Cognition
<Still tentative syllabus>

CNS/Bi/SS/Psy 176

2017 Spring

Shinsuke Shimojo

12 Units (6-0-6)

TIME: Monday/Wednesday 2:00 PM - 3:55PM
LOCATION: Broad 300

The cornerstone of current progress in understanding the mind, the brain, and the relationship between the two is the study of human and animal cognition. This course will provide an in-depth survey and analysis of behavioral observations, theoretical accounts, computational models, patient data, electrophysiological studies, and imaging results on mental capacities such as attention, object representation and recognition, memory, cognitive development, and language.

Undergraduates CAN take the course with an instructor's permission. Prerequisite (or preferred background) includes an introduction to experimental psychology, neuroscience, cognitive science, computational vision, biomedical engineering, etc.

General Information

Time and Location
Monday 2:00 – 3:55 pm Broad 300
Wednesday 2:00 – 3:55 pm Broad 300

Instructor
Shin Shimojo: sshimojo@its.caltech.edu x3324

Teaching Assistants
Connie Wang: cxw@caltech.edu
Office Hours: TBA

Class wiki (contains latest announcements and downloadable readings, accessible only to Caltech IPs): http://wiki.cns.caltech.edu/wiki/index.php/CNS176_Spring_2015 <Need to be updated for 2017>

Textbooks & Readings

No particular textbooks will be assigned, but particular chapters will be listed in the reading list (and provided as pdfs). Each student has to choose a chapter or a paper from the reading list, ahead of time, to present in the subsequent weeks. Each may be asked to present several times / term, depending on the number of participants.
Course Requirements

A. Class Format:
   Each class is either a lecture with student presentations or a tutorial / discussion section. The
   former is devoted to a single topic (with few exceptions). Class will begin with a 30-40 minute lecture
   from one of the instructors. The rest of the class will consist of student presentations (typically two) and
   discussion. The latter comprises tutorials, student project presentation, or TA hour.

B. Class Presentations and Attendance:
   Each participant will be responsible for presenting and leading the discussion on material in a
   topic of their choice from the offered topics. Materials will be one or more of the papers listed as that
   topic’s readings. The organizational meeting (the first class on 3/30) will include a survey of individual
   preferences for class presentations and every effort will be made to allot participants their top
   choice. Student presentations will count toward 25% of the final grade. These presentations will be peer
   evaluated with an evaluation sheet. Presenters’ score will be based on the mean of these peer
   evaluations. To ensure attendance, 5% of your grade will be based on attendance, participation in
   discussions, and the peer evaluations you fill out.

C. Homework:
   Each participant should choose one of the two topics for each two-week period, read relevant
   papers (starting from the reading list), and write three new experimental questions that would be
   interesting to investigate and why (2-3 pages). Thus all together, three review papers are required (the
   deadline will be in 1 week after the two weeks). 10% x 3 = 30% of the final grade will be based on these
   review papers. Please make sure that you come to class on time.

D. Presentation on Tentative Project Idea (April 27)
   Short presentation in discussion section on the topic (and type) of term paper will occur on April
   27th. Please generate two slides and email them to the TA by April 26th at 5 pm. Slide 1 should include
   a summary of the type of project you choose and the topic it will be on (i.e. if the project is an experiment,
   discuss the problem you are working on and previous work). Slide 2 should contain an outline of your
   plan (i.e. if you choose to review papers, outline the debate you are going to investigate etc.). The
   presentation should give the class a general idea of your term paper topic, type, and goals. This
   presentation counts 10% toward the final grade.

E. Term Paper: 30% of the final grade will be based on the term paper, which is due on June 1st.
   Please select ONE of the options below for your term project; the details of each type will be reviewed
   during the discussion section.
   1) Review Paper
      Each student should select one topic covered in class and review this scientific field in depth.
      The student should, in particular, outline one key debate within the scientific field, not only arguing each
      side but also choosing which option fits the data the best. The student should write up this analysis in 10-
      15 page paper (including figures and references).
   2) Meta-Analysis Paper
      Each student should select one topic covered in class and review this scientific field in depth.
      The student should draw data from multiple papers within the field and use it to justify or disprove theories
      about the cognition in the field. The student should write up this analysis in 10-15 page paper (including
      figures and references).
   3) Proposal
      Each participant should select one of the questions they posed in their homework and write 5-10
      page grant “proposal” (including figures and references). Students should propose in their proposal an
      explicit and detailed method to investigate the proposed question, provide background about the state of
the art, and make an argument about how answering this question will advance the field. Proposals will be reviewed according to NSF’s Merit Review Criteria.

4) Project/Experiment

Each student should select one topic covered in class and conceive a new idea for a novel and scientifically interesting psychophysical experiment or neural model. The student will generate the experimental concept, the code or experimental design to carry it out, and finally analyze data (from running several subjects or simulating several cases). The student will write up the project details in a final report that is 5-10 pages (including figures and references).

No midterm or final exam.

Grading Scheme

Point Distribution:

- Class presentations (25%)
- Attendance and participation (5%)
- Homework (3*10% = 30%)
- Tentative project idea presentation (10%)
- Term paper (30%)

Policy:

Faculty members and postdoctoral fellows are welcome to participate in the class discussions and presentations. Undergraduate and graduate students who are taking the class for credit should keep in mind the following exercises upon which their final grade will be determined.
## Course Schedule <Very tentative; susceptible to changes>

<table>
<thead>
<tr>
<th>Date</th>
<th>Week day</th>
<th>Type</th>
<th>Description</th>
<th>Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>4/3</td>
<td>Mon</td>
<td>Lecture Meeting</td>
<td>Class Introduction, Organizational Meeting (Shimojo)</td>
<td>First class</td>
</tr>
<tr>
<td>4/5</td>
<td>Wed</td>
<td>Tutorial</td>
<td>How to give a scientific presentation (Wang) Basics in MATLAB programming (Wang)</td>
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<tr>
<td>4/10</td>
<td>Mon</td>
<td>Lecture Presentation</td>
<td>Visual Representation and Recognition (Shimojo)</td>
<td></td>
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<tr>
<td>4/12</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Postdiction / Hindsight (Shimojo/Wu)</td>
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<tr>
<td>4/17</td>
<td>Mon</td>
<td>Tutorial</td>
<td>Psychtoolbox (Wang) Experimental Design (Wang)</td>
<td></td>
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<tr>
<td>4/19</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Development and Evolution of Cognition (Shimojo)</td>
<td>HW1</td>
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<tr>
<td>4/21</td>
<td>Fri</td>
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<td></td>
<td>Last add day</td>
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<tr>
<td>4/24</td>
<td>Mon</td>
<td>Tutorial TA hour</td>
<td>Tutorial on term project types Review and discussion of homework questions (please bring 1 question to discuss)</td>
<td></td>
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<tr>
<td>4/26</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Face and Expression (Shimojo)</td>
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<tr>
<td>5/1</td>
<td>Mon</td>
<td>Presentation</td>
<td>Presentation of Tentative Term Project Plan</td>
<td>Project plan due</td>
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<tr>
<td>5/3</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Attention and Memory (Shimojo)</td>
<td>HW2</td>
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<tr>
<td>5/8</td>
<td>Mon</td>
<td>Lecture Presentation</td>
<td>Visual Awareness (Shimojo)</td>
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<tr>
<td>5/10</td>
<td>Wed</td>
<td>TA hour</td>
<td>Review and discussion of homework questions</td>
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<tr>
<td>5/15</td>
<td>Mon</td>
<td>Lecture Presentation</td>
<td>Time Perception (Guest: Yong-Jun Lin)</td>
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<tr>
<td>5/17</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Human magnetoreception? (Connie Wang)</td>
<td>HW3</td>
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<tr>
<td>5/22</td>
<td>Mon</td>
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<td>No class due to Vision Sciences Society conference</td>
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<tr>
<td>5/24</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Developmental disorder (Wang) / VSS conference</td>
<td>Last drop day</td>
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<tr>
<td>5/29</td>
<td>Mon</td>
<td>Holiday</td>
<td>Memorial Day (Institute Holiday)</td>
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<tr>
<td>5/31</td>
<td>Wed</td>
<td>Lecture Presentation</td>
<td>Retinal Prostheses and Sensory Substitution for the Blind (Guest: Dr. Noelle Stiles)</td>
<td>Last class</td>
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<tr>
<td>6/??</td>
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<td>Term paper due</td>
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<tr>
<td>6/12</td>
<td>Mon</td>
<td></td>
<td></td>
<td>Grade reports for seniors and graduates</td>
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<tr>
<td>6/21</td>
<td>Wed</td>
<td></td>
<td></td>
<td>Grade reports for undergraduates</td>
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List of topics and reading list
Readings may be downloaded from the CNS wiki (only accessible from Caltech IP addresses) at this address: http://wiki.cns.caltech.edu/wiki/index.php/CNS176_Spring_2015
See the latest reading list online.

Visual Representation and Recognition (Lecture by Shimojo)


Postdiction/Hindsight (Lecture by Shimojo)

- Fischhoff B. (1975). I knew it would happen, Remembered probabilities of once-future things, Organizational Behavior and Human Performance, 13, 1 - 16
Development and Evolution of Cognition (Lecture by Shimojo)


Face and Expression (Lecture by Shimojo)


Attention and Memory (Lecture by Shimojo)

- O'Regan, J.K. et al. (1999). Change-blindness as a result of 'mudsplashes'. Nature 398, 34 Scientific Correspondence.

### Visual Awareness (Lecture by Shimojo)


### Time Perception (Lecture by Yong-Jun Lin)

Different modes of learning and the brain (Lecture by Dr. Sangwan Lee)


Neural Networks (Lecture by Yazan Billeh)


Retinal Prostheses and Sensory Substitution for the Blind (Lecture by Dr. Noelle Stiles)

• Araque NO, Dunai L, Rossetti F, Listl L, Mirmehdi M et al. (2008). Sound Map Generation for a Prototype Blind Mobility System Using Multiple Sensors. *Service Robotics & Smart Homes: How a gracefully adaptive integration of both environments can be envisaged?*