

## CLPS 1580A: Visually-Guided Action & Cognitive Processes Fall 2012

Professor: Joo-Hyun Song (Assistant Professor, Dept of Cognitive Linguistic & Psychological Sciences)

Course Website: <https://canvas.brown.edu/courses/350881>

Class: Thu 4:00pm-6:20pm (Metcalf 103)

Office Hours: 2:30-4:00pm Thu or by appointment (Metcalf 234)

Email: [joo-hyun\\_song@brown.edu](mailto:joo-hyun_song@brown.edu).

### Course description

One of the main purposes of encoding visual information is to perform visually-guided actions to directly interact with the external world. This seminar will shed light on the behavioral and underlying neural mechanisms involved in integrating perception and cognitive processes, and converting them into action. We will also explore how visuo-motor behavior can provide a useful tool to study a wide range of conscious and unconscious cognitive processes including the current locus of attention, the nature of language representation, spatial representation of number, and high-level decision-making.

### Prerequisites

Undergraduates and graduate students from other departments must have taken an introductory course in psychology (PSYCH 0010), cognitive science (COGS0010), neuroscience (NEURO0010) or the equivalent. Students who lack this prerequisite may be admitted to the course on a case-by-case basis.

### Objectives

- To understand how visual information is encoded and converted into visually-guided action
- To understand how visuo-motor behavior can provide a useful tool to study cognitive processes
- To critically evaluate research articles
- To integrate new research ideas
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### Expected work & grading

This is a seminar which participants lead discussions of selected readings. These discussions are intended to be highly interactive, with the strengths and weaknesses of the readings openly debated.

**1. Reading & Participation (10%):** Class will be no fun and won't work unless you come prepared to discuss the readings!

**2. Weekly journal (15%):** Seminar participant will be asked to submit a one page weekly journal about one of the readings: 1) what you like about the article; 2) what you don't like about the article, and wish the authors had done better; 3) research question to pursue in the future **by noon the day before the discussion**, and bring it to class.

\*\* Upload .doc file: don't forget to include your name!

\*\* *Late postings will receive no points.*

\*\* *Presenters of the week don't have to write a journal.*

**3. Presentation of research articles (25%):** Seminar participants will be required to present at least one research article every 2 or 3 weeks. Slide (e.g., powerpoint) presentations are required. Keep in mind that these presentations are not intended to be long point-by-point summaries of an article. Instead, in addition to the summary, they should include your reaction to the reading like an extended weekly journal (e.g., general comments, specific agreements or disagreements with the theoretical arguments or empirical findings, or suggestions for further experiments or theoretical clarifications not considered by the authors, etc).

**4. Written research proposal & presentation (50%):** Each seminar participant will be asked to write a research proposal. This proposal must be related to topics that we covered. It must be original. That is, it must NOT be (1) a study that has already conducted by you or other researchers, or (2) a study that you have proposed for another course.

\* This is your opportunity to propose a research project you want to conduct. Some feasible proposals can be sponsored via independent study credits, UTRA, or honor thesis.

Outline (5%): Post a one page outline of the written research proposal (**due: Oct 24, noon**) and give 5 minute summary in class.

\*\* You are strongly encouraged to meet with the instructor well in advance to discuss suitable topics.

Presentation (20%): Each student should give a short 15-min ppt presentation on overviews of the background and their proposal, followed by a 5-min discussion. (**due: Nov 29 & Dec 6**)

Written Proposal (25%): The proposal should include:

(1) A title

(2) Project Description (limited to 3000 words excluding references; use Times 12 points, double space, and leave 1 inch margin on each side): It should include: **Abstract** (200 words maximum), a brief **review** of the relevant literature, **aims** and **hypotheses**, **research design** and **methods**, and predicted **results and interpretation** of possible outcomes. **References** should be cited where necessary.

\*\* The entire written proposal is due at **12pm on Dec 13 (Thursday)**. Late submission will receive no points.

### ***Preliminary course outline***

Here is a preliminary outline of the materials that we'll cover in this course. The exact timing of these lectures and the exact readings are very subject to changes. We may end up spending more time than is listed here on topics that strike you as especially interesting or difficult.

### ***Week 1: 9/6/2012: Introduction to the course***

#### ***Week 2: 9/13/2012: Perception and action***

\* Readings: weekly journal required any 1 of the 3

- (1) Ungerleider, L.G., and Mishkin, M. (1982) Two cortical visual systems. In *Analysis of visual behavior* (Ingle, D., et al., eds), 549-586, MIT Press
- (2) Goodale, M.A., et al. (1991) A neurological dissociation between perceiving objects and grasping them. *Nature* 349, 154-156
- (3) Shin, Y.K., et al. (2010) A review of contemporary ideomotor theory. *Psychol Bull*, 136, 943-74

#### Supplementary readings:

(s1) Rizzolatti, G., and Craighero, L. (2004) The mirror-neuron system. *Annu Rev Neurosci* 27, 169-192

#### ***Week 3: 9/20/2012: Perceptual illusion & action***

\* Readings: weekly journal required for any 1 of the 3

- (1) Aglioti, S., DeSouza, J.F., & Goodale, M.A. (1995). Size-contrast illusions deceive the eye but not the hand. *Curr Biol*, 5 (6), 679-685.
- (2) Franz VH, Gegenfurtner KR, Bühlhoff HH, Fahle M (2000). Grasping visual illusions: no evidence for a dissociation between perception and action. *Psychol Sci*. 11(1), 20-5
- (3) Flanagan, J.R., and Beltzner, M.A. (2000) Independence of perceptual and sensorimotor predictions in the size-weight illusion. *Nat Neurosci* 3, 737-741

#### Supplementary readings:

- (s1) Goodale, M.A., et al. (2008) Action rules: why the visual control of reaching and grasping is not always influenced by perceptual illusions. *Perception* 37, 355-366
- (s2) Ganel, T., et al. (2008) A double dissociation between action and perception in the context of visual illusions: opposite effects of real and illusory size. *Psychol Sci* 19, 221-225

#### ***Week 4: 9/27/2012: Attention & action***

\* *Readings: weekly journal required for any 1 of the 3*

(1) Deubel, H., and Schneider, W.X. (1996) Saccade target selection and object recognition: evidence for a common attentional mechanism. *Vision Res* 36, 1827-1837

(2) Frischen, A., et al. (2009) Seeing the world through another person's eyes: simulating selective attention via action observation. *Cognition* 111, 212-218

(3) Blangero, A., et al. (2009) Pre-saccadic perceptual facilitation can occur without covert orienting of attention. *Cortex* 9, 1132-1137

Supplementary readings:

(s1) Khan, A.Z., et al. (2011) The eye dominates in guiding attention during simultaneous eye and hand movements. *J Vis* 11, 1-14

(s2) Jonikaitis, D., and Deubel, H. (2011) Independent allocation of attention to eye and hand targets in coordinated eye-hand movements. *Psychol Sci* 22, 339-347

**Week 5: 10/4/2012 Action as a tool to study internal processes**

\* *Readings: weekly journal required any 1 of the 3*

(1) Land, M., et al. (1999) The roles of vision and eye movements in the control of activities of daily living. *Perception* 28, 1311-1328

(2) Finkbeiner, M., et al. (2008) Engaging the motor system with masked orthographic primes: a Kinematic analysis. *Visual Cognition* 16, 11-22

(3) Spivey, M.J., et al. (2005) Continuous attraction toward phonological competitors. *Proc Natl Acad Sci U S A* 102, 10393-10398

Supplementary readings:

(s1) Song, J.H., and Nakayama, K. (2009) Hidden cognitive states revealed in choice reaching tasks. *Trends Cogn Sci* 13, 360-366

(s2) Van der Stigchel, S., et al. (2006) Eye movement trajectories and what they tell us. *Neurosci Biobehav Rev Neurosci Biobehav Rev* 30, 666-679

**Week 6: 10/11/2012: Higher-level decision-making, social cognition, & action**

\* *Readings: weekly journal required for any 1 of the 3*

(1) Shimojo, S., et al. (2003) Gaze bias both reflects and influences preference. *Nat Neurosci* 6, 1317-1322

(2) Freeman, J.B., and Ambady, N. (2009) Motions of the hand expose the partial and parallel activation of stereotypes. *Psychol Sci* 20, 1183-1188

(3) Dshemuchadse M., et al. (2012) How Decisions Emerge: Action Dynamics in Intertemporal Decision Making. *JEP: General*, Epub ahead of print.

**Week 7: 10/18/2012: Unconsciousness & action/Research for perception and action integration**

\* *Readings: weekly journal required for any 1 of the 2*

(1) di Pellegrino, G., et al. (2005) Implicitly evoked actions modulate visual selection: evidence from parietal extinction. *Curr Biol* 15, 1469-1472

(2) Almeida, J., et al. (2008) Unconscious processing dissociates along categorical lines. *Proc Natl Acad Sci U S A* 105, 15214-15218

\*\* Research example presentation by Jeff Moher, Ph.D, Brown University

**Week 8: 10/25/2012: Proposal outline presentation**

\*\* 5-minute proposal outline summary presentation

**Week 9: 11/1/2012: Population coding in motor-related areas**

\* *Readings: weekly journal required for any 1 of the 2*

(1) Georgopoulos, A.P., et al. (1986) Neuronal population coding of movement direction. *Science* 233, 1416-1419

(2) Eisenberg, M., et al. (2010) Functional organization of human motor cortex: directional selectivity for movement. *J Neurosci* 30, 8897-8905

**\*\* Guest Lecture by Dr. Beata Jarosiewicz, Brain Gate, Brown University**

Supplementary readings:

- (s1) Gallivan JP *et al.* (2011) Decoding effector-dependent and effector-independent movement intentions from human parieto-frontal brain activity. *J Neurosci*, 31, 17149-68.  
(s2) Norman, K.A., *et al.* (2006) Beyond mind-reading: multi-voxel pattern analysis of fMRI data. *Trends Cogn Sci* 10, 424-430

**Week 10: 11/8/2012: Sensory-motor mechanism & decision-making**

**\* Readings: weekly journal required for any 1 of the 3**

- (1) Churchland, A.K., *et al.* (2008) Decision-making with multiple alternatives. *Nat Neurosci* 11, 693-702  
(2) Resulaj A., *et al.*, (2009) Changes of mind in decision-making. *Nature*, 461, 263-266.  
(3) Song J-H., Rafal RD., McPeck RM. (2011) Deficits in reach target selection during inactivation of the midbrain superior colliculus. *PNAS U S A*, 20, E1433-40.

Supplementary readings:

- (s1) Cisek, P., and Kalaska, J.F. (2010) Neural mechanisms for interacting with a world full of action choices. *Annu Rev Neurosci* 33, 269-298

**Week 11: 11/15/2012: Motor learning**

**\* Readings: weekly journal required for any 1 of the 2**

- (1) Hemond, C., *et al.* (2010) A distraction can impair or enhance motor performance. *J Neurosci* 30, 650-654  
(2) Krakauer, J.W., *et al.* (2005) Adaptation to visuomotor transformations: consolidation, interference, and forgetting. *J Neurosci* 25, 473-478

**\*\* Guest Lecture by Dr. Patrick Bédard, Department of Neuroscience, Brown University**

Supplementary readings:

- (s1) Shadmehr, R., *et al.* (2010) Error correction, sensory prediction, and adaptation in motor control. *Annu Rev Neurosci* 33, 89-108  
(s2) Paz, R., *et al.* (2004) Viewing and doing: similar cortical mechanisms for perceptual and motor learning. *Trends Neurosci* 27, 496-503

**Week 12: 11/22/2012: Thanksgiving-no class**

**Week 13: 11/29/2012: Final Project Presentation I**

*Each presentation is maximum 20 minutes (15 min presentation + 5 min Q & A)*

**Week 14: 12/6/2012: Final Project Presentation II**

*Each presentation is maximum 20 minutes (15 min presentation + 5 min Q & A)*

**\*\* Upload final draft of the written proposal by Thu at noon on Dec 13, 2012**

## QALMRI INSTRUCTIONS

Adapted from: Kosslyn, S.M. & Rosenberg, R.S. (2001). *Psychology: The Brain, The Person, The World*. Boston: Allyn & Bacon.

The QALMRI method provides a means for critically evaluating experiments, as well as for organizing your own experiment proposals. It helps you to find **connections between theory and data** by making explicit the question being asked, the approach used to answer it, and the implications of the answer.

### Q stands for Question

All research begins with a question, and the point of the research is to answer it. For example, we can ask whether a placebo is better than no action in alleviating depression. For most journal articles, the General Introduction should tell the reader what question the article is addressing, and why it is important enough that anyone should care about the answer. Questions fall into two categories: broad and specific. In your QALMRI, state both the broad and the specific questions being asked. Broad questions are typically too general to answer in a single experiment, although one should view the experiment as one step on a journey to answer the broad question. An example of a broad question might be "Does language influence perception?" This sort of question provides the general topic of the paper, and can only be answered through compiling many experimental results. In contrast, the specific question can typically be addressed in a single experiment or set of experiments. A specific question might be "If one language has a specific term for one color, and another language does not have any term for that color, will speakers of the two languages perceive the color differently?"

**Again, be sure to identify the broad and specific question relevant to your data collection.**

### A stands for Alternatives

Good experiments consider at least 2 possible alternative answers to a specific question, and explains why both answers are plausible. For example, the possibility that speakers of different languages will perceive colors differently is plausible based on evidence that top-down processes can affect perception. The alternative hypothesis, that language does not influence perception of color, is also plausible because color perception in particular might be impervious to top-down influences. That is, it might be based solely on properties of the visual system which are unaffected by language. When describing an existing article or when proposing an experiment, you should identify the alternatives the authors considered. **There are always at least 2 alternatives:** that factor X will show an effect, or that it won't (that a null result will be obtained). If possible, identify other alternative patterns as well.

### L stands for Logic

The logic of the study identifies how the experiment's design will allow the experimenter to distinguish among the alternatives. The logic is typically explained towards the end of the study's introduction, and has the following structure: If alternative 1 (and not alternative 2) is correct, then when a particular variable is manipulated, the participants' behavior should change in a certain way. For example, the logic of the color experiment would be: If a person's native language influences their perception of color, then speakers who have a term for a given color should respond differently to that color than speakers whose language contains no term for that color. Alternatively, if language does not influence color perception, then speakers who have a color term should respond no differently than speakers who lack

## Evaluation criteria for oral presentations

Category	Excellent (4)	Good (3)	Adequate (2)	Inadequate (1)
<b>Opening &amp; intro</b>	Clearly, quickly established the focus of the presentation, gained audience attention	Established focus by the end of the intro, but went off on a tangent or two. Gained attention.	Audience had an idea of what was coming, but the intro did not clarify the main focus.	Little or no intro, such that audience did not know the speaker's main focus.
<b>Clarity &amp; Organization</b>	Main points clearly stated and explained; logical, smooth organization	Main points fairly clear; some missing links or transitions.	Main points must be inferred by audience; holes are evident.	Presentation jumps among random topics. Main points unclear
<b>Content</b>	Evidence clearly presented. Thorough, knowledgeable interesting, logical. Assumptions and interpretations clear, and clearly identified.	Evidence perhaps not quite clearly separated from assumptions and interpretation of evidence, but story is logical.	Evidence, assumptions, and interpretation difficult to untangle from one another.	Lacks key observations. Evidence unclear. Appears largely opinion-based.
<b>Style &amp; Delivery</b>	Audience could see & hear speakers clearly. Effective pauses and verbal intonation.	Audience could see & hear speakers clearly, Most pauses & verbal intonation were effective.	Audience could mostly see & hear speakers. Speakers show some hesitation or uncertainty.	Speakers spoke to the screen or mostly to one person in the audience. Poorly timed. Appears to have not practiced.
<b>Visual Aids</b>	Well-selected, well-placed images and text. Figures clearly support ideas presented without extraneous info.	Reasonable images and text, not always well-placed. Figures clearly support ideas presented. May have some extra/missing info	Some chosen images extraneous to presentation or marginally support presentation. Too much/little extra detail.	Chosen images and text marginally useful. Too much/little extra detail. Lack of connection to topic.
<b>Summary</b>	Conclusions clearly stated. Summary integrated main points and brought the presentation to a logical & effective closure	Conclusions stated. Summary perhaps not quite fully supported by evidence shown, but main points clear.	Summary shown but poorly explained by speaker. Audience has to summarize for themselves.	Summary non-existent or very abrupt. Lack of synthesis.
<b>Addressing questions</b>	Questions handled with confidence and in a knowledgeable way. Speaker clearly demonstrated further depth of knowledge than just the information in his/her presentation.	Questions handled in a knowledgeable way but with some hesitation. Speaker clearly demonstrated further depth of knowledge than just the information in his/her presentation.	Speaker made a strong effort to answer questions, but lacked depth of knowledge beyond what he/she already presented.	Speaker lacked answers to obvious questions the audience would be likely to ask. Speaker struggled to link answer to content of presentation.