CLPS 2500: Core Topics in Perception
Spring 2013

Course Website: https://canvas.brown.edu/courses/774520
Class: Mon 3:00pm-5:20pm, Metcalf 105
Office Hours: 1:30-3:00pm Monday or by appointment
Email: joo-hyun_song@brown.edu.

Course description
We will discuss what is known about how we see and how this reveals general principles of the functioning of our brains. Research in perception involves the fields of art, philosophy, biology, mathematics, physics, medicine, psychology, and computer science. Thus, in order to understand our visual brain, we will combine different types of knowledge in creative ways. Topics include, but are not limited to optics, brain modules, motion, visual attention, color, surface, perceptual decision-making, and visually-guided actions.

Objectives
- To understand general topics in perception
- To critically evaluate research articles
- To integrate new research ideas in the field of perception

Expected work & grading

1. Reading & Participation (15%): Class will be no fun and won't work unless you come prepared to discuss the readings. Be prepared to discuss the following questions:

(1) Did you find an alternative explanation for any piece of data upon which an argument rested? How might you test whether your alternative is correct?

(2) Did you find any important ambiguities or unanswered questions in the body of work under consideration? How do you propose to deal with these problems through refinement in the theory and/or through additional research?

(3) Propose a new experiment using the basic techniques and methods used in this line of research. Provide a clear theoretical motivation for your proposed experiment, and discuss what would be learned from each of the possible outcomes.

(4) Propose an experiment, which uses a totally different technique/method/paradigm to address the same questions addressed in this line of research. How might this new technique strengthen or supplement the lessons available from the technique currently in use?

(5) Discuss theoretical or empirical connections between this line of research and another line of research not normally thought to be related to it.

2. Presentation of research articles (15%): Students will be required to present research articles at least 1~2 times with slides. Keep in mind that these presentations are not simply intended to be long point-by-point summaries of an article. Instead, in addition to the sufficient summary, they should include your reaction to the reading (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). The presenters are also expected to lead a discussion after their presentation.

3. Student initiated symposia (25%): Each group (2~3 students/group) will organize 1 hr symposia, which should deal with contemporary research topics in perception. Symposia can be organized along the lines of content (e.g., neural bases of object recognition, attentional

mechanisms, etc.) or methodology (e.g., classification images, TMS, etc.), but in every case talks within a symposium should focus on broader conceptual themes than a typical article presentation. Individual talks should be no less than 15 minutes and no more than 30 minutes, including time for discussion. Discussion time can be scheduled according to the groups discretion (e.g., after individual talks, concentrated at the end of a session, or a mixture of the two approaches). ***Each group is strongly encouraged to communicate with other groups and the instructor to avoid potential overlaps.***

*Proposals (**5%: Due: 2/18 12pm**):* Each group requires writing one proposal together. Proposals will be evaluated using a variety of criteria including scientific merit, theoretical innovation and/or breadth, methodological innovation and/or diversity, and overlap (*less being better*) with our regular class topics. Symposia often benefit from a diversity of perspective.

The proposal should include:

1) Title:
2) List of Members:
3) Description of Proposed Symposium (500 word limit)
4) Reading list: each speaker should provide up to 1~2 references to published articles relevant to the proposed talk and each group should decide 3~4 papers to the class to read.

5. Written research proposal & presentation (40%): 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.

Presentation (15%): Each student should give a short 20-min ppt presentation on overviews of the background and their proposal, followed by a short discussion.
Written Proposal (25%): The proposal should include:
(1) A title
(2) Name
(3) Project Description (limited to 3000 words excluding references): It should include:

a. Abstract (200 words maximum)
b. A brief review of the relevant literature
c. Aims and hypotheses
d. Research design and methods,
e. Predicted results and interpretation of possible outcomes.
f. References.

** The written proposal should be uploaded to the course website by 12pm on May 13th. Late submission will receive no points.* The proposal should be named "final_yourlastname" (example: final_johnson).

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.

1/28	Week 1	Introduction	
2/04	Week 2	Light, Optics, Eyes &Vision loss	G1: 12-18; G3: 43-61 Ostrovsky (2009); Striemer (2009) *Supplementary:* Sacks (1993); Palmer (1999)
2/11	Week 3	Brain, Neurons, Pathways & Modules	G4: 73-96; G3: 61- 68 Haxby (2001); Kanwisher (1997); Tarr (2000) *Supplementary:* Livingstone (1988); Kanwisher (2000);
2/18	Week 4	Visual memory & Visual attention I	Luck (1997); Harrison (2009) *Supplementary:* Alvarez (2004); Xu (2006); Chun (2011)
		SYMPOSIUM PROPOSAL DUE	
2/25	Week 5	Visual attention II & Consciousness	G6: 133-150 Green (2003); Jiang (2006); Anderson (2010) *Supplementary:* Desimone (1995); Dehaene (2006); Koch (2007)
3/04	Week 6	**SYMPOSIUM I**	TBA
3/11	Week 7	**SYMPOSIUM II**	TBA
3/18	Week 8	Perceptual decision-making & Actions	G7: 155-172 Ho (2009); Pesaran (2008); Yang (2007) *Supplementary:* Gold (2007); Song (2009); Cisek (2010)
3/25	Week 9	SPRING BREAK	
4/01	Week 10	Surface, Color & Motion *(Demo: cortical color and motion blindness)*	G5: 99-130 G9: 201-227; G8: 178-188, 192-193 He (1992) *Supplementary:* Cavanagh (1992)
4/08	Week 11	Ecological Approach (Prof. Bill Warren)	TBA
4/15	Week 12	**FINAL PRESENTATION I**	
4/22	Week 13	**FINAL PRESENTATION II**	
4/29	Week 14	READING PERIOD	
5/13		**WRITTEN PROPOSAL DUE**	

Full reading lists

G: Goldstein EB (2009) Sensation and Perception, 8th, Wadsworth Publishing.

Week 2

Ostrovsky Y, Meyers E, Ganesh S, Mathur U, Sinha P (2009) Visual parsing after recovery from blindness. Psychol Sci 20:1484-1491.

Striemer, C. L., Chapman, C. S., & Goodale, M. A. (2009). "Real-time" obstacle avoidance in the absence of primary visual cortex. . Proc Natl Acad Sci U S A, 106:15996–16001.

Supplementary:

Sacks O (1993) To see and not see. New Yorker.

Palmer SE (1999) *Psychophysical Methods* in Vision Science, MIT press, pp 665-674.

Week 3

Haxby JV, Gobbini MI, Furey ML, Ishai A, Schouten JL, Pietrini P (2001) Distributed and overlapping representations of faces and objects in ventral temporal cortex. Science 293:2425-2430.

Kanwisher et al. The fusiform face area: a module in human extrastriate cortex specialized for face perception. The Journal of neuroscience (1997) 17: 4302-4311.

Tarr, MJ, Gauthier I (2000). FFA: A flexible fusiform area for subordinate-level visual processing automatized by expertise. Nat Neurosci 3: 764-769.

Supplementary:

Livingstone M, Hubel D (1988) Segregation of form, color, movement, and depth: anatomy, physiology, and perception. Science 240:740-749.

Kanwisher N (2000) Domain specificity in face perception. Nat Neurosci 3:759-763.

Week 4

Luck SJ, Vogel EK (1997) The capacity of visual working memory for features and conjunctions. Nature 390:279-281.

Harrison, S. A., & Tong, F. (2009). Decoding reveals the contents of visual working memory in early visual areas. Nature 458:632–635.

Supplementary:

Alvarez GA, Cavanagh P (2004) The capacity of visual short-term memory is set both by visual information load and by number of objects. Psychol Sci 15:106-111.

Xu Y, Chun MM (2006) Dissociable neural mechanisms supporting visual short-term memory for objects. Nature 440:91-95.

Chun et al. A taxonomy of external and internal attention. Annu Rev Psychol (2011) vol. 62 pp. 73-101

Week 5

Green CS, Bavelier D (2003) Action video game modifies visual selective attention. Nature 423:534-537.

Jiang Y, Costello P, Fang F, Huang M, He S (2006) A gender- and sexual orientation-dependent spatial attentional effect of invisible images. Proc Natl Acad Sci U S A 103:17048-17052.

Anderson, B. A., Laurent, P. A., & Yantis, S. (2011). Value-driven attentional capture. Proc Natl Acad Sci U S A,, *108*(25), 10367–10371.

Supplementary:

Desimone R, Duncan J (1995) Neural mechanisms of selective visual attention. Annu Rev Neurosci 18:193-222.

Koch C, Tsuchiya N (2007) Attention and consciousness: two distinct brain processes. Trends Cogn Sci 11:16-22.

Dehaene S, Changeux JP, Naccache L, Sackur J, Sergent C (2006) Conscious, preconscious, and subliminal processing: a testable taxonomy. Trends Cogn Sci 10:204-211.

Week 6

SYMPOSIUM I -TBA

Week 7

SYMPOSIUM II -TBA

Week 8

Yang T, Shadlen MN (2007) Probabilistic reasoning by neurons. Nature 447:1075-1080.

Pesaran B, Nelson MJ, Andersen RA (2008) Free choice activates a decision circuit between frontal and parietal cortex. Nature 453:406-409.

Ho, T. C., Brown, S., & Serences, J. T. (2009). Domain General Mechanisms of Perceptual Decision Making in Human Cortex. J Neurosci, 29(27), 8675–8687.

Supplementary:

Gold JI, Shadlen MN (2007) The neural basis of decision making. Annu Rev Neurosci 30:535-574.

Song JH, Nakayama K (2009) Hidden cognitive states revealed in choice reaching tasks. Trends Cogn Sci 13:360-366.

Cisek P, Kalaska JF (2010) Neural mechanisms for interacting with a world full of action choices. Annu Rev Neurosci 33:269-298.

Week 10

He ZJ, Nakayama K (1992) Surfaces versus features in visual search. Nature 359:231-233.

Supplementary:

Cavanagh P (1992) Attention-based motion perception. Science 257:1563-1565.

Week 11

INVITED LECTURE -TBA

Example: Description of Proposed Symposium (500 word limit)

Sensation, Perception, Action, and Awareness

There appears to be a tight coupling between sensation, perception, action, and awareness. Before we can act, we need to learn something about the world by perceiving some aspect of it with our senses. This intuitive linear relationship is made explicit in robotics. In the classical 'hierarchical paradigm,' a robot gathers data through its sensory systems (sensation/perception), builds a model of the world (awareness), builds and executes an action plan (action), and then begins the cycle again. But does this linear relationship apply to humans? In this symposium, we address this question by explore the links between sensation, perception, awareness, and action. We focus on three phenomena: change blindness, subliminal perception, and blindsight.

We begin by examining the link between ***sensation and perception*** by studying change blindness (Simons & Levin 1997). Humans experience a rich visual world. By looking around and foveating, we acquire detailed visual information about the objects and scenes around us, leading to an impression of a uniformly detailed visual field. But research on change blindness shows that we are unable to detect large changes made during visual disruptions in photographs, motion pictures, and even real world interactions, despite the fact that information about these changes reaches our sensory systems. Thus, change blindness suggests that it is possible to have sensation without perception.

Next we investigate the connection between ***perception and awareness*** through subliminal perception. Studies involving subliminal priming suggest that conscious visual perception is dependent on unconscious perceptual processes. In one such study, the presentation of a subliminal cue prior to an ambiguous visual stimulus influenced subjects' responses when asked to identify the display (Agafonov 2010). Additionally, evidence exists in behavioral, imaging and electrophysiological research that demonstrates the effect of unconscious processes on subject response (Eimer & Schlaghecken 2003). We discuss several examples of subliminal priming, both visual and auditory, in order to illustrate that perception not only occurs without awareness, but that unconscious perceptual processes also shape awareness.

Finally, we address the link between ***awareness and action*** by examining blindsight. Blindsight patients have damage to visual cortex and are perceptually blind in a certain part (or all) of their visual field, but nevertheless retain the ability to respond to certain visual stimuli and perform visually-guided actions. For example, patients perform better than chance when forced to guess whether a stimuli is present in blind portions of the visual field (Weiskrantz 1996), and can even navigate through a cluttered hallway without any visual awareness (de Gelder, et al. 2008). These results show that it is possible to guide action with explicit awareness.

Taken together, these phenomena of change blindness, subliminal perception, and blindsight reveal the complex relationship between sensation, perception, action, and awareness, and show that a simple linear hierarchy cannot fully capture the richness of human perceptual experience.

Required Readings:

1. Agafonov, A. (2010) Priming effect as a result of the nonconscious activity of consciousness. *Journal of Russian and East European Psychology*, 48 (3), p17-32.
2. Simons, D.J., & Levin, D.T. (1997) Change blindness. *Topics in Cognitive Science,* 1 (7), p261-267.

3. Weiskrantz, L. (1996) Blindsight revisited. *Current Opinion in Neurobiology*, 6 (2), p215-220.

Supplementary Readings:

4. Eimer, M., & Schlaghecken, F. (2003). Response facilitation and inhibition in subliminal priming. *Biological Psychology*, 64, p7-26.
5. de Gelder, B., Tamietto, M., van Boxtel, G., Goebel, R., Sahraie, A., van den Stock, J., Stienen, B., Weiskrantz, L., & Pegna, A. (2008) Intact navigation skills after bilateral loss of striate cortex. *Current Biology*, 18 (24), p1128-1129.

Rubric for a Research Project **Student Name(s)_____Final Grade_____**

	Thesis/Problem/Question	Information Seeking/Selecting and Evaluating	Analysis	Synthesis	Documentation	Product/Process
4	Student(s) posed a thoughtful, creative question that engaged them in challenging or provocative research. The question breaks new ground or contributes to knowledge in a focused, specific area.	Student(s) gathered information from a variety of quality electronic and print sources, including appropriate licensed databases. Sources are relevant, balanced and include critical readings relating to the thesis or problem. Primary sources were included (if appropriate).	Student(s) carefully analyzed the information collected and drew appropriate and inventive conclusions supported by evidence. Voice of the student writer is evident.	Student(s) developed appropriate structure for communicating product, incorporating variety of quality sources. Information is logically and creatively organized with smooth transitions.	Student(s) documented all sources, including visuals, sounds, and animations. Sources are properly cited, both in-text/in-product and on Works-Cited/Works-Consulted pages/slides. Documentation is error-free.	Student(s) effectively and creatively used appropriate communication tools to convey their conclusions and demonstrated thorough, effective research techniques. Product displays creativity and originality.
3	Student(s) posed a focused question involving them in challenging research.	Student(s) gathered information from a variety of relevant sources--print and electronic	Student (s) product shows good effort was made in analyzing the evidence collected	Student(s) logically organized the product and made good connections among ideas	Student(s) documented sources with some care, Sources are cited, both in-text/in-product and on Works-Cited/Works-Consulted pages/slides. Few errors noted.	Student(s) effectively communicated the results of research to the audience.
2	Student(s) constructed a question that lends itself to readily available answers	Student(s) gathered information from a limited range of sources and displayed minimal effort in selecting quality resources	Student(s) conclusions could be supported by stronger evidence. Level of analysis could have been deeper.	Student(s) could have put greater effort into organizing the product	Student(s) need to use greater care in documenting sources. Documentation was poorly constructed or absent.	Student(s) need to work on communicating more effectively
1	Student(s) relied on teacher-generated questions or developed a question requiring little creative thought.	Student(s) gathered information that lacked relevance, quality, depth and balance.	Student(s) conclusions simply involved restating information. Conclusions were not supported by evidence.	Student(s) work is not logically or effectively structured.	Student(s) clearly plagiarized materials.	Student(s) showed little evidence of thoughtful research. Product does not effectively communicate research findings.
Teacher/Librarian Comments						

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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 to 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

Evalutation criteria for oral presentations

Category	Excellent (4)	Good (3)	Adequate (2)	Inadequate (1)
Opening & intro	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.
Clarity & Organization	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
Content	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.
Style & Delivery	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.
Visual Aids	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.
Summary	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.
Addressing questions	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.