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Abstract Book

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The following organizations have made generous donations in support of this year's OPAM: Tobii Technology, Arrington Research, Psychology Software Tools, the Psychonomic Society, the Cognitive Science Program at Michigan State Univ., the Center for Visual Neuroscience at North Dakota State Univ., the Center for Cognitive Neuroscience at Duke Univ., and the Computational Visual Cognition Lab at MIT.

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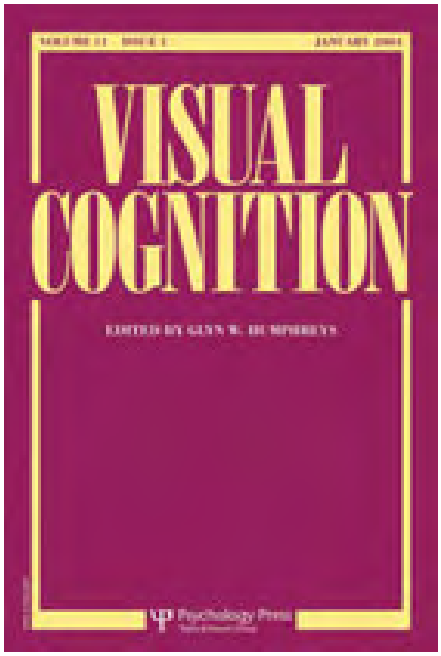

Visual Cognition

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We are pleased to announce the establishment of a formal association between OPAM and *Visual Cognition*. Both the workshop and journal began at the same time in the early 1990s with similar overarching goals of providing outlets for rapid sharing of experimental research and theoretical development in areas of scientific investigation that overlap greatly. Over the last dozen years, these entities have developed, expanding both in size and impact. Beginning with this year's workshop, the two organizations will be teaming up to bring the cutting edge research in the area of object processing presented at OPAM to the wider research community studying visual cognition.

The primary aspect of this relationship between OPAM and *Visual Cognition* is that the 1,000 word research summaries from the 15 talks presented at the workshop will be published in the journal. The summaries from this year's workshop will appear in early 2006 and in future years in a fall issue coinciding with the workshop. In addition to publishing the talk summaries, *Visual Cognition* encourages all individuals presenting research at OPAM to consider the journal as an outlet for full length manuscripts of the presented research.

OPAM has been rapidly growing in recent years, as can be seen in the record breaking number of submissions to OPAM this year. With this growth, OPAM has remained true to its mission of providing junior researchers with a venue for presenting high quality research. We believe that the association with *Visual Cognition* will further this important aim by allowing for the opportunity to share this work with the broader research community.

OPAM 2005 Organizers: Kate Arrington, Andrew Leber, Steve Mitroff, Aude Oliva

OPAM 2005 Short Program

Talk Sessions: Grand Ballroom East, Sheraton Centre
Poster Session: Sheraton Hall

7:45	**Registration Begins**
8:15 – 8:20	**Opening Remarks**
Session 1: Factors influencing object perception - Chaired by Aude Oliva, *MIT*	
8:20 - 8:35	**The unlikely perception of figural shape from 3D concavities** - Anthony Cate[1] & Marlene Behrmann[2], [1]*University of Western Ontario, Dept. of Psychology*, [2]*Carnegie Mellon University*
8:35 – 8:50	**Does emotion systematically influence visual perception? -** Areti Chouchourelou[1], Toshihiko Matsuka[2] & Maggie Shiffrar [1], [1]*Rutgers University-Newark*, [2]*Stevens Institute of Technology & W.J Howe School Of Technology Management*
8:50 – 9:05	**Recognising novel deforming objects** - Lewis Chuang[1], Quoc Vuong[1], Ian Thornton[2] & Heinrich Buelthoff[1], [1]*Max Planck Institute of Biological Cybernetics*, [2] *University of Wales*
9:05 – 9:20	**Axes vs. averages: High-level representations of dynamic point-light forms** - Javid Sadr[1], Nikolaus Troje[2] & Ken Nakayama[1], [1]*Harvard University*, [2]*Queens University*
9:20 – 9:30	**Coffee Break**
Session 2: Selection of object features - Chaired by Andy Leber, *Yale University*	
9:30 – 9:45	**The distinctiveness effect reverses when using well-controlled distractors** - Nicolas Davidenko & Michael Ramscar, *Stanford University*
9:45 – 10:00	**Affective consequences of attentional inhibition depend on selection task** - Brian Goolsby, Jane Raymond & Kimron Shapiro , *University of Wales, Bangor*
10:00 – 10:15	**Contingent capture: A visuo-spatial effect? Evidence from electrophysiology** - Emilie Leblanc, David Prime & Pierre Jolicoeur, *Universite de Montreal*
10:15 – 10:30	**Interference from irrelevant color-singletons during serial search depends on attention being spatially diffuse** - Bryan R Burnham[1], James H Neely[1,] Peter B Walker[1,2] & Neill W Trammell[1], [1]*University at Albany, SUNY*, [2]*Office of Naval Research*
10:30 – 11:50	**Poster Session**
11:50 – 12:50	**Lunch Break**
Session 3: Dynamics of object-based attention - Chaired by Steve Mitroff, *Duke University*	
1:00 – 1:15	**Differences in speed aid visual search and multiple-object tracking** - David E Fencsik[1,2] , Jessenia Urrea[3], Skyler S Place[1], Jeremy M Wolfe[1,2] & Todd S Horowitz[1,2], [1]*Brigham and Women's Hospital*, [2]*Harvard Medical School*, [3]*Boston Latin School*
1:15 – 1:30	**Spatiotemporal cues for tracking multiple objects through occlusion** - Steven Franconeri [1], Zenon Pylyshyn [2] & Brian Scholl [3, 1] *University of British Columbia*, [2] *Rutgers University*, [3] *Yale University*
1:30 – 1:45	**Effects of object-based attention: Sensory enhancement or prioritization** - Ashleigh M Richard, Hyunkyu Lee & Shaun P Vecera, *University of Iowa*
2:00 – 2:10	**Coffee Break**
Session 4: Object processing in other cognitive processes - Chaired by Kate Arrington, *Lehigh University*	
2:10 – 2:25	**Executive load in working memory induces inattentional blindness** - Daryl Fougnie & René Marois, *Vanderbilt University*
2:25 – 2:40	**fMRI reactivation of the lateral occipital complex during delayed actions** - Anthony Singhal, Liam Kaufman, Ken Valyear & Jody C Culham, *University of Western Ontario*
2:40 – 2:55	**Control of speed and accuracy set points in manual-pointing movements** - Joo-Hyun Song & Ken Nakayama, *Harvard University*
3:00 – 4:00	Keynote Speech: **Visual routes to knowledge and action** - Dr. Melvyn A. Goodale, *The University of Western Ontario*
4:00 – 4:05	**Closing Remarks**

Keynote Speech

Visual Routes to Knowledge and Action

Dr. Melvyn A. Goodale, *The University of Western Ontario*

Visual systems first evolved not to enable animals to see, but to provide distal sensory control of their movements. Vision as 'sight' is a relative newcomer on the evolutionary landscape, but its emergence has enabled animals to carry out complex cognitive operations on representations of the world. In the more ancient visuomotor systems, there is a basic isomorphism between visual input and motor output. In representational vision, there are many cognitive 'buffers' between input and output. Thus, in this system, the relationship between what is on the retina and the behaviour of the organism cannot be understood without reference to other mental states, including those typically described as "conscious". The duplex nature of vision is reflected in the organization of the visual pathways in the primate cerebral cortex. The dorsal 'action' stream projecting from primary visual cortex to the posterior parietal cortex provides flexible control of more ancient subcortical visuomotor modules for the control of motor acts. The ventral 'perceptual' stream projecting from the primary visual cortex to the temporal lobe provides the rich and detailed representation of the world required for cognitive operations.

This might sound rather like Cartesian dualism—the existence of a conscious mind separate from a reflexive machine. But the division of labour between the two streams has nothing to do with the kind of dualism that Descartes proposed. Although the two kinds of visual processing are separate, both are embodied in the hardware of the brain. Moreover, there is a complex but seamless interaction between the ventral and the dorsal streams in the production of adaptive behavior. The selection of appropriate goal objects depends on the perceptual machinery of the ventral stream, while the execution of a goal-directed action is mediated by dedicated on-line control systems in the dorsal stream and associated motor areas. Moreover, as I will argue, the integration of processing in the two streams goes well beyond this. The dorsal stream may allow us to reach out and grasp objects with exquisite ease, but it is trapped in the present. Evidence from the behaviour of both neurological patients and normal observers shows that, by itself, the dorsal stream can deal only with objects that are visible when the action is being programmed. The ventral stream, however, allows us to escape the present and bring to bear information from the past – including information about the function of objects, their intrinsic properties, and their location with reference to other objects in the world. Ultimately then, both streams contribute to the production of goal-directed actions.

References:

Goodale, M.A. & Milner, A.D. (2004). *Sight Unseen: An Exploration of Conscious and Unconscious Vision.* Oxford, UK: Oxford University Press. 135pp.
Goodale, M.A. & Westwood, D.A. (2004). An evolving view of duplex vision: Separate but interacting cortical pathways for perception and action. *Current Opinion in Neurobiology* 14:203-211.

TALKS
Grand Ballroom East

Factors influencing object perception
8:20 – 9:20

Chaired by Aude Oliva, MIT

8:20 – 8:35
The unlikely perception of figural shape from 3D concavities
Anthony Cate[1] & Marlene Behrmann[2], [1]*University of Western Ontario*, [2]*Carnegie Mellon University*

According to established models of how observers distinguish figure/ground relationships and part boundaries, concavities should not be perceived to have figural shape. Three experiments used shape-from-shading images that could appear either concave or convex while depicting the same 2D outline shape.The results show that figural shape is perceived from 3D concavities in spite of the absence of global object-based attention and holistic shape encoding found with convexities. Concavities may exploit a secondary process for shape perception that allows figures to be perceived from elements that are highly perceptually independent.

8:35 – 8:50
Does emotion systematically influence visual perception?
Areti Chouchourelou[1], Toshihiko Matsuka[2] & Maggie Shiffrar [1], [1]*Rutgers University-Newark,* [2]*Stevens Institute of Technology & W.J Howe School Of Technology Management*

Neurophysiological data indicate that the neural mechanisms involved in the visual analysis of human action (Superior Temporal Sulcus) are highly interconnected with the neural mechanisms underlying emotion recognition (amygdala).Psychophysical studies were conducted to determine whether this neuro-physiological connection has perceptual repercussions. Experiment 1 identified point-light depictions of human walking that reliably conveyed various emotional states. In Experiment 2, these point-light walkers were masked with similarly moving points and observers performed a walker detection task. Walker detection was emotion dependent indicating that the visual analysis of human motion cannot be understood independently of the visual analysis of emotion.

8:50 – 9:05
Recognising novel deforming objects
Lewis Chuang[1], Quoc Vuong[1], Ian Thornton[2] & Heinrich Buelthoff[1], [1]*Max Planck Institute of Biological Cybernetics*, [2] *University of Wales*

Current theories of visual object recognition tend to focus on static properties, particularly shape. Nonetheless, visual perception is a dynamic experience as a result of active observers or moving objects. Here, we investigate whether dynamic information can influence visual object learning. Three learning experiments were conducted that required participants to learn and subsequently recognize different non-rigid objects that deformed over time. Consistent with previous studies of rigid depth-rotation, our results indicate that human observers do represent object-motion. Furthermore, our data suggest that dynamic information could compensate for when static cues are less reliable, for example, as a result of viewpoint variation.

9:05 - 9:20
Axes vs. averages: high-level representations of dynamic point-light forms
Javid Sadr[1], Nikolaus Troje[2] & Ken Nakayama[1], [1]*Harvard University*, [2]*Queens University*

In a simple, sparse display of a few moving dots on a plain background, one's perception of a human actor can be remarkably compelling and rich; individual dots spontaneously cohere into a single object that relays extensive information about both actor and action. Here we show subjects' high-level categories (male vs.female) and related judgments (ratings of femininity or attractiveness) suggest representations of vectors or axes exploiting differences between classes, not simply averages, norms or prototypes defined within classes. Thus, for example, the most average female is not the one judged most feminine or most attractive.

Selection of object features
9:30 – 10:30

Chaired by Andy Leber, Yale University

9:30 - 9:45
The distinctiveness effect reverses when using well-controlled distractors
Nicolas Davidenko & Michael Ramscar, *Stanford Univ.*

The "distinctiveness effect" in face memory holds that distinctive faces are recognized with more hits and fewer false alarms than typical faces. We propose that this effect is not due to a better mental representation of distinctive faces, but rather to systematic biases in standard recognition paradigms that render distinctive faces more distinguishable from distractors. To test this claim, we first replicate the classic distinctiveness effect using parameterized face silhouettes.We then create controlled face stimuli that render distinctive and typical faces equally distinguishable from distractors, and find a recognition disadvantage for distinctive faces.

9:45 - 10:00
Affective consequences of attentional inhibition depend on selection task
Brian Goolsby, Jane Raymond & Kimron Shapiro , *University of Wales, Bangor*

Fenske, Raymond, & Kunar (2004) demonstrated that inhibition associated with successfully ignored distractors in a visual search task led to more negative emotional appraisals of distractors relative to attended or novel stimuli. We investigated whether the emotional effects of this attentional inhibition were specific to selection for defining features of the irrelevant stimulus. Observers selected and discriminated one of two colorized faces by gender (defining feature) or by color (incidental feature), and later rated a grayscale target, distractor, or a novel face on trustworthiness. Distractors were devalued only when selecting gender, suggesting that inhibition is associated with object-defining features.

10:00 - 10:15
Contingent capture: A visuo-spatial effect? Evidence from electrophysiology
Emilie Leblanc, David Prime & Pierre Jolicoeur, *Universite de Montreal*

Although several behavioural studies tend to show that contingent capture reflects a visuo-spatial effect (e.g.Remington, Folk, & McLean, 2001), there remains the possibility that it is due to mechanisms such as filtering costs, decisional processes or processing of the salient distractor.In the present study, ERPs recorded during an attentional capture task revealed an N2pc wave to irrelevant distractors only when they matched the target selection cue, inducing capture. The N2pc reflecting millisecond-by-millisecond orienting of visuo-spatial attention (Luck & Hillyard, 1994), this new result provides strong evidence in favour of a visuo-spatial account of the contingent capture effect.

10:15 - 10:30
Interference from irrelevant color-singletons during serial search depends on attention being spatially diffuse
Bryan R Burnham[1], James H Neely[1,] Peter B Walker[1,2] & Neill W Trammell[1], [1]*University at Albany, SUNY*, [2]*Office of Naval Research*

Theeuwes (2004) suggested that a singleton does not capture attention during serial-search, because an observer's attentional window narrows, which precludes the singleton from being perceived as salient. We presented featurally similar letters in displays that had a circular/predictable pattern to one group and a random/unpredictable pattern to a second. We observed stimulus-driven attention capture from a color-singleton when the letter-locations were random/unpredictable, but not circular/predictable, though serial-search was evident for both displays. This suggests that with random-unpredictable displays attention is initially diffuse, because the letter-locations must be determined before serial-search, which allows salient singletons to capture attention.

Dynamics of object-based attention
1:00 – 2:00

Chaired by Steve Mitroff, Duke University

1:00 - 1:15
Differences in speed aid visual search and multiple-object tracking
David E Fencsik[1,2] , Jessenia Urrea[3], Skyler S Place[1], Jeremy M Wolfe[1,2] & Todd S Horowitz[1,2], [1]*Brigham and Women's Hospital*, [2]*Harvard Medical School*, [3]*Boston Latin School*

Do the same perceptual mechanisms support visual search and multiple-object tracking (MOT)? Ivry and Cohen (1992) showed that it is easier to detect fast-moving targets among slow-moving distractors than vice versa.We replicated this result in visual search, then ran the same observers in a MOT task, manipulating whether targets and distractors could be segregated by speed. While it was easier to track slow targets than fast with homogenous stimuli, it was easier to track fast targets among slow distractors than vice versa, as predicted from the search results. The results support a common representation underlying search and MOT.

1:15 - 1:30
Spatiotemporal cues for tracking multiple objects through occlusion
Steven Franconeri [1], Zenon Pylyshyn [2] & Brian Scholl [3], [1]*University of British Columbia*, [2]*Rutgers University*, [3]*Yale University*

Abstract: Objects constantly move in and out of view as they occlude one another. Given these disruptions, how do we maintain attention on currently important objects? We asked observers to track a set of objects as they moved behind occluding surfaces. Tracking was impaired when objects reappeared in the 'wrong' locations (displaced along the occluders' edges) but not when objects reappeared at the 'wrong' angles (continuing along drastically different trajectories), suggesting that the object's location at the time of occlusion, but not the direction it was traveling, was critical for maintaining object continuity across occlusion.

1:30 - 1:45
Effects of object-Based attention: sensory enhancement or prioritization
Ashleigh M Richard, Hyunkyu Lee & Shaun P Vecera, *University of Iowa*

There are at least two possible effects of object-based attention: sensory enhancement of an attended object or prioritized selection of an attended object. To distinguish these effects, participants performed a target discrimination task with congruent or incongruent flankers appearing on either the same or different object as the target. Sensory enhancement predicts greater flanker compatibility effects for same-object flanker. Prioritization account predicts little to no difference in flanker compatibility effect. The results showed reliably higher interference when the flankers appeared on the same object as the target, supporting sensory enhancement effects.

1:45 - 2:00
Attentional enhancement along the path of a sequence of saccades.
Timothy Gersch[1], Brian Schnitzer[1] , Priyesh Sanghvi[1], Barbara Dosher[2] & Eileen Kowler[1], [1]*Rutgers University*, [2] *University of California, Irvine*

Attending to the target of an upcoming saccade is important for ensuring that saccades land accurately. In natural tasks, however, saccades are made as part of sequences. We examined attention during nonrepetitive saccadic sequences by measuring the perceptibility of targets flashed during intersaccadic pauses. Perceptual performance along the saccadic path (including previously visited locations) was better than at off-path locations at equivalent eccentricities. Best performance was found at the upcoming saccadic goal. Thus, spatial attention need not be confined to the immediate saccadic goal and can enhance different task-relevant locations without compromising saccadic performance.

Object processing in other cognitive processes
2:10 – 2:55

Chaired by Kate Arrington, Lehigh University

2:10 - 2:25
Executive load in working memory induces inattentional blindness
Daryl Fougnie & René Marois, *Vanderbilt University*

When attention is engaged by a primary task, unexpected salient visual events may go undetected, a phenomenon known as inattentional blindness (IB).We previously demonstrated that maintaining information in visual working memory (WM) can induce IB (Todd et al., 2005).Here we show that manipulating information in WM also generates IB. An unexpected visual stimulus presented during the retention interval of a verbal WM task was more likely to be missed if the task involved rearranging letters into alphabetical order compared to simply maintaining that information. Thus, the engagement of amodal, executive stages of processing is sufficient to induce IB.

2:25 - 2:40
fMRI reactivation of the lateral occipital complex during delayed actions
Anthony Singhal, Liam Kaufman, Ken Valyear & Jody C Culham, *University of Western Ontario*

We employed a delayed reaching and grasping paradigm to investigate brain areas involved in delayed hand actions to 3-D objects. This paradigm allowed for the discrimination of three separate phases: visual stimulus presentation, memory maintenance, and action execution. Many cortical areas were activated during each of the three phases. The most interesting finding was that the object-selective area, the lateral occipital complex (LOC), which was activated by visual stimulus presentation, was re-activated during action execution when the visual stimulus was absent. This suggests that LOC is involved in retrieval of object features from memory, and/or mental imagery.

2:40 - 2:55
Control of speed and accuracy set points in manual-pointing movements
Joo-Hyun Song & Ken Nakayama, *Harvard University*

During manual-pointing tasks with multiple targets, a range of movement latencies and trajectories was observed, which indicates different speed and accuracy "set points." In this study, we examine what mechanism determines set points. We conducted two experiments, where trials of varying difficulty, requiring differentiated speed and accuracy set points, were mixed in various ways to manipulate levels of prior knowledge and cumulative learning. Surprisingly, results showed that the repetition of trials with the same difficulty differentiates set points for each condition, whereas perfect a prior knowledge of upcoming trials does not.

POSTER PRESENTATION
Sheraton Hall

Object perception

(1) Interactions between perceptual filling-in of visual phantoms and binocular
Ming Meng[1] & Frank Tong[2], [1]*MIT*, [2]*Vanderbilt University*

We devised novel visual displays to investigate the interactions between binocular rivalry and perception filling-in. Binocular rivalry leads to selective perception of one of two competing monocular stimuli, whereas visual phantom formation involves perceptual filling-in of a large gap between two collinearly aligned gratings. Behavioral results showed that rivalry led to periodic suppression of

visual phantom perception, and fMRI experiments revealed concomitant suppression of filling-in activity in areas V1 through V3. Our results demonstrate a tight coupling between early visual activity and conscious perception of illusory visual phantoms, and indicate that rivalry can determine the outcome of perceptual filling-in.

(2) A curvature-based model of shape perception: data and predictions
Frederic J.A.M.Poirier & Hugh R Wilson, *York University*

Radial frequency patterns are used to investigate intermediate-level shape perception properties. We developed a 2-stage model of shape perception: (1) object center is recovered using V4-like concentric units previously used for Glass patterns, and (2) curvature detectors applied to responses of oriented receptive fields respond best at points of maximum curvature, thus encoding their number, amplitude, and locations. Human and model performance is compared for detection, discrimination, size constancy, and lateral masking. Predictions are made for amplitude tuning, masking from oriented noise, and size-invariance for large objects. Tests of these predictions are underway.

(3) Evaluating processes of visual integration in center/surround stimuli
Jordan R Wagge & Lynn A Olzak, *Miami University*

Researchers have demonstrated a decrease in performance on spatial discrimination tasks when a center grating is surrounded by a high-contrast patterned annulus (Olzak & Laurinen, in press), with different effects for high and low contrast surrounds. The purpose of this research was to determine what processes are involved when information is integrated over space under varying surround contrast conditions. An uncertainty paradigm (Thomas & Olzak, 1996) was used to evaluate the relative contributions of these mechanisms. Two of three observers' preliminary data reject full summation of center/surround configurations, while data from the third observer does not.

(4) Background texture alters motion predictability in the launching effect
Olga Nikonova & Michael Young, *Southern Illinois University at Carbondale*

We examined the impact of spatial contiguity, spatial variability, and the type of background on the predictability of motion onset in a launching paradigm. As anticipated, larger and more variable gaps produced more prediction errors. However, these effects differed as a function of the background. For the solid background, the anticipated effects of gap size and variability were present. Texturing the background decreased accuracy and altered the effects of gap size and variability. The results reveal a complex mediating effect of the background on the predictability of a distal object's motion onset.

(5) Inducing the perception of locomotion
Songjoo Oh & Maggie Shiffrar, *Rutgers University*

Duncker's (1929) classic demonstration of induced motion indicates that a stationary object appears to move when surrounded by larger moving objects. The current experiments investigated whether motion induction might be influenced by factors other than size. Observers viewed a slowly translating tree and a person walking in place. Observers then identified the initial positions of the tree and walker. The results indicate that observers are significantly more likely to attribute motion to animate stationary objects than to inanimate translating objects. Thus, the perception of an object's animacy influences its perceived motion.

(6) Inverse illusory line motion: Implications for extended gradient theory
Sean Green & William C Schmidt, *University at Buffalo*

We present two studies of a novel variant of illusory line motion (ILM; Hikosaka, 1993), termed inverse-ILM. Inverse-ILM occurs when the disappearance of a probe line is preceded briefly by the removal of a nearby object, resulting in the shrinking of the probe line away from the object. Experiment 1 employed a motion-rating task to demonstrate inverse-ILM and assess the range of SOAs at which the effect occurs. Experiment 2 examined the prediction of gradient theories, particularly Extended Gradient Theory (Schmidt & Klein, 1997), that the effect should weaken as distance between the primer and probe is increased.

(7) Eye movements during symmetry detection
Andrew M Herbert, Jeff B Pelz, Andrew B Cutter, Jessica L Smagner, Allyson E Flickner & Christopher J Louten, *Rochester Institute of Technology*

Although bilateral symmetry is detected easily, it does not pop-out of a background as an indicator of object location and orientation should. For example, small patches of symmetry embedded in a random background are difficult to detect. We examined eye movements during this difficult symmetry detection task. Symmetry was detected within very few fixations on some trials, suggesting an automatic, low-level mechanism may be operating. Nonetheless, an exhaustive search for symmetry occurs on many trials, and we propose this occurs because of accidental symmetries in random patterns. These produce noise in the symmetry mechanism, interfering with search.

(8) The chromatic and achromatic components of perceived transparency
Jacqueline M Fulvio[1], Manish Singh[2] & Laurence T Maloney[1], [1]*New York University*, [2]*Rutgers University*

How do chromatic and achromatic components of a color display combine to determine perceived transparency? Observers viewed six-region transparency displays, presented stereoscopically. They adjusted the color and/or luminance of one of the filter sectors in order to maximize the percept of transparency. Setting reliability (1/variance) was compared across various conditions: achromatic, equiluminant color, and their superimposition. The results revealed that, although each component independently elicits perceptual transparency, their combination yields greater reliability than either in isolation. However, this benefit is contingent upon observers' settings along both dimensions being consistent with the convergence model of transparency.

(9) Evaluating grouping via emergent features: a systematic approach.
Mary C Portillo & James R Pomerantz, *Rice University*

When basic elements combine and Gestalt grouping occurs, Emergent Features (EFs) arise. We identify EFs through configural superiority effects (CSEs) in an odd-quadrant task where RT and accuracy are diagnostic. We present a systematic approach to creating EFs from the ground up and hierarchically. Starting with two dots we obtain proximity and orientation, with three dots we get linearity and symmetry, and with four dots surroundedness. Using lines we get collinearity and parallelism. Our results indicate that orientation, proximity and linearity are EFs. We also present pilot data for collinearity and parallelism.

Infant object perception

(10) Can 6 month olds integrate individual elements to discriminate contours?
Thomas Baker[1], Scott Adler[1], James Tse[2] & Peter Gerhardstein[2], [1]*York University*, [2]*Binghamton University*

Research has suggested that children's ability to perform contour integration of individual elements in the presence of stimulus noise develops slowly. The present study investigated 6-month-old infants' ability to integrate individual elements into whole contours. Six-month-old infants' discrimination of contours was tested via a cueing paradigm in which a circle or square contour, defined by the alignment of oriented Gabor patches, embedded in background noise of randomly oriented Gabor patches, served as a cue for the subsequent presentation of a target on either the right or left. Preliminary data suggest that infants can discriminate circle from square contours.

(11) Infants individuate pairs of objects
Marian L Chen & Alan M Leslie, *Rutgers University*
Can infants use shape information to individuate pairs of objects?12-month-old infants were familiarized either to two discs and two triangles presented sequentially (XX/YY condition) or to two sequentially-presented pairs each containing a disc and a triangle (XY/XY condition).All infants viewed a disc/triangle pair in the test outcome. Infants in the XX/YY condition looked significantly longer at the test outcome than infants in the XY/XY condition, suggesting that 12-month-olds can use shape information to individuate two distinct pairs of objects. Spatio-temporal grouping assists infants in forming representations of 'large' arrays of multiple objects.

Face perception

(12) Different strategies used for recognising different race faces
Michael B Lewis, *Cardiff University*

Two explanations for the own-race bias are considered. First, people employ one strategy for own-race and other-race faces but this strategy is tuned to own-race faces. Second, different strategies are employed for different races and the strategy for own-race faces is superior. Recognition accuracy was tested for the internal features of faces that had been learnt with external features that either made the faces look like an either own-race face or an other-race face. Accuracy was greater for faces learnt as own-race faces suggesting different encoding strategies are employed for different race faces.

(13) Adaptation to unknown faces influences recognition of famous faces
Nathan Witthoft & Jonathan Winawer, *MIT*

We use a recognition paradigm to show that adaptation can help or hinder face recognition. In the experiment subjects tried to guess the identity of morphs made between famous faces and unknown faces. Subjects were not informed of the identity of the famous faces. Adaptation to the unknown face used in a morph allowed subjects to recognize a morph containing less of a famous face relative to a baseline of no adaptation. However, adapting to an unknown face not used in a morph lowered subjects performance relative to baseline.

(14) Emerging configural properties at face value: Assessing characteristics of face perception
Mario Fific & James Townsend , *Indiana University*

We provided a rigorous test of the structure and organization of cognitive processes in the configural perception of faces, using the systems factorial technology. Application of mathematical tests, statistical tools and simulation methods revealed the exact organization of mental processes during face recognition: face features, such as eyes, and lips, were visually recognized in parallel. Most importantly, we showed that, during initial sessions, face representations are utilized

as a set of independent face features, while configural face properties emerged over the course of learning.

(15) Effects of viewpoint and size on face recognition
Yunjo Lee & Hugh R Wilson, *York University*

We investigated the representation of faces changing in views and size using a face recognition task. Subjects learned each synthetic face for 30 seconds (memory phase), and after a 15-minute delay, recognized the learned face from a distractor face in a 2AFC paradigm (recognition phase).Face view or size between the memory and recognition phases was manipulated. The results reveal that subjects did not show statistically different thresholds among the different angular difference conditions and among the different size conditions. Recognition of learned faces was viewpoint- and size-invariant, presumably reflecting identity-specific memory of faces.

(16) Face detection advantage: capture or odd-one out?
Cheng-Ta Yang, Chia-Hao Shih, Siskerodir Mindos & Yei-Yu Yeh, *National Taiwan University*

We investigated whether male faces could capture attention. The face detection advantage was not replicated with short (Experiment 1) or long (Experiment 2) duration. It is possible that the similarity of faces counteracted with the detection advantage, because image analysis showed that the change magnitude for face stimuli was small. In Experiment 3, one more face was added to reduce the likelihood for a face to capture attention. The results showed worse performance in detecting face changes. In Experiment 4, the visual search paradigm was used to rule out the odd-one-out account for the detection advantage.

Scene perception

(17) The shape of a view: Are rectilinear views necessary to elicit BE?
Karen K Daniels & Helene Intraub, *University of Delaware*

The availability of boundary extension (BE; tendency to remember having seen beyond the edges of a view) may have been overstated in previous research by limiting the stimuli to rectilinear views, which do not occur in the natural world. Three experiments were conducted to determine if BE would occur with more naturally occurring view-boundary shapes. Using qualitative and quantitative tests, viewers not only exhibited BE, but did so to the same degree, irrespective of shape. BE seems to be a fundamental characteristic of scene representation and may be supported by amodal processes that influence perception of occluded surfaces.

(18) Changing gist makes all the difference
Xandra Van Montfort, *Technische Universiteit Eindhoven*

Although large changes in an image can go unnoticed, it is assumed that changes which affect the gist of the image will be noticed. If this is true, people might be able to detect even small changes provided that they do affect the gist. We report on three experiments that test whether or not Gist Changes are better detected than other changes using a memory recognition paradigm. This research confirms the long standing hypothesis that gist plays a central role in difference detection.

(19) Effects of scene-based contextual guidance on search
Mark Neider & Gregory Zelinsky, *SUNY Stony Brook*

How does scene context guide search behavior to likely target locations? In three experiments, we had observers search for scene-constrained and scene-unconstrained targets in either a pseudo-realistic desert scene, or on a white background. In both cases, we found that scene-constrained targets were detected faster and with fewer eye movements. Observers also directed more initial saccades to target-consistent scene regions. We interpret these data as evidence for (1) a rapid top-down biasing of search behavior by scene context to target-consistent scene regions, and (2) an object-driven guidance mechanism that can, to some extent, restrict gaze in lieu of scene information.

(20) Experience-induced effects on the representation of scene structure
Anne S Warlaumont, Claudia M Hunter & Shimon Edelman, *Cornell University*

Does our ability to remember scenes depend on our experience with similarly structured scenes? We investigated people's ability to remember specific configurations of objects under conditions that were either similar or different from training along two dimensions: general location of the configurations within the scene and identity of the objects comprising the configurations. Subjects' performance was best when the configuration was in a different location from training but consisted of the same objects. Our results suggest that specifics of scenes are remembered most accurately for scenes that are slight variations on a familiar scene structure.

Control and performance

(21) The inhibition of task-sets is modulated by response retrieval
Yuko Hibi & Takatsune Kumada, *AIST*

Mayr and Keele (2000) reported that it takes longer to switch to a recently disengaged task-set than to a less

recently disengaged task-set. They suggested that this set-alteration cost (SAC) is due to inhibition of an abolished task-set. We examined the effect of task-sequences on the SAC using a cueing procedure. As a result, the SAC was reduced with no task repetition, relative to the random task-sequence. The reduction of SAC depending on the task-sequences interacted with response repetition. Therefore, the SAC is not simply due to the inhibition of the task-set. Response retrieval processes may also modulate the SAC.

(22) Stimulus grouping and stimulus-response compatibility
Akio Nishimura & Kazuhiko Yokosawa, *Univ. of Tokyo*

Tlauka and McKenna (2000) reported the reversal of spatial stimulus-response compatibility (SRC) effect when a stimulus presented in one side was a member of the superordinate unit most of which were in the opposite side. They explained that this reversal was elicited by visually mediated groupings. We revealed the effect of a top-down grouping factor by showing a mere assignment of multiple stimuli to one response without any visual grouping cue. The top-down grouping was enough to elicit the reversal of SRC effect. The results were discussed in terms of the spatial coding with respect to multiple frames of reference.

(23) The role of working memory in the prepared reflex
Oshrit Cohen & Nachshon Meiran, *Ben-Gurion University*

We examined whether instructions can lead to autonomous response activation even without practice.Eriksen and Eriksen's (1974) flanker compatibility paradigm was used to show that the flanker compatibility effect (FCE) is already present in the first trials following the S-R instructions, before any of the stimuli have been repeated. This first-trials FCE was present even when participants were strongly motivated to ignore the flankers and it disappearing under condition of working memory (WM) load. The findings suggest that intention, formed by instructions, is involved in forming a representation in WM that operates like a prepared reflex (Woodworth, 1938).

(24) Effects of manual control and automation on object-based attention
Jerzy Jarmasz, Jocelyn Keillor, Justin Hollands, *Defence R&D Canada*

Object-based attention has been used to explain human-machine interaction phenomena. However, unlike typical object-based attention studies, human-machine interfaces combine controlled and automated objects. Two experiments examined the effects of automation on object-based attention. Experiment 1 presented a manual control condition followed by automated control, producing an object advantage in the manual control condition only. Experiment 2 presented the automated condition before manual control, producing an object advantage in both conditions, but which was smaller for manual control. We suggest that different control modes favour different cues for perceptual organization to varying degrees depending on which mode was used first.

Object selection and interference

(25) Cognitive characteristics of proofreaders: how do they detect misprints?
Michiko Asano & Kazuhiko Yokosawa, *Univ. of Tokyo*

This study focuses on cognitive characteristics of professional proofreaders and control participants, who have never experienced proofreading as professionals, to apply them to effective methods of proofreading. A questionnaire and two experiments (a misprint detection task and a Stroop color-word task) were conducted. Proofreaders showed higher misprint detection ability than control participants. This was not accounted by their lexical knowledge, although most of both proofreaders and control participants think it is important for effective proofreading. The absence of Stroop interference for proofreaders suggested that they can inhibit contextual information, which might interrupt misprint detection.

(26) Benefit and cost of distractor previewing in a stroop task
Hsuan-Fu Chao & Yei-Yu Yeh, *National Taiwan Univ.*

When one is trying to name the color of a printed color word, it takes longer time when the meaning of the word is incompatible with the name of the color. In a previous study, we demonstrated that this Stroop interference effect could be reduced by pre-cuing the distracting word. In the current study, we demonstrated that the effect of distractor previewing is due to inhibition of the word. Moreover, when the stimulus onset asynchrony was decreased to 320 msec, the cuing effect was still observed. Therefore, participants can inhibit pre-cued distractors in a short time.

(27) Central interference on sensory-perceptual processing
Benoit Brisson & Pierre Jolicoeur, *Université de Montréal*

Prominent theories of dual-task interference postulate that interference occurs at central or later stages of processing. To investigate whether concurrent central processing interferes with sensory-perceptual processing, electrophysiological responses were recorded while participants performed a cross-modal psychological refractory period (PRP) paradigm. The occipital N1 component elicited by a visual display containing the second target was measured separately for overlapping

and non-overlapping auditory-Task1 conditions. The attenuation of the occipital N1 in the overlapping Task1 condition provides evidence that concurrent central processing can interfere with sensory-perceptual processing in cross-modal PRP paradigms. Implications for extent theories of dual-task interference will be discussed.

(28) Modularity in dual task interference: Evidence from the PRP paradigm
Hagit Magen[1] & Asher Cohen[2], [1]*Princeton University*,[2] *The Hebrew University of Jerusalem*

Single and dual task interference paradigms have been studied separately over the years, and have often portrayed different views of the architecture of the cognitive system. The present research combined single and dual tasks under a single framework. We embedded variations of the Stroop and flanker tasks in the PRP paradigm, and examined their interaction with the PRP effect. Our results indicate that performance limitations observed in the PRP dual task paradigm can best be explained by a modular architecture of the visual system, a view that has been suggested by models from single interference tasks.

(29) The underlying mechanism of negative priming: An electrophysiological study
Hsin-Mei Sun[1], J L Tsai[1], O J L Tzeng[2] & D L Hung[3] [1]*National Yang Ming University*, [2]*Academia Sinica, Taipei*, [3] *National Central University, Taoyuan, Taiwan*

Negative priming (NP) refers to a longer delay when responding to a recently ignored item. Sun, et al.(2004) reported that a prominent negative shift extending from 520-670ms of the event-related brain potentials (ERPs) might correlate with the inhibitory process in the NP condition. The present study examined whether selection difficulty would modulate both behavioral response and the negative shift of the ERPs.Subjects were performing an NP paradigm in which target-distractor separation was manipulated. The results showed that reducing the target-distractor separation increased NP and the late negativity. Thus, the late negativity might reflect the inhibitory process in NP.

(30) Target-distractor conflicts and the brain
Nicolas Robitaille & Pierre Jolicoeur, *Université de Montréal*

The N2pc component of the ERP occurs when subjects must select and discriminate a visual target from potential distractors. The goal of this research was to determine if the N2pc would be influenced by the level of conflicts between the target and the distractors. The level of conflicts was manipulated by presenting the selection-cue of the target either 100 ms earlier, at the same time, or 100 ms later than the target itself. The results indicated that the offset of the N2pc was delayed when the level of conflicts was increased, indicating that the N2pc could reflect a conflict-resolution processing.

(31) Capture of visual attention: new evidence from electrophysiology
Clayton Hickey[1], John J.McDonald[1] & Jan Theeuwes[2]
[1]*Simon Fraser University*, [2]*Vrije Universiteit Amsterdam*

We investigated the ability of salient yet task-irrelevant stimuli to capture attention. A component of the event-related potential - the N2pc - was used to track the allocation of attention to lateralized stimuli. In Experiment 1 a distractor-elicited N2pc was observed when a concurrent target was presented on the vertical meridian of the display. In Experiment 2 both the target and distractor elicited the N2pc component when presented to opposite visual hemifields; critically, the distractor-elicited N2pc preceded the target-elicited N2pc on these trials. The results demonstrate that attention was oriented to the distractor before being reoriented to the target.

Attention to Objects

(32) Bottom-up and top-down modulations of temporal attention in RSVP
Atsunori Ariga & Kazuhiko Yokosawa, *University of Tokyo*

In a one-target RSVP task (e.g., a white target letter among light-blue distractor letters), observers cannot correctly report an early target but can a late target. This phenomenon would reflect the temporally modulating process of attention in the beginning of the RSVP sequence to improve one's sensitivity to extract a target from the temporally congested stream. This study examined how the temporal modulation of attention can be achieved in the RSVP task. Results showed that the temporal modulation of attention was accelerated by top-down clues for the task, but achieved only with bottom-up inputs of the task.

(33) Voluntary and stimulus-driven attentional priority in visual cortex
John Serences[1], Benjamin Rosenau[1] & Steven Yantis[2]
[1]*Salk Institute for Biological Studies*,[2]*Johns Hopkins Univ.*

When multiple objects are present in a scene, they compete for representation in visual cortex. Selective attention resolves this competition in favor of behaviorally relevant stimuli (voluntary orienting) or in favor of highly salient stimuli, such as abruptly appearing new objects (stimulus-driven orienting).We used fMRI to show that the cortical response evoked by ignored distractors was suppressed compared to that evoked by voluntarily attended targets. However, high-salience (abrupt-onset) distractors were more resistant to attentional suppression than were low-salience distractors, suggesting that salient stimuli have a relatively high attentional priority, even when attention is highly focused elsewhere.

(34) The cost of search for multiple complex abstract targets.
Tamaryn Menneer[1], Mark E Auckland[1], Kyle R Cave[2] & Nick Donnelly[1], [1]*University of Southampton*, [2]*University of Massachusetts*

These experiments investigated dual-target search with complex stimuli and distinct targets. Searching for two targets simultaneously was found to be less efficient than performing two independent single-target searches. This finding was robust over two different methodologies. These results have implications for improving performance in practical applications involving visual search, and also for models of the top-down control of visual attention. Acknowledgements: Funded by the U.S.Transportation Security Administration.

(35) Grouping by trailing motion in MOT: evidence from divided attention task
Mutsumi Suganuma[1] , Katsumi Watanabe[1] & Kazuhiko Yokosawa[2] , [1]*National Institute of Advanced Industrial Science and Technology*, [2] *University of Tokyo*

The aim of this study was to investigate the effect of grouping by trailing motion (Suganuma and Yokosawa, in press) more directly. Observers were asked to report whether the probes, which were presented on two MOT items, were identical or not. Probes appeared on two-targets, on two-distractors, on one target and a distractor which was trailing, or on a target and distractor which had no motion relation. We found no difference in RT for same-different judging between the probe conditions when items moved on trailing trajectory. This indicates that distractor trailing with target is not inhibited, and equally attended.

(36) Object-based attention is meditated by spatial attention
Liqiang Huang, *University of California, San Diego*

We examine whether the selection of a rotating transparent surface (Valdes-Sosa et al 1998) is meditated by selection for dots locations. Two sets of dots rotate in opposite directions and subject report the rotating directions. In one condition (shuffling), some dots (both red and green) were randomly relocated after 60 msec. In the critical condition (switching), some red dots switch locations with the green dots after 60 msec. Subjects tracked almost perfectly despite shuffling, but the switching disrupted tracking in about 2/3 of trials. This supports that selection of surface is still meditate by selecting dots locations.

(37) The influence of spatial configurations on visual change detection: An account of bias changes.
Aysecan Boduroglu & Priti Shah, *University of Michigan*

In a series visual change detection experiments we demonstrated that visual and spatial configuration information is tightly bound. Participants were asked to compare two consecutively presented displays and determine whether the colors of the objects were changed. When objects were presented in identical locations or in different locations preserving the overall configuration rather than in new random locations, participants were more likely to report no color changes. This pattern remained the same regardless of encoding time, how the random locations were determined, how the configurations were preserved (e.g. by expansion or shrinkage), and the predictability of configuration changes.

(38) Working memory updating encompasses all updateable objects
Yoav Kessler & Nachshon Meiran, *Ben-Gurion University*

Participants were required to keep track of one or two working memory (WM) objects, having to update their values in 80% of the trials. Updating cost, defined as the difference between update and non-update trials, was larger when two objects were involved compared to when there was only one object. This finding was interpreted as evidence that the updating process encompasses both objects in WM, even though only one of them is actually updated. Also, we showed that this feature of WM updating is limited to objects in an "updateable" state only.

(39) The nature of space-invariant object-based attention
Michi Matsukura, Steven J Luck & Shaun P Vecera, *University of Iowa*

Visual attention can select objects as well as locations, and this object-based selection operates on both grouped-array and space-invariant levels (Vecera & Farah, 1994). Although findings from space-invariant selection closely match findings from object-based visual short-term memory (VSTM; e.g. Luck & Vogel, 1997), no study has empirically tested whether space-invariant object-based attention and object-based VSTM share the same underlying mechanisms. By loading the feature-report task with the change detection task, we observed the significant interference between these two tasks. These results suggest that space-invariant object-based selection may operate on representations of VSTM.

Object memory and learning

(40) Unitary architecture of attention in visual working memory
Shahin Nasr & Hossein Esteky , *Institute for Studies in Theoretical Physics and Mathematics*

Previous studies of visual memory showed that attention played a critical role in keeping features bounded

together in visual working memory but the nature of attention still remained unclear. In this study we checked if attention is an embedded mechanism that could be activated within each feature pool independently or is a single mechanism which has access to all visual features. We determined that attention is a single process that can t be focused on different features when they re presented sequentially even when they belong to different pools. Thus, the attention must be understood as a general grand process.

(41) On the nature of percepts that are transformed into VSTM representations
Adam Niese & Steven J Luck, *University of Iowa*

Visual working memory representations are formed from perceptual representations, and a backward mask can disrupt the perceptual representation before the transformation is complete. The present study manipulated the mask's characteristics to explore the nature of the perceptual representation. The first experiment demonstrated that an effective mask can be quite dissimilar from the remembered items. The second and third experiments showed that an effective mask can occur anywhere within the to-be-stored object's hemifield. We conclude that the perceptual representations underlying visual working memory representations are stored in an area with large and complex receptive field properties, such as inferotemporal cortex.

(42) Representation and comparison failures cause CB in a single task setting
D. Alexander Varakin, Daniel T Levin & Krista M Collins, *Vanderbilt University*

Change blindness (CB) occurs when observers miss changes that occur across views. The current experiments examined the causes of CB in a real-world setting. The stimuli changed on one salient feature. We tested memory for the changing and a non-changing feature to examine whether CB is associated with generally poor memory, or poor memory only for change-relevant features. We also used confidence ratings to test whether CB can have multiple causes within the same setting. The results suggest that CB can be caused by both a failure to represent change-relevant information and a failure to compare representations.

(43) Distorted response, not distorted memory
Cristina Sampaio, Ranxiao Frances Wang & Michelle Wright, *University of Illinois at Urbana-Champaign*

The current paper aims to investigate the nature of the mental representation underlying the category bias effect in spatial memory. Participants saw a target within a blank circle and later reproduced its location from memory. At the time of retrieval, a new category membership was introduced for each target. Participants showed systematic errors corresponding to the post-encoding category but not the originally encoded category, suggesting memory distortion did not occur during the encoding or retrieval period when only the original category is available. Thus, memory representations of object locations themselves are not distorted despite the distorted responses.

(44) Sequential versus simultaneous presentation of objects in visual spatial learning: Effects of directing attention to individual object locations
Naohide Yamamoto & Amy L Shelton, *Johns Hopkins University*

Participants learned room-sized environments by sequentially or simultaneously viewing objects. Experiment 1 compared sequential and simultaneous presentation of objects and found improved memory performance after the sequential presentation. Experiment 2 replicated this result by presenting the objects simultaneously in a dim room and directing participants' attention to each object sequentially with a spot-light. These results suggest that focusing attention to a small number of object locations enhances visual spatial learning. In addition, we found evidence for changes in strategy following sequential exposure, further suggesting the importance of considering presentation procedures when studying spatial learning mechanisms.

(45) Perceptual unitization as a mechanism for configural learning
Leslie Blaha & James Townsend, *Indiana University*

A configural perceptual representation is one in which all an object's features perceptually interact such that they are treated as a unitary whole, rather than a collection of individual parts. We investigate perceptual unitization of novel objects as a possible mechanism for configural learning. Consistent with model predictions, the unitization process results in a qualitative shift in processing, evidenced by a shift from limited to super capacity processing over the course of learning. Data suggest that unitization led to the joining of individual object features into a single configural perceptual representation.

(46) The role of motion variability in recognizing dynamic novel objects
Quoc Vuong[1], Alinda Friedman[2] & Andries Hof[1] , [1]*Max Planck Institute for Biological Cybernetics*,[2] *University of Alberta*

Motion contributes to object recognition, particularly if shape is visually similar or if an object moves the same way on different encounters. Here we examined how shape diagnosticity and motion variability may interact and contribute to recognition. Observers learned novel objects that rotated in depth in a constant or variable way

on each trial. For shape-nondiagnostic objects, constant motion lead to faster learning and variable motion resulted in more robust representations to changes to object dynamics. By comparison, for shape-diagnostic objects, performance was similar with both types of motion and remained sensitive to changes to object dynamics.

(47) Viewpoint dependency in the recognition of symmetric familiar objects
Ryosuke Niimi & Kazuhiko Yokosawa, *University of Tokyo*

Visual recognition of bilaterally symmetric familiar object was investigated. The objects were symmetric about the vertical midsagittal plane (the symmetry plane, Figure 1) and had no salient axis of elongation. The performances of matching object names to succeedingly presented object pictures were impaired by viewpoints which foreshorten the symmetry plane (the front- and top-views, Figure 2).The effect was not explained by viewpoint familiarity. This result suggests that a symmetric structure, which seems common in familiar objects, is utilized for the visual object recognition through extraction of the symmetry plane.

(48) Path and view memory when navigating with certainty and uncertainty
Jane Pitts & Brian Stankiewicz, *The University of Texas at Austin*

Often when navigating through a familiar environment, one can become disoriented. Reorientation may require one to backtrack through actions and observations that one experienced. The current study investigates path and view memory when navigating through familiar virtual environments under conditions of uncertainty and certainty. We found that participants' memory depth for the path and the views that they observed was the same (Path Depth=1.7, View Depth=2.0). However, participants memory depth nearly doubled when they were certain about their position versus when they were uncertain.

(49) Measuring the channel capacity of the human cognitive map
Sahar Nadeem & Brian Stankiewicz, *The University of Texas at Austin*

The retention and recognition of landmarks within large-scale spaces (buildings or cities) appears to play an important role in our wayfinding and localization abilities. The current study investigates whether the internal representation that is generated of a large-scale space is capacity limited. By varying the information content of an environment from 3 bits to 7 bits we found no evidence of a capacity limitation. However, we did find that humans consistently lose about 1.25 bits of information about the environment regardless of the number of bits required to fully represent an environment.

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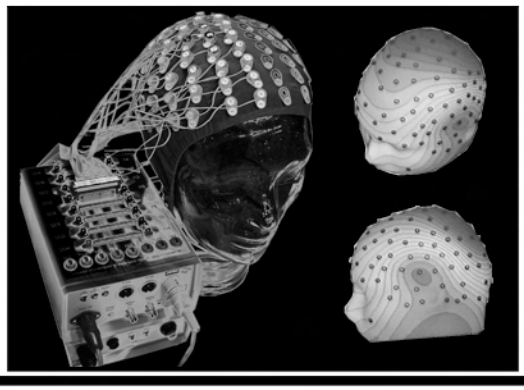

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Linda Langley: Cognitive aging, age-related changes in selective attention and visual search

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