PSY 407/507 F2009 – Sem Cortical Streams:
New Views on the Functions of Dorsal and Ventral Visual Streams

Instructor: Dr. Margaret Sereno
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Office Hours: Tues 4:00-5:00 or by appointment
Time: Tues 11:30-1:20 in room 139 Straub
CRN: PSY507 (16690) & PSY 407 (15124)

This seminar focuses on understanding the representation of shape and spatial processing in primate cortex. Decades of research suggest that visual processing proceeds along two separate cortical paths in temporal (ventral) and parietal (dorsal) cortices. The ventral stream is thought to be involved in encoding shape and color information required for object identification and discrimination, whereas the dorsal stream is generally associated with the representation of spatial relations as needed for visuomotor control.

The seminar explores recent developments in information coding and functional organization within the ventral and dorsal processing streams in the primate brain. It reviews 1) evidence for parallel processing in the primate visual system, 2) disorders of spatial perception, visual control of action, and visual recognition, 3) dissociations of visual function, 4) evidence for egocentric vs. allocentric coding, and 5) the representation of shape and space in both pathways. The goal of the seminar is to obtain an updated perspective on topics of the representation of objects and space in the primate brain and the functional organization of multiple visual pathways through the reading of original and review articles covering behavioral, neuropsychological, neuroimaging, and electrophysiological methods in humans and animals.

The course is offered for variable credit. All participants taking the class for 2 or more credits must make a presentation and lead a discussion on one of the topics. Participants taking the course for 3 credits are also required to write a short 1-page single-spaced reaction essay describing their insights and opinions of the research covered in the seminar and possible directions for future research. Those taking the course for 4 credits are also required to write a research proposal paper. Participant input is welcome regarding possible papers or topics for discussion not listed in the syllabus.

The syllabus and all readings will be posted on the course website (http://blackboard.uoregon.edu). Readings will be posted at least 1 week ahead of time. All participants are expected to come prepared with questions and comments on each week's readings.

Tentative Schedule and Topics:

Week 1 (Sept 28): **No Class** (Classes start Tues Sept 29th)
Week 2 (Oct 6): **Introduction and Organizational Meeting**
Week 3 (Oct 13): **Parallel Processing in the Visual System**
Week 4 (Oct 20): **No Class!! (Neuroscience Conference)**
Week 5 (Oct 27): **Disorders of Spatial Perception, Visual Control of Action, & Visual Recognition**
Week 6 (Nov 3): **Dissociations of Visual Function**
Week 7 (Nov 10): **Dissociations of Visual Function Cont.**
Week 8 (Nov 17): **Coding – Evidence for Egocentric vs. Allocentric Representations**
Week 9 (Nov 24): **Coding – Evidence for Egocentric vs. Allocentric Representations Cont.**
Week 10 (Dec 1): **The Representation of *Shape* in Dorsal and Ventral Streams**
Week 11 (Dec 8): **The Representation of *Space* in Dorsal and Ventral Streams**

Papers/Essays Due: Wednesday December 9th

Reading List

Note: The readings are selected from 2 books (Milner, A.D. & Goodale, M.A. (2006) The visual brain in action. Oxford: Oxford University Press; *and* Jeannerod, M. & Jacob, P. (2003) Ways of seeing: The scope and limits of visual cognition. New York: Oxford University Press Inc.) as well as journal articles.

Week 1 (Sept 28): No Class (Classes start Tues Sept 29th)

Week 2 (Oct 6): Introduction and Organizational Meeting

Week 3 (Oct 13): Parallel Processing in the Visual System

Milner & Goodale: Chapters 1-2
- Chapter 1: Introduction: vision from a biological viewpoint
- Chapter 2: Visual processing in the primate visual cortex

Jacob & Jeannerod: Chapter 2
- Chapter 2: Multiple pathways in the primate visual system

Creem, S.H. & Proffitt, D.R. (2001). Defining the cortical visual systems: "What", "Where", and "How". Acta Psychologia, 107: 43-68.

Supplement: Ungerleider L. & Mishkin M. (1982) Two cortical visual systems. In Analysis of visual behavior (ed. Ingle, D.J., Goodale, M.A., & Mansfield, R.J.W.), pp. 549-586. Cambridge: MIT Press.

Supplement: Jeannerod, M. & Jacob, P. (2005). Visual Cognition: a new look at the two-visual systems model. Neuropsychologia, 43: 301-312.

Week 4 (Oct 20): No Class!! (Neuroscience Conference)

Week 5 (Oct 27): Disorders of Spatial Perception, Visual Control of Action, & Visual Recognition

Milner & Goodale: Chapters 3-5
- Chapter 3: "Cortical Blindness"
- Chapter 4: Disorders of spatial perception and the visual control of action
- Chapter 5: Disorders of Visual recognition

Jacob & Jeannerod: Chapter 3
- Chapter 3: Dissociations of visual functions by brain lesions in human patients

Week 6 (Nov 3): Dissociations of Visual Function

Milner & Goodale: Chapters 6-8
- Chapter 6: Dissociations between perception and action
- Chapter 7: Attention, consciousness, and the coordination of behavior
- Chapter 8: Epilogue: twelve years on

Jacob & Jeannerod:
- Chapter 4: The varieties of normal human visual processing

Supplement: Goodale, M.A. (2008). Action without perception in human vision. Cognitive Neurophyschology, 25: 891-919.

Week 7 (Nov 10): Dissociations of Visual Function – Continued

Schenk, T. (2006). An allocentric rather than perceptual deficit in patient D.F. Nature Neuroscience, 9, 1369-1370.

Franz, V.H. & Gegenfurtner, K.R. (2008). Grasping visual illusions: Consistent data and no dissociation. Cognitive Neuropsychology, 25:920-50.

Bruno, N. & Franz, V.H. (2009). When is grasping affected by the Müller-Lyer illusion? A quantitative review. Neuropsychologia, 47:1421-33.

Supplement: McIntosh, R.D. & Schenk, T. (2009). Two visual streams for perception and action: Current trends. Neuropsychologia, 47:1391-96. [Please bring your computer if you would like a copy of this special issue of Neuropsychologia. I will bring a copy of it on my thumb drive.]

Supplement: Bruno, N., Bernardis, P., & Gentilucci, M. (2008). Visually guided pointing, the Müller-lyer illusion, and the functional interpretation of the dorsal-ventral split: Conclusions from 33 independent studies. Neuroscience and Biobehavioral Reviews, 32:423-37.

Week 8 (Nov 17): Coding – Evidence for Egocentric vs. Allocentric Representations

Colby, C.L. (1998). Action-oriented spatial reference frames in cortex. Neuron, 20: 15-24.

Boussaoud, D, & Bremmer, F. (1999) Gaze effects in the cerebral cortex: reference frames for space coding and action. Experimental Brain Research, 128: 170-180.

Sereno, M.I. & Huang. R.S. (2006) A human parietal face area contains aligned head-centered visual and tactile maps. Nature Neuroscience, 9:1337-1343.

Supplement: Duhamel, J.-R., Bremmer, F., BenHamed, S., & Graf, W. (1997). Spatial invariance of visual receptive fields in parietal cortex neurons. Nature, 389:845-8.

Week 9 (Nov 24): Coding – Evidence for Egocentric vs. Allocentric Representations Cont.

Committeri, G., Galati, G., Paradis, A.-L., Pizzamiglio, L., Berthoz, A., & LeBihan, D. (2004) Reference frames for spatial cognition: Different brain areas are involved in viewer-, object-, and landmark-centered judgments about object location. Journal of Cognitive Neuroscience, 16: 1517-1535.

Neggers, S.F.W., Van der Lubbe, R.H.J., Ramsey, N.F., & Postma, A. (2006) Interactions between ego- and allocentric neuronal representations of space. NeuroImage, 31: 320-331.

Vogels, R., Biederman, I., Mar, M., & Lorincz, A. (2001). Inferior temporal neurons show greater sensitivity to nonaccidental than to metric shape differences. Journal of Cognitive Neuroscience, 13:444-53.

Supplement: Booth, M.C.A. & Rolls, E.T. (1998). View-invariant representations of familiar objects in the inferior temporal visual cortex. Cerebral Cortex, 8:510-23.

Week 10 (Dec 1): The Representation of *Shape* in Dorsal and Ventral Streams Cont.

Konen, C.S. & Kastner, S. (2008). Two hierarchically organized neural systems for object information in human visual cortex. Nature Neuroscience, 11:224-31.

Lehky, S.R. & Sereno, A.B. (2007). Comparison of shape encoding in primate dorsal and ventral visual pathways. Journal of Neurophysiology, 97:307-19.

Janssen, P., Srivastava, S., Ombelet, S., & orban, G.A. (2008). Coding of shape and position in Macaque lateral intraparietal area. The Journal of Neuroscience, 28: 6679-90.

Supplement: Sereno A.B., Maunsell J.H.R. (1998). Shape selectivity in primate lateral intraparietal.cortex. Nature, 395:500-503.

Supplement: Sereno, M.E., Trinath, T., Augath, M., & Logothetis, N.K. (2002). Three-dimensional shape representation in monkey cortex. Neuron, 33:635-652.

Supplement: Peng, X., Sereno, M.E., Silva, A.K., Lehky, S.R., Sereno, A.B. (2008). Shape selectivity in primate frontal eye field. Journal of Neurophysiology, 100:796-814.

Week 11 (Dec 8): The Representation of *Space* in Dorsal and Ventral Streams

Op de Beeck, H., & Vogels, R. (2000). Spatial sensitivity of macaque inferior temporal neurons. Journal of Comparative Neurology, 426:505-518.

Aggelopoulos, N. C. & Rolls, E. T. (2005). Scene perception: inferior temporal cortex neurons encode the positions of different objects in the scene. European Journal of Neuroscience, 22:2903-2916.

Lehky, S. R., Peng, X., McAdams, C. J., & Sereno, A. B. (2008). Spatial modulation of primate inferotemporal responses by eye position. PLoS ONE, 3:e3492.

Supplement: Lehky, S.R. & Sereno, A.B. (manuscript). Population coding of space in dorsal and ventral pathways of the primate visual system.