

**Course Objectives:**

For the past half century, the computer has been the dominant metaphor for the mind, prompting many cognitive scientists to think about "software" issues independently of "hardware" issues. However, a growing number of scientists have recognized the utility of merging the disciplines of cognitive psychology and neuroscience into a unified field: cognitive neuroscience. The cognitive neuroscientist asks the question, "How do our brains give rise to cognition?" The quest to answer this question, which requires a thorough understanding of both the hardware and the software of the mind, is the focus of this course.

Although the "Decade of the Brain" (1990-1999) has come to an end, cognitive neuroscience is here to stay. Pick up the *Science Times* on almost any Tuesday, and you are likely to come across headlines such as: "Inside the Injured Brain, Many Kinds of Awareness" (04.05.05), "This is Your Brain on Motherhood" (05.08.05), and "Neuron Network Goes Awry and Brain Becomes an iPod" (07.122.05). Movies such as *Memento* and *Eternal Sunshine of the Spotless Mind* have their origins in cognitive neuroscience. And, cognitive neuroscience research is, for better or worse, fueling decisions made in medicine, education, public policy, and even national defense (e.g., Will brain-scanners replace metal-detectors in airports?). Cognitive neuroscience is all around you. The goal of this course is to immerse you in the research behind the headlines, so that you can be a better consumer (and perhaps creator) of the growing knowledge of the human brain.

**Instructor:** Dr. Sharon Thompson-Schill  
Tel: (215-57) 3-3533  
Email: [thompson@psych.upenn.edu](mailto:thompson@psych.upenn.edu)  
Office: 3810 Walnut Street, Room 208  
Office Hour: Tues 5-6 pm  
Out-of-office Hour: Thurs 10:00-11:00 am

**Teaching Assistant:** Ms. Kinjal Doshi  
Email: [kdoshi@psych.upenn.edu](mailto:kdoshi@psych.upenn.edu)  
Office Hour: Thurs 5:30-6:30 pm  
Office location & tel no. TBA

**Required Reading:**

Primary text: MS Gazzaniga, RB Ivry, GR Mangun. *Cognitive Neuroscience: The Biology of the Mind*. SECOND EDITION (2002)

Note. If you purchase a used copy of this book, be sure that you have the *second* edition, as it is substantively different from the *first* edition.

For some topics, additional required reading assignments will be posted on Blackboard.

**Recommended Reading:**

MF Bear, BW Connors, MA Paradiso. *Neuroscience: Exploring the Brain*. Second edition (2001).

WH Calvin, GA Ojemann. *Conversations with Neil's Brain*. (1994).

*APA Publication Manual*. Fifth Edition (2001).

RJ Sternberg. *The Psychologist's Companion*. Fourth Edition (2003).

**Blackboard:** <http://coursweb.library.upenn.edu>

Important information will be posted routinely on **blackboard**, including handouts, FAQs, exam answer keys, upcoming events, grades, links to useful resources, etc. All announcements posted on Blackboard are important and we will assume you have read them. If you have suggestions for the web page, please let us know.

**Grading Policies:**

Make-up policy: Do not miss an exam. With the exception of an authorized university absence, exams will **not** be rescheduled. If you miss an exam, that will automatically be the grade that is dropped when calculating your final grade for the course (see *Exams*).

Late policy: Papers must be turned in **by the beginning of class** (i.e., 1:30) on the day they are due. Any assignment received after this time will automatically receive a full letter grade deduction. Any assignment received more than 48 hours after this time will not be graded. There are no exceptions to this policy. You have been forewarned!

Re-grading: If you have a question or concern that there was an error in grading any of your work, you must submit your request **in writing** to have the work regraded, no more than one week after work was returned in class. No requests will be considered beyond this date. If you submit a request, your work will be regraded in entirety, and the final grade could be higher or lower than your original grade.

WATU credit: You have the **option** of enrolling in the writing-intensive version of this course (the program formerly known as WATU); additional WATU-requirements are noted in the syllabus. You must elect the WATU option **no later than 9/21** by completing the attached form. If you successfully complete the WATU requirements for the course, the designation “Writing Intensive Course” will appear on your transcript and, depending on your graduation year, your writing requirement may be partially fulfilled.

Plagiarism: Be sure you understand the University’s guidelines on Academic Integrity before submitting any assignment. See me or someone from the Office of Student Conduct (<http://www.upenn.edu/osc>) if you have any questions, especially about plagiarism (what it is and how it can be avoided).

Final grade: Your final grade will be a weighted sum of the following items:

Midterm Exams (best 2 of 3)	60%
Short Papers (2)	10%
Final Exam or Term Paper	30%

An opportunity for extra credit is described under “Short Papers” later in the syllabus.

*Schedule at a Glance*

Week	Recitation Topic (Mon 7pm)	Lecture Date	Lecture Topic	Important Deadlines
1		Sep 7	Introduction [1]	
2	Neuron Review [2]	Sep 12 Sep 14	Neuroanatomy and Neuropathology [3, 4]	
3	Neuroanatomy Lab [3] in Stem 102C	Sep 19 Sep 21	Methods [4] Perception [5]	<i>R: WATU enrollment deadline</i>
4	Journal Club 1	Sep 26 Sep 28	Visual systems [5, 6]	
5	<b>**on Wed**</b> Review Session for Exam 1	Oct 3 Oct 5	<i>No class – Yom Kippur</i> <b>Exam 1</b>	
6	Exam 1 Recap	Oct 10 Oct 12	Object Recognition [6]	<i>T: WATU topic due</i> <i>[Fri: Drop Deadline]</i>
7	Journal Club 2	Oct 17 Oct 19	Attention [7] Memory [8]	<b>R: Short Paper due</b>
8	<i>Fall Break</i>	Oct 24 Oct 26	<i>No class – Fall Break</i> Memory [8]	<b>R: Short Paper due</b>
9	Education/Career Planning	Oct 31 Nov 2	Working Memory and Cognitive Control [12]	<i>T: WATU reading list due</i> <b>R: Short Paper due</b>
10	Review Session for Exam 2	Nov 7 Nov 9	<b>Exam 2</b> Emotional/Social Cogn. [13]	<b>R: Short Paper due</b>
11	Exam 2 Recap	Nov 14 Nov 16	Emotional/Social Cogn. [s1] Language [9]	<b>R: Short Paper due</b>
12	Journal Club 3	Nov 21 Nov 23	Language [s2] <i>No class - Thanksgiving</i>	<i>T: WATU draft due</i>
13	<i>No recitation</i>	Nov 28 Nov 30	Development/Plasticity [15]	<b>R: Short Paper due</b>
14	Review Session for Exam 3	Dec 5 Dec 7	<b>Exam 3</b> Recap	

### *Exams*

**The purpose of the Midterm and Final Exams is to assess basic factual knowledge of topics covered in lectures and readings, to review critical concepts and theories that are important in the field of Cognitive Neuroscience, and to challenge you to think deeply about ideas presented in class. In addition, the Final Exam will also require you to synthesize information across diverse areas and perhaps think about topics in novel ways.**

There are three midterm exams scheduled during the semester. Each of these exams will be administered during the regular class time, and should last approximately 60 minutes (although you will be allowed to use the entire class time). The location of the exams will be announced in advance; be sure to check the Blackboard site to be certain that you arrive in the correct location for the exam.

The exams are scheduled as follows:

Exam 1	Oct 5	Lectures from Sep 7 – Sep 28; Lab on Sep 18, Chapters 1-5, part of 6
Exam 2	Nov 7	Lectures from Oct 10 – Nov 2, Chapters 6-8, 12
Exam 3	Dec 5	Lectures from Nov 9 – Nov 30, Chapters 9, 13, 15, and supp. readings

Two of these exams will contribute a total of 60% towards your final grade (30% each); the third exam score – with the lowest grade – will be dropped. If you are happy with your first two exam scores, you do not have to take the third exam.

**There are no make-up exams: With the exception of an authorized university absence, exams will not be rescheduled. If you miss an exam, that will automatically be the exam grade (0) that is dropped when calculating your final grade for the course.**

Each exam will consist of three types of questions: (i) multiple choice questions designed to assess detailed knowledge presented either in lecture *or* in readings; (ii) short answer questions designed to address basic knowledge about topics presented both in lecture and in readings; (iii) essay questions designed to assess in-depth knowledge and to integrate information across lectures or readings. Although the essay questions will be primarily graded based on content, clarity of expression and organization of ideas will not be ignored.

*A complete sample exam (and answer key) is available from the course Blackboard site.*

The final exam will be **cumulative**. It will last 2 hours, and will be worth 30% of your final grade. The final exam will follow the same general format as the exams, with multiple choice, short answer, and essay questions. The date of the final exam will be as set forth by the University. (As of this writing, the exam is tentatively scheduled for Wednesday, December 13, from 9 – 11 am, but you should check this.)

*If you elect to take the course for WATU credit, you will submit a term paper in lieu of taking the final exam.*

### *Short Papers*

**The purpose of the Short Papers is to gain experience reading and critically evaluating research articles in the field of cognitive neuroscience.**

Finding sources: For each Short Paper, you must select two related journal articles that fall under the assigned topic within the field of cognitive neuroscience. (If you aren't sure whether the topic encompasses your choices, check with the TA first.) A good test of whether they are related is that one probably will cite the other one. Both papers should report new experimental findings (i.e., primary sources); you may *not* choose a secondary source (i.e., a "review article" or chapter) as one of the two target articles, although you may use such references for background material if needed. At least one of the papers must be published in this century (i.e., 2000-2006) and neither should be older than 1990 (unless you get my permission).

Writing the paper: The Short Paper should contain the following three elements: (i) an introduction of the problem or issue that the two articles address; (ii) for each article, a *brief* summary of the methods and most significant findings, as well as any shortcomings or limitations; (iii) an integration of the two findings. *Be sure to explain the relation of the findings to each other (does one finding elaborate or build on a prediction of another; are the findings in disagreement, and if so, which is more convincing; if different methodologies are used, what unique contributions are made to the question by each?) as well as to the problem they address.* Sample Short Papers are available to download from the course Blackboard site.

The Short Paper may not exceed 1000 words (about 3-4 double-spaced pages). Note the total word count somewhere on your paper. Put your name on a separate cover sheet but not on the other pages of the paper (so you are anonymous when we are grading). Along with your paper, you must submit a copy of each article you are reviewing. Your paper may include additional references (it is a good idea!) but you should attach only the two articles that are the focus of your paper.

Submitting the paper: You will have six opportunities to submit a Short Paper. You are only **required to submit two** of these assignments: you must submit one Short Paper from Group A and one Short paper from Group B (see lists below). Each Short Paper will be worth 5% of your final grade. In addition, you have the **option of submitting one additional** Short Paper to earn extra credit; this could add an additional 5% towards your final grade. The extra Short Paper can be from either Group A or B.

The topics and due dates (by the beginning of class) for the Short Papers are as follows:

Group A: Object/Face Recognition <b>Oct 19</b> Attention/Neglect <b>Oct 26</b> Memory <b>Nov 2</b>		Group B: Cognitive Control <b>Nov 9</b> Emotional/Social Cognition <b>Nov 16</b> Language <b>Nov 30</b>
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**Checklist for Short Paper submission:**

- 1. Do you have two related, recently-published, empirical articles about the assigned topic?**
- 2. Have you included a full APA-style citation for each article *and* a copy of each article?**
- 3. Have you included all three elements of the assignment, described above?**
- 4. Is your name on a separate cover sheet *only*?**
- 5. Is your word count ( $\leq 1000$  words) noted somewhere in the paper (e.g., on the cover sheet)?**

### *Term Paper (WATU students only)*

**The purpose of the Term Paper is to gain in-depth knowledge about a particular subject area in the field of cognitive neuroscience and to develop your writing skills in organizing and synthesizing a large body of research, critically evaluating empirical and theoretical arguments, and expressing scientific ideas clearly.**

You have the option of submitting a term paper **instead of taking the final exam** by enrolling in the course for WATU credit. You must inform us of your intention to do so **by September 21**. After this date, you do not have the WATU option. However, if you sign up for WATU and change your mind or fail to meet the WATU requirements (see final page), you always retain the option of taking the final exam.

For your Term Paper, you must select some topic in the field of cognitive neuroscience that is of interest to you, and for which there is a sufficient literature to digest for your paper. You should read a number of secondary and primary references about this topic. Your paper should include a clear explanation of the problem of interest and a critical analysis of the current research findings in this area. The Term Paper must include the following components: (i) The paper must begin with an abstract that summarizes your research in no more than 200 words. (ii) The text of the paper should be around 12 pages and absolutely no longer than 5000 words (about 20 pages). (iii) The paper must end with a complete bibliography of work cited throughout the paper. You must include **at least 10 primary references** (i.e., empirical research studies), in addition to any secondary references (i.e., review papers) that you read. You should be clear to distinguish your ideas from ideas presented by other people, and follow APA format for citing references.

You may find it helpful to pick an area in which there is some controversy; in your paper you could present the relevant evidence for each side of the debate and provide your evaluation of which evidence is most compelling. The following are examples of topics, but this is by no means an exhaustive list: (i) *Are faces a special class of objects?* (ii) *Is semantic knowledge organized according to category or modality?* (iii) *Are there separate implicit and explicit memory systems?* (iv) *What is the relevant reference frame in neglect?* (v) *How homogeneous are the functions of prefrontal cortex?* (vi) *What is the best way to describe the specializations of the left and right hemispheres?* **You may also choose to expand one of your Short Papers into a longer, more in-depth analysis of a topic.**

*There is a series of assignments related to the term paper that you must complete:*

- Oct 10** Topic due: Brief summary (approx. 200 words) of proposed paper topic, including descriptions of at least 2 references. You will get advice on how to proceed, what references to start with, and other suggestions. (5% of term paper grade)
- Oct 31** Annotated reading list due: List of 10 references with 1-2 sentence description of main point of each article. You will get feedback on areas you may have overlooked. (10%)
- Nov 21** Term paper draft due: A complete draft of your term paper, including abstract and reference list. Review the late policy carefully, and make sure you have enough toner in your printer, a back-up copy of your document, no vacation plans for that week, etc. etc. well in advance of this deadline! You will get feedback on how to improve your paper. After this date you must schedule a writing conference to discuss your paper. (45%)
- Dec 13 (11 am)** Revision of term paper due: You should respond to suggestions for improvements to your first draft and incorporate additional research as advised. (40%)

### *Learning Outside the Classroom*

There will be a number of opportunities to participate in events outside of class where you can see real, live cognitive neuroscience in action. These events will be posted on the Blackboard Calendar and in some instances will be announced in class or by email. These include:

- **Patient case conferences.** Join a team of neurologists (and medical students and residents) for a discussion of fascinating, recent cases of patients with cognitive deficits following stroke or other neurological disorders. Case conferences take place at the hospital once a month (8 am on Sep 20, Oct 18, Nov 15) and require my permission to attend, due to space constraints. In past years, students have found these to be both interesting and informative; if you are interested, email me as early as possible to sign up.
- **Colloquia/Seminar on topics relating to cognitive neuroscience.** A number of groups on campus hold weekly or biweekly talks that may be related to topics we are discussing in class. Typically, these talks are given by leaders in the field of cognitive neuroscience. Attending a talk gives you an opportunity to hear the details of experiments that are only briefly described in your textbook or in lecture and to learn what is happening on the cutting edge of the field. Talks of interest may be held at:
  - Center for Cognitive Neuroscience (CCN) – montly Mon 12:00
  - Institute for Research in Cognitive Science (IRCS) – weekly Fri 12:00
  - Institute for Neurological Sciences (INS) – weekly Wed 4:00
  - Brain and Language Group – monthly Wed 3:00
- **Research participation.** The Center for Cognitive Neuroscience has ongoing research projects, ranging from cognitive testing to fMRI scans. We are routinely looking for participants for these studies: <http://www.experimentrix.com/ccn> Additional research participation opportunities will be posted on Blackboard, along with information and eligibility requirements. (Certain studies have exclusionary conditions that may not permit all students to participate.)

You are strongly encouraged to take advantage of as many of these opportunities as possible to extend your learning outside the classroom. To give you even more encouragement, you can write a summary of the event you attended. A Learning Outside the Classroom report can be substituted for any one of the Short Papers. Events that qualify for this assignment will be noted on the course web page. If the event is not listed on the Calendar, you must get approval before writing the paper. If you have questions about what information to include in this report, please see me prior to submitting it. Samples are posted on Blackboard.

**The due dates and length restrictions are the same as noted for the Short Papers.** Please note that you cannot submit two papers (i.e., one Short Paper and one Learning Outside the Classroom report) on the same day. Plan ahead.

You can only substitute a Learning Outside the Classroom report one time during the semester, although you may participate in the above events as many times as you would like.

*WATU students: You must submit two Short Papers. You can submit an LOTC report for a third (extra-credit) paper, but an LOTC report may not take the place of one of your two required Short Papers.*

If you have any questions, please ask!

## *Recitations*

You should be enrolled for both a lecture and a recitation section of this course. Unlike the lectures, which are required, the recitations sections are optional but highly recommended. There are several types of activities that will occur at the recitation (dates are as noted on the schedule):

- **Neuron Review.** Students enroll in this course with a wide variety of backgrounds. If your background does not include elementary concepts in neuroscience (or if you feel like you need a refresher), the first recitation is for you. As a guide, skim Chapter 2 prior to the recitation – if you are uncomfortable with the terminology and concepts introduced in this chapter (e.g., ionic equilibrium potentials, voltage gated channels, etc.), come to the recitation. **Attendance at this session is optional, although the material covered (Chapter 2) is required.**
- **Neuroanatomy Lab.** On Sept 19, a neuroanatomy lecture and lab will be held (**in Stemmler 102C**). This is material that will be covered on exams; it can all be found in the text, but all students are strongly encouraged to attend. Human specimens will be available for inspection, but handling of brain tissue is not required. If you are uncomfortable, please talk to us prior to the lab. This hands-on lab requires that we split into two groups; in addition to the regular recitation time, a second session will be scheduled for later that evening. **Attendance at one of these sessions is required.**
- **Review Sessions.** There are three scheduled review sessions, on the Monday before each exam. (Note that the Oct 2 recitation has been rescheduled for Wed, Oct 4 in observance of Yom Kippur.) The review sessions will be run by the TA and will be loosely structured in a question-answer format. They will begin at the scheduled time of 7pm, but unlike other recitation sessions, they may occasionally run for 2 hours. **Attendance at these sessions is optional and is open to everyone.**
- **Exam Recap.** At the recitation immediately following each of the first two exams, we will go over answers to the exam with a focus on common trouble spots. We will also discuss general tips for preparing for exams in this course. **Attendance at these sessions is optional and is open to everyone.**
- **Journal Clubs.** There will be two “journal club” sessions, during which a small group of students will gather during the recitation session to have an in-depth discussion with the Teaching Assistant about an empirical paper that has been briefly discussed in a recent lecture. Students must sign-up to attend the journal club in advance, and spaces will be limited to approximately 15 students. The article and room location will be announced in advance. The selected paper will pertain directly to material being discussed for that course unit. Students who attend the Journal Club may use the assigned article as one of their two required articles for the immediately following Short Paper deadline. **Attendance at these sessions is optional and is limited to the first 15 students who sign up (by email to TA).**
- **Educational/Career Planning.** There will be one recitation session devoted to a discussion with the Professor (and possibly a few guests) about education and career planning in fields related to psychology and neuroscience. This is conveniently scheduled during Advance Registration, and will include a discussion of related coursework at Penn and advice on getting involved in research here. Other topics will include: different career paths (PhD, MD, etc.), how to choose and get accepted into the right graduate program, and other career planning issues (e.g., combining work and family). Students must sign-up to attend this information session in advance, and spaces will be limited to approximately 25 students. **Attendance at this session is optional and is limited to the first 25 students who sign up (by email to TA).**

### *Writing Across the University (WATU) Requirements*

You have the **option** of enrolling in the writing-intensive version of this course (the program formerly known as WATU); additional WATU-requirements are noted in the syllabus. You must elect the WATU option **no later than 9/21** by completing the attached form. If you successfully complete the WATU requirements for the course, the designation “Writing Intensive Course” will appear on your transcript and, depending on your graduation year, your writing requirement may be partially fulfilled. (For more information about the critical writing program at Penn (including whether the writing-intensive version of this course fulfills certain requirements for you), visit the Writing Program’s web page at: <http://www.writing.upenn.edu/critical>)

You must decide if you are going to complete the WATU portion of the course by September 21. Please review the WATU requirements summarized on this handout, and return the attached enrollment form no later than September 21. After this date, you do not have the WATU option; if we do not hear from you, we will assume you have elected *not* to complete the WATU requirements. However, if you sign up for WATU and change your mind or fail to meet the WATU requirements, you always retain the option of taking the final exam.

#### *Additional WATU requirements:*

1. You must complete all four stages of the term paper assignment by the assigned deadline: (i) topic, (ii) annotated reading list, (iii) draft, and (iv) revision.
2. You must have at least two individual conferences with your Writing Fellow.
3. You must submit at least two Short Papers; you may still submit a Learning Outside the Classroom report as a third paper for extra credit. (That is, you may not submit only one Short Paper and one LOTC report.) You are strongly encouraged to write one of your Short Papers on your term paper topic.

***Writing Across the University (WATU) Enrollment Form***

Name: \_\_\_\_\_ (Please print legibly!)

Email: \_\_\_\_\_

PennID: \_\_\_\_\_

I have read and understood the following additional requirements for the WATU component of the course:

1. I will complete all four stages of the term paper assignment by the assigned deadline: (i) topic, (ii) annotated reading list, (iii) draft, and (iv) revision.
2. I will have at least two individual conferences with the Writing Fellow.
3. I will submit at least two Short Papers. I understand that I can only submit a Learning Outside the Classroom report for a third (extra-credit) paper, and I know that one of my two Short Papers can relate to my term paper topic.

I understand that if I fail to complete any of the above requirements, I will be automatically withdrawn from the WATU component of the course, and I will complete the standard course requirements (e.g., Final Exam) as described in the syllabus.

Signature: \_\_\_\_\_

***Return this form no later than September 21.***