

Cognitive Science Association for Interdisciplinary Learning

July 15–19, 1999
Hood River Hotel
Hood River, Oregon

PROGRAM

Thursday July 15, Evening

- 4:30 Appetizers
5:15 Opening Remarks
5:30-6:00 Deborah J. Aks
 The role of depth and $1/f$ dynamics in resolving perceptual ambiguity
6:10-6:40 Bill Prinzmetal & Diane Beck
 Visual illusions, the Mystery Spot, and the anti-Gravity chair
6:50-7:20 Scott R. Glover & Peter Dixon
 Reaching to an illusory orientation: Interacting systems in motor control
7:30 Adjourn
-

Friday July 16, Morning

- 8:30 Morning Refreshments
9:00-9:30 Diego Fernandez-Duque & Ian M. Thornton
 Implicit detection of change
9:40-10:10 Daniel Smilek, John D. Eastwood, & Philip M. Merikle
 Change detection: The importance of unattended information
10:20-10:50 Ethan Newby
 Understanding the correlational cueing effect
11:00 Break until 4:45
-

Friday July 16, Evening

4:45-5:30 Appetizers and Posters

4:45-5:30 Julie A. Higgins, William Milberg, Regina McGlinchey-Berroth, & Karen M. Duncan
The Gain/Decay hypothesis of the semantic memory deficit in Alzheimer's Disease: An account based on the dynamics of semantic activation

4:45-5:30 Karen Duncan, Regina McGlinchey-Berroth, Julie Higgins, & William Milberg
Time course of semantic activation in AD: Evidence from a masked semantic priming task

5:30-6:00 Christopher B. Brady & David A. Balota
Inhibitory processes in homograph disambiguation: Further evidence of spared identity suppression in healthy aging

6:10-6:40 Lin Chen
Topological Structure and Functional Hierarchy in Form Visual Perception

6:50-7:20 Kevin M. Sailor
Changes in verbal fluency with Alzheimer's Disease

7:30 Adjourn

Saturday July 17, Morning

8:30 Morning Refreshments

9:00-9:30 Ervin R. Hafter, Anne-Marie Bonnel, & Erick Gallun
Sharing attention and the kind of memory to which stimuli are compared

9:40-10:10 Elzbieta B. Slawinski
Detection of a tonal signal in the presence of uncertain tonal distractors

10:20-10:50 Peter Dixon
What they don't tell you in Intro Stats: Inferences are drawn by scientists, not statistics

11:00 Break until 4:45

Saturday July 17, Evening

- 4:45-5:30 Appetizers and Posters
- 4:45-5:30 Michael Esterman, Regina McGlinchey-Berroth, & William Milberg
Parallel and serial search in hemispatial neglect: Evidence for the preservation of preattentive processing
- 5:30-6:00 Jane Riddoch, Glyn Humphreys, & Martin Edwards
Separating selection of objects from selection of action: Neuropsychological evidence
- 6:10-6:40 Dell Rhodes & Sean Montgomery
Attention-centered reference frames
- 6:50-7:20 Marc Pomplun, Jiye Shen, & Eyal M. Reingold
The visual span in comparative visual search
- 7:30 Adjourn
-

Sunday July 18, Morning

- 8:30 Morning Refreshments
- 9:00-9:30 Michael P. Sullivan & Elona Cassady
The role of lexical and sublexical units during phonological encoding: Further evidence for a two-stage sequential model of spoken word retrieval
- 9:40-10:10 Enriqueta Canseco-Gonzalez & Eva Palmer
Language processing in bilinguals: An ERP study
- 10:20-10:50 Mark Van Selst, Tony Rodriguez, & Stacy Granada
Cognitive demands of a simple straight-line curve tracing task
- 11:00 Break until 4:45
-

Sunday July 18, Evening

- 4:45 Appetizers
- 5:30-6:00 Todd Parrish
The basics of functional magnetic resonance imaging
- 6:10-6:40 Tracy L. Luks
The role of interhemispheric communication and callosal morphology in attentional control
- 6:50-7:20 Thomas H. Carr & Catherine M. Arrington
Functional neuroimaging of attention and motor control: Identifying brain systems that support cognitive processes
- 7:30 Adjourn
- 8:00 Banquet

Note earlier starting time tomorrow morning!

Monday July 19, Morning

Note earlier starting time!

8:00 Morning Refreshments

8:30-9:00 Glyn Humphreys & Derrick Watson
Dual task interference on visual marking: Modality-independent and modality-dependent components of the marking state

9:10-9:40 Pierre Jolicœur
Capacity demands of access to short-term memory

9:50-10:20 Edward H. Cornell, C. Donald Heth, & Patricia M. Boehler
Home range and the development of selective attention to landmarks

10:30 Closing remarks

ABSTRACTS

Thursday July 15, Evening

Scott R. Glover & Peter Dixon
University of Alberta

Reaching to an Illusory Orientation: Interacting Systems in Motor Control

We investigated the effects of an orientation illusion upon different aspects of reaching. An orientation illusion was found to have equivalent effects upon the posture chosen (wrist adducted or abducted) in reaching, as it had upon perceptions. The illusion was also found to have a dynamic effect on the orientation of the hand during reaching under both open-loop and closed-loop conditions. The illusory effect was large at the beginning of the reach, but decreased to near zero by the end. We hypothesize that the illusion's effects upon reaching are due to the interaction of two systems in motor control: One system plans the reach using a visual representation that encodes the context surrounding the target, whereas another system corrects the reach on-line using a visual representation that ignores the context. The relation of this model to popular models of motor control is discussed.

Deborah J. Aks
University of Wisconsin, Whitewater

The role of depth and $1/f$ dynamics in resolving perceptual ambiguity

A dynamical systems approach is used to assess how the human visual system resolves perceptual ambiguity in stimuli that offer multiple interpretations. Subjects observed the Necker cube for brief, moderate and extended viewing conditions during which they pressed a key each time they perceived a change in orientation of the cube. Manipulations of binocular disparity served as a parameter to control perceptual stability. Low depth conditions yielded more perceptual reversals than intermediate and high depth conditions. Fourier analyses performed on time series of reversals show $1/f$ (pink noise) was predominant in high depth conditions and white noise was present in low depth conditions. These results together with contemporary theoretical models of complex systems (i.e., Bak, Tang & Wiesenfeld, 1987; Los Rios & Zhang, 1999) suggest that depth information may guide our perceptual system into a self-organized state allowing us to resolve ambiguous information.

William Prinzmetal & Diane Beck
University of California, Berkeley; University of London

Visual illusions, the Mystery Spot, and the anti-Gravity chair

The Orientation Framing Theory (OFT) provides a new account of many visual illusions such as the Ponzo, Zollner, Poggendorff, Wundt-Hering and Cafe Wall illusions. The inspiration for this theory comes from roadside attraction "anti-gravity" houses such as the Oregon Vortex and the Mystery Spot. In these locations, one's sense of vertical and horizontal is distorted by the visual environment. It has been found that the effect of visual context on orientation perception is increased by having observers sit in a tilted chair. (Because sitting in such a chair increases the effect of visual as opposed to gravity-based cues to orientation, it is called the "anti-gravity" chair). The anti-gravity chair increased the magnitude of those illusion explained by the OFT, but did not affect a control illusion. No other theory of visual illusions can account for these results.

Friday July 16, Morning

Diego Fernandez-Duque & Ian M. Thornton

University of Oregon; Cambridge Basic Research, Cambridge, MA.

Implicit detection of change

Several paradigms (e.g., change blindness, inattention blindness, transsaccadic integration) indicate that observers are often very poor at reporting changes to their visual environment. Such evidence has been used to suggest that the spatio-temporal coherence needed to represent change can only occur in the presence of focused attention. However, such studies almost always rely on explicit reports. It remains a possibility that the visual system can implicitly detect change, but that in the absence of focused attention, the change does not reach awareness and consequently is not reported. We use a modified change blindness task to demonstrate such implicit detection of change. Our results indicate that observers can correctly 'guess' the location of a change even when they report being unaware that any change had taken place. In addition to our basic findings, we will also discuss related evidence for implicit detection of change from our work using object priming, response compatibility, and electrophysiological measures.

Daniel Smilek, John D. Eastwood, & Philip M. Merikle

University of Waterloo

Change detection: The importance of unattended information

Does memory for unattended visual information play a functional role in change detection or is unattended information overwritten by each subsequent presentation of a visual display? Observers searched for the location of a changed item in pairs of alternating visual displays consisting of letters or digits. Each pair of displays consisted of 4, 7, 10, 13, or 16 items, and the discrepancy between the displays in each pair involved either a three-feature or a two-feature change between one pair of items. The slopes of the search functions for locating the easier to detect three-feature changes was shallower than the slopes of the search functions for locating the more difficult to detect two-feature changes. These results suggest that unattended visual information is not overwritten but rather that it accumulates in memory and plays a functional role in guiding attention to the location of a change between successive displays.

Ethan Newby

University of California, Berkeley

Understanding the correlational cueing effect

In the correlational cueing effect, in which target presentation is correlated with that of flanking stimuli, subjects are faster responding to targets presented with a correlated flanker than to targets presented with a flanker correlated with a different response. Miller (1987) suggested this difference was due to subjects implicitly learning the association between flanker and response. Cohen, Fuchs, Bar-Sela, Brumberg, and Magen (in press) argue that sequential priming and target-flanker similarity may account for this effect. The current experiments attempt to reconcile these apparently contradictory findings. Target-flanker similarity is controlled through stimulus selection from a set of similar letters, counter-balancing letter assignment, and the use of a control condition. Sequential trial effects are controlled by manipulating trial order and the overall probability of a given trial type being presented. When target-flanker similarity and sequential effects are accounted for there remains an advantage for the correlated trials which may demonstrate learning.

Friday July 16, Evening

Julie A. Higgins, William Milberg, Regina McGlinchey-Berroth, & Karen M. Duncan

Geriatric Neuropsychology Laboratory, Boston VA

The Gain/Decay hypothesis of the semantic memory deficit in Alzheimer's Disease: An account based on the dynamics of semantic activation

The Gain/Decay hypothesis posits that in Alzheimer's Disease (AD) there is an alteration in the dynamics that characterizes the normal activation of semantic representations. The Gain/Decay hypothesis states that language deficits in AD are due to a single underlying deficit in the modulation of excitatory and inhibitory processes within semantic memory. In particular, an accelerated rate of activation that surpasses the normal peak (i.e., gain) followed by an accelerated rate of decay in which activation falls well below normal (i.e., decay). The Gain/Decay hypothesis is consistent with recent data on dendritic loss and dysmorphology in AD. These studies suggest that changes in the modulation of neuronal connectivity are a central feature of the pathophysiology of the disease. The Gain/Decay hypothesis can account for much of the data used to support degradation and access theories of the semantic deficit in AD. It can also account for a number of core clinical phenomena of AD such as anomia and loss of abstraction that likely reflects alterations in semantic memory. The Gain/Decay hypothesis can be formalized mathematically and is highly amenable to computer modeling.

Karen Duncan, Regina McGlinchey-Berroth, Julie Higgins, & William Milberg

Geriatric Neuropsychology Laboratory, Boston VA

Time course of semantic activation in AD: Evidence from a masked semantic priming task

Deficits in semantic memory contribute to many of the cognitive impairments of early Alzheimer's disease (AD). As an alternative to degradation and retrieval accounts of this deficit, we have proposed the Gain/Decay hypothesis that posits a reduction in the time constant of spreading activation resulting in dynamic changes in the accessibility of semantic information. To test this hypothesis we examined the time course of semantic priming in AD patients in a lexical decision task with two different SOA's. To minimize possible confounding effects of strategic influences and post-lexical operations, this experiment employed a masked priming paradigm in which the spatial location of the prime was varied. Results revealed that AD patients showed priming only at the short SOA whereas healthy older adults showed priming at both the short and long SOA. The findings from this experiment support the Gain/Decay hypothesis by demonstrating that the activation of semantic information is relatively short-lived in AD and is, thus, only available for retrieval for an abnormally short period of time.

Inhibitory processes in homograph disambiguation: Further evidence of spared identity suppression in healthy aging

We examined the effects of healthy aging on inhibitory processes involved in lexical disambiguation in a speeded relatedness judgment task. Younger and older adults were first presented ambiguous primes followed by related or unrelated targets that appeared with the primes. Participants made speeded decisions as to whether the prime and target were related. In addition, selected primes were presented twice at varying lags. For these twice presented conditions, the target word was congruent (e.g., BANK–MONEY vs BANK–SAVE), incongruent (e.g., BANK–RIVER vs BANK–SAVE), or unrelated (e.g., BANK–CACTUS vs BANK–SAVE) across the presentations. The response latency results to the second presentation (e.g., BANK–SAVE) indicated that both groups exhibited priming in the congruent condition and response slowing in the incongruent condition across lag. Furthermore, both groups made relatively more relatedness judgment errors in the incongruent condition, suggesting the blocking of access to semantic meaning by an inhibitory process. These results suggest that identity suppression processes involved in homograph disambiguation are spared in healthy aging.

Lin Chen

Beijing Lab of Cognitive Science

Topological Structure and Functional Hierarchy in Form Visual Perception

To address the fundamental question of “what are primitives of representation for visual form perception,” the theory of topological structure and functional hierarchy proposes that a basic and general function of the visual system may be the perception of topological properties, and the time dependence of perceiving form properties may be systematically related to their structural stability under change, in a manner that is similar to the Klein’s hierarchy of geometries; the invariants at different geometrical levels, including, in turn, topology, projective, affine, and Euclidean geometry, rather than simple components of objects such as line-segments and other portions, are the primitives of visual form representation. In the present talk, several issues will be discussed to illustrate “why and how” to put forward the topological analysis of perceptual organization. These issues include the following three questions: Precisely what attributes of stimuli determine the segregation of figure from background? What are correspondence tokens in apparent motion with plastic deformation? How to define formally the concept of object or perceptual unit, a central concept in a theory of selective attention?

Kevin M. Sailor

City University of New York

Changes in verbal fluency with Alzheimer’s Disease

A common index of semantic memory and language impairments is the ability to generate members of a category. Although Alzheimer’s disease (AD) patients recall substantially fewer members of semantic categories than do the normal old, it is unclear whether this reduction is produced by a loss of the less typical members of a category (Ober, Dronker, Koss, Delis, & Friedland, 1986; Weingartner, Kawas, Rawlings, & Shapiro, 1993). The category fluency data of a large number of AD patients and controls were compared for the categories of male first names and footwear. AD patients recalled relatively fewer atypical members of the category footwear than the normal old but did not differ from the normal old when generating names. Interestingly, a simple sequential sampling model suggests that the reduction in atypical items could be the result of slower search rates rather than the loss of atypical items.

Saturday July 17, Morning

Ervin R. Hafter, Anne-Marie Bonnel, & Erick Gallun

University of California, Berkeley

Sharing attention and the kind of memory to which stimuli are compared

Here we study shared attention in an auditory/visual dual task. Signals can be increments $S(+)$ or decrements $S(-)$ in the levels of ongoing pedestals. In the *detection* task, signal and non signal trials are presented independently to the two modalities; in the *identification* task, signals appear to both modalities on every trial and each is identified as an $S(+)$ or $S(-)$. In earlier work, detection showed no cost (loss in performance) while identification produced a loss indicative of the need to share a single resource. In further examination of the demands of shared attention, we find that attentional cost is not so much based on differences between the detection and identification paradigms as on the types of stimulus memories against which stimuli are compared. For comparisons to a short-term sensory trace, there is no cost. However, for absolute judgments based on comparisons to labeled stimulus memories, attention must be shared.

Elzbieta B. Slawinski

University of Calgary

Detection of a tonal signal in the presence of uncertain tonal distractors

The present study was inspired by the previous research of Slawinski and Scharf (1998). This study demonstrated that a threshold of tone detection in noise increased in the presence of an uncertain weak tonal distractor, independently of listeners' age and type of noise (continuous versus intermittent).

In order to examine further informational masking the current study explored the detection of a 1 kHz tone burst in broadband noise in the presence of an uncertain tonal distractor. The participants in this experiment were professional musicians.

It was found that the threshold's increase was significantly smaller for musicians who played instruments which generated sounds of low intensity relatively to other instruments, than for musicians playing instruments of "dominant sound." The results suggest that informational masking may be controlled by attention resulting from intensive practice.

Peter Dixon

University of Alberta

What they don't tell you in Intro Stats: Inferences are drawn by scientists, not statistics

What is taught as statistical inference in intro stats courses is not what scientists really do when they draw conclusions from empirical evidence. Researchers are typically interested in comparing the relative adequacy of different explanations or theoretical accounts; they are rarely interested in rejecting an artificially constructed null hypothesis. This is a good thing, since the intro stats method of inference has a number of well-known logical fallacies and usually does not contribute much to understanding the implications of results. As an alternative, I propose that likelihood ratios be used to describe the evidence for and against competing explanations. Reporting likelihood ratios provides a simple and intuitive summary of the results, avoids the logical fallacies and interpretational problems of hypothesis testing, allows one to identify compelling evidence for null effects, provides a simple method for evaluating failures to replicate, and can be readily used to aggregate results across experiments.

Saturday July 17, Evening

Michael Esterman, Regina McGlinchey-Berroth, & William Milberg
Geriatric Neuropsychology Laboratory, Boston VA

Parallel and serial search in hemispatial neglect: Evidence for the preservation of preattentive processing

Although neglect is thought to be an impairment of visual attention, studies have demonstrated preserved implicit processing of neglected information without attention. This suggests that a great deal of processing may occur preattentively. This possibility was directly examined using a parallel and serial search task. In the parallel search task the target possessed a unique visual feature that appeared to 'popout' of the display regardless of the number of distractors. In the serial search the target lacked a feature that was present in the distractors. In the parallel search task, neglect patients' performance did not differ from healthy controls, either with regard to errors or decision latency, demonstrating that preattentive visual processes appear to be intact in neglect. In contrast, hemianopic control patients were severely impaired when targets appeared in the contralesional field in the same preattentive search task. In the serial search task, neglect patients made significantly more errors and were less efficient than healthy controls when targets appeared in their contralesional visual field. Therefore, when attention was required to perform a task, as in a serial search, neglect symptomatology was displayed.

Jane Riddoch, Glyn Humphreys, & M.G. Edwards
University of Birmingham

Separating selection of objects from selection of action: Neuropsychological evidence

Recently (Riddoch et al., 1998), we have used a simple response selection task to examine the effects of visual affordances and learned object-hand associations on manual interference responses in patients showing aspects of utilisation behaviour. The task rule was to pick up a left side object with the left hand and a right side object with the right hand. Opposite hand responses (interference responses) can be cued by the familiarity of the object and the compatibility between the object's parts and the hand used for action (eg the handle of a cup). In the present paper we report data on manual interference responses when multiple objects are presented and the patient has only to use for object for an action. We show that there can be no effect of the distractor on performance when it differs from the target in terms of colour, size, shape or orientation, even when the distractor is more strongly associated with the required action than the target. However a distractor close to the path of action to a target can block interference responses to that item. We conclude that there can be intact selection of objects for action, even when the process of action selection is impaired. In addition, distractors close to the path of action can be selected along with the target, though their subsequent rejection leads to the inhibition of co-active interference responses. We discuss the data in relation to the distinction between anterior and posterior attentional systems in the brain.

Reference

Riddoch, M.J. et al. (1998). Visual affordance direct action: Neuropsychological evidence from manual interference. *Cognitive Neuropsychology*, 15, 645–684.

Dell Rhodes & Sean Montgomery
Reed College

Attention-centered reference frames

A rightward spatial advantage in the letter reflection task rotates with the display (“scene”) and has an attentional component. We wanted to determine whether the origin of the horizontal axis of the scene-based reference frame is determined by the locus of attention or by fixation. In each trial, one of three crosses (left, center, or right) was cued. The target letter appeared to the left or right of the cued location. Participants maintained fixation throughout the trial, and reported the orientation of the target letter. The right target location with respect to the left cross and the left target location with respect to the center cross were identical, as were the left target location with respect to the right cross and the right target location with respect to the center cross. Both a strong rightward advantage and a Simon effect were obtained with respect to the cued location. When feedback for fixation breaks was provided, a smaller rightward advantage, but no Simon effect, appeared around fixation. These findings converge with others using very different paradigms to suggest that environmental reference frames can be attention centered.

Marc Pomplun, Jiye Shen, & Eyal M. Reingold
University of Toronto

The visual span in comparative visual search

In comparative visual search, subjects are presented with two displays side by side showing random distributions of simple geometrical objects. Each object in the left display has a counterpart at the corresponding location in the right display. The subjects’ task is to detect the only pair of corresponding objects sharing the same features (match task) or the only pair with different features (mismatch task). We use the technique of gaze-contingent displays to measure the subjects’ visual span size as a function of the task, e.g., match vs. mismatch. The basic idea of this technique is to monitor the subjects’ eye movements and change the display on the screen contingent on the current gaze position. For example, only a window being constantly centered at the current gaze position might show the actual items to be compared while the items outside the window might be replaced with blobs. By iteratively adapting the size of this window, the visual span can be estimated: It corresponds to the smallest window that still allows the subjects to proceed with approximately normal speed. Different measures using gaze-contingent displays show a convergent dependence on the subjects’ task, supporting the validity of our technique of measurement.

Sunday July 18, Morning

Michael P. Sullivan & Elona Cassady
Oregon Health Sciences University, Reed College

The role of lexical and sublexical units during phonological encoding: Further evidence for a two-stage sequential model of spoken word retrieval

In the present study, two cross-modal priming experiments were conducted to determine whether the activation and selection of phonemes occurs simultaneously or in two stages. In Experiment 1, participants were asked to listen to an auditory word prime and subsequently name a target picture that was either begin-related (e.g. rope, robe), end-related (e.g. dog, log), or unrelated. The results yielded an inhibitory effect that was reliably larger for begin-related than end-related targets. In Experiment 2, nonword auditory primes were employed to determine if the location-based inhibitory effect observed in Experiment 1 was mediated by lexical or sublexical units. In contrast to Experiment 1, the results yielded a reliable inhibitory priming effect that was of a similar magnitude across begin-related and end-related targets. The results provide support for a two-stage, sequential model of phonological encoding, and suggest that the competition for selection that underlies the inhibitory effects is mediated primarily by lexical units, and to a lesser extent by sublexical units.

Enriqueta Canseco-Gonzalez & Eva Palmer
Reed College

Language processing in bilinguals: An ERP study

Bilingual speakers successfully communicate using either one of their languages, or a mixture of the two. The phenomenon of code-switching is often observed in bilingual speakers. This raises the possibility of a common conceptual representation for the two languages, or a very rapid transition between languages at the lexical or conceptual levels.

In order to investigate this possibility, we used the recording of Event-Related Potentials (ERPs) associated with the detection and processing of English sentences ending with a semantically anomalous word. In prior studies, semantically anomalous words have been found to elicit a negative component appearing at about 400 msec post word-onset (N400). In this study we investigate semantic processing and language switching in bilingual speakers using the N400 component. Early and late Spanish-English bilinguals listened to English sentences ending with a visually presented word varying in semantic plausibility (plausible/implausible) and/or in language (English/Spanish).

In line with previous studies in monolinguals, we found an N400 effect elicited by anomalous words in English in both groups of bilinguals. Importantly, we found a similar N400 effect in both, early and late bilinguals, when the sentences ended with a Spanish anomalous word. However, the onset of the effect depended on language and age of acquisition. Early bilinguals showed an equivalent onset across languages. In contrast, late bilinguals showed an earlier onset in their native language but a later one in their second language.

Results are discussed based on theories of bilingual lexical representation and age of acquisition.

Edward H. Cornell, C. Donald Heth, & Patricia M. Boechler
University of Alberta

Home range and the development of selective attention to landmarks

Home range is the territory that includes the child's self-initiated travel and independent navigation. Home range expands significantly from early to middle childhood (6-12 years of age). The observations reported here bear on the thesis that children's autonomous excursions allow important opportunities for what Siegler (1996) has characterized as the natural selection of cognitive strategies. We interviewed Western Canadian parents and subsequently determined that they underestimate the extent of younger children's travel. Many parents expressed that, because adventure had been forbidden, specific way finding instructions were unnecessary. We measured actual travel by accompanying their children after asking them to take us to two of the most distant places they had ever traveled to by themselves. Behavioral observations and think-aloud protocols recorded during the walks indicated that, by 12-years of age, children direct horizontal scanning of the environment and selectively attend to objects that have good landmark qualities, permanence, uniqueness, proximity to locations where turns are required, and visibility in the skyline.

Sunday July 18, Evening

Todd Parrish
Northwestern University

The basics of functional magnetic resonance imaging

Functional magnetic resonance imaging (fMRI) offers unprecedented spatial and temporal resolution of brain cognition. The impact of this technology on neuroscience research is just now being explored. In this talk, a discussion of blood oxygenation level dependent (BOLD) based functional magnetic resonance imaging will be presented. The topics include the origin of the MR based signal, data acquisition and sequence dependence, block versus trial experiments, and paradigm design issues. All of these issues need to be fully understood in order to properly design and interpret fMRI data. Examples of memory, language and spatial attention will be shown.

Tracy L. Luks
The University of Chicago

The role of interhemispheric communication and callosal morphology in attentional control

Attentional control is required when behavioral goals drive the allocation of attention to processing systems and stimuli in a top-down fashion. Split-brain patients and other individuals with inefficient callosal function often exhibit impairments of attentional control. The role of callosal function in the attentional control of normal adults was assessed by within-subjects comparisons of MRI images of the corpus callosum, performance on two behavioral measures of interhemispheric communication, and performance on a behavioral measure of attentional control. Midsagittal callosal area was measured on a T1-weighted MRI image. Interhemispheric communication was tested with a visual task which required comparison of unilateral and bilateral stimuli, and with a bimanual coordination task. Attentional control was tested with a visual task which measured the cost of shifting attention between two processing goals. Superior performance on the attentional control task was associated with poorer visual and manual interhemispheric communication, and smaller anterior callosal area. These findings suggest that attentional control (at least in this task) benefits from conditions in which the activities of the cerebral hemispheres are relatively independent. A study addressing the generalization of these findings to other measures of attentional control is underway.

Thomas H. Carr & Catherine M. Arrington
Michigan State University

Functional neuroimaging of attention and motor control: Identifying brain systems that support cognitive processes

In attempting to identify the neural substrate of cognitive processing, cognitive neuroscience and neuropsychology increasingly emphasize interactions in distributed brain systems rather than one-to-one mappings between individual functions and individual neural structures. We illustrate the appropriateness of this approach with functional magnetic resonance imaging analyses of task performance in the domains of spatial attention and motor control. In one experiment, fMRI exposes a network of sites widely distributed through the left cortical hemisphere that comes into play when spatial attention is constrained to fill the boundaries of an object or shape. In a second experiment, fMRI indicates that when a simple motor movement must be controlled endogenously rather than simply being experienced passively, the major change in cortical activity involves recruitment of additional ipsilateral frontal regions. These frontal regions extend an already widely-distributed system of frontal and parietal regions being driven directly by sensory input from the moving limb and indirectly by communication back and forth among cortical regions. Emphasis will be on using neuroimaging methods to ask cognitive-psychological or computational-level questions.

Monday July 19, Morning

Glyn Humphreys & Derick Watson

University of Birmingham

Dual task interference on visual marking: Modality-independent and modality-dependent components of the marking state

Efficient selection of new objects depends not only on a passive prioritisation process to the new items but also on top-down inhibition of old objects: a process we have termed visual marking (Watson & Humphreys, 1997). Marking can be demonstrated in visual search tasks in which potentially harmful 'old' distractors can be shown to have little effect on search through large sets of new objects, when the new and old items are temporarily separated. However there is a systematic decrease in the ability to ignore old items if participants have to perform a secondary task whilst the old objects are present. In this paper we examine the factors that determine secondary task interference in marking. We manipulated the modality of the secondary task (visual or auditory) and its occurrence with respect to the old items (at onset or after an interval). Within-modality (visual-visual) interference occurred irrespective of the relative onsets of the two tasks; cross-modality (auditory-visual) interference occurred only when the tasks began together. We propose that there are both modality-dependent and independent components of the marking state. Establishing the marking state draws on modality-independent resources; maintaining it depends only on modality-specific resources.

Reference

Watson, D.G. & Humphreys, G.W. (1997). Visual marking: Prioritising selection for new objects by top-down attentional inhibition. *Psychological Review*, 104, 90-122.

Pierre Jolicoeur

University of Waterloo

Capacity demands of access to short-term memory

Does accessing information in short-term memory (STM) require central capacity-limited mechanisms? The Sternberg memory search paradigm was used as the second of two speeded tasks in the context of the psychological refractory period (PRP) paradigm (Task₁ was a speeded pitch discrimination). The effects of memory set size in the Sternberg task were statistically additive with SOA, implying that access to memory was suspended while central processing in Task₁ was taking place. The results support the view that access to STM requires the same capacity-limited central mechanisms as those required to make simple arbitrary decisions.

Cognitive demands of a simple straight-line curve tracing task

Ullman (1980) suggests that late perceptual processing of a visual scene takes place through an assembly of basic visual operations which include mental rotation, curve tracing, and spatial indexing operators. Previous dual-task studies using the Psychological Refractory Period (PRP) paradigm have investigated the cognitive demands of mental rotation. These earlier findings, including some presented at prior CSAIL conferences, have demonstrated that mental processes required to compensate for stimulus misorientation are largely subject to the same dual-task processing bottleneck that delays response selection and some forms of stimulus categorization in the PRP paradigm. The current work examines the stability of the inter-dot distance effect in curve tracing across the stimulus onset asynchrony (SOA) manipulation in the PRP paradigm. Distance effects in curve tracing, like misorientation effects in mental rotation, remain largely additive across SOA. Curve tracing requires central processing.

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