University of Kentucky*, & MARVIN W. DAEHLER, *University of Massachusetts* (sponsored by Marvin W. Daehler)—Abstract concepts or principles have often been found inefficient in transfer. Using an insight problem-solving paradigm, the present research indicated that both external exemplification (providing a concrete example of principle) and internal instantiation (encouraging learners to generate examples of a principle) facilitated analogical

transfer. The findings shed more light on the mechanisms of analogical transfer: mental efforts devoted to generate concrete instances facilitate applicability of abstract principles in concrete contexts.

(348)

Subgoal Learning Not Aided by Studying Multiple Methods. RICHARD CATRAMBONE, *Georgia Institute of Technology* (sponsored by Timothy A. Salthouse)—Categorization research indicates that increased variability of exemplars leads to better transfer. This suggests that problem solvers should best acquire subgoals for solving problems when they study examples demonstrating multiple methods for achieving subgoals. An experiment using algebra word problems failed to confirm this. Furthermore, learners were less likely to pursue old subgoals requiring familiar methods in novel problems when new methods for other subgoals were needed. Studying multiple methods did not reduce this context sensitivity.

(349)

Insights beyond Words: When Language Overshadows Thought. JONATHAN W. SCHOOLER, STELLAN OHLSSON, & KEVIN BROOKS, *University of Pittsburgh* (sponsored by Lauren Resnick)—Four experiments demonstrated that verbalization can disrupt insight problem solving. In Experiments 1 and 2, retrospective verbalization of attempted insight problem-solving strategies reduced the probability of successful solutions. In Experiment 3, concurrent verbalization similarly impaired the solving of insight problems but not noninsight problems. In Experiment 4, concurrent verbalization remained disruptive even though subjects were encouraged to consider alternative approaches. These findings suggest that verbalization may overshadow critical nonverbal insight processes.

(350)

Action Planning: The Role of Prompts in Command Production. STEPHANIE M. DOANE, DANIELLE S. McNAMARA, WALTER KINTSCH, & PETER G. POLSON, *University of Colorado* (sponsored by Walter Kintsch)—Learners can acquire planning skills in domains such as computer command production by receiving information in the form of help prompts. Depending on the learner's background knowledge, comprehension of prompt information may range greatly, and comprehension is required to translate prompt information into planning skills. Presented are empirical and modeling data that support this claim and suggestions for help instructions designed to optimize learner comprehension.

(351)

The Effect of Context on Judgments of Truth. DEBORAH A. PRENTICE, *Princeton University*, & ALBERT F. SMITH, *SUNY at Binghamton* (presented by Albert F. Smith) (sponsored by Ralph R. Miller)—Subjects read three true or three false biographical sketches of former presidents and then read a target sketch containing both true and false statements. Subsequent true-false judgments about the target depended on the truth of the context sketches. This pattern of results was found with familiar and with unfamiliar facts about the target president and when subjects evaluated the truth of statements about presidents before and after reading the sketches. Instructions emphasizing accuracy eliminated the effect.

(352)

Response Amplification: An Automatic or Learned Reaction to Failure? JASPER BRENER, SUZANNE H. MITCHELL, & ANDREW B. SLIFKIN, *SUNY at Stony Brook*—Rats in a high-force group pressed a beam with 10 g-force for food; a low-force group pressed with 1 g-force. When the probability of reinforcement was reduced from 1.0 to 0.25, immediate amplification of peak forces occurred in both groups. Since the low-force contingency did not differentially reinforce high peak forces, it is concluded that response amplification is unlearned. However, group differences in the form of amplification suggested that the process is modified by learning.

(353)

A Mapless Model of Spatial Performance in the Radial-Arm Maze. MICHAEL F. BROWN, JOANNA E. VONCULIN, & PATRICIA RISH, *Villanova University*—A previously described model of choice in the radial-arm maze will be reviewed. The model assumes that choices in the radial-arm maze consist of a sequence of yes/no decisions regarding

individual maze arms. Critically, the model does not include the guidance of choice behavior by a cognitive map. The performance of the model will then be compared with the performance of male Sprague-Dawley rats in a variety of new experimental situations.

(354)

Material Matching by a Bottlenosed Dolphin. HERBERT L. ROITBLAT, DAVID A. HELWEG, *University of Hawaii at Manoa*, PATRICK W. B. MOORE, & PAUL E. NACHTIGALL, *Naval Ocean Systems Center, Hawaii Laboratory*—A blindfolded dolphin was trained to perform the matching-to-sample task using echolocation. The stimuli were identical 0.3-liter aluminum bottles filled with different substances. The dolphin selected the correct matching alternative with substantially above-chance accuracy. Characteristics of the dolphin's echolocation clicks and the corresponding echoes returning from each target will be described.

(355)

Parts Is Parts: Use of Fraction Symbols by a Chimpanzee. SARAH T. BOYSEN, *Ohio State University and Yerkes Primate Research Center*—A chimpanzee was taught to label the relationship between symbols for fractions ¼ and ½, and portions of fruits. She was required to choose the correct Arabic numeral (0, ¼, ½, 1, 2, or 3) when whole or parts of fruits were presented. Following acquisition, the chimp readily generalized use of fraction symbols to novel foods. A final test evaluated her ability to generalize conceptual use of fractions with liquids (juice presented in glasses), including 1-3 full glasses, or glasses that were ½ or ¼ full.

(356)

Peak Shift Obtained After Discrimination Training on the Dimension of Relative Numerosity. W. K. HONIG, *Dalhousie University*—In two experiments, pigeons were trained to respond to positive arrays of 18 small red and 18 small blue elements, presented in randomized patterns on a response screen. They then discriminated these from arrays containing either more red than blue elements, or the reverse (but not both). The full range of relative numerosities was presented in postdiscrimination testing. This test produced a marked peak shift; the birds responded more to patterns that contained more than 18 positive elements. The discrimination and the peak shift transferred well, on a proportional basis, to arrays of 64 elements, presented in various proportions.

(357)

Hierarchical and Nonhierarchical Organization and Rat Serial Pattern Learning. STEPHEN B. FOUNTAIN, JAMES D. ROWAN, & MICHAEL L. NERING, *Kent State University*—Rats learned either hierarchically or nonhierarchically organized serial patterns. The hierarchically organized pattern was characterized by lower order rules relating pattern elements within chunks and higher order rules relating successively larger groups of chunks. In the nonhierarchical pattern, chunks from the first and second halves of the hierarchical pattern were exchanged. Rats learned the hierarchical pattern faster than the nonhierarchical. Rats' error profiles will be compared to those of human subjects performing an analogous task.

(358)

Appetitive Instrumental Learning in the Amphibian *Bufo arenarum*. RUBÉN N. MUZIO, ENRIQUE T. SEGURA, *Instituto de Biologia y Medicina Experimental*, & MAURICIO R. PAPINI, *Texas Christian University* (presented by Mauricio R. Papini)—A conventional runway procedure with access to water as reinforcer was used to study the performance of toads in several instrumental learning paradigms. Variables manipulated include trial distribution, reward magnitude, and reward schedule. Some basic learning phenomena were readily observed (acquisition, extinction, spontaneous recovery), but there was no evidence of partial reinforcement and magnitude of reinforcement extinction effects. The results will be presented in the context of comparative research on the paradoxical effects of reward.

(359)

Retention of Taste Aversions: Evidence for Retrieval Competition. W. ROBERT BATSELL, JR., & MICHAEL R. BEST, *Southern Methodist University* (sponsored by Michael R. Best)—Conditioned taste

aversions are significantly weaker 1 day after conditioning than 3, 5, or 10 days after conditioning. The retention deficits at 1 day are not due to nonassociative factors like toxicosis aftereffects or hydration differences. Instead, they seem to be mediated by retrieval interference provided by contextual associations.

(360)

Local Context during Training as a Modulator of Pavlovian Responding. ROBERT C. BARNET, NICHOLAS J. GRAHAME, & RALPH R. MILLER, *SUNY at Binghamton* (presented by Ralph R. Miller)—In a conditioned suppression task with rats, unsignaled USs during Pavlovian training attenuated responding to a target CS. Extinction of the training context partially restored responding to the CS, as did signaling the otherwise unsignaled USs with a "cover" stimulus. Immediately surrounding each target CS-US trial with the excitatory cover stimulus also attenuated responding to the target CS. In this case, posttraining extinction of the cover stimulus, but not extinction of the training context, restored responding to the target CS. These observations implicate the temporally local context of CS training as the comparator stimulus that modulates conditioned responding.

(361)

Time Discrimination in *Columba livia* and *Homo sapiens*. J. GREGOR FETTERMAN, *IUPUI*, & PETER R. KILLEEN, *Arizona State University*—We studied temporal discrimination in pigeons and humans, focusing on stimuli for less than 1 sec. A staircase technique was used in Experiment 1; the method of constant stimuli was used in Experiment 2. The data were consistent with the generalized form of Weber's law. Experiment 3 ruled out brightness as the effective cue. Experiment 4 employed a modified staircase procedure; the results indicated a substantial region over which the difference thresholds were constant.

(362)

Unconditioned Stimulus Factors in Sexual Approach Conditioning. MICHAEL DOMJAN & KEVIN HOLLOWAY, *University of Texas at Austin*—Male Japanese quail learned to approach a localized stimulus that signaled access to a female. Copulation with the female facilitated approach conditioning, but learning also occurred with exposure to the female behind a wire screen. Devaluations and revaluations of the unconditioned stimulus (through changes in serum testosterone levels) produced corresponding changes in conditioned approach behavior, suggesting that the learning was mediated by S-S mechanisms.

(363)

"Pet Whipping Boy" Behavior in Low Dominant Captive African Elephants. ROBERT H. I. DALE & MELISSA R. SHYAN, *Butler University*—Wild female African elephants live in herds with varying levels of consanguinity (matriarchies). Dominance hierarchies are stable, based on age, awareness of environmental resources, size, and aggressiveness. The most dominant animal is not always the most aggressive. An artificially established herd (no known consanguinity) was studied at the Indianapolis Zoo to determine dominance hierarchy behavior. Changes in dominance were studied when a new elephant was introduced. These findings are compared to reports from other zoos.

(364)

Rat and Human Temporal Discrimination: A Signal Detection Analysis. J. S. COHEN & M. A. BRAMLEY, *University of Windsor*—Rat and human subjects had to differentiate long from short signals with an immediate response (FI 0 sec) to the former and a delayed response (FI 10 sec) to the latter. Signal sensitivity, P(A), and bias, B, as a function of the difference between signal durations and of the delay between a signal and the opportunity to respond were investigated. Results support scalar expectancy theory (Gibbons, 1977) and prospective processing of signal duration.

(365)

Morphine Hyperalgesia and Developmental Changes in Nociception in Domestic Fowl. RICHARD A. HUGHES, MARK BOWES, & KENNETH J. SUFKA, *Iowa State University*—Morphine (2.5 mg/kg) produced hyperalgesia in 14-day-old chicks but not in 3-, 5-, or 7-day-olds. Respiration was lower in 3-day-old chicks than in older groups, but morphine depressed respiration at each age. Hyperalgesia and

depressed respiration were obtained in 5-day-old chicks when the thermal stimulus was decreased and morphine dose increased (5.0 mg/kg). Morphine hyperalgesia and respiratory depression were reversed by naloxone, but naloxone alone produced hypoalgesia.

(366)

Using Fragmentary Patterns to Compare Models of Category Learning. JOSHUA B. HURWITZ, *Harvard University* (sponsored by William K. Estes)—This study compares the accuracy of a feature-node network model and an exemplar model in predicting test-trial performance after category training with either whole stimulus patterns or pattern fragments. The network model's fit was superior to that of the exemplar model, more so than in previous paradigms. However, to achieve this superiority, the network model was modified to incorporate an averaging function into its computation of category-node output.

(367)

Structured Imagination: The Role of Category Structure in Exemplar Generation. THOMAS B. WARD, *Texas A&M University*—Subjects created drawings and descriptions of imaginary animals. Most of their creations were bilaterally symmetrical, had sensory receptors and appendages, and included attribute correlations (e.g., feathered creatures had beaks and wings). When creating variants on their initial animal, subjects varied shape and appendages more across than within species. The findings illustrate the concept of structured imagination. In generating novel exemplars of known categories, imagination is structured by principles that are characteristic of that category.

(368)

The Course of Forgetting in Connectionist Models. WILLIAM L. OLIVER, *Florida State University* (sponsored by George Weaver)—Forgetting caused by the learning of new information, probabilistic weight decay, and contextual fluctuation was investigated in connectionist models of recognition memory. The models were based on the backpropagation and mean field theory learning algorithms. Models were identified that displayed "exponential-power" forgetting functions for d' measures of recognition memory, which have been shown by Wickelgren (1972) to describe human forgetting. Implications for theories of long-term retention and amnesia will be discussed.

(369)

Do the Beginnings of Auditory Words Have a Special Status? CYNTHIA CONNINE, DEBRA TITONE, & DAWN BLASKO, *SUNY at Binghamton* (sponsored by Albrecht Inhoff)—Three cross-modal priming experiments are reported which investigated whether base words were activated by similarly sounding nonwords. Acoustic-phonetic similarity was manipulated by altering linguistic features of the initial (e.g., SEASON-ZEASON) or medial phoneme (LABEL-LAPEL) of a base word. Initial and medial nonwords showed significant priming effects for associates to the base word. The results support a model in which auditory words are recognized on the basis of goodness of fit.

(370)

The Impact of Thinking-Aloud Protocol Analysis on the Writing Process. SARAH E. RANSDELL, *New College of the University of South Florida* (sponsored by Ira Fischler)—Protocol analysis, which involves collecting spoken thoughts during problem-solving tasks, has been used extensively to reveal important on-line information about the writing process; however, its effects on such writing have received very little attention. Transcripts of writing samples were compared when writers produced a concurrent verbal protocol, no protocol, and when the writers produced a retrospective protocol based on watching a real-time replay of the original composition.

(371)

Recovery from Misanalyses of Garden-Path Sentences. FERNANDA FERREIRA & JOHN M. HENDERSON, *University of Alberta* (presented by John M. Henderson) (sponsored by Peter Dixon)—Sentences such as *After the Martians invaded the town was evacuated* are initially misanalyzed by the syntactic parser. We will present several experiments examining the process of reanalysis. Two conclusions emerge: First, reanalysis is more difficult when the head of the misanalyzed phrase is far from the disambiguating word. Second, effects of verb bias are

more pronounced when reanalysis is difficult. These results suggest an interaction between syntactic processing and thematic role assignment during reanalysis.

(372)

Gestures Precede Speech: A Temporal Interval Predicted by Word Familiarity. PALMER MORREL-SAMUELS, *EDS Center for Machine Intelligence*, & ROBERT KRAUSS, *Columbia University* (sponsored by Julian Hochberg)—Previous work suggests that conversational gestures are perceived as meaningful because observers can utilize the semantic content of accompanying speech. The current research analyzes the temporal relation between gesture onset and onset of the accompanying word. In our sample, gestures precede speech by longer intervals when the accompanying word is unfamiliar. Results suggest both gestures and words are accessed during lexical selection, and that gesture representations are generally less differentiated and more accessible than semantic representations.

(373)

Contextual Influences on the Comprehension of Complex Concepts. RICHARD J. GERRIG, *Yale University*, & GREGORY L. MURPHY, *University of Illinois*—Our experiments investigated how readers understand novel noun–noun phrases like "vodka face." One view argues that readers simply access a discourse element described by the head noun; another claims that readers form a new concept relating the two nouns. The experiments supported the latter view. A description of the relevant relation was sufficient for comprehension of the phrases, as shown by reading times and a later test of readers' interpretations of the phrases.

(374)

Forward Inferences about Specific Events during Reading. JOHN D. MURRAY, CELIA M. KLIN, & JEROME L. MYERS, *University of Massachusetts* (sponsored by Arnold Well)—Two experiments are reported which suggest that individuals make forward inferences about specific events during reading. Prior studies have concluded that such inferences are at best made minimally. Subjects showed a naming time facilitation for target words representing a previously unmentioned cause for an action stated in the last sentence of a narrative. A similar naming time facilitation occurred in passages that were considerably shorter and for targets representing highly predictable consequences.

(375)

Effects of Speech Act Verb Pragmatic Strength and Speaker Perspective on Judged Communication Goodness. PAUL C. AMRHEIN, *University of New Mexico* (sponsored by Henry Ellis)—The interaction of speech act verb pragmatic strengths in requesting-committing dialogs was investigated. Subjects judged dialog "communication goodness" from requestor and committor perspectives. (1) Relative to weaker "non-face-threatening" requesting verbs, communication goodness was judged higher for stronger "face-threatening" requesting verbs when paired with stronger committing verbs, but judged lower when paired with weaker committing verbs. (2) Stronger committing verbs increased judged communication goodness more when subjects judged from requestor's than from committor's perspective.

(376)

Modality Effects on Coherence: Is It Better to Be Seen than Heard? ROGER J. KREUZ, RICHARD M. ROBERTS, ELIZABETH A. BAINBRIDGE, & D. KRISTEN GILBERT, *Memphis State University* (sponsored by Arthur C. Graesser)—Previous research has indicated that discourse coherence is affected by subjects' expectations: Highly coherent plays and conversations became less coherent when their descriptive labels were reversed. Because these results were based only on written transcripts, the generalizability of this finding is limited. The present research uses a broader range of presentation modalities: (1) written transcripts, (2) audio presentation alone, and (3) audiovisual presentation. Modality effects on the perception of coherence will be discussed.

(377)

Looking Back Over Things Once Parced: Text Versus Knowledge Inconsistencies. O. VERONIKA PRINZO, *Fort Hays State University* (sponsored by Joseph H. Danks)—Mean sentence reading times and frequency of look backs for computer-presented text varied as a function of whether critical sentences embedded within text segments were consistent or inconsistent with preceding text, the reader's prior knowledge, or both. Look back as a recovery operation during comprehension may be reflected in what information is subsequently recalled and recalled following a one-week delay.

(378)

Studying Varieties of Lexical Structure with Word Association. JULIA C. JORGENSEN, *Teachers College, Columbia University* (sponsored by George Miller)—Responses in continued word association are viewed as reflections of lexical structure. Culturally important realms of activity tend to be marked by sets of highly distinctive terms (such as cooking vocabulary). We studied the conventionality and distinctiveness of associative responses to words which denote scenes, scripts, actions, and concrete objects in order to evaluate claims about the relative importance of such words in organizing human activity.

(379)

When Is Love a Journey? What Metaphors and Idioms Mean. MATTHEW S. McGLONE, SAM GLUCKSBERG, & MARY BROWN, *Princeton University* (presented by Sam Glucksberg)—We asked people to provide interpretations of novel metaphors. Contrary to Lakoff's proposals concerning conceptual root metaphors, people relied almost entirely on specific attributes of metaphor vehicles rather than on more general conceptual analogies. In contrast, stable conceptual frameworks do seem to underlie idiom comprehension. These results imply that metaphor use can be spontaneous and creative, while idioms (and perhaps frozen metaphors) tend to rely on prestored conceptual analogies in semantic memory.

(380)

The Development of "Dating Scripts" in Young Children. M. DIANE CLARK & BRIAN NEWCOMER, *Shippensburg University* (sponsored by Paula J. Schwanenflugel)—First-grade males and females were videotaped while discussing a date for Barbie and Ken. Videotapes were filmed in a play area that included Barbie, Ken, and three activity areas. Children manipulated the objects while responding to an interview protocol that probed for settings, activities, and conclusions of a date. An early generalized event representation of a date was clearly developed and was more similar between the sexes at this age than for adults.

(381)

Doing It for Themselves: College Experience and Appointment Keeping. SHARLENE WALBAUM, *Mount Holyoke College* (sponsored by Will Millard)—Appointment keeping is one domain of prospective remembering that may develop significantly during early adulthood. In this study, first- and fourth-year college students were surveyed regarding their use of appointment-keeping strategies. Results indicate that they differ in their reliance on strategies, with seniors reporting use of more accessible (and, therefore, more effective) cues. Results were explained in terms of changes in metacognitive awareness that come with the increased emphasis on independent living which is part of college life.

(382)

Age and Text Genre Effects on Capacity Expended While Reading. THOMAS V. PETROS, BARB K. BENTZ, TARA MILLER, & DAVID TUPA, *University of North Dakota*—The effects of age and passage characteristics on processing capacity expended while reading text was examined. Fourth grade, sixth grade, and college students' read narrative and expository texts from a computer. Subjects responded to secondary tones that periodically occurred while reading the texts. Older subjects required less capacity to process the texts than younger subjects, and the effect of text genre and idea unit importance on capacity expended was greater for younger than older subjects.

(383)

Visuospatial Precuing Effects in Young and Old Observers. LYNN ZIMBA & DONALD J. TELLINGHUISEN, *University of Iowa* (sponsored by James V. Hinrichs)—Age-related performance differences in visuospatial precuing effects were investigated in terms of identification latencies to targets presented at attended versus unattended locations. Young and old observers made 2AFC decisions about line orientation or lexical nature of targets presented at low or high luminances.

No differences in attention-effect magnitude were found between the groups in either task under either luminance condition. Results suggest some aspects of cognitive/perceptual function remain intact during the aging process.

(384)

Directed Forgetting Made Difficult. JONATHAN M. GOLDING, *University of Kentucky*, DEBRA L. LONG, *University of California, Davis*, & COLIN M. MACLEOD, *University of Toronto, Scarborough Campus* (sponsored by Philipp Kraemer)—Two experiments investigated semantic relatedness effects in directed forgetting. All combinations of "forget" and "remember" cues (R/F, R/R, F/F, F/R) were used with both unidirectionally related (crab-leg) and unrelated (seat-rope) word pairs. Among other findings, both recall and recognition showed facilitation for forget words only when they followed related remember words. This demonstrates that directed forgetting cannot override preexisting semantic connections, placing a clear constraint on the domain of directed forgetting explanations.

(385)

Mental Representations of Spatial Relations: Combining Recognition Times and Distance Estimates. KARL F. WENDER & MONIKA WAGENER, *Universität Trier*—We combine two approaches to investigate spatial memory that have been used separately in the past. Recognition times for places of a fictive city were measured under a priming condition and distances were estimated using a scaling procedure. Nonmetric multidimensional scaling recovered solutions in two dimensions. A stochastic model is developed and tested that predicts reaction times from the priming experiment on the basis of interpoint distances from 2-D space.

(386)

The Item-Specific/Relational Processing Distinction: Analysis of Cumulative Recall Performance. DANIEL J. BURNS, *Lafayette College* (sponsored by Todd R. Schachtman)—One limitation of the item-specific/relational processing distinction is the lack of good measures of item-specific and relational processing. Category access measures are shown to be fraught with difficulties. An alternative technique for measuring item-specific and relational processing (within the context of hypermnesia experiments) is explored. It is shown that number of items recalled during the early and late portions of a recall test differs for each type of processing.

(387)

Is the "Flash" Necessary to Form a Flashbulb Memory? CHARLES A. WEAVER III, *Baylor University* (sponsored by Lewis M. Barker)— As a laboratory demonstration, students were asked to remember an ordinary event on January 16, 1991—they were essentially asked to form a fake flashbulb memory. By happenstance, the U.S. bombing of Iraq commenced the same day, triggering a real flashbulb memory. Comparison of questionnaires completed immediately and three months later revealed minimal differences between true and fake flashbulb memories in accuracy, but substantial differences in the confidence with which these memories were held.

(388)

Analogies, Similarities, and Abstraction. LESLIE J. CAPLAN & CARMI SCHOOLER, *National Institute of Mental Health* (sponsored by Carmi Schooler)—Subjects read about pairs of analogous domains, then rated and described their similarities. We manipulated encoding complexity of the first passage, domain distance, and whether the analogy was stated. Similarity ratings were highest in near domain/no analogy and far domain/analogy cells. Near domains increased "surface" similarities. Providing analogy statements increased the number of parallel concepts described. Complex encoding increased statements that the domains were isomorphic. Results support the hypothesis that these variables affect abstraction.

(389)

Metamemory as a Function of Memory Load at Encoding and Retrieval. THOMAS S. CRITCHFIELD, *Auburn University*, & LEA T. ADAMS, *Illinois State University* (sponsored by Gordon M. Redding)— In a delayed matching-to-sample (DMTS) task, the number of stimulus items was manipulated both at encoding (sample stimuli) and retrieval (comparison stimuli), while trial-by-trial self-reports assessed knowl-

edge of DMTS success. Sample, but not comparison, manipulation influenced overall self-report accuracy. A signal detection analysis (signal = successful DMTS response) found opposite effects of the two manipulations on report sensitivity. Only comparison manipulation mediated a pervasive bias for reporting successful responses. The results suggest that metamemory can be differentially influenced by factors operating at encoding and retrieval.

(390)

Constraints on Similarity Effects for Situational Frequency Judgments of Words. CAREN M. JONES, *Stanford University*, & EVAN HEIT, *University of Michigan* (presented by Evan Heit) (sponsored by John Jonides)—Multiple-trace memory theories (e.g., Hintzman, 1988) predict that frequency judgments for a target word (e.g., tuna) will increase with increasing presentations of a similar word (e.g., salmon). Experimental results verified this prediction, showing a similarity effect, but suggested two constraints. First, when tuna was not shown, presentations of salmon did not affect judgments for tuna. Second, the similarity effect of each salmon presentation decreased with increasing frequencies of salmon.

(391)

Discourse Influences on Memory for Visual Forms. DEANNA WILKES-GIBBS & PETER H. KIM, *Wesleyan University* (sponsored by John G. Seamon)—Subjects examined abstract figures in conjunction with verbal labels, then conversed in pairs to arrange the forms identically. Subsequent memory tests confirmed that verbal labels at encoding can bias performance, but so can the basic pragmatic demands of referring in conversation. Recall was distorted most when partners shared the same perspectives on the referents, and least when their initial labels conflicted. These results imply that "private" representations may be affected in the establishment of common ground.

(392)

Recognition Level and the Misinformation Effect: A Meta-Analysis and Empirical Investigation. MICHAEL P. TOGLIA, *SUNY at Cortland*, DAVID G. PAYNE, & JEFFERY S. ANASTASI, *SUNY at Binghamton*—Examination of 32 experiments employing McCloskey and Zaragoza's (1985) modified recognition memory paradigm revealed that a significant misinformation effect (control-misled) tended to be observed only with moderately high levels of control performance. This observation may be a regression to the mean artifact. Computer simulations and an experiment (directly varying control performance levels) were conducted to investigate this possibility. Results of the simulations and the experiment are discussed in terms of their implications for memory impairment hypotheses.

(393)

Does Memory Reflect Statistical Regularity in the Environment? LAEL J. SCHOOLER & JOHN R. ANDERSON, *Carnegie-Mellon University* (presented by John R. Anderson)—Anderson and Milson (1989) derived optimal performance functions for memory on the basis of assumptions about memory's goals and a mathematical model of the statistical structure of the environment. Here, instead of using a mathematical model of the informational demands the environment places on memory, we analyzed these demands directly. We studied three environments: parental speech, newspaper headlines, and electronic mail. We show that the performance functions of memory are optimal given the structure of these environments.

(394)

Memory for Randomly Filled Matrices. THADDEUS M. COWAN, JEROME FRIEMAN, & CHARLES P. THOMPSON, *Kansas State University*—The capacity of a mnemonist was tested by presenting numbers singly in matrix form for matrices ranging from 3×3 to 10×10. The numbers appeared by row or randomly. The subject rehearsed the row presentation matrices after each row was completed and/or after 15 numbers were given. The rehearsal times for the smaller randomly presented matrices appeared when each row was completed. Rehearsal strategies for the larger matrices were more complex.

(395)

Young Adults' Perceived Versus Actual Experiences of Forgetting. JUDITH A. SUGAR, *Colorado State University*—Young adults completed a memory questionnaire in which they rated their use of various

memory strategies and estimated their average frequency of forgetting. They subsequently kept track of their everyday experiences of forgetting. Estimates of the frequency of forgetting were very poor: subjects recorded approximately six times more incidents than they estimated and there was no relationship between their estimates and the number of incidents they reported.

(396)

Age Memory Changes a Necessary Consequence of Aging? LEONARD GIAMBRA, HERBERT WEINGARTNER, DAVID ARENBERG, PAUL COSTA, ALAN ZONDERMAN, JUDY FRIZ, E. METTER, *National Institute on Aging*, & CLAUDIA KAWAS, *Johns Hopkins University*—When large decrements in recent memory do occur in the elderly, it may indicate pathology rather than normal aging. Fifty-nine subjects who took the Benton Visual Retention Test (BVRT) every six years during their fifth through eighth decades were examined for memory changes. Some individuals showed no change in BVRT scores over 25 years, whereas others showed large changes. Other than one DAT case, no differences were found in degree of chronic illness between those individuals who changed and those who did not change.

(397)

Effects of Arousal, Imagery, and Encoding in a Von Restorff Task. KINTA M. PARKER & LINDA WARREN DUKE, *University of Alabama at Birmingham* (presented by Linda Warren Duke)—A previous study found that recall of high-imagery words was more disrupted by arousal than recall of low-imagery words. This study separated encoding strategy from the imageability of the stimulus in a von Restorff paradigm. High- and low-imagery lists were presented to subjects who were assigned one of four encoding instructions (rote rehearsal, separation imagery, relational imagery, or uninstructed). Earlier findings were replicated. Encoding strategy also interacted with arousal to affect recall.

(398)

Age and Centrality Influence Recall and Susceptibility to Misleading Postevent Information. KRISTEN E. McKEE & TERRY R. GREENE, *Franklin and Marshall College* (presented by Terry R. Greene) (sponsored by Richard S. Lehman)—First and fifth graders and college students watched a videotape during which a waiter tripped and spilled spaghetti on a customer. Following the presentation, the experimenter summarized the events. Central or incidental information and true or misleading statements were embedded in the summary in a 2×2 design. Two days later, subjects recalled the videotape and responded to questions. Recall and susceptibility to misleading information were influenced by age and centrality. Results are discussed in the context of eyewitness testimony research.

(399)

Priming in a Very Large, Highly Organized Set of Numbers. JEROME FRIEMAN, CHARLES P. THOMPSON, THADDEUS M. COWAN, RODNEY VOGL, & RAJAN MAHADEVAN, *Kansas State University*—We tested a subject who had the first 30,000 digits of pi committed to memory. The first three experiments tested for priming based on the location and similarity of strings of digits to target strings in the set. The next three experiments showed that he has the digits organized in strings of 10 digits and that the primary information for the location of these strings is contained in the first three digits of each string.

(400)

Lexicality and Generation Effects on Memory Span. RICHARD SCHWEICKERT, BETH ANSEL, & MARK A. McDANIEL, *Purdue University*—A basic equation for immediate memory is that span equals speaking rate times trace duration, $s = rt$. We replicated the classic word length effect that longer words decrease the rate, without changing trace duration. We also found two factors that increase trace duration, when rate is constant: (a) lexicality and (b) generating words from fragments. Word length and generation had multiplicative effects on speaking rate, in accordance with the multiplicative factors method of Seth Roberts.

(401)

Hypermnesia in Cued- and Forced-Cued Recall. HAJIME OTANI, HOWARD L. WHITEMAN, KELLY LOVELACE, MATTHEW BOURLIER, & SARAH WILLIAMS, *Central Michigan University* (sponsored by John S. Monahan)—The role of response bias in cued recall hypermnesia was examined by comparing the standard- and forced-cued recall procedures. The standard test asked subjects to recall the studied words. The forced test required subjects to guess unrecalled items. The net improvement was greater for the standard test. However, hypermnesia was also observed in forced-cued recall. It was concluded that the cued recall hypermnesia is not an artifact of response bias.

(402)

Successive Attempts to Produce Interference in Associative Recognition Memory. WILLIAM E. HOCKLEY & NADIA BARGHOUT, *Wilfrid Laurier University*—Previous research (Hockley, 1991a, 1991b; Murdock & Hockley, 1989) has demonstrated that short-term recognition memory for associations between random pairs of words is far more resistant to interference effects than recognition memory for single words. The nature and degree of interference was varied in three experiments in order to establish the conditions that produce interference in associative recognition. The results have important implications for current global models of human memory.

(403)

Continuity between Recall and Recognition Revisisted. ZEHRA F. PEYNIRCIOGLU & LAURA J. MARGOLIS, *American University*—High-frequency words are better recalled than recognized; low-frequency words are better recognized than recalled. We tested memory for eight-letter high- and low-frequency words with 2, 4, and 6 letters given as cues. At all levels of cuing, the patterns of performance resembled those in free recall with fragment cuing instructions (explicit remembering), whereas they resembled those in recognition with fragment completion instructions (implicit remembering).

(404)

Frequency, Preference, and the Concurrent Process Model. MATTHEW A. LEE, JANET L. SUNDBERG, & IRA H. BERNSTEIN, *University of Texas at Arlington* (presented by Ira H. Bernstein)—Preferential ratings are more positive for familiar as opposed to unfamiliar stimuli. There has been debate as to whether preference (affect) precedes, succeeds, or operates concurrently with perceived frequency (cognition). Results obtained from judgments of both geometric forms and faces support the latter, concurrent process approach.

(405)

Re-paired Prime and Target Repetition in Lexical Decision. DAVID S. GORFEIN, *Adelphi University*, ANDREA BUBKA, *St. Peter's College*, & STEPHANIE A. BERGER, *Adelphi University*—At the Psychonomic meeting of 1990, we reported that the amount of repetition priming is decreased when a new prime is substituted on repetition. The aim of the present paper is to examine whether the repetition of both prime and target contributes to the size of the repetition effect. An identity repetition condition was contrasted with a condition in which two related prime-target pairs were re-paired on repetition to create two new related prime-target pairs. Surprisingly, both of these conditions produced large and equivalent repetition effects.

(406)

Suppression of Information in Word Recognition and Reading. GREG B. SIMPSON, HYEWON KANG, & MERILEE A. KRUEGER, *University of Nebraska at Omaha*—In word priming, a meaning of a homograph is suppressed if it is inconsistent with the meaning processed on an earlier trial. We present a priming experiment showing that the suppression is highly specific (other kinds of inappropriate information are not suppressed). A sentence-reading study is also presented, showing that the suppression does not depend on an explicit response to the homograph or any of its associates.

(407)

Spontaneous Remembering: The Role of Indirect and Direct Memory Tests. ROBERT F. BELLI, *Creighton University*, JEFFERY J. FRANKS, *Vanderbilt University*, & STACIE PANZA, *Creighton University* (sponsored by Jeffery J. Franks)—We tested indirect versus direct memory upon "spontaneous remembering" (Franks et al., 1989). Acquisition consisted of word fragments and solutions; testing consisted of half "old" acquisition fragments, and half "new" fragments. In-

direct memory involved fragment completion, whereas direct memory involved recognition. Finally, the spontaneous discovery of an old versus new classification rule was tested, which was not discovered following indirect memory, despite reporting the ease of completing acquisition fragments. The rule was discovered following direct memory.

(408)

Meaning Selective Access in Repetition Priming. J. VIVIEN BAIN-BRIDGE, *University of Oklahoma* (sponsored by Charles Gettys)—Several experiments examined the role of context in repetition priming, using the lexical decision task. Repetition priming disappeared following a simple change in the preceding context sentence, provided that change also altered the perceived sense of the target. A similar context change, failing to alter the perceived sense of the target, did not reduce repetition priming.

(409)

Repetition Blindness and Deafness: New Data and Theory. MICHELLE MILLER & DONALD G. MACKAY, *UCLA* (presented by Donald G. MacKay)—Words repeated in close temporal proximity are difficult to perceive if presented rapidly and visually (repetition blindness), but not if presented auditorily (repetition deafness) at equivalent rates using acoustic compression techniques. The present study presented computer-compressed words auditorily either in sentences or scrambled into lists. Repetition deafness was observed for words repeated in scrambled lists but not in sentences. These results suggested a new theory to account for repetition deafness and repetition blindness.

(410)

The Effects of Similarity and Frequency on Repetition Priming. PATRICIA L. TENPENNY, *Loyola University, Chicago,* & EDWARD J. SHOBEN, *University of Illinois* (sponsored by Eugene B. Zechmeister)—In a follow-up to an experiment presented last year, we investigated the influence of studied neighbors on repetition priming for target words. We varied relative target-neighbor frequency, the study status of targets and neighbors, the font used for the targets at study, the font used for the neighbors at study, and the font used for the targets in the per-

ceptual identification test. The results suggest some constraints on models of word identification.

(411)

Mental Manipulation of Numbers by Bilinguals. CHERYL FRENCK-MESTRE, *CNRS, Université de Provence,* & JYOTSNA VAID, *Texas A&M University* (presented by Jyotsna Vaid) (sponsored by Steven M. Smith)—Automatic activation of number facts was compared in the bilingual's two languages. Bilinguals in Experiment 1 verified whether a probe number (e.g., *eight* vs. *huit*) was the sum of a preceding number pair (e.g., *two five* vs. *deux cinq*) and in Experiment 2 whether the probe had been presented in the pair. RT for negative answers was compared for the two languages and for two levels of absolute difference between true sum and probe (split).

(412)

Beyond the Edges of a Picture. HELENE INTRAUB & DEBORAH BERKOWITS, *University of Delaware*—Observers remember a close-up as having shown more of a scene than was actually depicted (Intraub & Richardson, 1989). In two experiments, using recall and recognition tests, this effect was obtained with close-up, close-up-inverted, prototypic, and wide-angle views of the same seven scenes within minutes. Results suggest that a perceptual schema containing information likely to exist outside the picture's boundaries becomes active during scene perception and becomes incorporated into the memory representation.

(413)

Picture Naming Reveals the Major Invariances Expected of a Shape Recognition System. IRVING BIEDERMAN, *University of Southern California,* ERIC E. COOPER, & PETER C. GERHARDSTEIN, *University of Minnesota*—Priming of picture-naming RTs is virtually unaffected by a change in the primed picture's position, size, or orientation in depth. In contrast, such image changes produce striking interference in making old-new shape judgments. A comparison of performance on the two tasks may provide a behavioral, noninvasive technique for horizontally splitting the extrastriate visual systems, with naming reflecting the functioning of the ventral system and both dorsal and ventral systems determining episodic judgments.

PERCEPTION I
Embarcadero AB, Saturday Afternoon, 1:30–3:00

Chaired by James T. Todd, Brandeis University

1:30–1:45 (414)
Memory for Position and Identity across Saccades. DAVID E. IRWIN, *University of Illinois at Urbana-Champaign*—A transsaccadic partial report procedure was used to measure memory for position and identity information across saccades. The results suggest that memory across saccades decays slowly, has a limited capacity, and is maskable for a brief time. In addition, it appears to retain identity information better than position information. The implications of these results for theories of information integration and perceptual stability across eye movements will be discussed.

1:50–2:10 (415)
Haptic Triangulation: Distal Layout Information from Spatio-temporal Transformations. PATRICK A. CABE, *Pembroke State University*—Geometric analysis suggests that haptic information about the interval between two distal points is available via a string (with its ends connected at those points) pulled into slight tension by an observer's finger actively exploring the elliptical path defined by the connection points (foci) and the constant length string. Naive observers make such interfocal distance judgments reasonably accurately. Thus spatiotemporal haptic/kinesthetic transformations afford usable distal layout information. Some parallels to optical information are offered.

2:15–2:35 (416)
Perceptual Asymmetries in a Haptic Texture Search Task. SUSAN LEDERMAN, *Queen's University*, ROBERTA KLATZKY, *University of California, Santa Barbara*, & CHERYL WILSON, *Queen's University*—A haptic equivalent of Treisman's visual search perceptual-asymmetry paradigm was performed with rough and smooth items, delivered to the fingers using a new custom-designed apparatus. A rough target was consistently detected among varying numbers of smooth distractors more quickly than the reverse. The significance of different search functions obtained with other manipulations will also be discussed. This paradigm is being used to determine a reasonable set of tactile primitives for modeling the early stages of haptic processing.

2:40–2:55 (417)
Why Do We Touch Objects That We Can See? ROBERTA KLATZKY, *University of California, Santa Barbara*, SUSAN LEDERMAN, *Queen's University*, & DANA MATULA, *University of California, Santa Barbara*—Subjects judged real objects on size, shape, weight, roughness, hardness, or temperature. We recorded not only the response time, but also whether touch was used, when it was initiated, and the duration of haptic exploration. Judgments of structure (size, shape) appeared to use vision as a default, whereas difficult judgments of material used haptic exploration frequently and early. These results extend our model of haptic exploration to incorporate vision as an alternative "exploratory procedure."

REPETITION/PRIMING EFFECTS III
Embarcadero CD, Saturday Afternoon, 1:30–3:25

Chaired by Jamie Campbell, University of Saskatchewan

1:30–1:50 (418)
Semantic and Episodic Priming in a Perceptual Identification Task. JEROEN G. W. RAAIJMAKERS, *TNO Institute for Perception*, RENÉ ZEELENBERG, *University of Leiden*, & CHRIS SCHRIJNEMAKERS, *University of Nijmegen*—We investigate the storage of new associations in semantic memory. Three experiments are reported in which prime-target pairs were repeated five times in a perceptual identification task. Primes and targets could be semantically related, episodically related (unrelated but repeated), or unrelated. In two experiments, the episodic relation did not have any effect. In the third experiment, an effect was found but there was still no indication of storage of new information in semantic memory.

1:55–2:15 (419)
Masked Priming Studies of Episodic and Lexical Representation. DIANNE C. BRADLEY, *Monash University* (sponsored by W. D. Marslen-Wilson)—With masked (cf. unmasked) prime presentations, newly learned associations (e.g., fairy/SHARK) afford no reliable benefit in lexical decision, but only in episodic recognition. However, priming between established associates (e.g., table/CHAIR) is equivalent across tasks. This latter effect of association is unlikely to have arisen within the episodic system itself; and indeed, studies in form priming (e.g., fistance/DISTANCE) support an argument that access to episodic word representation can be lexically mediated.

2:20–2:35 (420)
Sense from Nonsense in Episodic Memory. J. W. WHITLOW, JR., *Rutgers University*—Efforts to understand priming and repetition effects for codified events, such as words, have been complicated by the availability of information in both lexical and episodic memory. This complexity is readily apparent in the many dissociations reported for implicit and explicit memory measures. However, studies using noncodified events (pseudowords) yield a relatively uncomplicated picture of priming and repetition effects. For noncodified events, a simple episodically based account appears sufficient for explicit and implicit tasks.

2:40–2:55 (421)
Word Repetition as Eyes See It. MICHAEL E. J. MASSON, *University of Victoria*—A shared foundation for three word-identification paradigms—masked repetition priming, repetition blindness, and parafoveal previewing—is proposed on the basis of informational persistence that follows brief visual exposure to stimuli. Effects in these paradigms may arise because informational persistence allows the visual system to assign discontinuous views of a stimulus to a single episode. New evidence is presented to support an orthographic basis for the contribution of informational persistence to masked repetition priming.

3:00–3:20 (422)
Implicit Memory for Novel Visual Objects: Function and Structure. DANIEL L. SCHACTER, *Harvard University*, & LYNN A. COOPER, *Columbia University*—Previous research has shown that priming effects on a possible/impossible object decision task depend on encoding of global object structure. We found that study tasks that require encoding of object functions produce quite different effects than do structural encoding tasks on object decision priming and explicit memory, respectively. Data are discussed with respect to structure/function dissociations in brain-damaged patients and in relation to the Gibsonian notion of affordances.

ATTENTION IV
San Francisco A, Saturday Afternoon, 1:30–3:10

Chaired by Harold Pashler, University of California, San Diego

1:30–1:45 (423)
Processing Visual Stimuli Inside and Outside the Focus of Attention. PAULA GOOLKASIAN, *University of North Carolina at Charlotte*—This research investigates attention to target and distractor stimuli that appear at locations from 0° to 15° to the right or left of a fixation point. The presentation location of the stimuli are varied so that in some conditions the target and distractor appeared together while in others they were presented at varied spatial locations. Results suggest that the influence of a distractor on target processing is determined by its probable location and its compatibility with the target.

1:50–2:05 (424)
Saccadic Eye Movement and Visual Selective Attention. BASKARAN SUBRAMANIAM & JAMES E. HOFFMAN, *University of Delaware* (read by James E. Hoffman)—The relationship between saccadic eye movements and covert orienting of visual spatial attention was inves-

tigated in a dual-task study which required subjects to make a saccade to a prespecified position while detecting a briefly presented target letter, whose likely position was cued prior to each trial. The cue produced no benefit in target detection accuracy when it conflicted with the direction of the saccade, suggesting that saccadic eye movements require spatial attention.

2:10-2:25 (425)
Can an Eye Serve as an Effective Cue for Selective Attention? RUTH KIMCHI, *University of Haifa*, ORI TRAININ, & DANIEL GOPHER, *Technion, Haifa*—In two experiments, subjects performed a target detection task under dichoptic viewing, using precuing procedure. The relative effectiveness of location precuing and eye precuing, and subjects' ability to utilize these two types of cues, were examined. The results indicated that advance knowledge about the location of the to-be-presented stimulus facilitated performance, and invalid information had an inhibitory effect. In contrast, advance knowledge about the eye had no effect whatsoever. These findings suggest that an eye does not constitute an information channel for attention.

2:30-2:45 (426)
Does Oculomotor Readiness Mediate Cognitive Control of Visual Attention? Revisited! AMANDA J. PONTEFRACT & RAYMOND M. KLEIN, *Dalhousie University* (read by Raymond M. Klein)—Are covert, endogenous shifts of visual attention accomplished by preparation to foveate the to-be-attended location? Klein (1980) described, tested, and disconfirmed this hypothesis. Given renewed interest in, and no further direct tests of, this hypothesis, we performed two new tests. We found that attending a location did not engender preparation to foveate it and preparing to foveate a location did not engender an attentional shift. Endogenous orienting is independent of oculomotor programming.

2:50-3:05 (427)
Visuospatial Sustained Attention. PATRIZIA BISIACCHI & MADO PROVERBIO, *University of Padua*—Phasic orienting of spatial attention has received in recent years a great deal of interest. Our aim was to study spatial attention using a sustained attention task (i.e., maintaining attention to visual locations throughout a series of events). We carried out two experiments in which subjects made speeded responses to peripheral stimuli in focused and diffuse attention conditions. Two and four spatial locations were used in the first and second experiment, respectively. The results are discussed in the light of the models proposed for describing properties of covert orienting mechanisms.

LETTER/WORD PROCESSING II
San Francisco B, Saturday Afternoon, 1:30-2:55

Chaired by Keith Rayner, University of Massachusetts

1:30-1:45 (428)
String Length and Repetition Affect Lexical Decisions about Disoriented Letter Strings. KEVIN JORDAN & LAREE A. HUNTSMAN, *San Jose State University*—Comparison of studies reporting an influence of disorientation on words but not alphanumerics confounds stimulus set size (and hence repetition) with stimulus type. We report that when letter strings are not repeated, there are persistent effects of disorientation on lexical decision times. However, when a small, six-item set of letter strings is repeated at each of six orientations, the effects of disorientation are absent or diminish quickly. The results may indicate multiple representations with broad tuning for orientation.

1:50-2:05 (429)
What Makes Targets Redundant? G. ROBERT GRICE, *University of New Mexico*—In go/no-go reaction time experiments investigating redundancy phenomena with letter stimuli, the effects of target redundancy were greater if the redundant targets were different members of the same response class than if they were physically identical. Analysis also supported a process of coactivation rather than serial processing. Apparently, nonidentical stimuli may be quickly processed parallel to the level of response evocation. Similar results were not obtained with the choice RT procedure.

2:10-2:25 (430)
The Effect of the Uniqueness Point in Processing Printed Words. MONIQUE RADEAU, JOSÉ MORAIS, PHILIPPE MOUSTY, MARCO SAERENS, & PAUL BERTELSON, *Université Libre de Bruxelles*—The time course of lexical access in written word recognition is examined by comparing words with early and with late uniqueness point (UP). Experiments using a normal (simultaneous) presentation of the letters provided no evidence for sequential processing. Incremental presentation of the word letters gave rise to a UP effect comparable in size to that obtained in an auditory study. Smaller UP effects were found with syllable-by-syllable and phoneme incremental presentation.

2:30-2:50 (431)
Computational Modeling of Reading: Dual or Single Route? MAX COLTHEART, BRENT CURTIS, PAUL ATKINS, & ZOLTAN SCHRETER, *Macquarie University*—Skilled readers can (a) read exception words correctly; (b) read nonwords correctly; (c) perform visual lexical decision; (d) become surface dyslexic after brain damage; and (e) become phonological dyslexic after brain damage. Some theorists hold that these basic findings can only be explained by positing two processing routes from print to speech (lexical and nonlexical). The one-route connectionist Seidenberg-McClelland model challenges this claim. We argue that this challenge fails, and introduce a dual-route computational (DRC) model of reading.

(432)
(withdrawn)

HUMAN LEARNING/MEMORY III
Golden Gate A, Saturday Afternoon, 1:30-3:10

Chaired by David G. Payne, SUNY at Binghamton

1:30-1:45 (433)
Judging the Frequency of Action Commands. DARRYL BRUCE, *Saint Mary's University*, & DAVID J. MINGAY, *NORC, University of Chicago*—Individuals performed commands or imagined performing them. The commands were variations on a number of generic actions. Frequency estimation and cued recall of the variations were tested. In comparison with individuals who imagined the commands, those who performed them typically showed poorer frequency estimation, better recall, and higher correlations between judged frequency and recall, indicating greater reliance on the retrieval of instances of generic actions to estimate frequency.

1:50-2:00 (434)
Learning Names of Faces with Imagery Techniques. LOWELL D. GRONINGER & JEFFERY STIENS, *University of Maryland Baltimore County*—Videotapes of students given concrete (Starr) and abstract (Anderson) names were shown to subjects at a 20-sec rate under one of three instructional conditions: (a) form an image of the name with a feature of the person, (b) form a bizarre image of the name with a feature of the person, or (c) learn the name of the person. The imagery techniques were better under both recall and recognition tests.

2:05-2:15 (435)
Tip-of-the-Tongue States and Blockers with Imaginary Animal Targets. STEVEN M. SMITH, *Texas A&M University*—After studying a list of imaginary animals, subjects recalled the animal names, given pictures as cues. More tip-of-the-tongue (TOT) states and recall failures were reported when an incorrect imaginary animal name accompanied the cue than for real animal names, unrelated words, or letters. Name recall was blocked only by other target names. The phonological similarity of targets and blockers had no effect on TOT levels.

2:20-2:30 (436)
Concreteness Effects in Free Recall: On Relational and Distinctive Processing. MARC MARSCHARK, *University of North Carolina at Greensboro*, & LUCA SURIAN, *MRC Cognitive Psychology Unit, London*—Recent research on imagery and memory suggests that concreteness effects may depend on joint distinctive (imaginal) and relational (interitem) processing. The relative contributions of the two were

distinguished using imagery and categorization tasks with related and unrelated lists of concrete and abstract words. Related abstract words were consistently recalled as well as related concrete words. Unrelated words (the usual scenario) yielded concreteness effects only after both relational and distinctive processing, a theoretically constraining result.

2:35-2:50 (437)

Keyword Learning and Retention: Easy Come, Easy Go. MARGARET THOMAS, ALVIN Y. WANG, KATHLEEN GUEST, & PEGGY NYLANDER, *University of Central Florida*—The keyword mnemonic yields impressive gains in learning speed when compared with other methods of studying second-language vocabulary. However, in several experiments, forgetting rates were actually greater for keyword learning than for rote rehearsal. Possibly, preexperimental associations to the keywords regain their prominence over time and inhibit retrieval of the keyword-translation image. Indeed, forgetting in keyword learners was dramatically accelerated when they free associated to the keywords before vocabulary learning.

2:55-3:05 (438)

Category Information and Verbal Recall. MATTHEW J. SHARPS, *California State University, Fresno*, & MICHAEL TINDALL, *Northwestern University*—Although items organized by category are generally better recalled than unorganized items, it was recently demonstrated that this effect is largely confined to verbal stimuli. This finding may reflect differences in the processing of item-specific and relational information. If so, the mnemonic effect of organization for verbal stimuli should diminish over long retention intervals, and this diminution should be attenuated by information, presented at encoding, about stimulus organization. The present results verified these hypotheses.

SYMPOSIUM II:
COMPARATIVE COGNITION: TAKING STOCK
Golden Gate B, Saturday Afternoon, 1:30-4:00

Chaired by Stewart H. Hulse, Johns Hopkins University

1:30-1:35 (439)

Introductory Remarks. STEWART H. HULSE, *Johns Hopkins University*—It has been 15 or 20 years (depending on when you start) since we began to entertain seriously the idea that animals might be cognitive creatures, and a lot has happened in the interim. It seems appropriate to take stock. Where has the field been? What are some possible developments in the future? What has been the impact of studies with nonhuman subjects on the search for facts and the development of theories in the human domain? Are we making animals miniature, rather cognitively impoverished people? What is the evidence that nonhuman species are cognitively different from each other and from humans? These issues provide for lively discussion, and this symposium offers just that.

1:35-1:55 (440)

Comparative Cognition: Toward a General Understanding of Cognition in Behavior. EDWARD A. WASSERMAN, *University of Iowa*—Human and nonhuman animals alike must adjust to complex and changing circumstances if they are to survive and reproduce. Advanced neural mechanisms enable animals to remember the past, to act in the present, and to plan for the future. Exploring the species generality of cognitive processes in behavior is central to the field of comparative cognition. A comparative perspective may not only broaden, but deepen our understanding of cognition—in both human and nonhuman animals.

2:00-2:20 (441)

Where is the Comparison in Comparative Cognition? SARA SHETTLEWORTH, *University of Toronto*—The implicit purpose of most work on comparative cognition is to discover whether nonhuman species process information in the same way as humans do. This research program goes back to Darwin and Romanes and has the same theoretical weaknesses as earlier work on "animal intelligence." An alternative program compares ecologically significant aspects of cognition in

closely and distantly related species. Research on song perception and memory for stored food in birds provides examples.

2:25-2:45 (442)

The Phylogeny and Ontogeny of Cognition. H. S. TERRACE, *Columbia University*—The opportunity to study cognitive processes in animals provides a unique opportunity to investigate the phylogeny and ontogeny of cognition. Much of our understanding of human cognition derives from the intensive study of adult human subjects. Serial learning provides an instructive example. Since Ebbinghaus, experiments on serial learning have been performed almost exclusively on subjects who have had much experience learning lists by virtue of their formal and information education. Recent research on serial learning in pigeons and monkeys provides a new perspective on this fundamental skill, one which does not require language and which appears to be phylogenetically quite old. Of greater interest are qualitative differences in what pigeons and monkeys know about a list as a consequence of having learned to produce it. Discussion of these observations will place in perspective similarities and differences in animal and human cognition.

2:50-3:10 (443)

The Experimental Analysis of Cognition in Animals. ROBERT COOK, *Tufts University*—The recent influence of cognitive science and ethology on the contemporary study of animal cognition is discussed. Whether or not the resulting changes in comparative cognition research represent an example of a scientific paradigm shift is evaluated. Some evidence of the historical and current relations between the study of cognition in animals and humans will be presented. Finally, several difficulties and problems with our current research strategies are considered.

3:15-3:35 (444)

Human Models of Animal Behavior. RUSSELL M. CHURCH, *Brown University*—Similarities between the behavior of humans and other animals in analogous tasks suggest that similar cognitive processes are involved. Human studies provide an efficient way to collect large amounts of data with low variability, and animal studies provide a way to establish generality, limit the range of plausible explanations, and develop explanations in terms of brain mechanisms. Examples will be taken from studies of timing that used similar procedures for humans and other animals.

3:40-3:55 (445)

Discussion. DONALD A. RILEY, *University of California, Berkeley*.

JUDGMENT/DECISION MAKING I
Embarcadero AB, Saturday Afternoon, 3:10-4:55

Chaired by Thomas S. Wallsten, University of North Carolina at Chapel Hill

3:10-3:25 (446)

Internal Attention and the Consideration of Decision Alternatives. MICHAEL E. DOHERTY & CLIFFORD R. MYNATT, *Bowling Green State University*—An attention hypothesis is proposed to account for the failure to consider alternatives on "inferences" involving decisions between unknown states of the world. It predicts that people *will* consider alternatives on "actions" involving decisions between courses of action and on inferences in which attention is drawn to alternatives. Subjects selected information about one alternative when given two-alternative inferences but about both alternatives when given actions. Manipulation of p(D/H) led to increased consideration of alternatives with inferences but not with actions.

3:30-3:50 (447)

The Accuracy-Informativeness Tradeoff in Judgment. ILAN YANIV, *University of Chicago*—In making judgments, individuals often communicate their belief or confidence via the *graininess* of their judgments. For instance, in estimating arrival time, the communications "5:00 p.m." and "fiveish" have different grain sizes; the first is more finely grained than the second. We propose that the selection of grain size in judgment under uncertainty depends on a tradeoff between ac-

curacy and informativeness and report studies in which subjects produced judgments and evaluated others' judgments.

3:55-4:10 (448)

Reflection of Risk Preferences and Scale of Magnitude. KRISTINE KUHN, *University of Illinois*, LOLA L. LOPES, & IRWIN P. LEVIN, *University of Iowa* (read by Lola L. Lopes)—We investigated the impact of numerical quantity on risky choice. Three groups of subjects made choices among both gain and loss lotteries expressed in artificial currencies: small (EV = 1.00), medium (EV = 100), and large (EV = 100,000). For gains, the majority of subjects were risk averse in all conditions. For losses, the majority of subjects were indeterminate for small and medium conditions and risk seeking for large conditions.

4:15-4:30 (449)

Group Versus Individual Probability Judgment: Accuracy and Process. J. FRANK YATES & HUN-TONG TAN, *University of Michigan*—Along what dimensions do individual and group probability judgments tend to differ in their accuracy? What mechanisms account for such differences? To pursue these issues, subjects were asked to make judgments about general knowledge questions individually and in triads. Groups were better at selecting correct alternatives and in the overall accuracy of their probability assessments. Notably, however, overconfidence was unaffected by group interaction. Analyses also supported a signed summation model of polarized group opinion.

4:35-4:50 (450)

The Structure of Arguments in Probability Assessment. SHAWN P. CURLEY, GLENN J. BROWNE, GERALD F. SMITH, & P. GEORGE BENSON, *University of Minnesota*—Reasoning is a central cognitive activity in probability assessment, and one that has been understudied. We collected verbal protocol data as subjects performed several probability judgment tasks. In response, subjects constructed arguments toward forming beliefs and their associated probabilities. Motivated and guided by a cognitive analysis of probability assessment, these data were analyzed for the structure of the subjects' arguments, including argument content, argument types, and argument strategies.

PSYCHOLINGUISTICS III
Embarcadero CD, Saturday Afternoon, 3:35-5:10

Chaired by Michael K. Tanenhaus, University of Rochester

3:35-3:50 (451)

Morphological Priming at Long and Short Lags in Visual Word Recognition. LAURIE B. FELDMAN, *SUNY at Albany and Haskins Laboratories*, & DARINKA ANDJELKOVIĆ, *University of Belgrade*—Effects of orthographic similarity with and without morphological relatedness were investigated in a lexical decision task with Serbo-Croatian materials at lags of 10 and 0 items (SOA 300). Facilitation due to morphological relatedness was evident at long and at short lags. Inhibition due to orthographic similarity (without morphological relatedness) was absent at lags of 10. At lags of 0, inhibition was weak and did not interact with relative frequency of prime and target.

3:55-4:15 (452)

Intonation Last: The Utility of Different Cues to Syntactic Structure. VIRGINIA VALIAN, *Hunter College, CUNY*, & ANDREA G. LEVITT, *Wellesley College and Haskins Laboratories*—College students learned an auditorily presented miniature artificial language in three experiments. We evaluated the roles of reference, marker frequency, and intonational cues to phrases (independent of pausing). Our results suggest that learners utilize intonation only when referential support is lacking, and primarily when marker frequency—a cue to syntactic structure—is low. We hypothesize that adult learners preferentially attend first to referential cues to structure, then to high-frequency syntactic cues, and finally to intonational cues.

4:20-4:40 (453)

Morphological Parsing in Turkish: An On-Line Experimental Study. ULI FRAUENFELDER, *Max Planck Institute, The Netherlands*, JORGE HANKAMER, *University of California, Santa Cruz*, JAKLIN KORNFILT, *Syracuse University*, & SUMRU OZSOY, *Boğaziçi Uni-*

versity—Psycholinguistic investigations of morphological processing and representation have been restricted to typologically similar languages with relatively impoverished morphologies. This research explores the time course of the morphological analysis of an agglutinative language (Turkish) by means of a series of on-line experiments (phoneme monitoring and nonword decision). The results suggest early and immediate activation of the phonological representation of the root and a sequential analysis of the suffix string.

4:45-5:05 (454)

Monitoring for Syllables in Morphologically Complex Words. PIENIE ZWITSERLOOD, *Max Planck Institute, The Netherlands* (sponsored by Arthur G. Samuel)—Experiments in Dutch and German showed that listeners are sensitive to the syllabic structure of spoken words of their native language. Subjects monitored for the presence of visually or auditorily presented targets in disyllabic, polymorphemic spoken carrier words. A clear effect of syllabic match between target and spoken word was obtained for derived and inflected words but not for compounds. A final study investigated whether acoustic or lexical information is responsible for this difference.

ATTENTION V
San Francisco A, Saturday Afternoon, 3:20-5:00

Chaired by John Palmer, University of Washington

3:20-3:40 (455)

Linguistic and Conceptual Control of Visual Spatial Attention. GORDON D. LOGAN, *University of Illinois*—Conceptual relations (above, below, left, right) were used to cue positions of targets in simple and complex arrays. Time to report target identity varied systematically with the cuing relation. The results violated the hypothesis, implicit in current space-based theories of attention, that all display locations are equally available. Instead, they suggest that the availability of display locations depends on their relation to the spatial reference frame that the subject imposes on the display.

3:45-4:05 (456)

Effects of Attention on Length and Distance Estimates. YEHOSHUA TSAL & LILACH MEVORACH, *Tel Aviv University*—Subjects estimated the length of a vertical line and the distance between two vertically displaced dots. For both types of judgments, estimates were consistently shorter when attention was directed to the stimulus than when attention was directed away from it. Results suggest that attentive and unattentive judgments are mediated by two distinctive modes of processing.

4:10-4:20 (457)

Far Peripheral Cues Can Do Better Than Near Cues. VERONICA J. DARK & MICHAEL B. TEPIN, *Iowa State University*—Targets occurred at two locations either alone or with an X at the opposite location. Cues occurring 100 msec prior to the target were central (20%), peripheral near (20%), or peripheral far (60%). Peripheral cues produced faster identification than central cues, with the fastest identification for far cues preceding a lone target. The distractor was more detrimental with far than near cues. Results suggest location priming in addition to "directing" attention.

4:25-4:40 (458)

Suppression of the Ability of Abrupt Onsets to Capture Visual Attention. HIDEYA KOSHINO, C. BRUCE WARNER, & JAMES F. JUOLA, *University of Kansas* (read by James F. Juola)—In several experiments, the detection of a target among noise characters was affected by the validities of various spatial cues. Although abrupt onset of a single character was shown to be a powerful attractor of attention, in some conditions the prior presentation of a central or peripheral cue indicating another position reduced the apparent attentional capture by the onset character. The results are relevant for determining the commonality of automatic and voluntary attentional processes.

4:45-4:55 (459)

Quantitative EEG during Different Levels of Performance on a Vigilance Task. DOMINIC A. VALENTINO, JAMES E. ARRUDA, SHERRI M. GOLD, MICHAEL D. WEILER, MARY RIEDFORD,

& LUZ TEIXEIRA, *University of Rhode Island*—Twenty-seven subjects performed an auditory continuous performance task (CPT) requiring them to direct targets (consecutive, identical letters) in a series of letters presented at a rate of 2/sec. EEG was sampled during early and late CPT performance. Detection accuracy decreased for all subjects between these periods. Comparisons of EEG power spectra showed differences for frontal delta and theta frequencies and for frontotemporal and temporal beta frequencies (they each decrease). Alpha was unaffected.

LETTER/WORD PROCESSING III
San Francisco B, Saturday Afternoon, 3:30–5:05

Chaired by Philip A. Allen, Cleveland State University

3:30–3:50 (460)
Regularity Effects in Word Recognition Reconceptualized.
RICHARD K. WAGNER, WILLIAM L. OLIVER, & CAROL A. RASHOTTE, *Florida State University*—The ease with which a back-propagation model learns a pattern provides a measure of its regularity. Regular patterns are those patterns that occur frequently and have few conflicting patterns in the training set. Using a backpropagation model, we derived phonological, orthographic, and orthographic-to-phonological regularity measures for 5,000 English words. We compared these regularity measures to traditional measures of word characteristics and examined the extent to which they account for variability in naming latency.

3:55–4:15 (461)
The Role of Phonology in the Activation of Meaning. DEBRA JARED, *McMaster University*, & MARK S. SEIDENBERG, *University of Southern California* (read by Mark S. Seidenberg)—Six experiments addressed the extent of phonologically based activation of meaning in visual word recognition, using variants of the semantic decision task developed by Van Orden. The results indicate that phonologically based activation of meaning is limited to lower frequency words and nonwords. The studies also suggest that subjects cannot strategically control the activation of phonological codes. Implications concerning the division of labor in dual-route models of word recognition are considered.

4:20–4:40 (462)
Phonetic Recoding of Phonologically Ambiguous Printed Words.
RAM FROST, *Hebrew University of Jerusalem*—Speech detection and matching simultaneously presented printed and spoken words were used to examine phonologic and phonetic processing of Hebrew heterophonic homographs. The results suggest that the visual presentation of phonologically ambiguous letter strings automatically activated both the dominant and the subordinate phonologic alternatives these letter strings represent. This result provides further confirmation for fast and mandatory phonetic recoding in reading.

4:45–5:00 (463)
Phonology and Orthography in Visual Word Recognition. JONATHAN GRAINGER, *CNRS, Paris*, & LUDOVIC FERRAND, *René Descartes University*—Some masked priming experiments independently manipulating orthographic and phonological prime/target overlap are described. With nonword primes, phonology provided clear facilitation over and above orthography. With word primes, facilitatory effects only occurred in conditions of maximal prime/target overlap and were influenced by the type of nonword distractors. Possible sublexical and postlexical mechanisms underlying facilitatory form priming effects in lexical decision are discussed.

INFORMATION PROCESSING III
Golden Gate A, Saturday Afternoon, 3:20–5:00

Chaired by Paula Goolkasian, University of North Carolina at Charlotte

3:20–3:40 (464)
Inverting the Simon Effect by Intention. BERNHARD HOMMEL, *Max Planck Institute, Munchen* (sponsored by Wolfang Prinz)—Choice reactions are performed faster if there is spatial correspondence between stimulus and response, even if stimulus position is irrelevant for the task (Simon effect). Experiment 1 shows that the crucial variable in determining the Simon effect is spatial correspondence between stimulus and action goal (i.e., intended action effect), the latter being manipulated by different instructions. Results of Experiment 2 indicate that non-goal-related correspondences between stimulus position and position or anatomical mapping of the hand contribute to the Simon effect as well by decreasing or increasing its size.

3:45–4:05 (465)
Impulsivity and Neural Noise in Perceptual-Motor Performance.
JENNIFER GLASS & DAVID E. MEYER, *University of Michigan* (read by David E. Meyer)—Subjects who scored high, medium, or low on a self-report scale of impulsivity tried to hit spatial targets by moving either at prespecified velocities or as rapidly as desired. From parameters of obtained speed–accuracy tradeoff curves, it appears that high impulsives may prefer to move faster than low impulsives because there is less neural noise in high impulsives' motor systems. This supports some extant theories about how impulsivity and cortical arousal are related.

4:10–4:30 (466)
Intersensory Facilitation with Multiple Stimuli: A Test of Competing Models. ADELE DIEDERICH & JEROME BUSEMEYER, *Purdue University* (read by Jerome Busemeyer)—An experiment was conducted investigating intersensory facilitation of reaction times where stimuli of three different modalities (light, tones in two different intensities, and vibration in two different intensities) were presented, separated by various interstimulus intervals. Three different models to explain the observed facilitation of reaction time are presented and tested: a separate action model, a superposition counter model, and a diffusion model, the last two belonging to the class of coactivation models.

4:35–4:55 (467)
Involuntary Capture of Spatial Attention Is Contingent on Control Settings. CHARLES L. FOLK, *Villanova University*, JAMES C. JOHNSTON, & ROGER W. REMINGTON, *NASA-Ames Research Center* (read by James C. Johnston)—Previous research suggests that involuntary capture of spatial attention is triggered by some cue properties (e.g., abrupt onsets) and not others (e.g., color). In these experiments, however, abrupt onsets were used to find target stimuli. New experiments show that when color is used to find targets, abrupt onset cues do not trigger involuntary attention shifts and color cues do. We argue that attention capture can be involuntary, but contingent on strategically alterable control settings.

REPETITION/PRIMING EFFECTS IV
Golden Gate B, Saturday Afternoon, 4:10–5:10

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

4:10–4:20 (468)
Cross-Modal Priming in Word Fragment Completion. WAYNE DONALDSON & ROBIN GENEAU, *University of New Brunswick*—Why does auditory presentation prime visual word fragment completion? Possibilities include visualization of presented words and the use of auditory information on the visual test. Participants saw or heard words and were prevented from cross-modal processing (i.e., those who saw could not verbalize and those who heard could not visualize). Visual word fragment completion performance was reduced only for the visual group who could not verbalize, suggesting an auditory component on the test.

4:25–4:45 (469)
Specificity of Operations in Perceptual Priming. HENRY L. ROEDIGER III, *Rice University*, SUPARNA RAJARAM, *Temple University School of Medicine*, KAVITHA SRINIVAS, *Boston College*, & KATHLEEN McDERMOTT, *Rice University*—We report several experiments in which priming on perceptual implicit memory tests is highly dependent on the match of perceptual operations applied to study

and test events. For example, picture fragments are primed more by pictures than by words and more by fragmented than by intact pictures. Generating images of the relevant scene enhances priming, but generating the name of the concept from a semantic clue does not. Similar results were obtained with verbal perceptual tests.

4:50-5:05 (470)

Name/Rhyme Similarity Effects on Category Decisions about Pictures and Words. PATRICIA SIPLE & ANNEMARIE CWIKIEL-GLAVIN, *Wayne State University*—Word, picture, and mixed picture-word pairs were presented at varying SOAs for superordinate category decision. Pairs differed in the name/rhyme similarity of the objects represented by the pictures and words. Name/rhyme similarity influenced category decision for all pair types. Comparison with similar studies varying object shape similarity suggests some differences in accessing and activating perceptual shape and lexical information.

POSTER SESSION III
Pacific Concourse East, Saturday Evening, 5:45-7:15

(471)

Some Subjects Are Not Influenced by How a Problem Is Framed.
DANIEL REISBERG & DAVID GOSSETT, *Reed College*—Subjects'
preferences are dramatically influenced by how a problem is framed;
in the extreme, subjects can be led to contradict themselves by shifts
in framing. However, not all studies of framing effects replicate these
results. We report data showing that some subjects seem systematically
immune to framing effects; we document that this is not merely a con-
sequence of some subjects being more careful in their decision making.
Other possible factors potentiating framing effects are discussed.

(472)

**An Alternative Interpretation of Framing Effect in Decision Mak-
ing.** JERWEN JOU, *Georgia Southern University*, JAMES SHAN-
TEAU, & RICHARD JACKSON HARRIS, *Kansas State University*
(sponsored by James Shanteau)—Tversky and Kahneman (*Science*, 1981)
demonstrated that people showed a risk-aversion or a risk-seeking choice
preference depending on whether a choice problem was presented in
a gaining or a losing frame. The authors suggested that such a reversal
of preference across the two framings indicated inconsistency or irra-
tionality of human judgments. The present study suggested that atten-
tional dissociation rather than inconsistency may be an alternative in-
terpretation of such choice behavior.

(473)

**Effects of Information Framing and Involvement in Investment
Decisions.** IRWIN P. LEVIN, *University of Iowa*, ANTHONIUS
BAGGERMAN, *Tilburg University*, & GARY J. GAETH, *University
of Iowa*—Subjects distributed a sum of money across two stocks and
a savings account. Realistic stock descriptions were framed in equivalent
positive or negative terms (e.g., chances of going up or chances of going
down) for different subjects. Involvement was manipulated by using either
hypothetical investments or real monetary payoffs based on actual stock
performance. Consistent with an anchoring-and-adjustment model, framing
effects were found with low involvement but not with high involvement.

(474)

The Role of Emotion in Framing Effects. DEBORAH FRISCH &
MICHAEL MURIAS, *University of Oregon* (sponsored by Douglas
Hintzman)—Framing effects demonstrate that seemingly minor changes
in decision presentation influence subjects' choices. In two experiments,
we examined the effect of framing on subjects' predictions of how they
would feel if different outcomes occurred. Framing was found to in-
fluence choice to the extent that it altered the perceived desirability of
the different possible decision outcomes. These results suggest that,
although framing effects violate utility theory, they may reflect accurate
and therefore normatively justifiable decisions.

(475)

**The Role of Computational Limitations in Producing "Neglect"
of Prior Probabilities.** MIRIAM W. SCHUSTACK, *California State
University, San Marcos* (sponsored by Patricia Worden)—The judgment
literature abounds with examples of departures from normatively
prescribed use of prior probabilities. Often, when information is provided
about the individual case being judged, effects of the prior probability
are inappropriately reduced or eliminated. My experimental findings
suggest that computational limitations play an important role in this
"neglect" of priors—people do not simply behave in accordance with
an erroneous belief or procedure whereby *any* case-specific informa-
tion supersedes *all* prior-probability information.

(476)

Salience of Irrelevant Information in a Probabilistic Environment.
JON M. BARNES & STEPHEN E. EDGELL, *University of Louisville*
(presented by Stephen E. Edgell)—Earlier work has shown that the phys-
ical representation of a relevant dimension in nonmetric multiple-cue
probability learning affects the utilization level. This salience effect was
theoretically explained by errors in memory affecting the perceived va-

lidity of the dimension. As a further test of this theory, the salience of
an irrelevant dimension was varied. As predicted by the theory, no ef-
fect was found on the utilization of a second relevant dimension.

(477)

There's More Than One Reason for the Base-Rate Fallacy.
CHRISTOPHER R. WOLFE, *Miami University* (sponsored by Micki
Chi)—Subjects in two experiments (*n* = 192) received a series of Bayes-
ian conditional probability problems and a menu of available informa-
tion including the base rate, hit rate, and contropositive. Subjects gener-
ally utilized the hit rate but ignored the base rate and contropositive.
Measures of reasoning indicate that subjects ignore base rates due to
misconceptions about the meaning of the base rate and hit rate, frequently
believing that $P(A|B) = P(B|A)$. These "conversion errors" are as-
sociated with the base-rate fallacy.

(478)

A Rational Use of Positive and Negative Testing. ANGELA
FRATIANNE & PATRICIA W. CHENG, *UCLA* (presented by Patricia W.
Cheng)—Hypothesis-testing research has shown that people tend to test
only positive cases of either the hypothesized condition or the target
phenomenon. We examine positive testing in terms of a covariation-
based causal reasoning and distinguish between a rational and irrational
use of positive tests. We report results showing that subjects obtain and
evaluate all information necessary for a normative causal decision and
that they spontaneously relinquish ineffective positive tests and use nega-
tive tests when appropriate.

(479)

On the Need to Take Action When Heading toward Defeat. ELDAR
SHAFIR & DALE MILLER, *Princeton University*—In a variety of
decision-making situations offering the options of action and inaction,
subjects' preference for action is found to increase as a function of the
likelihood and gravity of an impending defeat. Contexts investigated
include naturalistic exam-taking settings, as well as a number of hypothet-
ical decision scenarios. The propensity to act in panic situations is dis-
cussed in the larger context of rational decision making under pressure.

(480)

**Age and Sex Differences in Estimates of Long-Term Financial
Growth Functions.** DOUGLAS A. HERSHEY, DARLA SWANN, &
LESLIE BURKE, *George Mason University* (sponsored by David A.
Walsh)—People have been found to make systematic errors in estimat-
ing the value of various types of long-term financial growth functions.
It is unclear, however, whether the ability to make accurate financial
estimates varies as a function of age and sex. In the present study, 192
subjects who ranged in age from 20 to 79 made 24 estimates of long-
term financial yield. Results indicate that neither age nor sex were con-
sistently associated with the accuracy of subjects' estimates.

(481)

**The Decision to Buy Housing: Mental Models and Expected Util-
ities.** DAVID A. WALSH, RUBY R. BROUGHAM, *University of
Southern California*, & HAZEL SPEARS, *Princeton University*—
Expected utility theories propose that people's behavioral choices are
based on their evaluation of the probabilities and the hedonic values they
associate with outcome consequences. The present research examined
the relationship between the expected utilities that 438 subjects assigned
to the options of renting and buying housing and their actual housing
behavior. Furthermore, we examined the influence of subjects' mental
models of financial knowledge on their expected utilities for consequences
associated with buying or renting housing.

(482)

**Contingent Valuation: Stability and Meaning of "Not Willing to
Pay" Responses.** ROBERT M. HAMM, LYNNE BENNETT, KARL
WUNDERLICH, & CHUCK HOWE, *University of Colorado at
Boulder*—Citizens' willingness to pay (WTP) for gain is used to evalu-
ate public goods. Reliability of willing versus not willing responses was
studied in a survey of WTP for increased water supply reliability. More
than 25% of responses were reversed on telephone follow-up of mailed
survey. Explanations for not being willing to pay were coded into 12

categories that have different implications for value of the good. Suggestions for revised formats for WTP questions are made.

(483)

Aesthetic Production and Cognitive Activity: A Glance at the Interaction. PHILIP H. MARSHALL, *Texas Tech University*—Using a laboratory analogue of a portrait photography situation, Marshall and Thornhill (1990) determined the effects of certain subject matter characteristics (novelty and affect) on the probability a photograph would be taken and on the time course for making those decisions. This method of investigating aesthetic production was used in the present study to determine possible interactive effects between aesthetic production judgments and ongoing cognitive activity.

(484)

Format Changes on Ballot Propositions Affect How Voters Vote. DIANE F. HALPERN, DEBORAH CRISTAL WAITES, DAWN FISHER, & ERIC GUERRA, *California State University, San Bernardino*—Most voters are poorly informed about election ballot propositions that require them to make decisions about a wide range of complex and diverse topics. We found that the information in these propositions could be simplified with a modified outline format and that voters respond differently when costs are presented as cost per household or as cost for the entire state.

(485)

Seeding the Knowledge-Base: A Method for Analyzing and Improving Real-World Estimation. NORMAN R. BROWN & ROBERT S. SIEGLER, *Carnegie-Mellon University* (sponsored by Robert S. Siegler)—Estimates of national population are typically inaccurate in absolute terms and moderately accurate in relative terms. In four experiments, we "seeded the knowledge base" by presenting actual populations of a few countries. When arbitrary seed countries were presented, mean estimates for "transfer" countries improved, but rank order did not. However, when countries were selected to disconfirm specific misconceptions, both absolute and relative improvements were evident. Thus, range and rank-ordering factors influence quantitative estimation.

(486)

Weighting of Features in Judgments of Superiority and Inferiority. KIMIHIKO YAMAGISHI & JOHN M. MIYAMOTO, *University of Washington* (presented by John M. Miyamoto)—We compared the weighting of attributes in superiority judgments ("How much better is A than B?") to the weighting in inferiority judgments ("How much worse is B than A?"), where A and B are multicomponent stimuli like descriptions of apartments. An extension of Tversky's contrast model predicts the impact of assessment type (superiority vs. inferiority) on weights assigned to good and bad features of the superior and inferior options. The model was tested against the results of two experiments.

(487)

Discrimination of Auditory Fractal Contours. MARK A. SCHMUCKLER, *University of Toronto, Scarborough Campus,* & DAVID L. GILDEN, *Vanderbilt University* (sponsored by David L. Gilden)—Discrimination ability for a family of fractals known as scaling noises was examined. Given that many natural auditory and visual sources can be characterized as scaling noises, they are of paramount ecological significance. We found that listeners' discrimination of auditory pitch contours, derived from different scaling noises, varied as a function of fractal dimension. Subsequent analyses compared these discrimination functions to theoretical characterizations of the information contained in these noises by modeling listeners' judgments.

(488)

Melodic Tone Duration and Perceptual Judgments. BERNICE LADEN, *University of Washington* (sponsored by Earl B. Hunt)—Does tone duration influence perceptual judgments about music? Listeners heard short chromatic melodies followed by a target chord and rated how well the target chord fit the melody. Melodies were presented with several different durational patterns, including an isochronous one. Results provide evidence for an interaction between durational pattern and target chord.

(489)

Recognition Memory for Auditory Event Duration. MARILYN BOLTZ, *Haverford College*—The purpose of this research was to examine the effects of structural relationships on the recognition of event durations. In Experiment 1, subjects were asked to perform a series of perceptual ratings on computer-synthesized sounds that varied in their internal structure (continuous; rhythmically predictable, unpredictable) and ending (arbitrary, nonarbitrary) before performing a surprise memory test for the events' durations. Experiment 2 replicated this design but relied on sounds from the natural environment. The results of both studies indicated that learning and subsequent remembering was superior for events containing a nonarbitrary ending and/or rhythmically predictable structure. These findings are discussed in terms of a time estimation model that emphasizes the role of event structure on cognitive behavior.

(490)

Attention Goes A-roving: Frequency Cuing Aids Frequency-Roved Auditory Intensity Resolution. LAWRENCE M. WARD, *University of Brtitish Columbia,* & SHUJI MORI, *Nagasaki University*—Analogous to spatial attention cuing in vision and frequency cuing in auditory detection, frequency cuing aids auditory intensity resolution in a roving-frequency one-interval paradigm. Three experiments demonstrate an uncertain frequency effect for intensity resolution, and that both auditory cuing (a brief tone at the frequency at which the to-be-identified tone would appear) and informational cuing (a visual indication of the relevant frequency) improve performance over both uncued and uninformatively cued conditions.

(491)

Perceptual Factors in Aging and Auditory Selective Attention. JOAN M. McDOWD & DANA R. MURPHY, *University of Southern California* (sponsored by Joseph B. Hellige)—Twenty young and 20 older adults received audiometric work-ups, then repeated words in three selective attention conditions: targets in one ear without noise, with noise presented to the other ear, and with noise presented to the same ear. Presentation levels and signal-to-noise ratio were carefully controlled. An overall age-related deficit was obtained, but no age $\times$ condition interaction. These results highlight the importance of controlling hearing differences in studying auditory selective attention.

(492)

Induction Field Organization and Simultaneous Contrast. TIZIANO AGOSTINI & WALTER GERBINO, *University of Trieste* (sponsored by Dennis Proffitt)—We argue that when a black–white induction field is articulated into a complex figure-ground configuration, this can affect subjects' simultaneous lightness contrast (SLC) judgments. In two experiments, we manipulated a gray target belongingness with respect to either the white or the black ground, and to the white or the black figure. Results support the view that lightness judgments are independent from the black–white factor, whereas they are influenced by figure-ground belongingness of the target.

(493)

Laterality in Haptic Exploratory Strategies. JOËL FAGOT, AGNES LAGREUSE, & JACQUES VAUCLAIR, *CNRS-LNF, Marseille* (sponsored by Jacques Vauclair)—Forty-eight right-handed adults of both sexes had to monohaptically explore unseen meaningless stimuli during 4 or 10 sec, and then to recognize their outline drawing. Information on hand strategies were recorded along with the measurement of accuracy. Results indicate: (1) strong sex and hand differences in terms of exploratory strategies; (2) no hand difference in terms of accuracy for the 10-sec span. It is concluded that the measurement of accuracy is not always appropriate to demonstrate laterality effects and sex differences.

(494)

The Role of Strategies in Choice Reaction Time Tasks. ROBERT S. McCANN, *Sterling Federal Systems*, CHARLES L. FOLK, *Villanova University,* & ROGER W. REMINGTON, *NASA-Ames Research Center* (sponsored by Cynthia Null)—Subjects were cued to expect either a lex-

ical decision task or a numbers inequalities task. Cuing effects were additive with manipulations of task difficulty, such as word frequency and numerical distance between the digits. These results suggest that when cues were invalid, processing on the actual task presented could not begin until the incorrect task set was abandoned, and the correct task set was loaded. Implications for strategic involvement in speeded tasks are considered.

(495)
Attentional Mechanisms in Processing Hierarchical Patterns. LYNN ROBERTSON, *University of California, Davis, and VAMC, Martinez*, & ROBERT EGLY, *University of California, Davis*—Evidence will be presented for two separate attentional mechanisms that can influence response time in analyzing hierarchical patterns (Navon, 1977). One mechanism allocates attentional resources categorically to global and local levels, producing cost/benefit tradeoffs as target level probability changes over a block of trials. The other mechanism influences the diameter of an attentional window on a trial-by-trial basis, producing benefits for all targets within it. The relevance of these findings in interpreting parietal lobe damage and attentional dysfunction will be discussed.

(496)
Disengaging from the Disengage Mechanism: A Reinterpretation of Parietal Deficits. JONATHAN D. COHEN & MARTHA J. FARAH, *Carnegie-Mellon University* (sponsored by James L. McClelland)—In a spatially cued simple RT task, parietal-damaged patients respond abnormally to targets presented in the affected field when preceded by a cue in the intact field. The inability of such targets to disengage attention has been interpreted as evidence for a distinct "disengage" mechanism. We demonstrate, through the use of computer simulation models, that identical deficits can arise by lesioning a system characterized by interactivity and competition, but which does not contain any "disengage" mechanism.

(497)
The Influence of Phonotactic Constraints on Phonetic Coding. CAROL A. WANNEMACHER & JAMES R. SAWUSCH, *SUNY at Buffalo* (presented by James R. Sawusch)—Previous studies demonstrate that the perception of ambiguous phonemes is altered by the surrounding phonetic context to produce percepts consistent with the phonotactic constraints of the language. The influence of phonotactics was examined using speeded classification of synthetic series in which the constraining phonemes occurred either before or after the target. Results will be presented on the time course of phonotactic effects, the role of phoneme intelligibility, and their implications for models of speech perception.

(498)
Phonological Priming Effects: A Function of Lexical Stress? BÉATRICE DE GELDER & JEAN VROOMEN, *Tilburg University* (sponsored by Paul Bertelson)—Effects of phonological priming on an auditory lexical decision task were examined in Dutch. Recognition of word targets is inhibited by word primes. The size of the effect is a function of the stress pattern of the prime. First-syllable-stressed primes lead to the strongest inhibition provided that the initial phoneme group shared by prime and target is a syllable (as opposed to consisting of the same initial phonemes but not making a syllable).

(499)
Combining Isolable Physical and Semantic Codes. PETER GROSSEN-BACHER, PAUL COMPTON, MICHAEL I. POSNER, & DON TUCKER, *University of Oregon* (presented by Michael I. Posner)—How are different codes of a visual stimulus bound together into a common representation? We have approached this problem for the visual and semantic codes of words with both cognitive and electrophysiological methods. We have found that the processing of semantic and visual codes overlap heavily in time, while they maintain their separate anatomy. We consider the role of attention in amplifying, speeding, and conjoining these distinct but interacting computations.

(500)
All-or-None Versus a Graded Process Conception of Attention. LISA R. FOURNIER & CHARLES W. ERIKSEN, *University of Illinois at Champaign* (presented by Charles W. Eriksen)—To determine whether attention is a gradual or all-or-none process, attention was directed to one stimulus in a multiletter display by a precue (0-200 msec before display onset). Stimuli varied in size, shape, and color. Subjects looked for 1, 2, or 3 specific cued stimulus features and indicated their presence or absence using choice RT. Results supported a gradual attention process. Also, consistent with template theory, detection performance increased as the features to be identified increased.

(501)
Symmetry, Perception, and Figure–Ground Parsing in Neglect. JON DRIVER, *University of Cambridge*, ROBERT RAFAL, *University of California, San Diego, and VAMC, Martinez*, & GORDON C. BAYLIS, *University of California, San Diego* (presented by Gordon C. Baylis)—Recent views of visual attention suggest that visual scenes are first parsed into candidate objects to which attention is directed. The attentional deficit of a patient with RH damage supports this. The patient neglected the left half of objects and was consequently unable to judge symmetry about the vertical. Nevertheless, symmetry of shapes had normal effects on his figure-ground segregation. Both sides of shapes were available for preattentive parsing, prior to the operation of neglect.

(502)
Superimposed Information Displays: Attentional Deficits and Potential Solutions. DAVID C. FOYLE, *NASA-Ames Research Center*, ROBERT S. McCANN, *Sterling Federal Systems*, & BEVERLY D. SANFORD, *San Jose State University* (sponsored by Stephen R. Ellis)—Head-up displays (HUDs) superimpose display information on the outside world such that both information sources are in the pilot's field of view. However, studies have shown that people may not process simultaneously both the superimposed and out-the-window information. We report results suggesting that cognitive and perceptual cues may cause the two sources of information to segregate, yielding a divided attention deficit. Possible solutions involving the integration of display and world information will be discussed.

(503)
Individual Differences in Speeded Classification: An Analysis of Cognitive Style. LAURA FORD & BARBARA BURNS, *University of Louisville* (presented by Barbara Burns)—The goal of the present study was to further characterize the individual differences in information processing by highly analytic and holistic adults. Filtering, condensation, and grouping tasks were used with highly separable (circle size vs. angle), separable (color vs. form), and integral (height vs. width of rectangle) dimensional combinations. Cognitive style, as measured by Kagan's MFFT, was found to interact with both stimulus structure and task demands. Results are discussed in the context of current models of integral-to-separable processing.

(504)
Interference and Two Measures of Implicit Memory. LAWRENCE M. SCHOEN & BEN T. BROWN, *Lake Forest College* (sponsored by Richard Jackson Harris)—Subjects were given a traditional interference task, learning three 20-item word lists. After each list they solved word puzzles (anagrams or fragments). Priming of puzzles occurred in either the first or third word list, with the primed puzzles appearing in either the first or third puzzle list. Interference from the explicit recall task influenced solution rates of the implicit task, both for type of measure and among the three presentation combinations of prime/test.

(505)
Limits of Structural Complexity in Implicit Sequence Learning. PEDER J. JOHNSON, JONATHAN REED, & PHILIP KRAGNES, *University of New Mexico*—Cohen, Ivry, and Keele (1990) reported that when subjects were engaged in a secondary tone-counting task, implicit learning of sequences was limited to first-order conditionals (e.g., each response is determined by the previous response). Using this dual-task procedure, we found that subjects were able to learn both first- and second-order conditionals (i.e., response determined by previous two responses). Results are discussed in terms of those aspects of sequence complexity that are related to difficulty of implicit learning.

(506)
The Components of Recollective Experience: Remembering and Knowing. SUPARNA RAJARAM, *Temple University School of Medi-*

cine (sponsored by Michael J. Watkins)—The nature of recollective experience was examined in several experiments where subjects made "remember" judgments (to items recollected vividly) or "know" judgments (to items recognized on some other basis) in a recognition memory task. Results show that "remembering" is sensitive to conceptual manipulations and "knowing" to perceptual manipulations. These results indicate that dissociations similar to those obtained between perceptual implicit memory and conceptual explicit memory tasks are observed between remember and know judgments.

(507)
Prior Knowledge Affects Reports of the Dates of Events. VINCENT PROHASKA, *Lehman College* (sponsored by Karyl Swartz)—People's prior knowledge about the usual temporal intervals between events affects their reports, from memory, of particular dates. Subjects read a number of two-event vignettes whose dates created intervals that were less, greater, or equal to people's prior knowledge of the usual intervals (established independently). After reading the vignettes, subjects recalled the presented dates. Results indicated that the dates reported were influenced by both the dates presented and prior knowledge.

(508)
Why We Recall More about a Tourist than a Thief. CATHERINE HANSON, *Temple University* (sponsored by Nora Newcombe)—Changes in schema activation are shown to lead to changes in the way prose material is organized into events and subsequently remembered. Subjects who believed they were reading a story about a tourist not only parsed the story into more events than subjects who believed they were reading about a thief, but also recalled significantly more of the story. Consistent with earlier work (Hanson & Hirst, 1989), recognition performance was not similarly affected by orientation.

(509)
Effects of Experiential Deprivation on Recognition Failure of Recallable Famous Names. CHANDRA BHAL DWIVEDI & SUDHA SRIVASTAVA, *Banaras Hindu University* (sponsored by R. Parasuraman)—Forty-eight experientially deprived subjects studied boldface Hindi name and non-name targets in the context of ordinary face cues. Following the recognition failure (RF) paradigm, recognitions and cued recalls were obtained based on retrieval queries directed at episodic or semantic memory systems. The results (a) indicate significant main effects of deprivation and famousness, (b) demonstrate the robustness of the RF phenomenon unaffected by degree of deprivation, and (c) fail to support the episodic–semantic distinction.

(510)
Perspective in Autobiographical Recall. JOHN A. ROBINSON & KAREN SWANSON, *University of Louisville*—Nigro and Neisser (1983) contrasted field (F) and observer (O) perspectives in autobiographical recall and offered two explanations for the phenomenon. We tested their hypotheses in two studies. Both received some support. Recent F and O memories differed in several qualities. Old F and O memories did not. Changing from F to O altered memory qualities. The reverse change had no effect. Prior awareness of perspective and metacognitive accuracy were also assessed. People were aware of perspective but insensitive to its features.

(511)
Source and Content Memory for Conversations. PAUL J. JURICA & ARTHUR P. SHIMAMURA, *University of California, Berkeley* (presented by Arthur P. Shimamura)—Subjects were asked to generate answers from questions ("When was the last time you voted?") or to read statements ("Breakfast is my favorite meal of the day") presented by one of three sources (faces on a computer). Memory for content was better for questions than for statements. However, source memory was better for statements than for questions. These findings support a limited-resource view of memory for conversations and limits the scope of generation effects.

(512)
Everyday Planning: An Analysis of Daily Time Management. DANIEL J. SIMONS, *Harvard University*, & KATHLEEN M. GALOTTI, *Carleton College* (presented by Kathleen M. Galotti)—We assessed planning, prioritization, and completion of daily activities in 88 college students. Subjects listed and prioritized their goals for the following day and 2 days later, reported their accomplishments. Subjects also defined "planning" in a short essay. Self-reported good and poor planners did not differ in the proportion of goals completed or in sensitivity to goal priority. Planners' definitions of planning did differ. The importance of ecologically valid measurement in planning research is discussed.

(513)
Transfer from Computer-Based Laboratory Environments to Real-World Tasks. COLLEEN M. ZEITZ, *University of Pittsburgh* (sponsored by Robert Glaser)—An important issue in the development of learning skills is the degree of transfer to novel contexts. Undergraduates who explored one, two, or three computer environments were compared to assess whether they developed skills that facilitated exploration in a novel noncomputerized domain. Subjects who explored three environments discovered more laws, asserted fewer erroneous conclusions, and collected more exhaustive data in a real-world laboratory. Protocol analyses revealed that they abstracted general methods for scientific inquiry.

(514)
Scientific Induction: Effects of Test Strategy and Multiple Hypotheses. ERIC G. FREEDMAN, *Michigan Technological University* (sponsored by Ryan Tweney)—Scientific induction was investigated using Wason's 2-4-6 task. Subjects tested either a single hypothesis or a pair of hypotheses. Subjects were also instructed to use either a positive- or negative-test strategy. Induction improved when subjects employed a combination of either a positive-test strategy and single hypothesis or a negative-test strategy and multiple hypotheses. A combination of multiple hypotheses and a negative-test strategy may have facilitated induction because subjects could eliminate incorrect hypotheses.

(515)
Hypothesis Generation and Changes in Representation in Medical Diagnosis. JOSE F. AROCHA & VIMLA L. PATEL, *McGill University* (presented by Vimla L. Patel)—This paper addresses two related issues: changes in mental representation of clinical cases and the strategies that accompany those changes. Medical students were asked to solve three clinical cases describing patients whose initial presentation indicated a single common disorder. Subsequent information, however, indicated more strongly a different disorder. The results suggest that as the subjects' experience with the clinical domain increased, their initial disease space becomes fuzzier while their strategies become more focused.

(516)
Strategies for Hypothesis Induction. KEVIN DUNBAR, *McGill University*, ANNE L. FAY, & DAVID KLAHR, *Carnegie-Mellon University* (sponsored by David Klahr)—The strategies used to induce hypotheses from data were investigated. Subjects had to discover how a new function key worked. There were two groups: one was told that the key was a repeat key and the other that it was a mystery key. Subjects in the mystery group used a strategy of inducing hypotheses by contrasting a series of experimental outcomes, whereas the repeat subjects used single-experimental results to induce hypotheses.

(517)
Structure Versus Variety in Concrete Representations of Number. SUK-FONG TANG & JAMES W. STIGLER, *University of Chicago* (presented by James W. Stigler)—Although children are thought to benefit by using concrete representations of number, little is known about which concrete representations benefit them most. In this experiment, third-grade children practiced quantifying computer-generated arrays of blocks that were either random and varying from trial to trial, or canonically organized and nonvarying. Pre- and posttests used numerals to present a series of arithmetic tasks. Results showed significantly greater gains for the group exposed to canonical nonvarying block arrangements.

(518)
Postsecondary Mathematical Education Has Little Impact on Mathematical Problem Solving. JOHN B. COONEY, *University of Northern Colorado*—Contrary to its intention, postsecondary education in mathematics does not appear to enhance students' memorial representation of relevant problem information, perception of problem struc-

ture, translation of problems into equations, or problem-solving accuracy. Advanced mathematics coursework, however, was related to algebraic proficiency. Consistent with predictions from the fuzzy-trace theory of reasoning (Brainerd & Reyna, 1990), students' memory for problem information was found to be independent of problem-solving accuracy. The nature of students' functional representation is currently under investigation.

(519)

The Effect of Intuitive Representations on Math Strategy Verification. JAMES A. DIXON & COLLEEN F. MOORE, *University of Wisconsin-Madison* (presented by Colleen F. Moore)—Intuitive understanding of an acid mixture task was manipulated by instructing subjects about one of five principles of acid mixture. Subsequently, subjects evaluated the answers to pairs of problems. Both problems in each pair had been solved the same way by an unspecified mathematical strategy. Pairs of problem answers violated different principles, but were objectively the same distance from the correct answers. Subjects evaluated problem pairs that violated principles they understood more quickly than other problem pairs.

(520)

Context Effects, Field Dependence, and Gender Differences in Proportional Reasoning. CAROL A. LAWTON, *Indiana-Purdue University at Fort Wayne* (sponsored by Bruce B. Abbott)—Few studies have systematically examined the effects of context on proportional reasoning. In this study, college students were presented with the following problem: 4 is to 6 as 6 is to __?, in either a mixture-of-liquids or Piagetian-type cylinders context. Better performance was found on the mixture problem, although even subtle structural changes in this problem affected performance. Verbal analytic ability, field dependence/independence, and gender also contributed significantly to performance.

(521)

Learning from Mistakes: Source Solution Failures and Analogical Problem Solving. MARY L. GICK & SUSAN J. McGARRY, *Carleton University* (sponsored by R. S. Lockhart)—Several transfer experiments tested the hypothesis that the solution to a target insight problem that typically results in persistent solution failures (due to inappropriate problem representations) is facilitated if a source problem tends to induce initial (before feedback) analogous solution failures. Results supported the hypothesis, and further indicated that surface similarity of words and diagrams between source and target problems had no effect. The relationships among failed solutions, problem representation, and surface similarity are discussed.

(522)

The Illusory Transparency of Utterances: A Problem of Perspective. BOAZ KEYSAR, *University of Chicago* (sponsored by William Prinzmetal)—Subjects read scenarios specifying the meanings of otherwise ambiguous utterances. For each utterance, half of them were informed that speakers were being sarcastic and the other half were told that speakers were truthful. This information was unknown to the addressees. These overhearers thought that addressees perceived sarcasm only when they knew it was intended. They could not disregard their privileged knowledge even though it was irrelevant for addressees, because it made the utterance appear "transparent."

(523)

Parts and Wholes in Face Recognition. JAMES W. TANAKA, *Oberlin College*, & MARTHA J. FARAH, *Carnegie-Mellon University* (sponsored by Martha J. Farah)—Are faces recognized using more holistic representations than other types of stimuli? We define a "holistic" representation as one without internal part structure, in contrast to objects with explicit part representations. Explicitly represented parts should be more easily identified than nonrepresented parts. Consistent with the holistic hypothesis, features in normal faces were disproportionately more difficult to recognize relative to features in scrambled faces, inverted faces, and nonface objects when recognition of wholes was equated.

(524)

Measures of Memory for Possible and Impossible Figures: Study-to-Test Transfer. BRIAN J. LYMAN, *Trinity University* (sponsored by Paula T. Hertel)—Recent research has found implicit/explicit memory dissociations for line drawings of novel possible and impossible 3-D

objects that depend upon whether the orienting task emphasizes elaborative or structural encoding of the drawings (e.g., Schacter, Cooper, & Delaney, 1990). Two experiments indicate further dissociations when structural encoding involves generation (construction) of targets compared with conditions involving elaborative processing of targets. Additionally, differential transfer of processing is observed by varying the format of targets from study to test.

(525)

Multiple Sources of Spatial Information for Aimed Limb Movements. RICHARD A. ABRAMS, VICKI A. STEMMONS, & LINDA VAN DILLEN, *Washington University*—Experiments are reported in which subjects produced rapid arm movements toward a visible target. The perceived location of the target was distorted in one experiment by an induced motion illusion, and in another experiment by the eye movements required of the subject. The limb's initial submovement toward the target was more affected by the distortion than was the overall movement, suggesting that component submovements are programmed on the basis of distinct sources of spatial information.

(526)

The Effect of Variations in Analog Representation on Transfer between Analogous Stories. C. A. CLEMENT, *Eastern Kentucky University*, R. W. MAWBY, *Kentucky State University*, & D. E. GILES, *Eastern Kentucky University* (sponsored by Rachel Joffe Falmagne)—Analogical transfer was examined in three experiments with college students. Three manipulations were each found to improve transfer between analogous stories. Transfer was significantly better when (a) analogous structural relations were relatively less embedded in domain-specific detail and language, (b) abstract rather than domain-specific verbs were used to convey key analogous relations, and (c) the domain-specific instantiation of an analogous structure was accompanied by a general term that lexicalized this structure.

(527)

Stage-Based Versus Continuous Models of Spatial Learning. JOSEPH P. MAGLIANO, ROBERT COHEN, *Memphis State University*, GARY L. ALLEN, *University of South Carolina*, & JAMES R. RODRIGUE, *University of Florida* (presented by Gary L. Allen)—Stage-based models of spatial acquisition posit an invariant representational format, while the continuous-based models posit flexible, experientially based, knowledge acquisition. Adults viewed slides of a walk through a small town and were instructed to attend to either landmark information, route information, or configural information. A control group was given no specific spatial instructions. Tests of landmark, route, and configural knowledge supported the stage-based model.

(528)

Mirror Tracing Is Learned Via a Series of Direction-Specific Associations. DANIEL B. WILLINGHAM, DAVID E. HUBER, JOHN L. SPEAR, *Williams College*, & JOHN D. E. GABRIELI, *Northwestern University* (sponsored by Richard O. Rouse, Jr.)—Neurophysiological studies indicate that simple visuomotor associations and tracking skills both rely on posterior parietal and premotor cortices. We sought evidence that tracking tasks are in fact learned via a series of direction-specific visuomotor associations. College students traced a straight line in a single orientation via a mirror. Some subjects mirror traced more lines in other orientations, but they did not benefit from the extra training, indicating that the skill is direction specific.

(529)

The Representation of Color and Form in Memory. AURA HANNA & ROGER W. REMINGTON, *NASA-Ames Research Center* (sponsored by Geoffrey Loftus)—We investigated the effect of color on recognition memory for geometric shapes. Subjects studied sequences of stimuli composed of colored or monochrome geometric shapes and were tested for their recognition of shape only. Performance was best when the same colors were present at study and test regardless of whether they were assigned to the same geometric shapes. These results are consistent with the hypothesis that color and shape are represented separately in memory.

(530)

McCollough Effects in a Transwitching Paradigm. R. M. YAREMKO, *San Diego State University*—McCollough color aftereffects (MEs) were

induced in a transwitching (similar to occasion setting) classical conditioning procedure to test the hypothesis that MEs result from Pavlovian processes or from specific feature detectors. Subjects were given red-vertical/green-horizontal bar training with one background context, alternating with green-vertical/red-horizontal patterns on a distinctive background in four 40-min sessions. Posttests indicated MEs were dependent on presence of a context but not the context associated with induction.

(531)

Circadian Rhythm of Semantic Memory Activation in Dream Production. CORRADO CAVALLERO, *Universita' di Bologna* (sponsored by David Foulkes)—Retrieval efficiency from semantic memory appears to vary according to a circadian cycle characterized by a trough at about 4 a.m. and a peak late in the afternoon. The present experiment investigates whether semantic memory involvement in dream production follows this circadian cycle. Results indicate that semantic memory is maximally involved in the production of dreams in second REM (i.e., approximately when retrieval efficiency from semantic memory of sleep-deprived subjects is at its worst).

(532)

Hiding Valuables: Age Differences in a Mnemonically Risky Behavior. ALAN S. BROWN & TAMARA A. RAHHAL, *Southern Methodist University*—A questionnaire assessed subjects' experiences with hiding valuables and having difficulty locating them later. Age differences were found between younger and older adults for the type of item hidden, reason for hiding the item, how long ago the item was hidden, number of searches for the item, who eventually found the item, and time taken to find the item. There were no age differences in percent of items recovered and where an item was found.

(533)

Cross Talk and Computational Momentum in Cognitive Processes. CAROL A. VAREY, *University of Waterloo* (sponsored by Daniel Kahneman)—The Stroop effect is a paradigmatic example of subjects performing more cognitive operations than required. A series of experiments in which tasks were varied within a block of trials demonstrated a new source of unnecessary processing. Cross-talk effects in reaction times suggested that subjects were performing the previous task on the new stimulus in addition to the new task. This "computational momentum" effect was observed in feature-verification tasks and same-different judgments.

(534)

Question Asking in Tutoring Sessions. ARTHUR C. GRAESSER, JOHN D. HUBER, & NATALIE K. PERSON, *Memphis State University*—We analyze the questions that students and tutors ask during tutoring sessions on topics in research methods (e.g., statistics, operational definitions, and interactions). A very small percentage of the questions were well specified. The types of questions and question mechanisms were quite different for students and tutors. We will discuss these results in the context of natural conversation, instructional pedagogy, and intelligent tutoring systems.

(535)

Effects of Circadian Rhythm Optimality on Reactions to Advertising. RICHARD JACKSON HARRIS & JULIA CANDACE POUNDS, *Kansas State University*—Subjects read a series of 12 brief advertisements and afterward rated (1) the truth of a critical claim which had been either stated directly or pragmatically implied in the ad, and (2) their likelihood of purchasing the product. Results showed that both the truth of the claims and the likelihood of purchase were rated higher by subjects in their circadian rhythm optimal time of day (e.g., morning people tested in the morning).

(536)

Human Behavioral Variability and Symbolic Support. LOUIS G. LIPPMAN, *Western Washington University*, & LINDA R. TENNISON, *Washington State University*—Humans were reinforced for producing binary response patterns that differed from a set number (lag) of prior strings. Visual displays conveyed different amounts of information about the current strings. Results suggest that when memory limits are challenged (high lag value) or if external symbolic support is limited,

then different processes or coping strategies may come into play. Under these circumstances, subjects must resort to using internally generated representations of response strings, and performance suffers.

(537)

The Time Course of Perceptual and Conceptual Processes in Priming. MARY SUSAN WELDON, *University of California, Santa Cruz* (sponsored by Henry L. Roediger III)—Two experiments provided evidence that perceptual information becomes available before conceptual information during priming on an implicit data-driven test. Primes were presented visually (words), auditorily, or pictorially. Later, priming on the word fragment completion test was measured. In Experiment 1, word fragments were exposed for 12 sec, 5 sec, 1 sec, or 500 msec. All primes produced priming at the longest exposure time, but only visual words produced priming at the shortest time. Further evidence that perceptual information becomes available fastest was obtained in Experiment 2, in which cumulative response functions were examined.

(538)

Stem Completion Versus Cued Recall: The Role of Response Bias. EYAL M. REINGOLD, *University of Toronto, Erindale Campus*, & PHILIP M. MERIKLE, *University of Waterloo* (sponsored by Philip M. Merikle)—Graf and Mandler (1984) found that under shallow encoding conditions, stem completion is a more sensitive indicator of memory relative to cued recall, whereas under deep encoding the reverse pattern was observed. In the present experiments, we demonstrate that differences in response criteria across tasks may account for these results: the original pattern was obtained when subjects were discouraged from guessing during cued recall (conservative criteria) but not with forced cued recall instructions (lenient criteria).

(539)

Cue-Compounding Versus Cue-Decompounding of Complex Causes. MICHAEL R. WALDMANN, *University of Frankfurt* (sponsored by Norman H. Anderson)—Current theories of causal induction see learning as a bottom-up process that is biased toward additive integration of independent causes. Experiments will be presented which show that identical causes are integrated differently depending on the effect of the causes. Furthermore, the results demonstrate that subjects have a strong preference for using additive integration rules when decomposing compounds of multiple causes even when they would use an averaging rule when compounding them.

(540)

Specificity of Priming in Nonverbal Tests. KAVITHA SRINIVAS, *Boston College* (sponsored by James R. Pomerantz)—Two experiments were conducted to investigate whether priming is specific to the viewing angle of an object. Subjects studied objects photographed from either usual or unusual viewing angles. At test, subjects were required to name brief presentations of the same or different viewing angles. In general, priming was greatest when objects were presented in the same viewing angle at study and test, supporting the transfer-appropriate processing account of priming.

(541)

Strategic and Automatic Mechanisms of Syntactic Priming in Speech Perception. AVITAL DEUTCH & SHLOMO BENTIN, *Hebrew University of Jerusalem* (sponsored by Shlomo Bentin)—The interaction between facilitation and inhibition components of syntactic priming and attention was examined in speech identification. Relative to a neutral condition, the identification of masked targets was equally inhibited and facilitated by syntactic context. Presenting the congruency conditions in separate blocks reduced the inhibition by 20%. Increasing the ISI between the context and the target to 350 msec reduced inhibition by 9%. Facilitation was unaffected by either manipulation. The results suggest the involvement of two cognitive mechanisms in syntactic priming.

(542)

List Subset Effects and the Tulving-Wiseman Function. CARL A. BARTLING, *McNeese State University*—Three experiments provided results inconsistent with the Tulving-Wiseman function. With type of word pair a within-subject variable, obtained probabilities of recognition failure of recallable words exceeded predicted probabilities from

the Tulving-Wiseman function for noun-adjective, cue-target pairs. The reverse was true for adjective-noun pairs. Additional research on the relation between recognition and recall is suggested before supporters elevate the Tulving-Wiseman function to the status of a law.

(543)
Time Course of Retrieval: Implications for Models of Memory. SCOTT D. GRONLUND, MARK B. EDWARDS, & EUGENIE L. BERTUS, *University of Oklahoma* (sponsored by Francis T. Durso)—To link memory models (predict asymptotic accuracy, but not how that result is achieved) and retrieval models (predict the latency of processing) requires specifying how information accumulates over time using the response signal paradigm. A series of experiments establish an equivalence between the retrieval of item and position information and between associative and order information. Also, the retrieval of item information is unaffected by dividing attention while the retrieval of associative information is delayed.

(544)
Retrieving Order and Item Information from STM: Serial and Parallel Mechanisms. BRIAN McELREE, *University of California, Irvine*, & BARBARA ANNE DOSHER, *Columbia University* (sponsored by Barbara Anne Dosher)—Serial and parallel models for retrieving order information from short-term memory were tested with reaction time (RT) and speed-accuracy tradeoff (SAT) variants of a relative judgment of recency task. RT means and distributions suggest that order information was retrieved by a self-terminating mechanism. Large dynamic differences observed in SAT retrieval functions indicate a serial self-terminating mechanism. In contrast, an SAT forced-choice item recognition study demonstrated that item information was retrieved by a parallel mechanism.

(545)
Associative Recognition and Recall in Mixed and Pure Frequency Lists. STEVEN E. CLARK & RICHARD E. BURCHETT, *University of California, Riverside* (sponsored by George J. Andersen)—Previous research has shown that the word-frequency effect reverses for associative recognition: Common, high-frequency (HF) words are recognized better than rare, low-frequency (LF) words. By comparing performance in mixed and pure frequency lists, the current experiments test the hypothesis that the HF advantage is due to recall-like retrieval processes. Results showed that frequency mixing eliminates the HF advantage in cued recall, but not for associative recognition, contrary to the recall hypothesis.

(546)
Interference Context and Short-Term Recall of Sentences. WILLIAM S. MAKI & DAVID GEORGESON, *North Dakota State University*—Potter and Lombardi (*JML*, 1990) suggested that immediate recall results from conceptually based reconstruction using recently activated words. Sentences were followed by unstructured word lists; intrusions occurred if a list contained a synonym (lure) of a word in the sentence. The same effect was found in the present study. Moreover, intrusions were frequent even when the interfering material was changed from a list to a coherent sentence in which the meaning of the lure was preserved.

(547)
Noninformative Peripheral Cues and Motor Facilitation. CAMILLE-AIMÉ POSSAMAÏ, *CNRS-LNF, Marseille* (sponsored by Jean Requin)—Many studies have shown that a noninformative leading cue decreases response time to a subsequent target presented in the same region as the cue. Some authors have assumed a perceptual origin of this facilitation, which lasts about 150 msec. During the last few years, I have collected a series of data which suggest that the origin of this facilitation is, at least in part, in the postperceptual, decisional, and/or motor processes.

(548)
Hypermnesia Occurs in Both Free Recall and Cued Recall Tests. DAVID G. PAYNE & JEFFREY S. ANASTASI, *SUNY at Binghamton*—Payne and Roediger (1987) suggested that hypermnesia would typically not be obtained with cued-recall tests because the tests provide strong retrieval cues. In several experiments, we obtained hypermnesia

with free-recall and cued-recall tests, and the magnitude of the effect was similar across test types. In some cases, the rates of item recovery and intertest forgetting were differentially affected by the type of test. The results have implications for retrieval-based accounts of hypermnesia.

(549)
Separating Strategic and Data-Driven Components of Skilled Performance. ARTHUR F. KRAMER, *University of Illinois*, & DAVID L. STRAYER, *University of Utah*—The contributions of strategic and data-driven factors to skilled performance were separated by manipulating the predictability of two classes of stimuli in a series of memory search tasks. When consistently mapped (CM) and variably mapped (VM) stimuli were blocked, large performance differences were observed. However, when CM and VM trials were mixed, performance differences were substantially reduced. The dynamics of strategic shifts between automatic and nonautomatic processes will be discussed in the presentation.

(550)
Autobiographical Memories for Emotional Events and Physical Feelings. PETER E. MORRIS, *Lancaster University* (sponsored by Eugene Winograd)—Autobiographical memories of emotional events (e.g., being angry or thrilled) are used in a series of studies to evaluate theories of the nature of emotions and to elucidate the properties of the emotional memories themselves. Scherer's theory of stimulus evaluation checks predicts well the properties of the memories. Memories of emotional events are also compared with those for physical feelings (e.g., being cold or wet). Differences reflect the personal implications of emotional events.

(551)
Speed of Mental Processing in HIV-Infected Intravenous Drug Abusers. DAVID DORFMAN, *Mount Sinai School of Medicine*, PAUL RINALDI, *VAMC, Bronx*, LEONARD HANDELSMAN, & CHARLENE BANG, *Mount Sinai School of Medicine* (sponsored by Thomas Toppino)—Like other subcortical-type dementias, AIDS Dementia Complex (ADC) is characterized by slowed mental processes. This slowing is difficult to discriminate from the motor slowing frequently accompanying HIV infection. HIV-infected intravenous drug abusers performed the Sternberg reaction time task. Using an additive factors analysis, we were able to discriminate motor from mental slowing. The results suggest that, as in other risk groups, ADC is unlikely to occur early in HIV infection.

(552)
Age Differences in Text Memory: Continuity or Discontinuity in Failure? JOELLEN T. HARTLEY & KIKU ANNON, *California State University, Long Beach*—If text presentation speed is titrated so that older and younger adults recall a single sentence equivalently, can equivalence be maintained as number of sentences increases? We varied the number of sentences in a text and looked for a critical point where age differences emerged. There was only weak evidence that a catastrophic, age-related failure occurs in the integration of increasingly larger amounts of information. Further analyses bearing on this conclusion will be discussed.

(553)
Memory Constraints in Early Lexical Acquisition. MIRELLA DAPRETTO, ELIZABETH LIGON BJORK, & ROCHEL GELMAN, *UCLA* (presented by Elizabeth Ligon Bjork)—The relationship between increasing retrieval abilities and linguistic advances in the second year of life was investigated by comparing the performance of 18-26-month-olds in the receptive and productive stages of lexical development on a memory task involving recall of both verbal and nonverbal information about pairs of related and unrelated objects. The results support the hypothesis that enhanced retrieval abilities underlie the advances in word production witnessed in children toward the end of the second year.

(554)
A Practical Application of "Old" Psychophysics in Dermal Warmth Sensation. THOMAS HECKMANN & DAVID M. ROESSER, *General Motors Research Laboratories*—Magnitude estimation is preferred for evaluating dermal warmth sensation but is inappropriate for rapidly determining how well different materials protect people from solar ex-

posure. We used simultaneous forearm exposure and "warmer than" responses to evaluate warmth sensations under automotive window glasses. Estimates of Weber's law for dermal warmth corresponded to the most recent published account (50 years ago), validating our procedure for purposes of product engineering, financial decision making, and evaluation of solar simulators.

(555)
An Analysis of Ability/Performance Relationships as a Function of Practice and Age. WENDY A. ROGERS, *Memphis State University*, ARTHUR D. FISK, & CHRISTOPHER HERTZOG, *Georgia Institute of Technology* (presented by Arthur D. Fisk)—The relationships between cognitive/speed abilities and performance on consistently mapped (CM) and variably mapped (VM) visual search tasks were assessed for 70 young (age 20) and 70 old (age 70) adults. LISREL techniques were used to assess the influence of general, fluid, and crystallized intelligence, working memory, perceptual speed, semantic memory access, and psychomotor speed abilities on search performance. Age differences and CM/VM differences are discussed in terms of ability/performance relationships.

(556)
Infant Recognition as a Function of Habituation/Test Format. BEVERLY J. RODER, *Fitchburg State College*, THOMAS H. SCHILLING, *Harvard University*, & EMILY W. BUSHNELL, *Tufts University* (sponsored by Emily W. Bushnell)—Four-month-olds saw repeated presentations of a visual target and a comparison stimulus until habituated. Then, in a recognition test, they saw the target with a novel stimulus. Stimulus presentations were either sequential or simultaneous throughout each habituation/test sequence. Results indicated that the opportunity to compare stimuli facilitated recognition. Infants recognized difficult (dull, complex) and easy (bright, simple) targets when stimuli were presented simultaneously, but only easy targets when stimuli were presented sequentially.

(557)
Children's Metalinguistic Representation of Linguistic Units. RICHARD P. MEIER & ANN REPP, *University of Texas at Austin* (sponsored by Lawrence M. Parsons)—We examined children's metalinguistic abilities by asking them to isolate syntactic constituents. Children, aged 3½ or 5, were trained to echo subject NPs out of modeled sentences. Children were assigned to one of two training conditions: they were trained either on one-word or multiword subject NPs. Subsequently, all children were tested on stimuli of both types. By examining children's responses on test stimuli, we gain insight into how they represented the constituents modeled during training.

(558)
Event Representation and Preschool Children's Conversational Skills. M. GRAZIA CARELLI, BEATRICE BENELLI, *University of Padua*, & TIMO MÄNTYLÄ, *University of Stockholm* (sponsored by Timo Mäntylä)—The effects of scripted knowledge and contextual support on children's conversational skills were examined in two experiments. Pairs of preschool children interacted in realistic settings that varied in terms of event familiarity and contextual richness. The results showed that although both event familiarity and contextual richness were important for children's conversation, high levels of event familiarity did not compensate for the absence of contextual support.

(559)
Age Changes in the Processing of Implicitly Activated Information. CATHY L. McEVOY, *University of South Florida*—Younger and older subjects were compared on cued recall of words varying in number of associates theoretically activated during study. Type of study context cue (meaning-related, unrelated, or no context cue) determined whether older subjects showed either diminished or comparable effects of number of associates, relative to younger subjects. The results suggest age changes in the processing of implicit representations, but also suggest one condition in which comparable processing may occur.

(560)
Infant Attention to an Object's Correlated Form and Function. LISA M. OAKES, *University of Iowa*, KELLY L. MADOLE, & LES-

LIE B. COHEN, *University of Texas at Austin* (presented by Leslie B. Cohen)—An object-examining task was used to investigate infant attention to form/function correlations. Following familiarization with two toys, 10-, 14-, and 18-month-old infants received two trials, one with a familiar toy, in which the form/function correlation presented during familiarization was maintained, and one with a new toy, in which the correlation was violated. The 18-month-olds, but not the younger infants, increased responding to the latter toy, indicating recognition of the correlation.

(561)
Sequential Effects in Bimanual and Unimanual Serial Two-Choice Reaction Time. ERIC SOETENS & JOHAN HUETING, *University of Brussels* (sponsored by Johan Hueting)—Previous research has shown that sequential effects in two-choice reaction time are caused by two independent mechanisms, automatic facilitation and subjective expectancy. In a follow-up experiment, using unimanual responses, we found the same patterns of higher order effects as for bimanual responses. However, the first-order alternation effect, which is typical for subjective expectancy, did not appear in the unimanual condition. These data imply that subjects' performance for alternations over repetitions is purely a response property.

(562)
Incentive Processes Determine Instrumental Performance after a Shift in Primary Motivation. BERNARD BALLEINE, *University of Cambridge* (sponsored by Mark E. Bouton)—Several experiments examined the role of incentive learning in instrumental performance following a shift in primary motivation. Rats trained to perform an instrumental action when nondeprived increased their performance when subsequently food-deprived but only if they had previously consumed the reinforcer when deprived. Similarly, when trained deprived and tested nondeprived, performance was only reduced if animals were preexposed to the reinforcer when nondeprived. These experiments indicate that instrumental performance following reinforcer-revaluation depends upon incentive learning.

(563)
Analogical Codes, Common Codes, and Temporal Samples in Many-to-One-Matching. ANGELO SANTI, STEVE BRIDSON, & MARY JO DUCHARME, *Wilfrid Laurier University*—Pigeons were trained to match temporal and color samples to line comparisons in many-to-one matching. There was no choose-short effect for temporal samples during delay testing. Following the acquisition of new comparison associations to one sample dimension, asymmetrical transfer effects occurred. Interference tests produced evidence of temporal summation when either temporal or color presamples preceded temporal target samples. These data are discussed with reference to both analogical coding and common coding hypotheses.

(564)
Self-Control and Postponed Reinforcer Consumption. DAVID A. CASE & EDMUND FANTINO, *University of California, San Diego* (sponsored by Ben Williams)—Studies have reported lower self-control in pigeons and young children with immediate access to reinforcers than in college students who accumulated reinforcers until session end. The effect on self-control choice of postponing utilization of reinforcers was examined in pigeons. Total choice response rate was reliably higher with conventional within-session consumption of food. However, self-control preference was not significantly affected, tending to decline with postponed consumption counter to the prediction based on subject-correlated differences.

(565)
Changeover Contingencies and "Sensitivity" to Reinforcement on Multiple Concurrent Schedules. LEON R. DREYFUS, DEE DEPORTO-CALLAN, & SARAH ANNA PESILLO, *Vassar College* (sponsored by J. Gregor Fetterman)—On a multiple concurrent schedule with different changeover contingencies in the components, response ratios undermatched reinforcer ratios under a changeover delay and overmatched under a fixed-ratio requirement. An interpretation of these differences in overall response allocation, in terms of local contingencies arranged by changeover requirements and a failure to find differences

in slopes of the generalized matching equation computed early or late in sessions, raises questions about the status of the "sensitivity" parameter of the generalized matching equation.

(566)

Orthogonal Cues and Dimensional Contrast. JOHN M. HINSON & LINDA R. TENNISON, *Washington State University*—Two experiments examined the effects of orthogonal cues on dimensional contrast obtained during visual wavelength discrimination by pigeons. Signaling characteristics of visual stimuli were manipulated by adding an auditory stimulus as either a redundant or conditional cue. Range of wavelength stimuli was also varied. Redundant cues enhanced visual discrimination, while conditional cues reduced discrimination. These results may be due to changes in attention near the dimensional border between positive and negative stimuli.

(567)

Enhancement of Conditioned Reinforcement during Repeated Exposure to Cocaine. MARC N. BRANCH, *University of Florida*—Pigeons keypecked in two-part sessions. In the first, a second-order schedule operated; in the second, extinction was in effect. In some sessions, a brief stimulus associated with food could be obtained by keypecking in the second part of the session. When an intermediate dosage of cocaine was given before each session, responding during extinction that produced brief stimuli gradually increased to levels as high as those maintained by food reinforcement.

(568)

Selective Flavor Neophobia in Mongolian Gerbils. RODERICK WONG & CHRISTOPHER McBRIDE, *University of British Columbia*—In contrast to studies indicating absence of neophobia to flavored liquids in gerbils, we present data indicating the prevalence of this phenomenon to specific flavored foods. Gerbils in the experimental group were tested with a nut flavored with either NaCl, sucrose, citric acid, or quinine crystals and were compared to control animals tested with an unflavored nut. The results indicated that sweet-, salty-, and sour-tasting nuts elicited longer oral latencies than plain nuts. However, there was no evidence of neophobia to bitter-tasting nuts.

(569)

Learning Modes, Feature Correlations, and Postencoding Analyses. WILLIAM D. WATTENMAKER, *University of Pittsburgh* (sponsored by James F. Voss)—Wattenmaker (1991) found that incidental category learning tasks produced greater sensitivity to correlated features than intentional category learned tasks. To explain this result, it was hypothesized that the incidental tasks preserved more information about the individual exemplars, and that the correlations were computed from the stored exemplars. The present research provides direct support for this interpretation, and provides additional evidence that storing examples can be valuable for addressing unanticipated needs and goals.

(570)

Comprehension of Superordinate Category Terms Among Young Japanese-Speaking Children. M. MICHAEL AKIYAMA, *University of Michigan–Dearborn*—Sixteen 1-year-olds, 16 2-year-olds, and 16 3-year-olds in Japan were tested on the comprehension of four superordinate categories (i.e., vehicle, clothing, food, and animal). They were shown four basic-level objects from one superordinate category with four ob-

jects from another category. The experimenter asked the children to select all four objects under one category. The majority of 1-year-olds showed categorical behavior despite poor comprehension. Three-year-olds showed near perfect comprehension on all categories. The nature of initial categories will be discussed.

(571)

Unconscious Recognition in Prosopagnosia: An Alternative Explanation. MARTHA J. FARAH, RANDALL C. O'REILLY, & SHAUN P. VECERA, *Carnegie-Mellon University*—Prosopagnosics, who appear unable to recognize faces, may nevertheless respond appropriately to faces when tested using certain indirect methods (e.g., priming). This has been interpreted as evidence that brain damage did not affect face recognition but rather conscious access to face recognition, implying separate neural substrates for consciousness. We present a computational model of face recognition which, when face recognition units are lesioned to abolish overt recognition, shows preserved performance on the indirect tasks.

(572)

Rule-Like Learning Behavior from an Exemplar-Based Network. JOHN K. KRUSCHKE, *Indiana University* (sponsored by James T. Townsend)—Proponents of rule-based theories of category learning adduce two classic phenomena (among others): (1) High-frequency exceptions to rule-describable categories can show three-stage (U-shaped) learning (e.g., Rumelhart & McClelland, 1986). (2) Intradimensional feedback reversals are easier to learn than extradimensional (nonreversal) shifts (Kendler & Kendler, 1962). In this poster, I present new human data and show that ALCOVE (Kruschke, 1990a, 1990b, in press), an exemplar-based connectionist network, exhibits both effects.

(573)

Negative Occasion Setting in Flavor-Calorie Conditioning. RON MEHIEL, CATHERINE McCARTHY, & DEBRA A. ZELLNER, *Shippensburg University* (sponsored by Debra A. Zellner)—Rats were conditioned to prefer a flavor (S1) paired with calories over a flavor (S2) paired with water. Then a novel flavor (S3) was paired with either S1 or S2. When tested for preference between the water-paired and calorie-paired flavors (S1-S2), the presence of S3 decreased the preference for the calorie-paired flavor. Thus, S3 served as a negative occasion setter.

(574)

Producing Confusions in Source Monitoring: A Reality Monitoring Approach. TRACEY L. KAHAN, *Santa Clara University* (sponsored by Marcia K. Johnson)—Three experiments reliably produced confusions between memories for imagined and perceived events. A computerized mental rotation task was used to present 12 seen and 12 imagined letters and numbers. Each subject ($N = 120$) then received one of two incidental memory tests. Old/new recognition and source identification measures were thus obtained for characters rotated clockwise (Experiment 1) and counterclockwise (Experiment 2) and for characters not rotated (Experiment 3). The major findings are discussed in light of recent models of reality monitoring and source monitoring.

(575)

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MOTOR CONTROL
Embarcadero AB, Sunday Morning, 8:00-10:15

Chaired by Gordon M. Redding, Illinois State University

8:00-8:15 (576)
Speed and Accuracy of Aimed Hand Movements toward Shifted Targets. HOWARD ZELAZNIK, *Purdue University*—The "smoothness" of corrective movements towards a target that can be shifted 1 cm toward or away from the subject's starting position was examined. Eight subjects performed line drawing movements toward a .8-cm target 20 cm from a home position. Target shifts could be either asymmetrical or symmetrical. The shift occurred coincident with movement onset. Subjects were able to move towards the shifted target regardless of type of possible target movement. Movement time effects were very small.

8:20-8:35 (577)
Separable Components of 3-D Tracking with Misalignment between Display and Control Axis. STEPHEN R. ELLIS, MITCHEL TYLER, *NASA-Ames Research Center and University of California, Berkeley*, WON SOO KIM, & LAWRENCE STARK, *JPL*—Subjects performed 3-D tracking with misaligned display/control frames of reference on perspective displays. Their RMS tracking error in orthogonal components exhibits a visual component linearly separated from a visual-motor component. The visual component appears proportional to the average screen projection of the orthogonal components. The visual-motor component may not exhibit characteristics expected were it due to an added time lag caused by mental rotation. Practice allows subjects to adapt to multiple misalignment angles.

8:40-9:00 (578)
Symmetry Breaking Dynamics of Coordination. JOHN J. JEKA & J. A. S. KELSO, *Florida Atlantic University* (read by J. A. S. Kelso)—Rhythmically moving human arms and legs were used to study the dynamics of relative phase between multiple components with anatomical differences. Two-limb patterns showed bifurcations from limbs moving in different directions to limbs moving in the same direction and not vice versa. Four-limb patterns displayed unidirectional transitions from "trot" to "pace." These results were theoretically modeled as saddle-node bifurcations because of two symmetry breaking features in the relative phase dynamics, drifting attractors and preferred transition routes.

9:05-9:25 (579)
Cooperative Selection of Action in Tapping: A Quantitative Model. JONATHAN VAUGHAN, *Hamilton College*, DAVID A. ROSEN-BAUM, *University of Massachusetts*, & CATHLEEN MOORE, *Hamilton College*—We may displace the fingertip by innumerable combinations of finger, hand, and arm movements. In our model, each segment independently "bids" on a movement, based on its biomechanical efficiency. The movement is then realized by activation of each segment in proportion to its bid. The model accounted for 73% of the variance in the apportionment of movement among the three segments as subjects alternately tapped two bumpers at various tapping rates and impulses of collision.

9:30-9:50 (580)
Turing Tests for Movement. DAVID A. ROSENBAUM, *University of Massachusetts*, & SASCHA E. ENGELBRECHT, *Philipps-Universität Marburg*—The ultimate test of a theory of action might be an artificial device whose movements are indistinguishable from movements produced by people. We describe such a test, using animated stick figures, some of which are under the control of a new model of movement generation, others of which represent digitized positions of university students reading for objects. Can you tell the difference?

9:55-10:10 (581)
A Positive Aftereffect in Timed Tapping. CHARLES E. COLLYER, *University of Rhode Island*—There is a within-session carryover effect in repetitive tapping tasks, such that tapping rates in one condition are biased in the direction of the preceding condition. This finding indicates that the fine timing adjustments made to match rates between 1 and 5 Hz persist into the minute range. The biases attributable to this aftereffect are distinct from the biases that Collyer, Broadbent, and Church have interpreted as evidence for discreteness in motor timing.

LETTER/WORD PROCESSING IV
Embarcadero CD, Sunday Morning, 8:00-10:50

Chaired by Mark S. Seidenberg, University of Southern California

8:00-8:20 (582)
Individual Differences in Lexical Fluency: Bigger Is Better. DAVID B. PISONI, MARY JO LEWELLEN, STEPHEN D. GOLDINGER, & BETH G. GREENE, *Indiana University*—Investigations of individual differences frequently show that "high-verbals" surpass "low-verbals" on various tasks. Proposed differences between groups typically focus only on the automatized subprocesses of reading. Using word familiarity ratings, we identified two groups of subjects and compared them on several tasks requiring extensive lexical processing, such as lexical decision, naming, and recall. The groups did not differ consistently on every task. Results suggest that individual differences in lexical fluency extend beyond early subprocesses of reading.

8:25-8:40 (583)
Determinants of Word Translation. A. M. B. DE GROOT, *University of Amsterdam*—This study addressed the question of which word characteristics determine performance in translating words from the native to a second language. The following variables were included: frequency of the stimulus word; frequency of the to-be-produced translation; familiarity, imageability, context availability, and ease-of-definition of the stimulus; length of the stimulus and of its translation; length difference between the translations; and cognate status of the translations. Four of them accounted for about 50% of the variance in performance. These were: frequency of the stimulus; frequency of its translation; cognate status; and context availability. Implications for bilingual knowledge representation will be discussed.

8:45-9:00 (584)
Reading Spanish Words in English Sentences. JEANETTE ALTARRIBA, *University of Massachusetts*, JUDITH F. KROLL, *Mount Holyoke College*, KEITH RAYNER, & ALEXANDRA SHOLL, *University of Massachusetts* (read by Judith F. Kroll)—The present study examined bilingual reading performance when Spanish target words were embedded in English sentences. Word frequency, sentence constraint, and language of the target word were manipulated. Eye movements and fixation durations were affected by both frequency and language. Increases in contextual constraint typically decrease fixation times on target words. We examined the stability of this effect by observing the interaction of language and constraint. Implications for lexical access across languages will be discussed.

9:05-9:20 (585)
Letter Detection Errors Reveal Phrase Structure. ASHER KORIAT, *University of Haifa*, & SETH GREENBERG, *Union College*—Letter detection is more difficult in function than in content words. This function-disadvantage effect is also obtained for nonwords, which produced more errors when placed in function slots than when occupying content slots in sentences. In Hebrew, the initial letter of a nonword engendered more errors when interpreted as a function prefix than when interpreted as part of the stem. Thus, letter-detection errors are symptomatic of the extraction of phrase structure during reading.

9:25-9:40 (586)
The Effect on Reading of Information Below the Line. ALEXANDER POLLATSEK, LINDA L. LAGASSE, GARY E. RANEY, & KEITH RAYNER, *University of Massachusetts*—Subjects read passages of text while their eye movements were monitored. The line of text that the subject was reading and all text above it was normal, but the text below was altered in several ways. The results indicate that

readers do not extract any semantic information from below the line of text they are reading; however, the visual information below the line of text being read modulates the speed of reading.

9:45-10:00 (587)
Impact of Word Shape on Word Recognition. PHILIP A. ALLEN & BENJAMIN WALLACE, *Cleveland State University*—We conducted two lexical decision experiments examining case alternation. Experiment 1 compared consistent, lowercase presentation to mixed-case presentation. Experiment 2 compared consistent, uppercase presentation to mixed-case presentation. For both experiments, letter shapes were always familiar, but word shapes were unfamiliar for mixed-case presentation and familiar for consistent-case presentation. There was a mixed-case disadvantage for both experiments, indicating that subjects used word-shape information rather than letter-shape information to recognize words presented in consistent case.

10:05-10:20 (588)
Parafoveal Versus Foveal Processing: Effects of Phonemic Priming and Motivation. EVA DREIKURS FERGUSON, *Southern Illinois University-Edwardsville*—Parafoveal and foveal word processing are different. Previous studies found significant word characteristic effects and facilitation from motivation (hunger vs. satiation) for foveal, *not* parafoveal, word recognition. Now, three parafoveal rhyming-list studies with cortical magnification, versus three foveal studies, showed: for first time, word frequency, typically significant with foveal processing, significantly affected parafoveal processing also; although motivation facilitated foveal processing, unexpectedly phonemic priming occurred significantly with parafoveal but *not* foveal processing. Implications are discussed.

10:25-10:45 (589)
Orthographic Rime Frequency Effects Are Independent of Word Frequency. JUDITH A. BOWEY & ANDREW J. SHATTE, *University of Queensland* (sponsored by Michael S. Humphreys)—Orthographic rime frequency was defined as the number of monosyllabic words within the Kučera and Francis word count sharing the same orthographic rime, excluding nonwords and proper nouns. Experiment 1 investigated the potential interaction of orthographic rime frequency and word frequency within a word naming task. Rime frequency and word frequency were both significant, but did not interact. In Experiment 2, nonwords with high-frequency rimes were read faster than those with low-frequency rimes.

PERCEPTION II
San Francisco A, Sunday Morning, 8:00-10:20

Chaired by Michael Kubovy, University of Virginia

8:00-8:20 (590)
Stimulus-Onset Asynchrony Is Not Necessary for Motion or Metacontrast. VINCENT DI LOLLO, *University of Alberta*—Coherent directional motion is seen if a translated image is displayed in two sequential frames (F1 and F2). In a related paradigm—metacontrast masking—F1 contains the target and F2 the mask. Although temporal succession is considered essential in both paradigms, I obtain both coherent motion and metacontrast masking with simultaneous onsets of F1 and F2, provided that F2 outlasts F1. Current theories can account for the motion outcomes but not for the masking outcomes.

8:25-8:40 (591)
Apparent Motion and Attention. ARIEN MACK, BENYU TANG, *New School for Social Research*, IRVIN ROCK, *University of California, Berkeley*, & WILLANN STONE, *New School for Social Research*—Features of visual stimuli shown to be processed preattentively are not perceived under conditions of inattention (Mack et al., 1990; Rock et al., 1990). Using the technique described at these meetings last year, we examined whether this is the case for apparent motion. Results suggest that short-range apparent motion is more likely to be perceived without attention than long range. This is consistent with the view that the latter entails more cognitive processing than the former.

8:45-9:05 (592)
Relative Luminance Is Not Derived from Absolute Luminance. JAMES SCHUBERT & ALAN L. GILCHRIST, *Rutgers University* (read by Alan L. Gilchrist)—Thresholds were measured for detection of the direction of change of overall luminance level in a homogeneous (Ganzfeld) and a patterned visual field, and the direction of change of the edge ratio in a two-part visual field. The results indicate that detection of absolute luminance level (1) occurs, but grossly, in the absence of spatial and temporal gradients, (2) is not aided by the presence of spatial gradients, and (3) is not the basis for relative luminance detection.

9:10-9:30 (593)
On Filling in the Blind Spot and Other Medical Marvels. V. S. RAMACHANDRAN, *University of California, San Diego*—We designed several novel stimuli to explore the "filling in" of the blind spot. (1) Several small rings were viewed with one alone positioned on the blind spot. This ring looked like a homogeneous disc and popped out preattentively. (2) A vertical illusory contour composed of horizontal lines was placed on the blind spot. The illusory line was completed rather than the horizontal lines defining it. (3) A cross made of intersecting black and white lines was presented. The lines competed for completion unless one was made longer.

9:35-9:50 (594)
The Effect of Pitched Environment on Apparent Height: Task Dependence. ARNOLD E. STOPER & ABIGAIL B. BAUTISTA, *California State University, Hayward*—Both apparent eye level and apparent height of a standing target object have been previously shown to be influenced by the pitch of a structured visual environment. The effect of pitch on apparent height was strong when apparent height was indicated either by pointing to a position on a vertical standard or by verbal estimation. Now we report that this effect almost disappeared when a matching task was used to indicate apparent height.

9:55-10:15 (595)
Visually Perceived Eye Level, Visually Perceived Vertical, and the Great Circle Model. LEONARD MATIN & WENXUN LI, *Columbia University*—Pitching a frontal plane containing two vertical lines in darkness systematically influences the elevation visually perceived as eye level (VPEL), but the orientation perceived as vertical (VPV) is unaffected. However, when two lines are pitched by equal amounts in opposite directions, VPV changes linearly with pitch but VPEL is unaffected. Identical results with both manipulations were obtained with equivalent stimuli in an erect plane. These results are predicted by the Great Circle Model.

JUDGMENT/DECISION MAKING II
San Francisco B, Sunday Morning, 8:00-10:15

Chaired by Valerie F. Reyna, University of Arizona

8:00-8:10 (596)
Modeling Strategies in Dynamic Decision Making. ALEXANDER J. WEARING, CHRIS PIVEC, & MARY M. OMODEI, *University of Melbourne*—Determining the effectiveness of strategies in dynamic decision making is constrained by the difficulty of identifying strategies subjects use, and ensuring consistent behavior. We have simulated a firefighting task. Artificial subjects were developed that model various strategies. These were tested in a variety of task environments. We report the effects of various task factors (properties of fires and appliances, information delay, complexity) on the performance of artificial subjects. Some comparisons with human subjects are presented.

8:15-8:30 (597)
Representativeness and the Disjunction Fallacy. MAYA BAR-HILLEL & EFRAT NETER, *Hebrew University of Jerusalem*—Under conditions of certainty, people prefer to categorize items into basic-level categories. We show that under uncertainty, the level at which one categorizes items interacts with representativeness. The narrower of two representative categories is preferred, whereas between unrepresenta-

tive categories, the broader is preferred. When categories are ranked by probability, or by willingness to bet, this pattern results in a disjunction fallacy. The pattern is hardly higher, however, in tasks in which it is not fallacious, as when ranking by suitability, or by tendency to predict.

8:35–8:50 (598)

A Foolish Consistency Is the Hobgoblin of Little Minds. BARBARA MELLERS & LISA ORDONEZ, *University of California, Berkeley*— One of the most perplexing violations of expected utility theory is the preference reversal phenomenon: Subjects' preferences for risky options can change rank order depending on the response mode (e.g., choice vs. selling price). Six new experiments investigate the robustness of the phenomenon. Preference reversals continue to occur even when subjects are directly confronted with their own inconsistent behavior.

8:55–9:10 (599)

Portable Measurement of Price and Income Effects with Auditory Stimuli. JUSTIN ENGLISH & JAMES ALLISON, *Indiana University* (read by James Allison)—Individual consumers interacting with a portable computer allocated budgets to two alternative goods available at various behavioral prices. The goods were two different tones sounded when the consumer pressed a key a specified number of times. The response to Slutsky-compensated budgets revealed the tones as substitutes, and revealed each tone as a normal good. The results validate this experimental method as a means of studying basic economic processes in individual humans.

9:15–9:35 (600)

Expert Versus Novice Decision Makers: It's Not How Much Information but What Kind of Information That Matters. JAMES SHANTEAU, *Kansas State University*, & RUTH H. PHELPS, *U.S. Army Research Institute, Boise*—Experts are often assumed to make use of more information than novices—the "information-use hypothesis." However, recent studies report experts rely on the same or less information than novices (e.g., expert livestock judges have 5.3 significant cues vs. 5.2 for novices). But the information used by the experts was more diagnostic. Thus, experts are better able than novices to discriminate between what is relevant in a given context and what is not.

9:40–9:55 (601)

Acquired Modularity for Assigning Relations in Problems. STEPHEN K. REED & ROBERT ZELMER, *San Diego State University*—We examine modularity for assigning relations in word problems by determining whether a decision regarding the arithmetic relation between two traveled distances is influenced by the two speeds of travel. The decisions of psychology students were significantly biased by whether the goal of the problem was to find the slower or the faster of two speeds. The decisions of mathematics students were significantly influenced only by the correct arithmetic relation between the two distances.

10:00–10:10 (602)

Mental Arithmetic: Japan Versus United States. MARK H. ASHCRAFT, *Cleveland State University*, & OSAMU ISHIHARA, *Nihon University*—We report the first studies of a cross-cultural project examining simple arithmetic performance among Japanese and U.S. college students. Subjects rated the difficulty of basic addition and subtraction facts, then produced answers to these in both pure and mixed blocks. Although both groups show standard mental arithmetic effects, the group differences in ratings and reaction times suggest a large educational and cultural impact on performance.

ASSOCIATIVE LEARNING: ANIMAL III
Golden Gate A, Sunday Morning, 8:00–10:05

Chaired by Stanley J. Weiss, American University

8:00–8:15 (603)

Peak-Procedure Evidence for a Separately Changeable Dimension-Selection Process. SETH ROBERTS & AFSHIN GHARIB, *University of California, Berkeley*—When the probability of food is varied in a peak-procedure experiment, two measures of performance change simultaneously, and their time courses show that two different kinds of associative learning are happening at the same time. A variety of evidence suggests that the two changes correspond to the two kinds of learning assumed by selective-attention theorists: learning what dimension to attend to, and learning what response to make.

8:20–8:40 (604)

Fixed-Duration Treatment Shocks, Feedback, CS Preexposure, and Fear: Where's the Cognition? D. CHRIS ANDERSON, CHARLES R. CROWELL, *University of Notre Dame*, NEIL R. BOYD, *Pennsylvania State University*, & JOSEPH TORREZ, *University of Notre Dame*—In Experiment 1 (four groups), preexposure to a feedback stimulus offset its shock-treatment-attenuating effects on posttreatment activity, skin resistance, and escape/avoidance performance. In Experiment 2 (11 groups), preexposure to the feedback stimulus factorially was crossed with preexposure to the shock chamber. The findings of Experiment 1 were duplicated only when preexposure combined both the chamber cues and the feedback stimulus. Preexposure to either without the other did not offset the impact of feedback. Furthermore, in the four instances where feedback effects were manifest, none entailed complete attenuation of the symptoms of shock treatment. Three more studies are reported showing that ST promotes fear "loading" to both the chamber cues and to the shocks per se of the treatment regimen.

8:45–9:00 (605)

Unusual, Strange, and Special Aspects of Local Contrast. JOHN C. MALONE & DEANNA L. TIMMERMANN, *University of Tennessee at Knoxville*—Strangely, some researchers have been unable to produce local contrast. We sought to determine what conditions maximize and minimize the effects. Pigeon subjects showed few or no effects when faced with alternating VI/EXT components signaled by key colors. Some effects appeared when the duration of S+ was varied, but very strong and durable effects resulted when stimuli were difficult to discriminate, the identity and duration of S− varied, and the presentation sequence changed daily.

9:05–9:20 (606)

Contingent Adaptation to Color. SHEPARD SIEGEL, LORRAINE G. ALLAN, & LISA LINDERS, *McMaster University*—Evidence that conditioning contributes to adaptation to various stimuli (e.g., drug administrations or exposures to a cold environment) is provided by demonstrations of "contingent adaptation": the display of adaptation is especially pronounced in the presence of cues previously paired with such stimuli. We demonstrate contingent adaptation to color. We hypothesize that the contingent color aftereffect (McCollough effect) is the CR that mediates contingent chromatic adaptation, as other compensatory CRs mediate contingent adaptation to other stimuli.

9:25–9:45 (607)

Contingency Manipulations and the McCollough Effect. LORRAINE G. ALLAN, SHEPARD SIEGEL, & TOM EISSENBERG, *McMaster University*—According to a conditioning analysis of the McCollough effect (ME), orientation stimuli become associated with chromatic stimuli. Contrary to this interpretation are reports that the ME is not degraded by decreasing the contingency between the putative CS (grid orientation) and the putative UCS (color). In fact, as predicted by the Rescorla–Wagner model, when a "superordinate context" is present, contingency manipulations affect the ME as they affect other types of conditional responses.

9:50–10:00 (608)

Signaled Avoidance of Proboscis Extension in Restrained Honey Bees. CHARLES I. ABRAMSON, *SUNY Health Science Center at Brooklyn*, & BRIAN H. SMITH, *Ohio State University*—Differential conditioning was used to assess the ability of harnessed foragers to discriminate between two odors—one associated with sucrose and the other with sucrose plus a 10-V ac shock. The results indicated that most subjects learn to extend their proboscis to the odor associated with sucrose and to withhold proboscis extension to the odor associated with sucrose plus shock. Analysis of the individual learning curves reveal several types of response patterns.

HUMAN LEARNING/MEMORY IV
Golden Gate B, Sunday Morning, 8:00-10:30

Chaired by Mark A. McDaniel, Purdue University

8:00-8:15 (609)

Gross Improvements in Text's Memory Representations with Minimal Misconception-Driven Revisions. BRUCE K. BRITTON & PAMELA TIDWELL, *University of Georgia*—Our goal was to strategically target each punctate text change toward a central misconception in the readers' mental representations, to get the maximum learnability-improvement bang for each text change. We used cognitive maps of Air Force recruits ($N = 80$) mental representations after reading to discover their misconceptions, including previously unsuspected misconceptions. Misconception-driven text revisions in 6 of 43 sentences in the 1,000-word text improved to near ceiling ($r = .8-.9$) the match of new recruits' ($N = 100$) representations to the text's author and seven subject matter experts.

8:20-8:35 (610)

Tuning and Capacity Limitations in Feedback (Instrumental) Learning. LARRY E. ROBERTS, DENISE PRESTON, & BOB UTTL, *McMaster University*—We studied feedback arrangements that permitted instrumental adaptation without spatially directed action. Response differentiation and self-report of feedback behavior were observed, but subjects spent little time looking at what they were doing. When feedback was given in an auditory modality, subjects closed their eyes as training progressed. Feedback and perceptual tasks interfered with one another when presented in the same (visual) modality. Tuning by a centripetal convergence of kinesthetic and exteroceptive pathways is suggested.

8:40-9:00 (611)

Isolating Primary Memory Processes: Expectancy and Item Value in Recall. THOMAS F. CUNNINGHAM, *St. Lawrence University*, ALICE F. HEALY, *University of Colorado*, ROBERT E. TILL, *University of North Dakota*, DAVID W. FENDRICH, *Widener University*, & CHRISTINA Z. DIMITRY, *St. Lawrence University*—In two experiments, subjects recalled one of two letter segments following a digit-filled retention interval. In Experiment 1, precues correctly informed or misinformed subjects concerning which letter segment would be tested. In Experiment 2, one segment was cued as important but the uncued segment was recalled first. Recall performance decreased very rapidly when subjects were misinformed or when the segment was unimportant. The retention functions were compared to predictions of the Estes perturbation model.

9:05-9:20 (612)

Direct Coding for Frequency of Occurrence. JOHN JONIDES, *University of Michigan*, & CAREN M. JONES, *Stanford University*—Evidence for the contribution of direct frequency codes to frequency judgments is demonstrated. Subjects were shown words whose frequencies were later judged. Encoding conditions were manipulated by having subjects generate either numerical or word associates to the stimuli. Frequency estimates were poorer when the generated associates were numerical, though free-recall data indicated that the encoding conditions led to equal learning of the words.

9:25-9:40 (613)

The Rhyme-Word Mnemonic Technique with Elementary School Children. RICHARD KRINSKY & SUZANNE G. KRINSKY, *University of Southern Colorado*—In two experiments, the rhyme-word mnemonic device was employed with elementary school-age children. In Experiment 1, fourth and fifth graders recalled reliably more target items that were associated with rhyme words 10 months after original learning. In Experiment 2, fifth graders at risk for academic failure, when compared with classmates who were not at risk, were similar in their immediate memory and disproportionally superior in their delayed memory for target items associated with rhyme words.

9:45-10:05 (614)

A Generation Advantage for Multiplication Skill and Nonword Vocabulary Acquisition. DANIELLE S. McNAMARA & ALICE F. HEALY, *University of Colorado* (read by Alice F. Healy)—In two experiments, subjects were trained in either a *read* or a *generate* condition. In Experiment 1, subjects performed simple and difficult multiplication problems. A generation advantage occurred only for the difficult problems. In Experiment 2, subjects learned to associate nonword vocabulary terms with common English nouns. A generation advantage occurred, and in both conditions subjects using mnemonic strategies showed superior performance. The results are explained in terms of a procedural account of the generation advantage.

10:10-10:25 (615)

Effects of Caffeine on Automaticity in Human Information Processing Tasks. WING HONG LOKE, *National University of Singapore*—The present study examined whether caffeine facilitates low-difficulty nonautomatic performance relative to placebo but decreases high-difficulty nonautomatic performance relative to placebo, and that it does not affect automatic performance across levels of task difficulty relative to placebo. The results supported an instance of the predicted three-way interaction and also demonstrated the viability of using pharmacological agents to test concepts of automaticity and other mechanisms of information processing.

PSYCHOPHYSICS
Embarcadero AB, Sunday Morning, 10:25-12:45

Chaired by Gregory R. Lockhead, Duke University

10:25-10:35 (616)

Sweet Taste of Water Induced by Little Red Pills (*Pilula rubelhula*). DEBRA A. ZELLNER, *Shippensburg University*, SCOTT PARKER, *American University*, & CARINA TORNOW, *Shippensburg University* (read by Scott Parker)—Sucking on Jin-tan, a Japanese-made breath freshener pill, makes water taste sweet. It also elevates ratings of the sweetnesses of aqueous sucrose solutions. Postpill sweetness ratings of pure water exceed ratings of a .075 M sucrose solution before the pill. The effect lasts for at least 2 min. Jin-tan does not affect saltiness ratings of NaCl solutions. Neither Jin-tan's taste nor its aftertaste is sweet. Gymnema sylvestre administered prior to the pill abolishes the effect.

10:40-10:55 (617)

A Novel Model for Qualia. STANLEY A. KLEIN, *University of California, Berkeley*—Progress is slowly but steadily being made on mental models of the "objective," testable aspects of subjective experience. The one area that has continued to escape being pinned down by psychologists and philosophers is qualia, the "feel" of an experience. This talk shows how von Neumann's insight into the movable split of dualistic quantum mechanics provides the key to developing a surprisingly consistent language for handling the qualia problem.

11:00-11:15 (618)

Visible Persistence as Error. GEORGE WOLFORD, *Dartmouth College*—There are several counterintuitive findings associated with visible persistence. For example, visible persistence is inversely related to stimulus intensity and to stimulus duration. I will present additional counterintuitive findings and a new way of looking at visible persistence that renders the various findings less counterintuitive.

11:20-11:35 (619)

Aerial Visual Acuity of a Risso's Dolphin at Two Distances. PAUL E. NACHTIGALL, *Naval Ocean Systems Center, Hawaii Laboratory*, & JEFFREY L. PAWLOSKI, *Science Applications International Corporation*—Minimum angles of resolution for the vision of a Risso's dolphin were determined by presenting varying line width Ronchi rulings at distances of 1 and 2.5 m from the animal's eyes. Behavioral 75% thresholds based on both two-alternative forced-choice and successively presented go/no-go procedures demonstrated that, like the bottlenosed dolphin, Risso's dolphins, in air, resolve detail better at 2.5 m than they do at 1 m.

11:40-11:55 (620)

Measuring the Subjective Magnitude of Brain Stimulation Reward. C. R. GALLISTEL, MATTHEW LEON, & TERRY A. MARK, *UCLA*—We used rats' tendency to match the allocation of their time between two levers to the relative net rates of return to measure the

effect on the subjective magnitude of reward of varying current, pulse frequency, and train duration. Subjective reward magnitude grows as a steep sigmoidal function of stimulation strength (current × frequency). It grows as an approximately linear function of train duration to an abrupt saturation at a duration of about 1 sec.

12:00-12:20 (621)
Wave Similarity Theory of Same-Different (Equality) Judgments. STEPHEN LINK, *McMaster University*—Wave similarity theory describes the way in which stimuli are compared in order to make judgments of same-different or equal-unequal. Such judgments are common to many psychological tasks that measure response times and response proportions. The new theory accounts for the empirical results and permits estimation of the psychological function for the feeling of equality.

12:25-12:40 (622)
Is Measured Channel Capacity Limited by the Absolute Identification Paradigm? KENNETH A. DEFFENBACHER, *University of Nebraska at Omaha*, FRANCIS J. CLARK, *University of Nebraska Medical Center*, M. ELIZABETH DAVIS, & KONNEY J. LARWOOD, *University of Nebraska at Omaha*—Subjects either pointed to visual targets with the not-visible outstretched arm or absolutely identified (AI) the same targets with an integer. The AI paradigm showed a limit of about seven identifiable targets, irrespective of the number of targets, whereas the pointing paradigm showed no such limit. We argue that the AI paradigm estimate of channel capacity was imposed by the paradigm itself, a limitation not imposed by any limits on precision of target acquisition.

LANGUAGE PROCESSING
Embarcadero CD, Sunday Morning, 11:00-12:50

Chaired by Morton Ann Gernsbacher, University of Oregon

11:00-11:15 (623)
The Relative Ease of Writing Narrative Texts. RONALD T. KELLOGG, MERILEE KRUEGER, & ROSE BLAIR, *University of Missouri-Rolla*—The narrative writing task, we hypothesize, is most compatible with the structure of conscious thought. Hence, composing a narrative text should demand less cognitive effort, occur more fluently, and yield a more coherent document than composing persuasive and descriptive texts. Analyses of secondary task reaction times and subjective ratings confirmed that narrative writing is least effortful. An analysis of coherence ties and document length indicated that persuasive writing exhibited the least cohesion and fluency.

11:20-11:35 (624)
Locating Objects From Memory or From Sight. DAVID J. BRYANT, *Northeastern University*, & BARBARA TVERSKY, *Stanford University* (read by Barbara Tversky)—Subjects learned two kinds of spatial arrays from observation and were later probed for objects by locations from memory or from perception. Memory reaction times yielded the spatial framework pattern found for arrays learned from descriptions (Bryant, Tversky, & Franklin, in press; Franklin & Tversky, 1990) but perception reaction times were different, indicating that these spatial mental models are not like internalized perceptions.

11:40-11:55 (625)
Word Recognition in Continuous Speech. PATRIZIA TABOSSI, *Universita' di Bologna*, DONIA SCOTT, *Brighton Polytechnic*, & CHRISTINA BURANI, *CNR, Rome*—Two cross-modal experiments investigate word identification in continuous speech. A word (e.g., SAND) followed by another one (e.g., ALONE) whose first syllable forms with the preceding word a longer item (e.g., SANDAL) facilitates the recognition of a target associated to that item (e.g., SHOE) (Experiment 1). The effect, however, disappears when the ambiguity is removed (e.g., SAND CASTLE) (Experiment 2). The results suggest that recognition cannot always be a sequential, word-by-word process.

12:00-12:15 (626)
Metaphor and Analogy Use by U.S. Senators in the Gulf Crisis Debate. JAMES F. VOSS, JOEL KENNET, TONYA SCHOOLER, & JENNIFER WILEY, *University of Pittsburgh*—Statements of U.S. senators made during the Gulf Crisis debate were obtained from the *Congressional Record* and analyzed with respect to metaphor and analogy usage. The senators compared the political situation to movies, political events and personalities, historical analogies, and gambling. Usage was also related to a person's political position. Personalization of issues was also observed. The findings are considered in relation to one's political motives and to cultural standards.

12:20-12:30 (627)
Effect of Reading Strategies for Procedural Text on Recall, Comprehension, and Task Performance. CAROL BERGFELD MILLS, *Goucher College*, VIRGINIA A. DIEHL, *Western Illinois University*, LIEN-CHONG MOU, *University of Maryland*, & DEBORAH P. BIRKMIRE, *U.S. Army Human Engineering Laboratory*—Fifty subjects read procedural texts using one of three reading strategies: (1) they performed the task described by the text while reading, (2) they looked at the object involved in the task while reading, or (3) they only read the text. After reading the text, they recalled the text, answered true-false questions, and performed the task. The different strategies resulted in different patterns of results for the three performance measures.

12:35-12:45 (628)
Cognitive Control in Reading Expository Text: Goal Manipulations and Working Memory. PAUL WHITNEY & ROBERT BRAMUCCI, *Washington State University*—One means for investigating whether "schemata" affect encoding or retrieval is to test for recall of previously unrecalled information after a perspective shift. With narratives, we found that the effects of a perspective shift vary with working memory span. We extended this research to expository text by manipulating high- and low-span readers' goals at encoding and retrieval. The results are relevant to understanding how readers adapt to their own working memory constraints.

PERCEPTION III
San Francisco A, Sunday Morning, 10:30-1:00

Chaired by Andrea R. Halpern, Bucknell University

10:30-10:50 (629)
Are Texture Segregation by Form and Color Independent of Each Other? MICHAEL KUBOVY & DALE COHEN, *University of Virginia*—In gestalt detection (= RSVP + texture segregation), we embed in a sequence of distractor textures a target texture, which is the only one to have a boundary. On some trials the target's boundary is defined by color, by form, or by both. When more than one feature defines boundaries, they sometimes coincide. The subject reports the location of *one* boundary. Detection of a dual-feature coincident boundary is better than probability summation of the individual single-feature boundaries.

10:55-11:15 (630)
Shape Recognition Contributions to the Organization of 3-D Displays. MARY A. PETERSON & BRADLEY S. GIBSON, *University of Arizona*—We examined whether shape recognition processes influence the initial and sustained organization of 3-D displays, using stereograms in which binocular disparity specified that one of two regions (equal in area but not in meaning) was forward. Results showed that the meaningful region was seen in front, even when disparity specified that the meaningless region was forward. These effects were obtained for contrast, but not random-dot, stereograms, constraining the nature of critical shape recognition mechanisms.

11:20-11:35 (631)
The Perceptual Identification of Image Contours. JAMES T. TODD & PETER SCHNITTMAN, *Brandeis University*—Optical contours can arise from a variety of physical causes including smooth occlusions, specular highlights and abrupt discontinuities of surface reflectance, orientation, or illumination. Our research has investigated the abilities of human observers to identify these contour types in natural images with minimal amounts of contextual information. In contrast to the re-

cent arguments of Cavanagh and Leclerc (1989), our results indicate that image contours can be reliably identified even within scenes that contain no recognizable objects.

11:40-11:55 (632)

Auditory Perceived Distance of Familiar Speech Sounds. DONALD H. MERSHON & JOHN W. PHILBECK, *North Carolina State University—*Digital recordings of a man and a woman using different vocal styles were presented from a stationary loudspeaker to 192 blindfolded male and female listeners in an acoustically dead space. Included were shouts, whispers, and a normal conversational style. Playback levels were adjusted to avoid extraneous sound level cues. The shouting voice was reported as appearing farthest, the whispering voice closest. The conversational voice was intermediate. Auditory perceived distances may be affected by past experience.

12:00-12:15 (633)

"Adaptation" to Displacement Prisms Is Sensorimotor Skill Acquisition. GEOFFREY P. BINGHAM, MICHAEL M. MUCHISKY, & JENNIFER ROMAK, *Indiana University—*We show that adjustment to glasses is difficult only on the first day because one acquires a sensorimotor skill. We measured trajectories in a rapid targeting task, alternating sets of trials with monocular viewing and with monocular viewing through a 10° displacement prism. Trials were performed within a set to criterion accuracy. The number of trials per set decreased over sets. Trajectories revealed continuous sensorimotor control along trajectories of duration of 1 sec or less.

12:20-12:40 (634)

The Acquisition of "Dual Adaptations" and "Adaptation Sets." ROBERT B. WELCH, *NASA-Ames Research Center,* BRUCE BRIDGEMAN, SULEKHA ANAND, & KAITLIN BROWMAN, *University of California, Santa Cruz—*In two experiments, we confirmed that repeatedly alternating between two different prismatic displacements eventuates in the ability to adapt and re-adapt more quickly—a "dual adaptation." We then asked the question: What is the underlying basis of this adaptive flexibility? The answer, as demonstrated in our second experiment, is an "adaptation set" (analogous to a "learning set"): Subjects have acquired the capacity to adapt more readily to prismatic displacements never previously encountered.

12:45-12:55 (635)

Local-Global Processing as a Function of Visual Field Locus. STEPHEN CHRISTMAN, *University of Toledo—*Processing of Navon-type hierarchical letter stimuli in the upper versus lower and left versus right visual fields was examined. In Experiment 1, a lower visual field advantage (VFA) was found for global processing, while an upper VFA was obtained for local processing. No significant left-right differences were found. In Experiment 2, significant left and lower VFAs were obtained for global processing, while an upper VFA was again obtained for local processing.

JUDGMENT/DECISION MAKING III
San Francisco B, Sunday Morning, 10:25-12:50

Chaired by Lola L. Lopes, University of Iowa

10:25-10:45 (636)

Generation of Random Binary Series in Strictly Competitive Games. DAVID V. BUDESCU, *University of Haifa,* & AMNON RAPOPORT, *University of Arizona—*Numerous studies have shown that human subjects are poor judges and generators of random sequences. In particular, they associate randomness with series including too many runs. These studies are criticized on several grounds and a new paradigm is proposed based on performance in two-person zero-sum games. Results of an experiment, in which the regular "biases" associated with random series generation are almost completely eliminated, are reported.

10:50-11:10 (637)

Separating Response Bias from Judgment in Statement Verification. THOMAS S. WALLSTEN, CLAUDIA G. GONZALEZ, &

ORIEL STRICKLAND, *University of North Carolina at Chapel Hill—*Two experiments demonstrate subjects' propensity to judge statements "true." A model applied to judgments of complementary pairs of statements in multiple paradigms separates covert judgment from response selection. It is supported in a third experiment that shows the bias for "true" to be one of response assignment relative to underlying judgment. Another experiment asks within the context of the model whether covert judgments are biased in the true-false relative to the pair-comparison paradigm.

11:15-11:35 (638)

An Adaptive Strength-Comparison Model of Predicting Basketball Winners. EVAN HEIT, PAUL PRICE, *University of Michigan,* & GORDON BOWER, *Stanford University* (read by Gordon Bower)—For each game of a simulated basketball season, subjects predicted the point-spread, then received feedback about the actual outcome. Subjects' predictions showed sensitivity to the win-loss record of each team, the strengths of each team's past opponents, and home-court advantage. Trial-by-trial performance was accounted for by a mathematical model incorporating an adaptive learning rule that estimated each team's strength and a response rule that predicted outcomes by comparing team strengths.

11:40-12:00 (639)

Theoretical Implications of Children's Decision Making. VALERIE F. REYNA & DANA NARTER, *University of Arizona—*Data demonstrating phenomena of inconsistent choice in children (e.g., framing effects and the Allais paradox) are used to evaluate theoretical interpretations of adult data. The existence of such phenomena in children challenges theories whose process assumptions are implausible for immature subjects. We examine the relationship between specific cognitive abilities, especially compensatory thought, and inconsistent choices, and we also consider the developmental path that leads to adult performance: the computation-intuition shift.

12:05-12:25 (640)

Effects of Multiple Plays on Evaluations of Gambles. DOUGLAS H. WEDELL, *University of South Carolina,* & ULF BÖCKENHOLT, *University of Illinois—*Previous research has demonstrated reductions in decision anomalies (preference reversals and certainty/possibility effects) when gambles are represented as being played multiple times. The present research investigated effects of representing simple or more complex bets as being played once or multiple times on preferences elicited by different response modes. Additionally, two techniques were used to infer subjective utility and probability functions. Theoretical interpretations of the effects of the multiple play representation are discussed.

12:30-12:45 (641)

Judging the Effectiveness of Interventions. NIGEL HARVEY & FERGUS BOLGER, *University College London—*Sequences of a diagnostic index were simulated with autoregressive algorithms. At some point in half these series, a "drug" changed the overall level of the index. Subjects were poorer and slower at assessing drug effectiveness in trended and cyclical series. They may subject the raw series to time-consuming error-prone global analyses to filter out these overall pattern components before assessing intervention effectiveness. We therefore studied effects of presenting the series in small segments.

ANIMAL COGNITION II
Golden Gate A, Sunday Morning, 10:15-12:55

Chaired by Sarah T. Boysen, Ohio State University

10:15-10:30 (642)

A Spencian Model of Categorization. EDWARD A. WASSERMAN, *University of Iowa,* & S. L. ASTLEY, *Cornell College—*We present a model of categorization based on Spence's 1937 theory of discrimination learning. In addition to Spence's postulates of conditioned excitation, conditioned inhibition, and stimulus generalization, we propose that naturalistic stimuli are locatable along *categorical* dimensions. This framework explains most known facts of categorization in animals,

including category learning and transfer to new examples, errors of categorization, learning of true and pseudocategories, and the effects of repetition and category size on learning and generalization.

10:35-10:45 (643)
Categorization and Identification. K. GEOFFREY WHITE & FIONA McPHERSON, *University of Otago*—We examined category and identity matching by pigeons. Responses to a probe stimulus were rewarded according to whether the probe was identical to or in the same category (color or shape) as a preceding target stimulus. Increasing the retention interval between target and probe stimuli produced a greater discrimination decrement for identity matching than for category matching. We conclude that categorization is based on matching of features and is faster and more accurate than identification.

10:50-11:05 (644)
Development of Backward Associations during Establishment of Forward Associations by Pigeons. THOMAS R. ZENTALL, LOU M. SHERBURNE, *University of Kentucky*, & JANICE N. STEIRN, *Georgia Southern University*—Following conditional discrimination (DMTS) training involving differential outcomes (food vs. no food), one of the two samples was replaced by "food" and the other by "no food" presentation. Transfer data from three experiments indicated that pigeons developed backward associations between correct comparisons and their associated outcomes during original training. These results cannot be attributed either to sample-outcome associations or to response mediation (i.e., the similarity between sample responding during training and testing).

11:10-11:30 (645)
Relative Size Discrimination by an African Grey Parrot. IRENE M. PEPPERBERG, *University of Arizona*—Some laboratory studies suggest that birds respond relationally only after learning about absolute values of stimuli. A parrot, Alex, learned to answer questions concerning the relative size of certain exemplars and transferred to novel situations that did not provide information about the absolute values of stimuli. He answered (accuracy of 78.7%) vocal questions about which was the larger or smaller exemplar by vocally labeling its color or material, or saying "none" for equally sized exemplars.

11:35-11:55 (646)
Transitive Inference in Pigeons. JANICE N. STEIRN, *Georgia Southern University*, & THOMAS R. ZENTALL, *University of Kentucky*—Pigeons' use of transitive inference was examined in a task involving successively presented simple hue discriminations of the form A+B−, B+C−, C+D−, D+E−. When nonadjacent, nonendpoint stimuli (BD) were then tested, strong evidence for transitive inference (i.e., preference for B) was found. Explanations of pigeons' performance on a transitive inference task were examined.

12:00-12:15 (647)
Delayed Auditory Feedback Disrupts Bird Song Production. JEFFREY CYNX & UTA VON RAD, *Rockefeller University*—Adult bird song production, unlike juvenile song development, has rarely been approached as a cognitive phenomenon. Both ethological and neuro-ethological studies have suggested that it is an autonomous motor program. However, the use of delayed auditory feedback indicates that adult song production, like human speech, is amenable to cognitive processes that govern the relation between perception and production of learned vocalizations.

12:20-12:35 (648)
Periodic Response Patterns in Temporal Search Behavior. HILARY A. BROADBENT & RUSSELL M. CHURCH, *Brown University* (read by Russell M. Church)—Rats on an FI schedule received food probabilistically. Following food, responses occurred near the end of the next interval, suggesting that food delivery resets an interval timer. Following omission, bursts of responses occurred throughout the interval, suggesting the timer is not reset after omission: animals must search through time for the next reinforcer. Spectral analysis (Walsh transform) indicated a strongly significant periodicity in the bursts. This periodicity may indicate an endogenous oscillator that controls searching.

12:40-12:50 (649)
Classical Conditioning with Intracerebellar Electrical Stimulation as CS and US. PAUL G. SHINKMAN, *University of North Carolina*, RODNEY A. SWAIN, ALAN F. NORDHOLM, & RICHARD F.

THOMPSON, *University of Southern California*—The present experiment was designed to establish a highly localized memory trace within the cerebellum, using classical conditioning of discrete motor responses. Stimulating electrodes were chronically implanted in rabbit cerebellum, to provide an electrical CS activating cortical parallel fibers and thence Purkinje cells, and an electrical US activating white matter underlying lobule HVI and eliciting unconditioned responses. Preliminary results indicate that associative conditioning occurs using this paradigm.

HUMAN LEARNING/MEMORY V
Golden Gate B, Sunday Morning, 10:40-12:55

Chaired by Judith A. Sugar, Colorado State University

10:40-10:50 (650)
Remembering the Earthquake: "Flashbulb" Memory for Experienced Versus Reported Events. STEPHEN PALMER, CHARLES SCHREIBER, & CRAIG FOX, *University of California, Berkeley*—Within 3 days after the 1989 California earthquake, University of California, Berkeley, students recalled their experiences both for a direct experience (the earthquake itself) and a reported event (the Bay Bridge collapse). Memory was retested 1.5 years later. High-confidence, virtually error-free recall was obtained for several questions about the experienced earthquake, but performance was significantly worse for corresponding questions about the reported bridge collapse, despite greater concern. The results will be compared with memory by students at Emory University and University of California, Santa Cruz, for the same earthquake.

10:55-11:10 (651)
Remembering the Earthquake: "What I Experienced" Versus "How I Heard the News." ULRIC NEISSER, EUGENE WINOGRAD, *Emory University*, & MARY SUSAN WELDON, *University of California, Santa Cruz*—Shortly after the 1989 California earthquake, students at Emory University recorded how they had first heard about it; three weeks after the quake, students at University of California, Santa Cruz, recorded how they had actually experienced it. Tested 1.5 years later, some of the Emory subjects made gross recall errors despite high confidence; no Santa Cruz subjects made such errors. Affect was uncorrelated with recall in either sample. These data will be compared with direct and indirect recall of the same earthquake by Berkeley students.

11:15-11:35 (652)
The Role of Autobiographical Memories in Trait Judgments about Self and Others. STANLEY B. KLEIN & JUDITH LOFTUS, *University of California, Santa Barbara*—We report studies exploring the role of behavioral exemplars (autobiographical memories) in trait judgments about self and others. The studies use a priming paradigm to examine whether (a) retrieval of trait-relevent autobiographical memories facilitates a judgment of the trait's descriptiveness and (b) a trait descriptiveness judgment facilitates retrieval of trait-relevant autobiographical memories. We find considerable facilitation for judgments about other, but none for judgments about self. We discuss the implications of these findings for exemplar and abstraction models of social judgment.

11:40-11:50 (653)
Aging and Time- Versus Event-Based Prospective Memory. GILLES O. EINSTEIN, *Furman University*, & MARK A. McDANIEL, *Purdue University*—We tested for age differences in prospective memory. In the first experiment, subjects were asked to perform an action every 10 min (a time-based task presumed to be high in self-initiated retrieval); in the second experiment, subjects were asked to perform an action whenever a particular word was presented (an event-based task presumed to be low in self-initiated retrieval). Age differences were found only with the time-based task, thereby suggesting (a) important differences between time- and event-based prospective memory tasks and (b) that self-initiated retrieval is an important determinant of age differences in prospective memory.

11:55-12:10 (654)
Evidence for Using Partial Information to Reconstruct Dates of Events. CHARLES P. THOMPSON, *Kansas State University*, JOHN J. SKOWRONSKI, *Ohio State University at Newark*, & ANDREW L.

BETZ, *Ohio State University*—We present a theoretical distribution of errors based on the use of partial information in reconstruction of dates of personal events. The theoretical distribution is compared to data from a diary memory study. The model captures the major characteristics of the data.

12:15-12:25 (655)

When and How to Prepare Best for Test about the Professor's Lectures? DANIEL BLOM, KARIN HEGAR, DIETER HAENGGI, & GERHARD F. STEINER, *University of Basel* (read by Gerhard F. Steiner)—In a series of three experiments, college students took notes from ordinary lectures, reprocessed their notes according to different time schedules (spacing and retention intervals were varied), as well as reprocessing procedures (massed vs. spaced), thus preparing them-selves for a test containing free-recall, cued-recall, and specific-knowledge reconstruction. Results are discussed in terms of these time-bound variations as well as in terms of different levels of information processing.

12:30-12:50 (656)

An Extreme Statistics Model for Forgetting and Retrieval. TAROW INDOW, *University of California, Irvine*—Forgetting and retrieval of relevant items from long-term memory are interpreted as Weibull processes. A parameter (the exponent) gives useful insight about the structure of underlying memory supports and cues to lead to retrieval. Methodology of parameter estimation in independent and nonindependent data points is discussed. Memory of social events over a span of 30 years and very short retrieval processes are used as data.