

Syllabus

(Wed Jan 23, 2019 01:40 PM - Sat May 04, 2019 03:00 PM)

Advanced Topics in Human Cognition 830:402 Spring 2019

Perceptual Judgments and Decision Making

Instructor: Dr. Melchi M. Michel
Office: 125 Psychology Bldg. (Busch Campus)
Email: melchi.michel@rutgers.edu
Phone: (848) 445-8919
Office Hours: by appointment (schedule via email)

Lecture

Sections	Days	Time	First Meeting	Location
01	Mon. & Wed.	1:40pm – 3:00pm	01/23/2019	ARC 110

Course Description

In this course, we will examine contemporary studies of perception, with an emphasis on normative approaches to studying perceptual judgments and perceptual-motor decision making. The course will include an introduction to normative approaches (including Bayesian and Ideal Observer/Actor models), but will focus on reading, discussing, and critiquing recent primary source papers. Specific topics will include: visual motion perception, depth perception, visual perception of shapes and objects, combination of information across different senses (e.g., vision and hearing, vision and touch), visual search, and perceptual-motor interaction.

Course Materials

Readings:

There is no assigned textbook for this course. Instead, you will be assigned weekly readings, which will be a mix of original empirical research, book chapters, and review articles. See the tentative list below in the Course Schedule.

Course Requirements

Attendance

Attendance for this course is mandatory. Much of what you learn will come from leading and participating in in-class discussions, which you cannot do if you are not present in class. If you expect to miss one or two classes, please use the University absence reporting website <https://sims.rutgers.edu/ssra/> to indicate the date and reason for your absence. An email is automatically sent to me.

Participation

This course is a seminar (not a lecture-based course), which means that: - the course will center on in-class discussions of assigned topics and readings - for you (and your peers) to get the most out of the course, you must actively participate in these discussions - you must complete all readings, even those not assigned to you as a discussion leader

We will be delving into some fairly difficult readings and you will undoubtedly confront new terrain. However, as long as you do the following, we should be able to successfully use the class as a place to explore the readings, discuss their merits, and get a good understanding of modern approaches to the study of perception: - You must complete all the readings, even those not assigned to you (as a discussion leader). - For each assigned reading, you should come to class with a number of related discussion questions

In each seminar the group dynamics are different. However, you should keep the following general points in mind: - There is a tendency for some students to speak more than others. This is perfectly fine, as long as everyone always makes *some* contribution to the discussion. - Students will inevitably have different backgrounds; they will have taken different courses and read different things. However, your lack of familiarity with the material in a reading should not be a barrier to participation. - A simple contribution and/or discussion question is often best. For example, don't be afraid to ask what the authors of an article meant in a particular phrase, or to ask why the authors used a particular experimental approach to tackle a research question.

Discussion Leaders

Each week (starting the third week of classes), a group of two or three students will be assigned to serve as Discussion Leaders for the week's topic. They will be responsible for putting together a "mini-presentation" and leading the discussion for the week's readings. You can choose a topic within the first two weeks of class (it will be first-come first-served, with a maximum of three students per topic), otherwise, I will assign you to one of the available topics.

As a Discussion Leader, you should consider yourself a co-professor for the week, and strive to guide the other students in the class toward a deeper understanding of the readings. Often, this will require that you find and read additional articles that serve as important references in the assigned reading. The Discussion Leaders for the week can decide how to divide responsibilities among themselves (e.g., whether each Discussion Leader should act as leader for one of the week's readings, or whether each should be responsible for a particular section of the readings, etc.), but all Discussion Leaders should strive to have a thorough understanding of all the papers assigned for the week.

Each student will serve as a Discussion Leader at least *twice* throughout the course of the semester, once for an assigned topic and reading, and once for a student selected reading (see below).

Student-Selected Readings

You will each have to select a recent (2010 or later) course-relevant research article on perception to present as a Discussion Leader in the second half of the course (e.g., after you return from Spring Break). Your suggested readings will be due before Spring Break (see the Course Schedule below). I will try to assign you into weekly groups based on the topic of your selected readings.

Article Summaries & Questions:

This seminar relies on active participation, which is difficult to achieve if you don't complete the assigned readings. Thus to help motivate you to do the assigned readings ahead of time, you will be required to complete a brief (~250 word) summary of *one* article each week and to provide two discussion questions for *each* article assigned for that week (i.e., if we have two articles assigned in a week, this means that you'll have to provide one summary and four questions).

The questions should aim to spur discussion and/or to clarify some aspect of an experimental method or model that is not evident in the text. The summaries should not be mere restatements of article abstracts, but should contain descriptions, in your own words, of the authors' procedures and results, along with your own takeaway message.

The questions and summary will be due (via the Sakai Assignments tool) by **5pm every Sunday evening**, starting the third week of class. This will give me time to read and organize your questions so that they can be used to guide discussions in Monday's class.

Research Proposal Project & Presentation:

The research project will provide you with the opportunity to apply the background and concepts that you learned about in the course to a topic of interest to you to propose and design an idea for your own research study. Now that you have a working knowledge of modern perception research and of normative approaches to the study of perception, what questions do you feel remain to be answered? What would you like to know about how human observers make perceptual judgments, or how they use perception to guide actions? It is your opportunity to play the part of the experimenter. You can build off of the empirical work that we covered in class or design a study in a completely new domain. **Note: you are not required or expected to actually carry out this study**, just to design it. You should plan to have a rough idea ready by the first class following the midterm indicating the question(s) that you are interested in and your plan for investigating this question. You will need to schedule a meeting with me at least four weeks prior to the end of the semester to pitch your research idea and to receive feedback. At the end of the semester, you will have to prepare a project report detailing:

- Brief background on and motivation for your topic of interest (i.e., why are you interested in this topic, what is the current state of scientific knowledge regarding it?)
- A precise statement of your research question(s) and hypotheses.

- A detailed description of your experimental methods and procedure.
- A description of your anticipated analysis and results (include an explanation of why you chose the analysis you did, what your assumptions were, a description of the results of each analysis)

The write-up for your research proposal should be approached like a standard APA-style paper (e.g., with appropriate citations where necessary), but should not be overly long (i.e., 10-15 pages max.) and should focus on your proposed experimental approach and your motivation and justification for this approach.

You will also prepare a brief (15-20 min.) presentation to explain your research proposal to the class. Detailed information regarding the requirements the project will be posted on Sakai.

Grade Breakdown

Component	Weight
Attendance & Participation	40%
Weekly Summaries & Questions	20%
Mini-Presentations	20%
Research Proposal Project Write-up & Presentation	20%
Total	100%

Academic Integrity

Collusion (getting any form of assistance from other students or outside sources) on exams is prohibited. Students suspected of doing so will be brought up on charges before university's Office of Student Conduct, and penalties, up to and including expulsion, will be imposed for those found guilty. (See <http://academicintegrity.rutgers.edu/academic-integrity-policy/> for specifics).

Academic Accommodations

Should you require academic accommodations, you must file a request with the Office of Disability Services for Students (<https://ods.rutgers.edu/my-accommodations>). You should register with disability services as soon as possible. It is your responsibility to self-identify with the Office of Disability Services and to provide me with the appropriate documentation from that office at least one week prior to any request for specific course accommodations. There are no retroactive accommodations. The request form can be found at <https://ods.rutgers.edu/my-accommodations/exam-request>.

Anticipated Course Schedule

The schedule below is subject to change. Please check the Sakai site regularly for announcements, updates, and additional readings.

Date	Topics	Assigned Readings
Wed. 1/23	Course Orientation	
Mon. 1/28 Wed. 1/30	Review of Probability Theory & Introduction to Bayesian Ideal Observers	<p data-bbox="841 268 1369 294">OpenIntro Statistics Chapter 2 (Probability)</p> <p data-bbox="841 359 1425 474">Kersten, D., Mamassian, P., & Yuille, A. (2004). Object perception as Bayesian inference. Annual Review of Psychology, 55, 271–304.</p> <p data-bbox="841 537 1425 695">Kersten, D., & Mamassian, P. (2009). Ideal Observer Theory. In L. R. Squire (Ed.), Encyclopedia of Neuroscience, Volume 5 (Vol. 5, pp. 89–95). Oxford: Academic Press.</p>
Mon. 2/4 Wed. 2/6	Sensory Integration I: Combining Independent Measurements across (and within) Sensory Modalities	<p data-bbox="841 737 1425 894">Knill, D. C., & Saunders, J. A. (2003). Do humans optimally integrate stereo and texture information for judgments of surface slant? Vision Research, 43(24), 2539–2558.</p> <p data-bbox="841 957 1425 1115">Ernst, M. O., & Banks, M. S. (2002). Humans integrate visual and haptic information in a statistically optimal fashion. Nature, 415(January), 1–5.</p> <p data-bbox="841 1178 1425 1381">Battaglia, P. W., Jacobs, R. A., & Aslin, R. N. (2003). Bayesian integration of visual and auditory signals for spatial localization. Journal of the Optical Society of America A, 20(7), 1391.</p>
Mon. 2/11 Wed. 2/13	Combining Sensory Measurements with (Environmental) Prior Information	<p data-bbox="841 1430 1425 1545">Weiss, Y., Simoncelli, E. P., & Adelson, E. H. (2002). Motion illusions as optimal percepts. Nature Neuroscience, 5(6), 598–604.</p> <p data-bbox="841 1608 1425 1766">Geisler, W. S., Perry, J. S., Super, B. J., & Gallogly, D. P. (2001). Edge co-occurrence in natural images predicts contour grouping performance. Vision Research, 41(6), 711–724.</p> <p data-bbox="841 1829 1425 1944">Brainard, D. H., Williams, D. R., & Hofer, H. (2008). Trichromatic reconstruction from the interleaved cone mosaic: Bayesian model and</p>

Date	Topics	Assigned Readings
		the color appearance of small spots. Journal of Vision, 8(5), 15.
Mon. 2/18 Wed. 2/20	Combining Sensory Measurements with Previous Measurements (Memory & Tracking)	Körding, K. P., & Wolpert, D. M. (2004). Bayesian integration in sensorimotor learning. Nature, 427(January), 244–247. Kwon, O.-S., Tadin, D., & Knill, D. C. (2015). Unifying account of visual motion and position perception. Proceedings of the National Academy of Sciences, 112(26), 8142–8147.
Mon. 2/26 Wed. 2/28	Sensory Integration II: Robust Cue Integration	Shams, L., Ma, W. J., & Beierholm, U. (2005). Sound-induced flash illusion as an optimal percept. NeuroReport, 16(17), 1923–1927. Knill, D. C. (2007). Robust cue integration: A Bayesian model and evidence from cue-conflict studies with stereoscopic and figure cues to slant. Journal of Vision, 7(7), 5.
Mon. 3/5 Wed. 3/7	Ideal Actors I: Simple Sensorimotor Control	Trommershäuser, J., Maloney, L. T., & Landy, M. S. (2003). Statistical decision theory and the selection of rapid, goal-directed movements. Journal of the Optical Society of America. A, Optics, Image Science, and Vision, 20(7), 1419–1433. Battaglia, P. W., & Schrater, P. R. (2007). Humans Trade Off Viewing Time and Movement Duration to Improve Visuomotor Accuracy in a Fast Reaching Task. Journal of Neuroscience, 27(26), 6984–6994.
Mon. 3/11 Wed. 3/13	Ideal Actors II: Active Vision	Legge, G. E., Hooven, T. a, Klitz, T. S., Stephen Mansfield, J. S., & Tjan, B. S. (2002). Mr. Chips 2002: new insights from an ideal-observer model of reading. Vision Research, 42(18), 2219–2234. Najemnik, J., & Giesler, W. S. (2005). Optimal eye movement strategies in visual search.

Date	Topics	Assigned Readings
		Nature, 434(7031), 387–391.
		Group article selections due (Mon. 3/11)
Mon 3/18 Wed. 3/20	Spring Break	
Mon. 3/25 Wed. 3/27	Student-Selected Topic: Sensorimotor Planning	<p data-bbox="841 468 1430 674">Lyu: Kwon, O.-S., & Knill, D. C. (2013). The brain uses adaptive internal models of scene statistics for sensorimotor estimation and planning. Proceedings of the National Academy of Sciences, 110(11), E1064–E1073.</p> <p data-bbox="841 730 1430 936">Hadaya: Sengupta, S., Medendorp, W. P., Praamstra, P., & Selen, L. P. J. (2018). Uncertainty modulated exploration in the trade-off between sensing and acting. PLoS ONE, 13(7), 1–22.</p>
Mon. 4/1 Wed. 4/3	Student-Selected Topic: Motion Perception	<p data-bbox="841 978 1409 1230">Grant (1): Ueda, H., Abekawa, N., & Gomi, H. (2018). The faster you decide, the more accurate localization is possible: Position representation of “curveball illusion” in perception and eye movements. PLoS ONE, 13(8), 1–13.</p> <p data-bbox="841 1287 1409 1493">Grant (2): Aguilar-Lleyda, D., Tubau, E., & López-Moliner, J. (2018). An object-tracking model that combines position and speed explains spatial and temporal responses in a timing task. Journal of Vision, 18(12), 12.</p>
Mon. 4/8 Wed. 4/10	Student-Selected Topic: Sensory Coding & Saliency	<p data-bbox="841 1535 1430 1829">Rodriguez: Vasas, V., Hanley, D., Kevan, P. G., & Chittka, L. (2017). Multispectral images of flowers reveal the adaptive significance of using long-wavelength-sensitive receptors for edge detection in bees. Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioral Physiology, 203(4), 301–311.</p> <p data-bbox="841 1885 1360 1965">Khezri: Kaya, E. M., & Elhilali, M. (2014). Investigating bottom-up auditory attention.</p>

Date	Topics	Assigned Readings
Mon. 4/15 Wed. 4/17	Student-Selected Topic: TBA	<p data-bbox="841 195 1357 226">Frontiers in Human Neuroscience, 8, 327.</p> <p data-bbox="841 264 1052 289">McNamara: TBA</p> <p data-bbox="841 348 992 373">Pasek: TBA</p>
Mon. 4/22 Wed. 4/24	Student-Selected Topic: Oculomotor Planning	<p data-bbox="841 422 1414 537">Barber: Vergheese, P. (2012). Active search for multiple targets is inefficient. Vision Research, 74, 61–71.</p> <p data-bbox="841 600 1414 758">Vitale: Cain, M. S., Vul, E., Clark, K., & Mitroff, S. R. (2012). A Bayesian Optimal Foraging Model of Human Visual Search. Psychological Science, 23(9), 1047–1054.</p> <p data-bbox="841 821 1414 936">Schollenberger: Hoppe, D., & Rothkopf, C. A. (2019). Multi-step planning of eye movements in visual search. Scientific Reports, 9(1), 1–12.</p>
Mon. 4/29 Wed. 5/1 Mon. 5/4	Student Project Presentations	<p data-bbox="841 978 976 1003">Order TBA</p> <p data-bbox="841 1062 1073 1087"><i>Project reports due</i></p>