Cognitive Science Association
for Interdisciplinary Learning
Hood River, Oregon
Aug. 2 – 6, 2007

Thursday, August 2

Note that 5 minutes will be allocated for short talks, and 10 minutes will be allocated for long talks allowing for questions and discussion following each presentation.

4:30 PM **Reception and Appetizers**

5:00 PM **Welcome and Introductory Remarks**

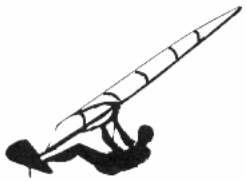
5:10-5:40 PM Andrew Yonelinas, Kane Elfman, Colleen Parks, Shawn Bolin, and Isaac Liao
Testing a Hippocampal Model of Source Recollection

5:50-6:20 PM Amy Lynne Shelton, Naohide Yamamoto, and Steven Marchette
Spatial Representation at the Intersection of Perception, Attention, Reasoning, and Memory

6:40-7:10 PM Candice Coker Morey
Articulatory Suppression Impairs Spatial Working Memory in a Cross-domain Binding Context

7:20-7:50 PM Steffen Werner
Human Memory and Computer Security – Improving User Authentication Interaction through Graphical Passcodes

8:00 PM **Adjourn For Evening**



Friday, August 3

8:15 AM **Morning Refreshments**

8:45-9:15 AM Ayelet Landau, Lisa Aziz-Zadeh, and Richard Ivry
Physiological Responses During Face Perception are Affected by Semantic Content of Preceding Sentences

9:25-9:55 AM Nina Dronkers
Brain Areas Associated with Speech and Language Disorders

10:05-10:35 AM William Hula and Malcolm McNeil
Lexical Frequency and Models of Dual-Task Performance in Picture Naming

10:40 AM **Break until 4:45 PM**

4:45 PM **Appetizers**

5:00 – 5:10 Michael Sullivan, Annmarie Bauer-Murphy, and Jennifer Peddicord
Automatic and Strategic Error Minimization during Lexical Encoding

5:20-5:50 PM Melissa Gregg and Arthur Samuel
Change Deafness and the Organizational Properties of Sounds

6:00-6:30 PM Carla Hudson Kam
Learners, Statistics, and Syntax: Adults' Learning of Probabilistic Word Orders

6:40-7:10 PM Psyche Loui
From Sounds to Music: Learning Probabilities and Frequencies

7:20 PM **Adjourn For Evening**

~ Enjoy Hood River's First Friday Festival

Saturday, August 4

8:15 AM Morning Refreshments

8:45-8:55 AM Alexandra List and Timothy Justus
Relative Priming of Temporal Ranges Using Auditory Local-Global Stimuli

9:00-9:30 AM Frederick Gallun
On the Limits of Selective and Divided Auditory Attention

9:40-10:10 AM Ian Rasmussen, Daniel Brooks, and Eliot Hazeltine
The Simon Effect Occurs Without Shifts of Attention: A New Look at the Attentional Explanation

10:20-10:50 AM Lynn Robertson
Unilateral Spatial Neglect and Preattentive Processing in Visual Search

11:00 AM **Break until 4:45 PM**

Saturday, August 4

4:45 PM **Appetizers**

5:00-5:10 PM Nelson Cowan, J. Scott Saults, and Candice Coker Morey
Distinguishing Central and Domain-Specific Components of Working Memory

5:15-5:25 PM Edward Ester and Edward Awh
The Locus of Processing Interference Produced by Salient Visual Distractors

5:30-5:40 PM Pierre Jolicœur, Stéphan Grimault, Nicolas Robitaille, Kevin Sauvé, Jean-Marc Lina, Christophe Grova, and Anne-Sophie Dubarry
Brain Oscillations Specifically Related to Visual Short-term Memory: Frequencies, Times, and Neural Loci

5:50-6:20 PM Edward Awh and Brian Barton
Interactions between Number and Resolution in Visual Working Memory

6:30-7:00 PM Andrew McCollough and Edward Vogel
Visual Chunking Allows Efficient Allocation of Memory Capacity

7:10-7:40 PM Trafton Drew and Edward Vogel
The Limits of Divided Attention: An Electrophysiological Measure of Selection and Occlusion during Multiple Object Tracking

7:50 PM **Adjourn For Evening**

Sunday, August 5

8:15 AM **Morning Refreshments**

8:45-9:15 AM Miranda Scolari, Jun Ishikawa, and Edward Awh
Attention Biases Competition Between Individuated Objects

9:25-9:55 AM Kim Halvorson, Eliot Hazeltine, and Bill Prinzmetal
Priming Effects Reveal Distinct Attentional Mechanisms

10:05-10:35 AM Bill Prinzmetal and Ruby Ha
A Taxonomy off Spatial Attention

10:55 AM **Break until 4:45 PM**

Note: No Appetizers on Banquet Night!

5:00-5:10 PM Alice Albrecht, A. List, and Lynn Robertson
Object-based Attention to Holes and Wholes

5:15-5:45 PM Gordon Logan and Darryl Schneider
Plans and the Structure of Behavior

5:55-6:25 PM Suzanne Mitchell, William Hoffman, Vanessa Wilson, Stacy Legg, Daniel Schwartz, and Alexander Stevens
Cognitive and Neural Substrates of Impulsive Decision Making

6:35 PM **Adjourn**

7:00 PM **Banquet at Pasquale's Restaurant**

Monday, August 6

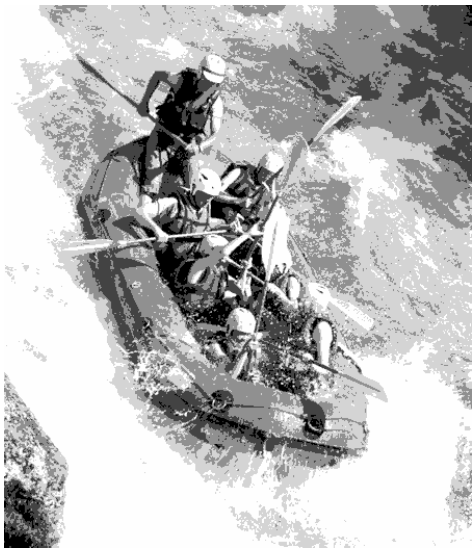
8:15 AM **Morning Refreshments**

8:30-9:00 AM Bruce Bridgeman, Eric Chiu, and Joshua Quan
Interaction of Motor Activity and Perception of Slope

9:10-9:40 AM Neil Albert, Richard Ivry, and Matthew Brett
The SMA is Not Selectively Engaged during Internally-selected Actions

9:50-10:20 AM Peter Dixon
Action Planning or Action Retrieval?

10:30 AM **Have a safe trip home.**



Roll on, Columbia
Woody Guthrie

Roll on, Columbia, roll on,
Roll on, Columbia, roll on,
Your power is turning our darkness to dawn.
So roll on, Columbia, roll on.

Other great rivers lend power to you,
Yakima, Snake, and the Klickitat too,
Sandy Willamette and the Hood River too,
So roll on, Columbia, roll on.

And on up the river is Grand Coulee Dam,
The biggest thing built by the hand of a man,
To run the great factories and water the land,
So, roll on, Columbia, roll on.

Tom Jefferson's vision would not let him rest,
An empire he saw in the Pacific Northwest,
Sent Lewis and Clark and they did the rest.
So, roll on, Columbia, roll on.

Abstracts Thursday

Andrew Yonelinas, Kane Elfman, Colleen Parks, Shawn Bolin, and Isaac Liao, University of California, Davis

Testing a Hippocampal Model of Source Recollection

Receiver operating characteristics (ROCs) observed in source recognition tests are typically U-shaped when plotted in z-space. The extent to which the source zROCs are U-shaped, however, can vary considerably, and the factors influencing the shape of zROC are not well understood. In the current study, we examined the ability of the Complementary Learning Systems (CLS) model (Norman & O'Reilly, 2003) to account for these results, and empirically tested a novel prediction of the model which is that as the studied items become less distinct the threshold nature of the recollective signal produced by the hippocampus should break down and the zROCs should become more linear. The results from several source recognition experiments confirmed the predictions of the model and indicated that the model provides a viable account of source recollection. The results are found to be problematic for a wide variety of alternative recognition memory models.

Amy Lynne Shelton, Naohide Yamamoto, and Steven Marchette, Johns Hopkins University

Spatial Representation at the Intersection of Perception, Attention, Reasoning, and Memory

A comprehensive theory of human spatial memory representation has been elusive, due in part to the numerous ways that spatial information can be learned--from different perspectives, in different modalities, with different encoding demands, etc. Typically, spatial memory research has focused on establishing the general characteristics shared by all long-term spatial representations. However, careful analysis of the differences resulting from changes in encoding conditions can be equally informative about different possible spatial representational systems and/or the flexible parameters of a more general spatial memory system. In a series of studies, we investigated brain activation and behavioral performance during spatial learning and memory under several different perceptual and attentional constraints and among individuals with different spatial skill profiles. The results suggest that spatial memory research requires combining investigations of general principles with a detail-oriented approach that incorporates perceptual qualities, attentional demands, reasoning strategies, and individual differences.

Candice Coker Morey, University of Missouri-Columbia

Articulatory Suppression Impairs Spatial Working Memory in a Cross-domain Binding Context

The working memory (WM) system is thought to include both domain-specific and domain-general stores (e.g., Baddeley's phonological, visuo-spatial, and episodic buffers). Prevailing thought suggests independence of the verbal and visuo-spatial stores but it remains unclear whether the domain-general store operates independently of other WM components. A letter-location memory task, designed to detect differences between memory for only verbal or spatial features as well as verbal-spatial binding, shows that a concurrent articulatory suppression task negatively affects memory for spatial location information and cross-domain binding as well as letter information. Conversely, when only one dimension (letter or spatial location) is tested, articulatory suppression impairs only letter memory and not location memory. These results suggest that a domain-general WM store is sensitive to interference from a concurrent verbal task. Implications for the domain-general buffer's relationship with other WM components responsible for continuous rehearsal or executive control will be discussed.

Steffen Werner, University of Idaho

Human Memory and Computer Security – Improving User Authentication Interaction through Graphical Passcodes

When attempting to gain access to protected files or processes on a computing system or network, the user usually has to identify him/herself (UserID) and provide an authentication key (e.g., password) to be permitted access. Dual-authentication systems in addition ask for a separate way of authentication, e.g, a token that the user possesses or additional knowledge only the user is thought to possess (name of old high-school, etc.) A secure password needs to be difficult to guess and secure to keep. Unfortunately, most current password-based authentication systems rely either on arbitrarily assigned passwords that are difficult to remember (e..g, 74dcXS2iu4) or user-generated passwords that are easy to remember, but often also easy to guess (e.g., mypassword1). This obvious conflict of high-security demands and limited memorability of secure passwords has led some researchers to investigate alternatives to common alphanumeric passwords. One proposed solution relies on the use of graphical passcodes to take advantage of the picture superiority effect in human memory to present the user with arbitrary and complex yet easy to remember information. In my lab we have tested a particular method, composite scene authentication (CSA), to investigate the benefits of this approach. In a number of studies, CSA information has proven to be highly memorable and to provide a secure (46 bit) passcode length. In our most recent study (n=250), we pitted CSA against three competing graphical authentication mechanisms and compared performance at different retention intervals (up to 3 weeks) to alphanumeric passwords of same complexity. The results clearly show a benefit for all graphical authentication systems, with CSA being most successful with 82% of users successfully entering their passcode information into a system after a 1 week retention interval, whereas only 30% of users were able to do so with the traditional, alphanumeric passwords. Among all systems, CSA proved to be the most optimal implementation. The close relation between basic visual memory research and HCI and Cybersecurity will be discussed.

Abstracts Friday

Ayelet N. Landau[1], Lisa Aziz-Zadeh[2] and Richard B. Ivry[1], Department of Psychology, UC Berkeley[1], University of Southern California[2]

Physiological Responses During Face Perception are Affected by Semantic Content of Preceding Sentences

We examined the interaction of language and perception by having participants listen to sentences prior to the presentation of faces. Using EEG, we asked whether the face-sensitive N170 response was modulated by the semantic content of the sentences. Specifically, each trial contained a sentence (auditory presentation) followed by a picture. The sentences either described a face (e.g., "The farmer has a bushy mustache beneath his small nose") or a place (e.g., "The house has a couch near the fireplace"). The pictures were either of faces or places which were unrelated to the sentences. To ensure that participants attended to the sentences and pictures, 10% of the trials contained an implausible sentence or picture. Participants were required to perform plausibility judgments for the sentence and the picture at the end of each trial. As in prior studies, the amplitude of the N170 to face stimuli was larger over the right hemisphere. However, we observed a lateralized context effect in the modulation of the N170. For left hemisphere sites only, this component was larger following the presentation of face-content sentences compared to place-content sentences. These results support an embodied theory of semantics where linguistic concepts are closely linked to perceptual representations of these concepts

Nina Dronkers, VA Northern California Health Care System, University of California, Davis, University of California, San Diego

Brain Areas Associated with Speech and Language Disorders

Classic descriptions of the brain areas involved in language have focussed on those in the left cerebral hemisphere known as Broca's area, Wernicke's area and the connecting bundle of fibers between them, the arcuate fasciculus. These descriptions have served a useful clinical purpose over the last century, but recent advances in the study of language and in neuroimaging have found additional areas that contribute to language processing. This presentation discusses findings from our work with aphasic patients examining the relationship between specific speech and language disorders and the brain lesions underlying these deficits. The results of recent MR imaging of the brains of Paul Broca's first patients will also be presented in relation to contemporary theories. It will be shown that numerous brain areas help to subserve language, that traditional language areas may serve somewhat different functions than originally described, and that the identification of very specific behavioral deficits and their neuroanatomic correlates can lead to effective mapping of language functions in the brain.

William Hula and Malcolm McNeil, VA Pittsburgh Healthcare System and University of Pittsburgh

Lexical Frequency and Models of Dual-Task Performance in Picture Naming

We investigated the temporal locus of lexical frequency effects in picture-naming and examined whether a bottleneck or resource model better accounts for dual-task naming performance. We conducted three experiments using speeded picture naming and tone identification tasks presented at varying stimulus onset asynchronies (SOAs), and found that lexical frequency effects were additive with SOA, suggesting that frequency-sensitive processing requires central attention. In the third experiment, we presented the tasks in variable order and instructed subjects to give equal attention to both. On tone-primary trials, RT1 increased as SOA decreased, consistent with the resource model. Also, analyses restricted to those participants demonstrating a frequency effect in naming-secondary conditions found that tone responses preceding low-frequency names were slower than those preceding high-frequency names at 50 ms SOA only. This suggests that these subjects allocated more resources to the secondary naming task on low-frequency trials and further supports the resource model. On naming-primary trials, SOA did not affect RT1, suggesting that participants processed the tasks serially in those conditions. Considered together with prior dual-task naming studies, these data suggest that word frequency affects lexical-phonological, as opposed to lexical-semantic processing.

Michael P. Sullivan[1], Annmarie Bauer-Murphy[2], & Jennifer Peddicord[2], Oregon Health and Science University & Portland VA Medical Center[1], Portland State University[2]

Automatic and Strategic Error Minimization During Lexical Encoding

Overt slips-of-the-tongue can occur at lemma (lexical-semantic) and lexeme (phonological) levels, which suggests that a competition for selection can occur during the encoding process. However, the infrequency of these errors suggests that there may be a mechanism(s) that operates to minimize their occurrence. Within the context of current connectionist models of lexical encoding, we will present the results of dual-task studies that provide an initial framework for when competition, in particular, may be minimized by attention to response selection, rather than only by automatic processes intrinsic to encoding. This framework will be discussed with a view toward the important question of why these processes may fail to allow for the occurrence of overt error.

Melissa Gregg and Arthur Samuel, Department of Psychology, SUNY Stony Brook

Change Deafness and the Organizational Properties of Sounds

Change blindness, or the failure to detect (often large) changes to visual scenes, has been demonstrated in a variety of different situations. Failures to detect auditory changes are far less studied, and thus, little is known about the nature of change deafness. We have explored the processes involved in change deafness by measuring explicit change detection as well as auditory object encoding. The experiments revealed that considerable change deafness occurs, even though auditory objects are encoded quite well. Familiarity with the objects did not affect detection or recognition performance. While spatial location was not an effective cue, fundamental frequency and the periodicity/aperiodicity of the sounds provided important cues for the change detection task. Implications for the mechanisms responsible for change deafness and auditory sound organization are discussed.

Carla Hudson Kam, University of California, Berkeley

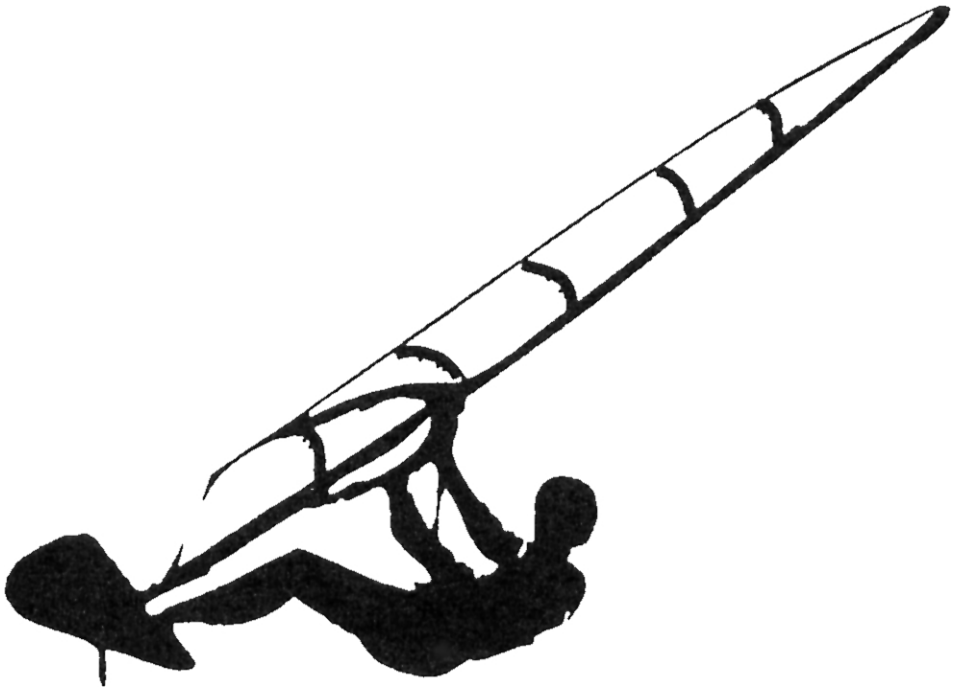
Learners, Statistics, and Syntax: Adults' Learning of Probabilistic Word Orders

Statistical learning, a powerful and relatively modality independent form of learning, operates over particular forms. On this basis some have suggested that statistical learning is much better suited to tasks such as word segmentation than to acquiring aspects of language learning that involve relationships between abstract categories. This kind of learning, it is argued, may be better suited to an algebraic learning mechanism that extracts rules over variables. The implication is that statistical information is unrelated to rule-like knowledge. However, there is much evidence from adult language processing that mature language users are quite sensitive to frequencies, even of syntactic constructions. I present evidence from a language learning study in which adult learners were exposed to miniature artificial languages containing unpredictable inconsistency in word order (the ordering of Subject, Object, and Verb constituents was variable). Different orders occurred in the input with different frequencies, but one was always more frequent than the others. Importantly, the occurrence of one order versus another was not predictable. The question was whether participants would extract a deterministic rule based on the more frequent order, or instead learn the probabilities associated with the different orders. Production and judgement measures showed that learners reproduced the probabilities present in the input with a high degree of accuracy, suggesting the involvement of statistical learning mechanisms.

Psyche Loui, University of California at Berkeley

From Sounds to Music: Learning Probabilities and Frequencies

How does the brain learn music? To address this question, a new music system was designed based on the Bohlen-Pierce scale, a microtonal scale tuned differently from traditional musical scales. In several behavioral studies, participants were presented with melodies in the new music system, followed by tests assessing grammar-learning, statistical sensitivity, and preference for melodies. Results show that given exposure to small numbers of melodies, listeners recognized and preferred melodies they had heard, but when exposed to large sets of melodies, listeners learned the underlying statistical regularities of the novel music. Event-Related Potentials in response to chords in the new musical system revealed two components of cortical activity which are sensitive to sound probabilities and individual differences in learning. Results suggest that the human brain rapidly picks up on structural and statistical aspects of sounds, and that neural mechanisms enabling statistical learning may be fundamental to the musical experience**.**



Abstracts Saturday

Alexandra List[123] and Timothy Justus[12], Department of Psychology, University of California, Berkeley[1], Medical Research Service, Veterans Affairs, Martinez, CA[2], School of Psychology, University of Wales, Bangor, UK[3]

Relative Priming of Temporal Ranges Using Auditory Local-Global Stimuli

We have previously shown that attending to the local or global temporal structure of an auditory stimulus improves attending to subsequent structures presented at the same (vs. a different) temporal scale, i.e. we have demonstrated auditory temporal priming. Here, we explore whether auditory temporal priming is confined to absolute temporal ranges, or whether auditory attentional persistence can occur in a relative manner across temporal ranges. To accomplish this, we presented participants with hierarchical stimuli in which a local pattern was repeated three times sequentially to produce a global pattern. We employed two sets of stimuli: the Fast-Mid Stimuli that contained local patterns spanning 300 ms and the global pattern emerged over 900 ms, and the Mid-Slow Stimuli, that contained local patterns spanning 900 ms and the global pattern emerged over 2700 ms. Participants were given target patterns to identify, which occurred equally often at the local or global temporal range. When presenting one set of stimuli alone, whether the Fast-Mid or Mid-Slow, temporal priming was present. More importantly, however, when presenting both sets of stimuli together, we found that temporal priming occurred even when the absolute temporal range changed. These data reveal a form of auditory attentional persistence which is sensitive to relative temporal information.

Frederick Gallun, Portland VA Medical Center

On the Limits of Selective and Divided Auditory Attention

Listeners presented with two auditory signals separated along some dimension (such as frequency or perceived location) have often been asked either to ignore one and report the other (“selective attention”) or to report both (“divided attention”). Despite more than fifty years of research on this topic, the task and stimulus factors that influence the ability to perform these two tasks are still not well understood. Several sets of data will be used to illustrate the difficulties associated with characterizing such a situation. In one experiment, tonal stimuli separated by three octaves in frequency could not be processed selectively, while in another listeners were able to divide attention between two speech utterances processed into random interleaved frequency bands. I will present an analysis that emphasizes two factors: 1) the role of temporal modulations on the grouping of frequency components, and 2) task-dependent demands on specific types of auditory processing resources.

Ian Rasmussen, Daniel Brooks, and Eliot Hazeltine, University of Iowa

**The Simon Effect Occurs Without Shifts of Attention:
A New Look at the Attentional Explanation**

In choice reaction time tasks, individuals are faster when the stimulus appears in a location that corresponds to the correct response (congruent trial) than when the stimulus appears in a location the corresponds with an incorrect response (incongruent trial). This phenomenon is known as the Simon effect, and it is usually explained as an attentional effect. Some argue that the location of the attentional field might bias responses within that location, others claim that the Simon effect can only occur when there is a lateral shift in attention. However, the Simon effect can also be explained in terms of a conceptual priming effect, one based on the relative position of objects in the world. In three experiments, we attempted to test these two accounts. In Experiment 1, two potentially task-relevant stimuli were maintained in working memory and the critical stimulus was subsequently indicated by a central cue. Despite the fact that the irrelevant stimulus information was no longer visible, and the locus of attention spanned two response locations, the Simon effect was present. Experiment 2 follows the same methodology as experiment one, but replaces the working memory task with a dual stimuli-go/no go task. In Experiment 3, the absolute middle position of the display showed congruency effects if there was only one other potential stimulus location (i.e. right and middle, or left and middle), but not when subjects were presented with all three, suggesting that subjects were sensitive to the spatial arrangement of object-response mappings rather than the absolute position of the objects on the screen. These results may suggest a conceptual or relational coding of spatial configuration relative to available response locations.

Lynn Robertson and Thomas Van Vleet, Veterans Administration, Martinez, CA and University of California

Unilateral Spatial Neglect and Preattentive Processing in Visual Search

Feature integration theory (FIT) proposes that searching for a feature vs. conjunction of two or more features is qualitatively different in that spatial attention is needed to properly bind features into displayed conjunctions, whereas features are processed without spatial attention. Hemispatial neglect provides a unique opportunity to examine levels of processing at which feature binding occurs. We first determined two stimulus presentation times (TPT) that produced high and low detection probabilities (.75 vs. .25) in the neglected field for detecting targets for feature and conjunction search. This initial procedure was followed by a priming study with feature and conjunction display acting as primes and shown for the estimated TPTs, respectively. Participants were instructed to response as rapidly as possible to a single centrally presented probe on each trial. Reaction times to this single probe were not affected by differences in feature detection probability, but mirrored detection probability patterns when conjunction displays were presented as primes (i.e., more priming when detection probability was high than when it was low). These findings support FIT by questioning preattentive conjunction formation and supporting preattentive feature coding.

Nelson Cowan, J. Scott Saults, and Candice Coker Morey, University of Missouri - Columbia

Distinguishing Central and Domain-Specific Components of Working Memory

Previous studies of working memory have not been able to clarify how much of working memory storage is central and how much is domain-specific. Through novel applications of traditional techniques, we are disentangling these components of working memory. One series of experiments involved the presentation of visual arrays of colored spots along with acoustic arrays of spoken digits from four loudspeakers concurrently. Sometimes participants were responsible for both sensory modalities (bimodal condition) and sometimes they were responsible for only one modality (unimodal condition). Upon a probe presentation, the task was to indicate whether the probe was identical to the first array in the same modality, or whether one of its items had changed. The sum of visual and auditory memory in the bimodal condition exceeded the larger of the two unimodal memories (the visual), suggesting that domain-specific and central storage both were used. However, when the target arrays were followed by post-perceptual masks to eliminate sensory-specific information, the sum of visual and auditory bimodal memory was about equal to visual unimodal memory, suggesting a fixed central capacity limit. In other experiments, two stimulus sets in the same modality or different modalities were followed by a cue indicating which set had to be retained, or indicating that both sets had to be retained, for another 3 seconds before the probe. The dual-maintenance costs for that 3-second period did not depend on modality. This further suggests a limited-capacity, central working memory store functioning across domains.

Edward Ester and Edward Awh, University of Oregon

The Locus of Processing Interference Produced by Salient Visual Distractors

Numerous studies have shown that responses to visual targets are slowed by the presence of an irrelevant singleton. However, it is unclear as to whether this impairment is due to disruptions in perceptual or post-perceptual processing. The present studies attempted to disentangle these two possibilities. We reasoned that if the RT cost engendered by an additional singleton is due to a disruption in perceptual processing, then this item should also impair target discriminability under data-limited conditions. However, if an additional singleton acts so as to disrupt post-perceptual processing, one would expect to observe only an RT cost. In the present studies, we employed both resource- and data-limited implementations of an additional singleton task to show that while a salient singleton distractor impairs response latencies under resource-limited conditions, it does not affect the accuracy of target discrimination under data-limited conditions. This result suggests that salient additional singletons disrupt post-perceptual rather than perceptual processing.

Pierre Jolicœur, Stéphan Grimault, Nicolas Robitaille, Kevin Sauvé, Jean-Marc Lina, Christophe Grova, and Anne-Sophie Dubarry, Université de Montréal

Brain Oscillations Specifically Related to Visual Short-term Memory: Frequencies, Times, and Neural Loci

We developed a novel method of analysis of magnetoencephalographic data to localize the neural generators of induced brain oscillatory activity specifically related to the maintenance of information in visual short-term memory. The neural generators of induced oscillatory activity were located bilaterally in the superior parietal cortex, near the intraparietal sulcus. The results, which converge nicely with previous work using fMRI, complement ongoing research using event-related methods and pave the way for future work making use of indices of synchrony to study how the node in parietal cortex fits into the broader neural network supporting visual short-term memory.

Edward Awh and Brian Barton, University of Oregon

Interactions Between Number and Resolution in Visual Working Memory

What are the basic determinants of capacity in visual working memory? Awh, Barton and Vogel (in press) observed that a fixed number of items could be represented in visual working memory regardless of the complexity of those items, although the effective resolution or fidelity of the representations was reduced as object complexity increased. In addition, a correlational analysis suggested that the number of items that an individual can hold does not predict the resolution with which complex items are represented, suggesting that number and resolution are distinct aspects of memory ability. Nevertheless, the present research demonstrates strong interactions between these factors, with decreasing resolution of each representation as the number of items in memory increases. This drop in resolution might be explained either by a larger total information load across all activated slots in memory, or simply by the increase in the total number of active slots. In support of the latter, we found that large variations in information load have no effect on mnemonic resolution when the number of items is held constant.

Andrew McCollough and Edward Vogel, University of Oregon

Visual Chunking Allows Efficient Allocation of Memory Capacity

The ability to group information into "chunks" is a well know phenomenon in verbal working memory paradigms. However, the effects of chunking in the visual domain has not been well described. Here, we investigate the effects of visual chunking on working memory capacity, or K, utilizing gestalt principles to bias subjects to group individual items into larger, virtual objects. Subjects were presented with groups of three "pacmen", elements of Kaniza figures, that were either coherently organized to form illusory Kaniza triangles or randomly oriented, and asked to remember the orientation of the individual pacmen. Subjcts performed a change detection task on a single pacman probe after a brief delay, indicating whether the pacman probe was in the same or different orientation as the sample. We then measured memory capacity based on the number of chunked objects versus individual elements in the display. Memory capacity was greater in the Kaniza triangle condition than the random condition. ERPs were also recorded during the experiment. In particular, the contralateral delay activity is an ERP component sensitive to the number of items held in memory during the delay activity of a visual working memory task. The effects of visual chunking on this component will be discussed.

Trafton Drew and Edward Vogel, University of Oregon

The Limits of Divided Attention: An Electrophysiological Measure of Selection and Occlusion during Multiple Object Tracking

Attention can be divided so that multiple objects can be tracked simultaneously as they move amongst distractors. Although attentional tracking is known to be highly limited such that most individuals can track only about four objects simultaneously, the neurophysiological mechanisms that underlie this capacity limitation have not been established. Here, we provide electrophysiological measures in humans of the initial selection and sustained attention processes that facilitate attentional tracking. Both of these measures was modulated by the number of objects the subject was tracking and was highly sensitive to each individual's specific tracking capacity. By manipulating the difficulty of both the tracking and selection, we are able to effectively modulate the predictive strength of the selection and tracking components. Furthermore, we found that amplitude decreased when the objects stopped moving, but not when they traveled behind an occluder. Consequently, these measures may provide us with a better understanding of the neural substrates that underlie the ability to select and then track multiple objects.

Miranda Scolari, Jun Ishikawa, and Edward Awh, University of Oregon

Attention Biases Competition Between Individuated Objects

When multiple objects are presented simultaneously in a given scene, the objects compete with each other for selection and further processing. Previous research indicates that spatial attention biases these competitive interactions in favor of relevant stimuli. This biased competition account makes a clear prediction that attention effects should be larger when interference is strong. In line with this, psychophysical studies have demonstrated larger attention effects in displays with strong interference compared to those without interference. In the current project, however, we found conditions in which high levels of interference from crowding distractors had no influence on attention effects. Thus, not all forms of visual interference produce the empirical pattern that is predicted by the biased competition account. One possibility is that biased competition effects are specific to competition between individuated object files. When crowding effects are strong, however, target and distractor representations may be combined into a single "pooled" percept (e.g., Parkes et al., 2001; Pelli et al., 2004), so that no competition between objects occurs. This account predicts that biased competition effects should actually be inversely proportional to the strength of crowding. We tested this hypothesis by manipulating various factors that influence crowding, including target/distractor similarity and eccentricity. Crowding was strongest in cases where similarity was high or eccentricity was large, but the biased competition effect was eliminated in these displays. Furthermore, a meta-analysis of several studies revealed a significant negative correlation between crowding and biased competition. These results suggest that attention mediates a specific kind of "object-based" competition between individuated target and distractor representations.

Kim Halvorson[1], Eliot Hazeltine[1] & Bill Prinzmetal[2], University of Iowa[1], University of California, Berkeley[2]

Priming Effects Reveal Distinct Attentional Mechanisms

Prinzmetal, Park, and McCool (2005) proposed that two distinct types of visual attention are engaged by spatial cues. Voluntary attention, engaged when cues are predictive of the target's location, serves to facilitate the perceptual representation of the object. Involuntary attention is always engaged by spatial cues (predictive or non-predictive) and serves only to select an object for a response while having no effect on the perceptual representation. To test the dissociation between these two types of attention within the response time domain, we asked participants to make speeded responses to a target that appeared in either the spatially cued (valid) or uncued (invalid) location. In a trial sequence, a spatial cue (the darkening of a box) was followed by a 50 ms prime (a small arrow pointing either up or down) followed by the target (a large up or down arrow) in either the same or different location. Faster response times were recorded for valid trails, but a larger priming effect was observed only when the prime appeared in the cued location and when voluntary attention was invoked, consistent with the proposal that voluntary and involuntary attention play distinct computational roles.

Bill Prinzmetal and Ruby Ha, University of California, Berkeley

A Taxonomy of Spatial Attention

In previous work, using the spatial cueing task (Posner, 1980), we have claimed that there are at least two different attentional mechanisms: voluntary and involuntary attention. These mechanisms have different behavioral consequences and are mediated by different neural mechanisms. The research reported here demonstrates that involuntary attention can be further differentiated into two different mechanisms. The first involuntary attentional mechanism is a consequence of the response decision stage of processing. This mechanism can be characterized by the "leaky competitive accumulator model" (Usher & McClelland, 2001). The second mechanism is a serial-search mechanism, where the search is through either the display items, or through visual working memory. The two mechanisms can be differentiated by the limits in performance in a particular task. If performance is limited because subjects do not know which display location contains the target, the search model provides the best account of the data. Alternatively, if the primary limit is not in determining the target location, but rather in discriminating which target was present, the accumulator model provides the best fit of the data. Thus "involuntary attention" is not a unitary mechanism. These finding raise the possibility that different involuntary attention phenomena (e.g., inhibition of return, contingent capture) might be due to different mechanisms.

Alice Albrecht, A. List, and Lynn Robertson, University of California, Berkeley & Veterans Administration Northern California Health Care System

Object-based Attention to Holes and Wholes

Object-based effects of visual attention were reported by Egly, Driver and Rafal (1994) using a modified Posner cueing paradigm. In a two-rectangle (i.e., "object") display, they cued one end of one rectangle on each trial. Targets were most likely to appear at the cued location. In invalid-within conditions, the target appeared in the same object as the cue, but at the opposite end. In invalid-between conditions, the target appeared in the object opposite the cue. Importantly, invalid targets appeared the same distance away from the cue in both within- and between-conditions, holding space constant. When comparing the two invalid conditions, within-object targets were detected faster than between-object targets, i.e., RTs showed object-based facilitation. In a set of similar experiments, we replicated these effects when the objects were white but, surprisingly, not when they were black. We theorized that the white rectangles were being perceived as "holes" instead of objects. To investigate the disappearance of the object-based effect, the present studies attempted to manipulate the rectangles so that they were either perceived as "holes" or as objects using two-dimensional or stereoscopic depth cues. The data partially supported our hypothesis: we found a trend for an interaction between object-based effects and the holes/no-holes manipulation.

Gordon Logan and Darryl Schneider, Vanderbilt University, Nashville

Plans and the Structure of Behavior

Plans are mental representations of intentions for future thought and action. Plans structure behavior and direct it toward the fulfillment of goals. They are as important in predicting what people will do as the immediate stimulus situation. Much of the research on planning has concerned the processes by which people create plans. Our research is concerned with how people implement plans once they are created. To investigate the processes underlying the implementation of plans, we conducted experiments in which subjects were given a plan to remember and then a series of stimuli on which they were supposed to carry out the plan. The plan was a list of simple tasks to be performed and the stimuli were "multivalent" in that each task could be carried out on each stimulus. Thus, performance depended on subjects' ability to coordinate the representation of the plan with the stimuli in the environment. The experiments reported in this paper were designed to explore a distinction between plan-level processing (i.e., processes directed toward the representation of the list of tasks in memory) and task-level processing (i.e., processes directed toward the environmental stimuli), finding empirical measures of each kind of processing and creating a model that explains how they interact.

Suzanne Mitchell1, William Hoffman[1,2,] Vanessa Wilson1, Stacy Legg[1], Daniel Schwartz[2], Alexander Stevens[1] Oregon Health & Science University[1], Portland VA Medical Center[2]

Cognitive and Neural Substrates of Impulsive Decision Making

When offered a choice between a small reward available immediately versus a larger reward available after a delay, some individuals are more likely to select the smaller reward than wait for the delivery of the larger reward. Presumably this is because the value of the larger reward has been devalued to a level that is small than that of the small reward. Such heightened temporal discounting is a characteristic of drug abusing populations (e.g., smokers, alcoholics, opioid-dependent) and various psychiatric populations (e.g., ADHD, conduct disorder), and is often referred to as “impulsive” decision making. The talk will describe several studies that demonstrate the importance cognitive processes such as memory and attention in such decision-making, as well as recent data from 16 healthy normal volunteers performing this type of decision making task while undergoing functional magnetic resounance imaging (fMRI).

Abstracts Monday

Bruce Bridgeman, Eric Chiu, and Joshua Quan, University of California, Santa Cruz

Interaction of Motor Activity and Perception of Slope

Slope perception has been used as a way to measure the interaction between objective reality and perception. Until now, estimation of slope has been limited to (relatively) long-distance estimation. These experiments assess differences between estimates of slope in near space (within reach) and far space. In the first experiment, we found that slope measured verbally is overestimated more in far-space than in near-space, while proprioceptive estimates were accurate at both ranges. In the second experiment, we found that verbal slope estimations increase more dramatically when participants are asked to make estimates at a variety of distances, while proprioceptive estimates increase less strongly. The apparent slope vs. distance functions fit well to both logarithmic and power functions, but differ from distance estimations. Further experiments investigate the effect of walking on a hill with estimates of its slope.

Neil B. Albert[1], Richard B. Ivry[2] & Matthew Brett[3], [1]University of Birmingham, [2]University of California, Berkeley, [3]Medical Research Council, Cambridge

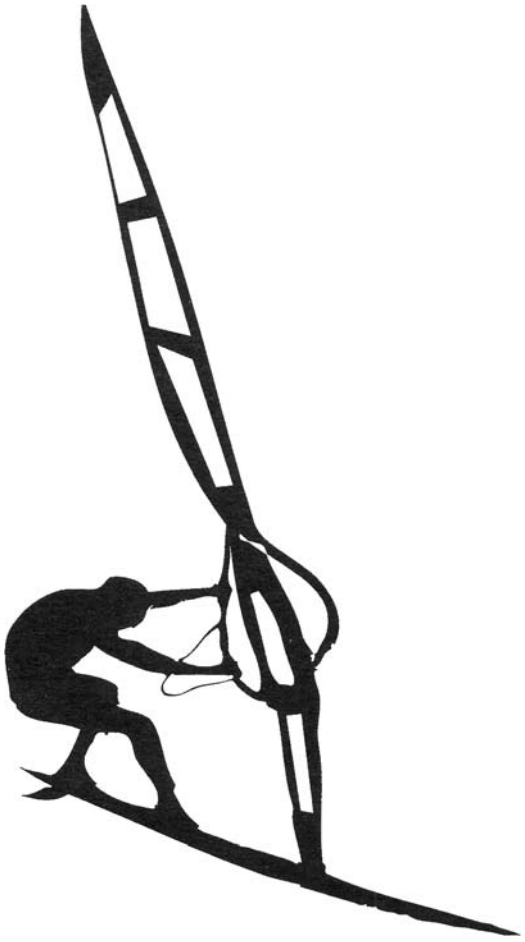
The SMA is Not Selectively Engaged During Internally-selected Actions

A central theory in motor control is the qualitative difference between the internal and external selection of actions. Multiple theorists have suggested that actions selected based upon external cues engage parietal and lateral premotor areas, whereas internally-selected movements (without external cues to limit selection demands) engage the supplementary motor area (SMA). A widely-cited study by Deiber et al. (1991) validated this distinction, but was confounded by movement preparation. Therefore, we revisit this theory. We used event-related fMRI to compare movements selected based upon the presentation of a direct cue (e.g., a potential target that changed from a ring to a disc), with movements to a target location chosen by the participant from two alternatives. A third task involved symbolically cued trials, in which participants selected targets based upon a centrally-presented cue (e.g., an arrow). Reaction time and accuracy data were obtained to ensure that comparisons were made between accurate movements of comparable reaction times. BOLD signal in the SMA was significant across all movements, but no differences between external and internal tasks were observed. Based upon our results, we argue that the SMA is not selectively engaged by internal action selection. We also reconsider the utility of an internal-external dichotomy for action selection.

Peter Dixon, University of Alberta

Action Planning or Action Retrieval?

A common view in cognitive science is that action is computed: First, an intention is formed; then, a suitable sequence of motor actions is planned using some form of means-ends analysis; and finally, computations based on feedback loops and servomechanisms are used to control the required movements. In this talk, I develop a different perspective: Detailed movement trajectories are simply retrieved from a large store of actions carried out previously in similar circumstances. The problem for the actor is thus not one of computing movement details, but rather one of framing a suitably precise memory cue that will serve to retrieve an appropriate action from memory. This perspective unifies a wide range of different episodic retrieval accounts of repetition and priming phenomena. Evidence is provided from a range of different tasks in which an actor must select among several different, but equally correct, actions to achieve a given goal.



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Internet

The Hood River Hotel has free wireless internet in the lobby, and several businesses have free wireless internet, so the area around the hotel is pretty well covered with free wireless internet.

Useful web pages:

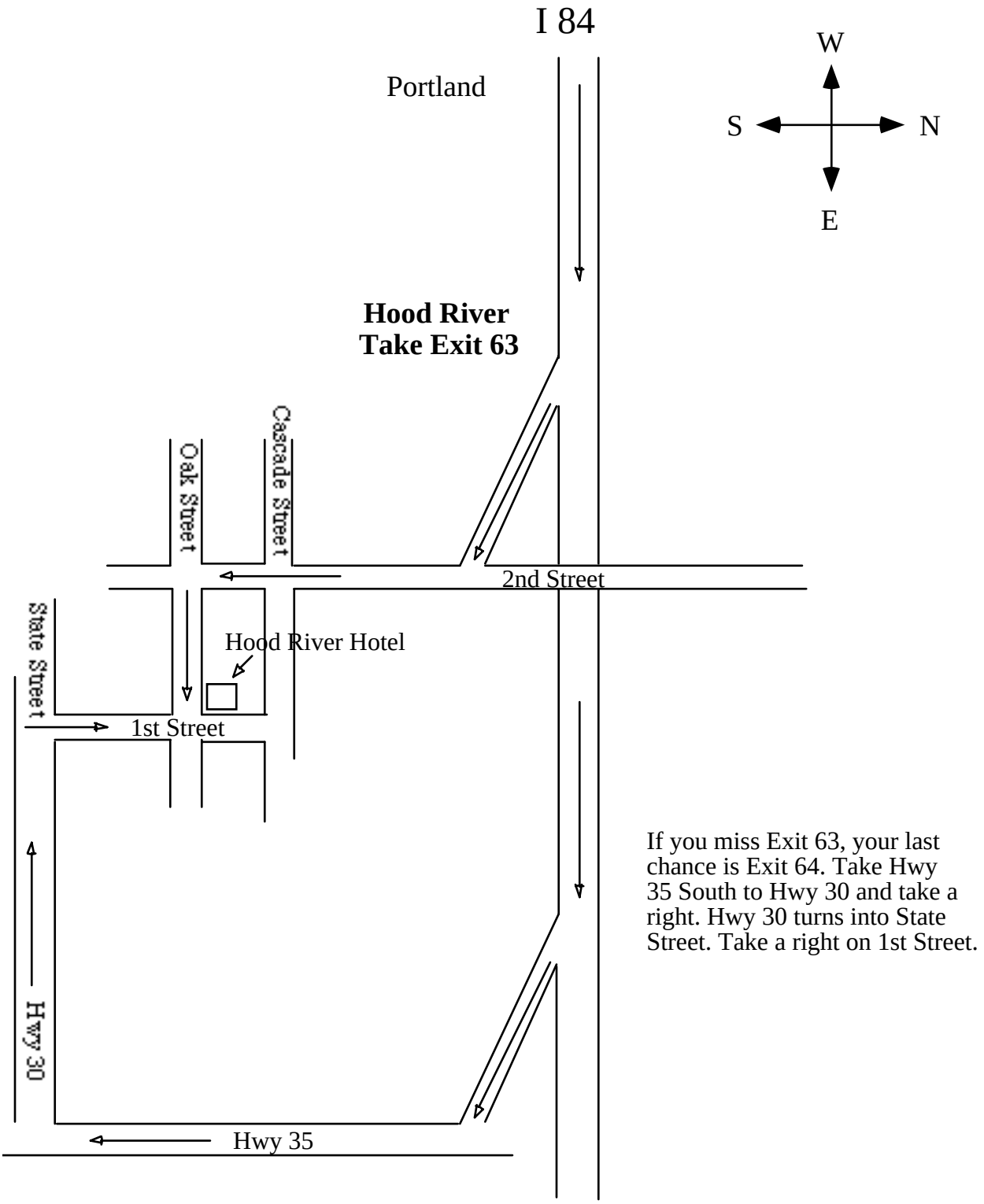
Conference Home Page:	http://www.ohsu.edu/csail/
Hood River Hotel:	http://www.hoodriverhotel.com/
Gorge Activities:	http://www.ohsu.edu/csail/billpages/ (Bill's picks)
	http://gorgeexplorer.com/ (Almost everything)
	http://www.mind.net/dlmark/gorge.htm (More sights to see)

Cover Design:

The cover was designed by Cassie Nobbs, Bill Prinzmetal, and Edward Ayoh

Directions to Hood River Hotel from Portland

(Approximately 60 miles)



If you miss Exit 63, your last chance is Exit 64. Take Hwy 35 South to Hwy 30 and take a right. Hwy 30 turns into State Street. Take a right on 1st Street.