COGNITIVE SCIENCE

Adviser for Columbia College and School of General Studies students:

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Department website: https://cogsci.barnard.edu/

Department Assistant: Maia Bernstein, mbernste@barnard.edu

Cognitive Science is the cross-disciplinary study of how the mind works, with a focus on perception, reasoning, memory, attention, language, decision-making, motor control, and problem solving. Cognitive scientists often compare minds to computers. In particular, they describe mental processes as computational operations on internal representations. For instance, perception is seen as a representation of the external world that results from sensory stimulation; learning is analyzed as the addition of new representations through interactions with the environment; reasoning is treated as the addition of new representations through operations on existing representations.

Cognitive Science is an interdisciplinary field: it draws on tools and ideas from psychology, neuroscience, linguistics, economics, computer science, and philosophy, with affiliated faculty in each of these disciplines. Psychologists study the computational operations that we use to solve specific tasks; neuroscientists study the implementation of those operations in the brain; linguists study the representations involved in communication; economists study the representations involved in decisions involving uncertainty and reward; computer scientists consider how the processes involved in human cognition fit into a more general theory of computations and a larger space of tasks; and philosophers ask fundamental questions about the nature of representation and computation.

Learning Objectives

Cognitive Science majors will gain fluency in computational methods; a capacity for rigorous and careful thought; a broad understanding of the affiliated disciplines; and a deep understanding of cognition.

Barnard Director: Professor John Morrison (Philosophy, Barnard)
Columbia Director: Professor Mariusz S. Kozak (Music, Columbia)

Steering Committee:
Mariusz S. Kozak (Music, Columbia)
John McWhorter (Linguistics, Columbia)
John Morrison (Philosophy, Barnard)
Kevin Ochsner (Psychology, Columbia)
Christopher A.B. Peacocke (Philosophy, Columbia)
Robert Remez (Psychology, Barnard)
Ann Senghas (Psychology, Barnard)
Michael Woodford (Economics, Columbia)
Rebecca Wright (Computer Science, Barnard)

Affiliated Faculty:
Mariam Aly (Psychology, Columbia)
Dima Amso (Psychology, Columbia)
Christopher Baldassano (Psychology, Columbia)
Peter Balsam (Neuroscience & Behavior, Psychology, Barnard)
Sian Beilock (President, Barnard)
Akeel Bilgrami (Philosophy, Columbia)
BJ Casey (Neuroscience & Behavior, Barnard)
Jessica Collins (Psychology, Barnard)
Lila Davachi (Psychology, Columbia)
Mark Dean (Economics, Columbia)
Aaron A. Fox (Music, Columbia)
David A. Freedberg (Art History & Archaeology, Columbia)
Melissa Fusco (Philosophy, Columbia)
Larisa Heiphetz (Psychology, Columbia)
Jenann Ismael (Philosophy, Columbia)
Niko Kriegeskorte (Psychology, Columbia)
Karen Lewis (Philosophy, Barnard)
Caroline Marvin (Psychology, Columbia)
Koleen McCrink (Psychology, Barnard)
Janet Metcalfe (Psychology, Columbia)
Christos Papadimitriou (Computer Science, Columbia)
Daphna Shohamy (Psychology, Columbia)
Rae Silver (Psychology, Columbia)
Lisa Son (Psychology, Barnard)
Alfredo Spagna (Psychology, Columbia)
Herbert Terrace (Psychology, Columbia)
Nim Tottenham (Psychology, Columbia)
Carl Vondrick (Computer Science, Columbia)
Alex White (Neuroscience and Behavior, Barnard)
Keren Yarhi-Milo (Political Science, Columbia)

Cognitive science is the cross-disciplinary study of how the mind works, with a focus on perception, reasoning, memory, attention, language, decision-making, motor control, and problem solving. It draws on tools and ideas from psychology, neuroscience, linguistics, economics, computer science, and philosophy. The major requirements are designed to provide breadth in the affiliated disciplines and depth in the student’s chosen area of specialization.

A major in Cognitive Science consists of seven required courses and four electives in a chosen area of specialization culminating in the senior capstone. The minimum number of courses is 13 and the minimum number of points is 39.

Required courses (7 classes)

- COGS UN1001 Introduction to Cognitive Science
- One course in each of four areas: psychology, neuroscience, philosophy, and linguistics.
- Two courses in a fifth area: mathematical and computational methods. These two courses must be selected in consultation with the program director to make sure they aren't redundant.
- Please see below for the lists of approved courses in each area.

Area of Specialization and Electives (four classes)

Students must choose an area of specialization when they declare the major and choose four electives to build expertise in that area.

- Possible areas of specialization include: spatial learning, musicality, consciousness, emotion, dynamic semantics, natural language processing, talker recognition, computer vision, audiovisual integration, decision science, and neuroeconomics.
The choice of specialization is flexible; there is not a predefined list. This is an opportunity for students to be creative; a student who has ideas about a new specialization that they would like to pursue may do so with the approval of the program director.

Although there is no predefined list, each student’s area of specialization and choice of electives must be approved by the program director, and there must be at least one faculty member affiliated with the program who has expertise in the student’s chosen area.

The program director will consult with a faculty member who has expertise in the student’s area of specialization to ensure that the student’s electives will provide sufficient preparation for the senior project.

Please see below for a list of courses that students might want to consider as possible electives (depending upon their specialization), but please note that this list is not definitive. Any Barnard or Columbia (or approved transfer) course that builds expertise in the student’s area of specialization may be counted as an elective with the approval of the program director.

Senior Capstone

Students may fulfill the Senior Capstone requirement in two ways: with a year-long senior project, or by taking two additional advanced courses.

The senior project is a year-long project in a student’s area of specialization under the supervision of a chosen advisor. The project could be an experiment or a paper.

Students who do senior projects must register for both COGS UN3903 Senior Project (3 points) and COGS UN3901 Senior Project Seminar (1 point) in the fall and COGS UN3904 Senior Project (3 points) and COGS UN3902 Senior Project Seminar (1 point) in the spring (8 points total).

The Senior Project Seminar is an opportunity for students to present their projects to each other.

While a year-long project is recommended, students may also satisfy the senior capstone requirement by taking two advanced courses, at least one of which must include a significant paper or project. The courses must be chosen in consultation with the program director and must be related to the student’s area of specialization. Both courses should be at the 3000-level or above.

Courses approved to count in each area:

**Psychology**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSYC BC2110</td>
<td>PERCEPTION-LECTURE</td>
</tr>
<tr>
<td>PSYC BC2115</td>
<td>COGNITIVE PSYCHOLOGY - LEC</td>
</tr>
<tr>
<td>PSYC UN2210</td>
<td>COGNITION: BASIC PROCESSES</td>
</tr>
<tr>
<td>PSYC UN2220</td>
<td>COGNITION: MEMORY AND STRESS</td>
</tr>
<tr>
<td>PSYC UN2430</td>
<td>COGNITIVE NEUROSCIENCE</td>
</tr>
</tbody>
</table>

Please note that PSYC UN2430 Cognitive Neuroscience may be used to fulfill either the Neuroscience requirement or the Psychology requirement, but not both.

**Neuroscience**

<table>
<thead>
<tr>
<th>Course Code</th>
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<tbody>
<tr>
<td>NSBV BC1001</td>
<td>INTRODUCTION TO NEUROSCIENCE</td>
</tr>
<tr>
<td>PSYC UN2430</td>
<td>COGNITIVE NEUROSCIENCE</td>
</tr>
<tr>
<td>PSYC UN2435</td>
<td>Social Neuroscience</td>
</tr>
<tr>
<td>NSBV BC2381</td>
<td>Visual Neuroscience: From the Eyeball to the Mind’s Eye</td>
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</table>

Please note that PSYC UN2430 Cognitive Neuroscience may be used to fulfill either the Neuroscience requirement or the Psychology requirement, but not both.

**Philosophy**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>PHIL UN2655</td>
<td>COGNITIVE SCIENCE AND PHILOSOPHY</td>
</tr>
<tr>
<td>PHIL UN3252</td>
<td>Philosophy of Language and Mind</td>
</tr>
<tr>
<td>PHIL UN3565</td>
<td>TOPICS IN COGNITIVE SCIENCE AND PHILOSOPHY</td>
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<tr>
<td>PHIL UN3912</td>
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Please note that only the “Perception” section of PHIL UN3912 counts.

**Linguistics**

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<tbody>
<tr>
<td>LING UN3101</td>
<td>INTRODUCTION TO LINGUISTICS</td>
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**Mathematical and Computational Methods**

**Logic and Decision Theory**

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<tr>
<td>ECON GU4850</td>
<td>COGNITIVE MECH # ECON BEHAVIOR</td>
</tr>
<tr>
<td>PHIL UN1401</td>
<td>INTRODUCTION TO LOGIC</td>
</tr>
<tr>
<td>PHIL UN3411</td>
<td>SYMBOLIC LOGIC</td>
</tr>
<tr>
<td>PHIL GU4561</td>
<td>PROBABILITY # DECISION THEORY</td>
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<tr>
<td>PSYC UN2235</td>
<td>THINKING AND DECISION MAKING</td>
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**Statistics**

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<td>STATISTICS FOR ECONOMICS</td>
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<tr>
<td>PSYC BC1101</td>
<td>STATISTICS LECTURE AND RECITATION</td>
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<tr>
<td>PSYC UN1610</td>
<td>STATISTICSC-BEHAVIORL SCIENTISTS</td>
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<tr>
<td>STAT UN1001</td>
<td>INTRO TO STATISTICAL REASONING</td>
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<tr>
<td>STAT UN1101</td>
<td>INTRODUCTION TO STATISTICS</td>
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<td>STAT UN1201</td>
<td>CALC-BASED INTRO TO STATISTICS</td>
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**Computer Science**

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<tr>
<td>COMS BC1016</td>
<td>Introduction to Computational Thinking and Data Science</td>
</tr>
<tr>
<td>COMS W1001</td>
<td>Introduction to Information Science</td>
</tr>
<tr>
<td>COMS W1002</td>
<td>COMPUTING IN CONTEXT</td>
</tr>
<tr>
<td>COMS W1004</td>
<td>Introduction to Computer Science and Programming in Java</td>
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<tr>
<td>COMS W1007</td>
<td>Honors Introduction to Computer Science</td>
</tr>
<tr>
<td>COMS W3134</td>
<td>Data Structures in Java</td>
</tr>
<tr>
<td>COMS W3136</td>
<td>ESSENTIAL DATA STRUCTURES</td>
</tr>
<tr>
<td>COMS W3137</td>
<td>HONORS DATA STRUCTURES # ALGOL</td>
</tr>
<tr>
<td>STEM BC2223</td>
<td>PROGRAMMING BEHAV SCIENCES</td>
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</table>
Possible electives:

- ANTH UN1009: INTRO TO LANGUAGE # CULTURE
- COGS GU4050: Natural and Artificial Neural Networks
- COGS GU4051: Natural and Artificial Neural Networks Lab
- COGS GU4800: Resource-Constrained Decision Making
- COMS W4170: USER INTERFACE DESIGN
- COMS W4701: ARTIFICIAL INTELLIGENCE
- COMS W4705: NATURAL LANGUAGE PROCESSING
- COMS W4731: Computer Vision I: First Principles
- COMS W4771: MACHINE LEARNING
- COMS W4772: Advanced Machine Learning
- ECON GU4202: ECON OF UNCERTAINTY # INFORMTN
- ECON GU4840: BEHAVIORAL ECONOMICS
- ECON UN4860: BEHAVIORAL FINANCE
- LING GU4430: COGNITIVE LINGUISTICS
- LING GU4206: ADV GRAMMAR AND GRAMMARS
- LING GU4376: PHONETICS # PHONOLOGY
- LING GU4903: SYNTAX
- MUSI GU2320: Introduction to Music Cognition
- MUSI GU4325: Introduction to Cognitive Musicology
- PHIL GU2685: INTRO TO PHIL OF LANGUAGE
- PHIL UN3685: PHILOSOPHY OF LANGUAGE
- PHIL UN3840: The Nature and Significance of Animal Minds
- PHIL GU4495: PERCEPTION
- PHIL GU4660: PHILOSOPHY OF MIND
- PSYC BC2107: PSYCHOLOGY OF LEARNING - LEC
- PSYC BC2129: DEVELOPMENTAL PSYCHOLOGY-LEC
- PSYC BC2163: Human Learning and Memory
- PSYC BC3164: PERCEPTION AND LANGUAGE
- PSYC BC3369: Language Development
- PSYC BC3372: Comparative Cognition
- PSYC BC3381: Theory of Mind and Intentionality
- PSYC BC3384: Social Cognition
- PSYC BC3390: CANINE COGNITION
- PSYC BC3394: METACOGNITION
- PSYC BC3399: HUMAN AND MACHINES
- PSYC UN2250: Evolution of Cognition
- PSYC UN2280: Developmental Psychology
- PSYC UN3270: COMPUT APPROACHES-HUMAN VISION
- PSYC UN3290: Self: A Cognitive Exploration (Seminar)
- PSYC UN3445: THE BRAIN AND MEMORY
- PSYC UN3450: Evolution of Intelligence, Animal Communication, # Language
- PSYC GU4202: Theories of Change in Human Development
- PSYC GU4222: The Cognitive Neuroscience of Aging (Seminar)
- PSYC GU4223: MEMORY # EXEC FUNCTIONLIFESPAN
- PSYC GU4225: CONSCIOUSNESS # ATTENTION
- PSYC GU4229: ATTENTION AND PERCEPTION
- PSYC GU4239: COG NEURO NARRATIVE FILM
- PSYC GU4242: Evolution of Language (seminar)
- PSYC GU4244: LANGUAGE AND MIND
- PSYC GU4270: COGNITIVE PROCESSES
- PSYC GU4280: CORE KNOWLEDGE
- PSYC GU4281: The Psychology of Curiosity
- PSYC GU4287: DECISION ARCHITECTURE
- PSYC GU4289: THE GAMES PEOPLE PLAY:PSYCH OF STRAT DEC
- PSYC GU4430: Learning and the Brain (Seminar)
- PSYC GU4435: NON-MNEMONIC FUNC OF MEMORY SYSTEMS
- SOAR AV4000: SOUND:Music, Math, and Mind

Required Courses

Required for all Cognitive Science majors:

**COGS UN1001 Introduction to Cognitive Science. 3 points.**

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>COGS 1001</td>
<td>001/00074</td>
<td>T Th 2:40pm - 3:55pm</td>
<td>John Morrison, 3</td>
<td>3.00</td>
<td>137/150</td>
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<tr>
<td></td>
<td></td>
<td>202 Altschul Hall</td>
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Required for Cognitive Science majors doing senior projects:

**COGS UN3901 Senior Project Seminar. 1.00 point.**

Discussion of senior research projects during the fall and spring terms that culminate in written and oral senior theses. Each project must be supervised by a cognitive scientist working at Barnard or Columbia

<table>
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<th>Course Number</th>
<th>Section/Call</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>COGS 3901</td>
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<td>John Morrison</td>
<td>1.00</td>
<td>20/32</td>
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<td></td>
<td></td>
<td>502 Diana Center</td>
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**COGS UN3902 Senior Project Seminar. 1.00 point.**

Discussion of senior research projects during the fall and spring terms that culminate in written and oral senior theses. Each project must be supervised by a cognitive scientist working at Barnard or Columbia

<table>
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<th>Course Number</th>
<th>Section/Call</th>
<th>Times/Location</th>
<th>Instructor</th>
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<td>Robert Remez</td>
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**COGS UN3903 Senior Project. 3.00 points.**

Senior Project in Cognitive Science

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<thead>
<tr>
<th>Course Number</th>
<th>Section/Call</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
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<tr>
<td>COGS 3903</td>
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<td>COGS 3903</td>
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<td>Mariusz Kozak</td>
<td>3.00</td>
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<td>COGS 3903</td>
<td>003/13996</td>
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<td>Janet Metcalfe</td>
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<td>COGS 3903</td>
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<td>John Glendinning</td>
<td>3.00</td>
<td>1/10</td>
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**COGS UN3904 Senior Project. 3.00 points.**

Senior Project in Cognitive Science

**Psychology:**

- PSYC GU4270: COGNITIVE PROCESSES
- PSYC GU4280: CORE KNOWLEDGE
- PSYC GU4281: The Psychology of Curiosity
- PSYC GU4287: DECISION ARCHITECTURE
- PSYC GU4289: THE GAMES PEOPLE PLAY:PSYCH OF STRAT DEC
- PSYC GU4430: Learning and the Brain (Seminar)
- PSYC GU4435: NON-MNEMONIC FUNC OF MEMORY SYSTEMS
- SOAR AV4000: SOUND:Music, Math, and Mind
**PSYC BC2110 PERCEPTION-LECTURE. 3.00 points.**
Prerequisites: PSYC BC1001 or permission of the instructor. Lecture course covering an introduction to problems, methods, and research in perception. Discussion of psychological studies of seeing, hearing, touching, tasting, and smelling. Note that this lecture can be taken without its affiliated lab, PSYC BC2109, however, if a student completes this lecture, she cannot enroll in the lab in a later semester. The following Columbia University course is considered overlapping and a student cannot receive credit for both the BC course and the equivalent CU course: PSYC UN1480 Perception and Attention; and PSYC UN2230 Perception and Sensory Processes.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>PSYC 2110</td>
<td>001/00406</td>
<td>M W 10:10am - 11:25am</td>
<td>Robert Remez</td>
<td>3.00</td>
<td>56/55</td>
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**PSYC BC2115 COGNITIVE PSYCHOLOGY - LEC. 3.00 points.**
Prerequisites: BC1001 or permission of the instructor.
Prerequisites: PSYC BC1001 Introduction to Psychology or COGS UN1001 Introduction to Cognitive Science or permission of the instructor. Lecture covering selected topics illustrating the methods, findings, and theories of contemporary cognitive psychology. Topics include attention, memory, categorization, perception, and decision making. Special topics include neuropsychology and cognitive neuroscience. Note that this lecture can be taken without its affiliated lab, PSYC BC2114, however, if a student completes this lecture, she cannot enroll in the lab in a later semester. The following Columbia University courses are considered overlapping and a student cannot receive credit for both the BC course and the equivalent CU course: PSYC UN1480 Perception and Attention; and PSYC UN2230 Perception and Sensory Processes.

<table>
<thead>
<tr>
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<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<td>Lisa Son</td>
<td>3.00</td>
<td>83/100</td>
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| Location       | 310 Milstein Center |

**PSYC UN2210 COGNITION: BASIC PROCESSES. 3.00 points.**
Spring 2023: PSYC UN2210

<table>
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<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
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<td>001/14052</td>
<td>M W 1:10pm - 2:25pm</td>
<td>Nora Isacoff</td>
<td>3.00</td>
<td>84/90</td>
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</table>

| Location       | 310 Fayerweather |

**PSYC UN2220 COGNITION: MEMORY AND STRESS. 3.00 points.**
CC/GS: Partial Fulfillment of Science Requirement
Attendance at the first class is mandatory.

Prerequisites: PSYC UN1001 or PSYC UN1010 or the instructor’s permission. Memory, attention, and stress in human cognition.

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
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<td>Janet Metcalfe</td>
<td>3.00</td>
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</table>

**PSYC UN2430 COGNITIVE NEUROSCIENCE. 3.00 points.**
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: PSYC UN1001 or equivalent introductory course in Psychology
Prerequisites: PSYC UN1001 or equivalent introductory course in Psychology
This course provides an in-depth survey of data and models of a wide variety of human cognitive functions. Drawing on behavioral, neuropsychological, and neuroimaging research, the course explores the neural mechanisms underlying complex cognitive processes, such as perception, memory, and decision making. Importantly, the course examines the logic and assumptions that permit us to interpret brain activity in psychological terms.

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| Location       | 501 Schermerhorn Hall |

**NSBV BC1001 INTRODUCTION TO NEUROSCIENCE. 3.00 points.**
This course is required for all the other courses offered in Neuroscience and Behavior. The course introduces students to the anatomy and physiology of the nervous system. The topics include the biological structure of the nervous system and its different cell types, the basis of the action potential, principles of neurotransmission, neuronal basis of behavior, sleep/wake cycles, and basic aspects of clinical neuroscience.

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<th>Instructor</th>
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<td>Alex White</td>
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<td>94/90</td>
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| Location       | 405 Milbank Hall |

**NSBV BC1001 INTRODUCTION TO NEUROSCIENCE. 3.00 points.**

Please note that PSYC UN2430 Cognitive Neuroscience may be used to fulfill either the Neuroscience requirement or the Psychology requirement, but not both.

**Neuroscience**

**NSBV BC1001 INTRODUCTION TO NEUROSCIENCE. 3.00 points.**

This course is required for all the other courses offered in Neuroscience and Behavior. The course introduces students to the anatomy and physiology of the nervous system. The topics include the biological structure of the nervous system and its different cell types, the basis of the action potential, principles of neurotransmission, neuronal basis of behavior, sleep/wake cycles, and basic aspects of clinical neuroscience.
The level approach to understanding the brain in its social context will introduce students to the field of social neuroscience and its multi-impact of culture and development, among others. Overall, this course examines the logic and assumptions that permit us to interpret brain activity in psychological terms.

PSYC UN2435 Social Neuroscience. 3.00 points.
This course will provide a broad overview of the field of social neuroscience. We will consider how social processes are implemented at the neural level, but also how neural research helps us to understand social phenomena and cultural experiences. Many believe that the large expansion of the human brain evolved due to the complex demands of socializing with others—rivalry, cooperation or competing with them, deceiving or empathizing with them, understanding or misjudging them. The kind of "social brain" has this evolutionary past left us with? In this course, we will review core principles, theories, and methods guiding social neuroscience, as well as research examining the brain basis of processes such as theory of mind, emotion, stereotyping, social group identity, empathy, judging faces and bodies, morality, decision-making, the impact of culture and development, among others. Overall, this course will introduce students to the field of social neuroscience and its multi-level approach to understanding the brain in its social context.

PSYC UN2450 Behavioral Neuroscience. 3.00 points.
Prerequisites: PSYC UN1001 or equivalent introductory course in Psychology
Prerequisites: PSYC UN1001 or equivalent introductory course in Psychology
This course will survey a number of topics at the intersection of cognitive science and philosophy. Potential topics include free will, consciousness, embodied cognition, artificial intelligence, neural networks, and the language of thought.

PSYC UN2481 Developmental Cognitive Neuroscience. 3.00 points.
The course will be an introduction to the science of structural and functional brain development beginning in the prenatal period. We will cover major domains in both cognitive and social development. This is a flipped course, where students will watch lectures online (three 55 minute lectures each week) and participate in classroom discussions and exercises (1 hour 50 minutes twice a week) with the Professor and each other when in person.

NSBV BC3381 Visual Neuroscience: From the Eyeball to the Mind’s Eye. 4.00 points.
By absorbing electromagnetic radiation through their eyes, people are able to catch frisbees, recognize faces, and judge the beauty of art. For most of us, seeing feels effortless. That feeling is misleading. Seeing requires not only precise optics to focus images on the retina, but also the concerted action of millions of nerve cells in the brain. This intricate circuitry infers the likely causes of incoming patterns of light and transforms that information into feelings, thoughts, and actions. In this course we will study how light evokes electrical activity in a hierarchy of specialized neural networks that accomplish many unique aspects of seeing. Students will have the opportunity to focus their study on particular aspects, such as color, motion, object recognition, learning, attention, awareness, and how sight can be lost and recovered. Throughout the course we will discuss principles of neural information coding (e.g., receptive field tuning, adaptation, normalization, etc.) that are relevant to other areas of neuroscience, as well as medicine, engineering, art and design.

Please note that PSYC UN2430 Cognitive Neuroscience may be used to fulfill either the Neuroscience requirement or the Psychology requirement, but not both.

Philosophy:

PHIL UN2655 Cognitive Science and Philosophy. 3 points.
This course will survey a number of topics at the intersection of cognitive science and philosophy. Potential topics include free will, consciousness, embodied cognition, artificial intelligence, neural networks, and the language of thought.
PHIL UN3252 Philosophy of Language and Mind. 3 points.
This course will provide an introduction to meaning, reference, understanding, and content in language, thought, and perception. A central concern will be the question of the relation of meaning to truth-conditions, and what is involved in language and thought successfully latching on to reality. If you have not already taken an elementary course in first order logic, you will need to catch up in that area to understand some crucial parts of the course. All the same, the primary concerns of the course will be philosophical, rather than technical.

PHIL UN3655 TOPICS IN COGNITIVE SCIENCE AND PHILOSOPHY. 3.00 points.
This course will focus on one topic at the intersection of cognitive science and philosophy. Potential topics include free will, consciousness, modularity, mental representation, probabilistic inference, the language of thought, and the computational theory of mind.

PHIL UN3912 SEMINAR. 3.00 points.
Required of senior majors, but also open to junior majors, and junior and senior concentrators who have taken at least four philosophy courses. This exploration will typically involve writing a substantial research paper. Capped at 20 students with preference to philosophy majors

LING UN3101 INTRODUCTION TO LINGUISTICS. 3.00 points.
An introduction to the study of language from a scientific perspective. The course is divided into three units: language as a system (sounds, morphology, syntax, and semantics), language in context (space, time, and community), and language of the individual (psycholinguistics, errors, aphasia, neurology of language, and acquisition). Workload: lecture, weekly homework, and final examination

PHIL UN1401 INTRODUCTION TO LOGIC. 3.00 points.
Explicit criteria for recognizing valid and fallacious arguments, together with various methods for schematizing discourse for the purpose of logical analysis. Illustrative material taken from science and everyday life

PHIL UN3411 SYMBOLIC LOGIC. 4.00 points.
Corequisites: PHILV3413 Required Discussion Section (0 points). Advanced introduction to classical sentential and predicate logic. No previous acquaintance with logic is required; nonetheless a willingness to master technicalities and to work at a certain level of abstraction is desirable

Mathematical and Computational Methods

PHIL UN4850 COGNITIVE MECH # ECON BEHAVIOR. 4.00 points.
Prerequisites: ECON UN3211 and ECON UN3213 and STAT UN1201

Prerequisites: ECON UN3211 and ECON UN3213 and STAT UN1201

Standard economic theory seeks to explain human behavior (especially in economic settings, such as markets) in terms of rational choice, which means that the choices that are made can be predicted on the basis of what would best serve some coherent objective, under an objectively correct understanding of the predictable consequences of alternative actions. Observed behavior often seems difficult to reconcile with a strong form of this theory, even if incentives clearly have some influence on behavior, and the course will discuss empirical evidence (both from laboratory experiments and observations in the field) for some well-established anomalies. But beyond simply cataloguing anomalies for the standard theory, the course will consider the extent to which departures from a strong version of rational choice theory can be understood as reflecting cognitive processes that are also evident in other domains such as sensory perception; examples from visual perception will receive particular attention. And in addition to describing what is known about how the underlying mechanisms work (something that is understood in more detail in sensory contexts than in the case of value-based decision making), the course will consider the extent to which such mechanisms — while suboptimal from a normative standpoint that treats perfect knowledge of one’s situation as costless and automatic — might actually represent efficient uses of the limited information and bounded information-processing resources available to actual people (or other organisms). Thus the course will consider both ways in which the realism of economic analysis may be improved by taking into account cognitive processes, and ways in which understanding of cognitive processes might be advanced by considering the economic problem of efficient use of limited (cognitive) resources

Logic and Decision Theory
PHIL GU4561 PROBABILITY & DECISION THEORY. 3.00 points.
Examines interpretations and applications of the calculus of probability including applications as a measure of degree of belief, degree of confirmation, relative frequency, a theoretical property of systems, and other notions of objective probability or chance. Attention to epistemological questions such as Hume’s problem of induction, Goodman’s problem of projectibility, and the paradox of confirmation

Fall 2023: PHIL GU4561
Course Number  Times/Location  Instructor  Points  Enrollment
PHIL 4561  Th 10:10am - 12:00pm  Jessica Collins  3.00  19/30
716 Philosophy Hall

PSYC UN2235 THINKING AND DECISION MAKING. 3.00 points.
CC/GS: Partial Fulfillment of Science Requirement
Prerequisites: an introductory course in psychology.
Prerequisites: an introductory course in psychology. Models of judgment and decision making in both certain and uncertain or risky situations, illustrating the interplay of top-down (theory-driven) and bottom-up (data-driven) processes in creating knowledge. Focuses on how individuals do and should make decisions, with some extensions to group decision making and social dilemmas

Spring 2023: PSYC UN2235
Course Number  Times/Location  Instructor  Points  Enrollment
PSYC 2235  T Th 11:40am - 12:55pm  Katherine Fox-Glassman  3.00  129/135
501 Schermerhorn Hall

Statistics
ECON BC2411 STATISTICS FOR ECONOMICS. 4.00 points.
Elementary computational methods in statistics. Basic techniques in regression analysis of econometric models. One-hour weekly recitation sessions to complement lectures

Fall 2023: ECON BC2411
Course Number  Times/Location  Instructor  Points  Enrollment
ECON 2411  Th 10:10am - 11:25am  Randall Reback  4.00  30/40
LIL 01 Milstein Center

PSYC BC1101 STATISTICS LECTURE AND RECITATION. 4.00 points.
Prerequisites: BC1001 and instructor permission. Enrollment limited to 20 students per recitation section.
Prerequisite (or co-requisite): PSYC BC1001. Lecture course and associated recitation section introducing students to statistics and its applications to psychological research. The course covers basic theory, conceptual underpinnings, and common statistics. The following Columbia University courses are considered overlapping and a student cannot receive credit for both the BC course and the equivalent CU course: STAT UN1001 Introduction to Statistical Reasoning; STAT UN1101 Introduction to Statistics; STAT UN1201 Introduction to Statistics

Fall 2023: PSYC BC1101
Course Number  Times/Location  Instructor  Points  Enrollment
PSYC 1101  M 10:10am - 11:25am  Robert Brotherton  4.00  17/20
203 Diana Center
PSYC 1101  Th 12:10pm - 2:00pm  Robert Brotherton  4.00  17/20
222 Milbank Hall
PSYC 1101  Th 10:10am - 11:25am  Robert Brotherton  4.00  18/18
203 Diana Center
PSYC 1101  Th 2:10pm - 4:00pm  Robert Brotherton  4.00  18/18
222 Milbank Hall
PSYC 1101  M 11:40am - 12:55pm  Katherine Thorson  4.00  24/24
328 Milbank Hall
PSYC 1101  M 11:40am - 12:55pm  Katherine Thorson  4.00  24/24
328 Milbank Hall
PSYC 1101  M 11:40am - 12:55pm  Katherine Thorson  4.00  17/18
516 Milstein Center
PSYC 1101  M 11:40am - 12:55pm  Katherine Thorson  4.00  17/18
516 Milstein Center

Fall 2023: PSYC BC1101
Course Number  Times/Location  Instructor  Points  Enrollment
PSYC 1101  M W 10:10am - 11:25am  Katherine Thorson  4.00  17/18
203 Diana Center
PSYC 1101  M 12:10pm - 2:00pm  Katherine Thorson  4.00  18/18
516 Milstein Center
PSYC 1101  M 10:10am - 11:25am  Katherine Thorson  4.00  16/18
328 Milbank Hall
PSYC 1101  M 10:10am - 11:25am  Katherine Thorson  4.00  16/18
328 Milbank Hall
PSYC 1101  M 10:10am - 11:25am  Katherine Thorson  4.00  16/18
516 Milstein Center
PSYC 1101  M W 2:40pm - 3:55pm  Doris Zahner  4.00  18/18
207 Milbank Hall
PSYC 1101  M 4:10pm - 6:00pm  Doris Zahner  4.00  18/18
222 Milbank Hall
PSYC 1101  M W 2:40pm - 3:55pm  Doris Zahner  4.00  17/18
207 Milbank Hall
PSYC 1101  M 6:10pm - 8:00pm  Doris Zahner  4.00  17/18
222 Milbank Hall

PSYC UN1610 STATISTICS-BEHAVIORL SCIENTISTS. 4.00 points.
Lecture and lab. Priority given to psychology majors. Fee $70.
Prerequisites: PSYC UN1001 or PSYC UN1010 Recommended preparation: one course in behavioral science and knowledge of high school algebra.
Corequisites: PSYC UN1611
Prerequisites: PSYC UN1001 or PSYC UN1010 Recommended preparation: one course in behavioral science and knowledge of high school algebra. Corequisites: PSYC UN1611 Introduction to statistics that concentrates on problems from the behavioral sciences

Fall 2023: PSYC UN1610
Course Number  Times/Location  Instructor  Points  Enrollment
PSYC 1610  T Th 11:40am - 12:55pm  Katherine Fox-Glassman  4.00  43/45
208 Schermerhorn Hall
STAT UN1001 INTRO TO STATISTICAL REASONING. 3.00 points.
A friendly introduction to statistical concepts and reasoning with emphasis on developing statistical intuition rather than on mathematical rigor. Topics include design of experiments, descriptive statistics, correlation and regression, probability, chance variability, sampling, chance models, and tests of significance.

Spring 2023: STAT UN1001

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<th>Course Number</th>
<th>Section/Call Number</th>
<th>Times/Location</th>
<th>Instructor</th>
<th>Points</th>
<th>Enrollment</th>
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<tr>
<td>STAT 1001</td>
<td>001/14229</td>
<td>T Th 10:10am - 11:25am 520 Mathematics Building</td>
<td>Pratyay Datta</td>
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<td>STAT 1001</td>
<td>002/14230</td>
<td>T Th 10:10am - 11:25am 207 Mathematics Building</td>
<td>Guy Cohen</td>
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<td>Ha Nguyen</td>
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Fall 2023: STAT UN1001

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<td>Anthony Donoghue</td>
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<td>Musa Elbulok</td>
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STAT UN1101 INTRODUCTION TO STATISTICS. 3.00 points.
Prerequisites: intermediate high school algebra. Designed for students in fields that emphasize quantitative methods. Graphical and numerical summaries, probability, theory of sampling distributions, linear regression, analysis of variance, confidence intervals and hypothesis testing. Quantitative reasoning and data analysis. Practical experience with statistical software. Illustrations are drawn from a variety of fields. Data-collection/analysis project with emphasis on study designs is part of the coursework requirement.

Spring 2023: STAT UN1101

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<th>Course Number</th>
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<th>Times/Location</th>
<th>Instructor</th>
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<td>Wayne Lee</td>
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<td>Ronald Neath</td>
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Fall 2023: STAT UN1101

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<td>Dobrin Marchev</td>
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STAT UN1201 CALC-BASED INTRO TO STATISTICS. 3.00 points.
Prerequisites: one semester of calculus. Designed for students who desire a strong grounding in statistical concepts with a greater degree of mathematical rigor than in STAT W1111. Random variables, probability distributions, pdf, cdf, mean, variance, correlation, conditional distribution, conditional mean and conditional variance, law of iterated expectations, normal, chi-square, F and t distributions, law of large numbers, central limit theorem, parameter estimation, unbiasedness, consistency, efficiency, hypothesis testing, p-value, confidence intervals, maximum likelihood estimation. Serves as the pre-requisite for ECON W3412

Spring 2023: STAT UN1201

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<th>Course Number</th>
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<td>Joyce Robbins</td>
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<td>Alex Pijyan</td>
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Fall 2023: STAT UN1201

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<td>David Rios</td>
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Computer Science

COMS BC1016 Introduction to Computational Thinking and Data Science. 3.00 points.
This course and its co-requisite lab course will introduce students to the methods and tools used in data science to obtain insights from data. Students will learn how to analyze data arising from real-world phenomena while mastering critical concepts and skills in computer programming and statistical inference. The course will involve hands-on analysis of real-world datasets, including economic data, document collections, geographical data, and social networks. The course is ideal for students looking to increase their digital literacy and expand their use and understanding of computation and data analysis across disciplines. No prior programming or college-level math background is required.
COMS W1001 Introduction to Information Science. 3 points.
Lect: 3.

Basic introduction to concepts and skills in Information Sciences: human-computer interfaces, representing information digitally, organizing and searching information on the internet, principles of algorithmic problem solving, introduction to database concepts, and introduction to programming in Python.

Fall 2023: COMS W1001

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<td>Adam Cannon</td>
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COMS W1002 COMPUTING IN CONTEXT. 4.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Introduction to elementary computing concepts and Python programming with domain-specific applications. Shared CS concepts and Python programming lectures with track-specific sections. Track themes will vary but may include computing for the social sciences, computing for economics and finance, digital humanities, and more. Intended for nonmajors. Students may only receive credit for one of ENGI E1006 or COMS W1002

Fall 2023: COMS W1002

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<th>Course Number</th>
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COMS W1004 Introduction to Computer Science and Programming in Java. 3 points.
Lect: 3.

A general introduction to computer science for science and engineering students interested in majoring in computer science or engineering. Covers fundamental concepts of computer science, algorithmic problem-solving capabilities, and introductory Java programming skills. Assumes no prior programming background. Columbia University students may receive credit for only one of the following two courses: 1004 or 1005.

Spring 2023: COMS W1004

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<th>Course Number</th>
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Fall 2023: COMS W1004

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<td>Paul Blaer</td>
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COMS W1007 Honors Introduction to Computer Science. 3 points.
Lect: 3.

Prerequisites: AP Computer Science with a grade of 4 or 5 or similar experience.

An honors-level introduction to computer science, intended primarily for students considering a major in computer science. Computer science as a science of abstraction. Creating models for reasoning about and solving problems. The basic elements of computers and computer programs. Implementing abstractions using data structures and algorithms. Taught in Java.

COMS W3134 Data Structures in Java. 3 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W1004) or knowledge of Java.

Data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing such structures: sorting and searching, hashing, garbage collection. Storage management. Rudiments of the analysis of algorithms. Taught in Java. Note: Due to significant overlap, students may receive credit for only one of the following three courses: COMS W3134, COMS W3136, COMS W3137.

Spring 2023: COMS W3134

<table>
<thead>
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<th>Course Number</th>
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<td>Paul Blaer</td>
<td>3</td>
<td>358/398</td>
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<td>COMS 3134</td>
<td>002/12400</td>
<td>M W 5:40pm - 6:55pm 501 Northwest Corner</td>
<td>Paul Blaer</td>
<td>3</td>
<td>148/164</td>
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Fall 2023: COMS W3134

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<td>Brian Borowski</td>
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<td>COMS 3134</td>
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<td>M W 5:40pm - 6:55pm Room TBA</td>
<td>Brian Borowski</td>
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COMS W3136 ESSENTIAL DATA STRUCTURES. 4.00 points.

Prerequisites: (COMS W1004) or (COMS W1005) or (COMS W1007) or (ENGI E1006)

Prerequisites: (COMS W1004) or (COMS W1005) or (COMS W1007) or (ENGI E1006) A second programming course intended for nonmajors with at least one semester of introductory programming experience. Basic elements of programming in C and C++, array-based data structures, heaps, linked lists, C programming in UNIX environment, object-oriented programming in C, trees, graphs, generic programming, hash tables. Due to significant overlap, students may only receive credit for either COMS W3134, W3136, or W3137.

Fall 2023: COMS W3136

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<td>001/11210</td>
<td>T Th 5:40pm - 6:55pm Room TBA</td>
<td>Timothy Paine</td>
<td>4.00</td>
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COMS W3137 HONORS DATA STRUCTURES # ALGOL. 4.00 points.
Prerequisites: (COMS W1004 or (COMS W1007)
Corequisites: COMS W3203
Prerequisites: (COMS W1004 or (COMS W1007) Corequisites: COMS W3203
An honors introduction to data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing such structures: sorting and searching, hashing, garbage collection. Storage management. Design and analysis of algorithms. Taught in Java. Note: Due to significant overlap, students may receive credit for only one of the following three courses: COMS W3134, W3136, or W3137

Spring 2023: COMS W3137
Course Number Section/Call Number Times/Location Instructor Points Enrollment
COMS 3137 001/12401 M W 10:10am - 11:25am Daniel Bauer 4.00 25/50

STEM BC2223 PROGRAMMING BEHAV SCIENCES. 4.00 points.

Possible Electives
ANTH UN1009 INTRO TO LANGUAGE # CULTURE. 3.00 points.
This is an introduction to the study of the production, interpretation, and reproduction of social meanings as expressed through language. In exploring language in relation to culture and society, it focuses on how communication informs and transforms the sociocultural environment

Spring 2023: ANTH UN1009
Course Number Section/Call Number Times/Location Instructor Points Enrollment
ANTH 1009 001/00489 T Th 2:40pm - 3:55pm Elizabeth Green 3.00 58/60

COGS GU4800 Resource-Constrained Decision Making. 4.00 points.
There is a fundamental puzzle about human intelligence: How are we incredibly smart and stupid at the same time? Humans deal successfully with the world in a way that no machine can (for now), yet we routinely behave in ways that seem grossly inconsistent with normative canons of rational inference and rational choice. This course will seek to resolve the paradox by exploring the idea that while we make many mistakes, these mistakes are not haphazard; instead, they reflect a brain that is highly efficient at inference and decision making within the information, time, and energy constraints imposed by the finite resources available to it. In other words, our brains may be "resource-rational" even if they fail to conform to ideal canons of rationality. We will explore this idea by considering the structure of errors, biases and illusions in the context of perceptual judgments, more abstract cognitive judgments (perceptions of numerical magnitudes or probabilities), and economic decisions; we will see that there are many analogies between the kinds of characteristic errors that people make in all of these contexts. A potential explanatory framework, which can be applied across contexts, considers what optimal decisions should be like in the case of a decision unit that has only imprecise information about its situation. Hence statistical modeling and statistical inference are key elements in the computational models of human decision making that we wish to discuss

Spring 2023: COGS GU4800
Course Number Section/Call Number Times/Location Instructor Points Enrollment
COGS 4800 001/14598 T 10:10am - 12:00pm Michael Woodford 4.00 15/15

COGS GU4050 Natural and Artificial Neural Networks. 3.00 points.
Artificial neural networks can do amazing things. They can play chess, recognize faces, predict human behavior, learn language, and create art. Natural neural networks – that is to say, brains -- can do many of the same things, often a little more clumsily. But, unlike artificial networks, they can switch seamlessly between two tasks, learn to perform them without supervision, and do not need to be told to -- actually, they can choose to refuse. Brains provided the initial inspiration for the artificial networks, which is why we call them 'artificial neural networks.' But how deep are the similarities between the two? Do they share more than a few abilities, a similar structure, and a common nomenclature?

COGS GU4051 Natural and Artificial Neural Networks Lab. 1.00 point.
Understanding the powers and limitations of artificial neural networks requires exposure to both concepts and practice. This lab section focuses on the latter, supplementing the conceptual framework from the lecture, Natural and Artificial Neural Networks. The lab focuses on giving students without a background in computer science hands-on experience with basic programming in Python, tools for data science, and a variety of machine learning algorithms

COMS W4170 USER INTERFACE DESIGN. 3.00 points.
CC/GS: Partial Fulfillment of Science Requirement
Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137)
Introduction to the theory and practice of computer user interface design, emphasizing the software design of graphical user interfaces. Topics include basic interaction devices and techniques, human factors, interaction styles, dialogue design, and software infrastructure. Design and programming projects are required

Fall 2023: COMS W4170
Course Number Section/Call Number Times/Location Instructor Points Enrollment
COMS 4170 001/11225 T Th 1:10pm - 2:25pm Brian Smith 3.00 0/120
COMS W4701 ARTIFICIAL INTELLIGENCE. 3.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and any course on probability. Prior knowledge of Python is recommended.

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) and any course on probability. Prior knowledge of Python is recommended. Provides a broad understanding of the basic techniques for building intelligent computer systems. Topics include state-space problem representations, problem reduction and and-or graphs, game playing and heuristic search, predicate calculus, and resolution theorem proving. AI systems and languages for knowledge representation, machine learning and concept formation and other topics such as natural language processing may be included as time permits

COMS W4705 NATURAL LANGUAGE PROCESSING. 3.00 points.
Lect: 3.

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) or the instructor's permission.

Prerequisites: (COMS W3134 or COMS W3136 or COMS W3137) or the instructor's permission. Computational approaches to natural language generation and understanding. Recommended preparation: some previous or concurrent exposure to AI or Machine Learning. Topics include information extraction, summarization, machine translation, dialogue systems, and emotional speech. Particular attention is given to robust techniques that can handle understanding and generation for the large amounts of text on the Web or in other large corpora. Programming exercises in several of these areas

COMS W4731 Computer Vision I: First Principles. 3.00 points.
Lect: 3.

Prerequisites: Fundamentals of calculus, linear algebra, and C programming. Students without any of these prerequisites are advised to contact the instructor prior to taking the course.

Introductory course in computer vision. Topics include image formation and optics, image sensing, binary images, image processing and filtering, edge extraction and boundary detection, region growing and segmentation, pattern classification methods, brightness and reflectance, shape from shading and photometric stereo, texture, binocular stereo, optical flow and motion, 2D and 3D object representation, object recognition, vision systems and applications

Spring 2023: COMS W4701
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
COMS 4701 | 001/12837 | M W 2:40pm - 3:55pm 301 Urs Hall | Tony Dear | 3.00 | 163/220
COMS 4701 | 002/12838 | M W 4:10pm - 5:25pm 501 Schermerhorn Hall | Tony Dear | 3.00 | 149/180
COMS 4701 | V01/18057 | | Tony Dear | 3.00 | 19/99

Fall 2023: COMS W4701
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
COMS 4701 | 001/11234 | T Th 10:10am - 11:25am Room TBA | Ansaf Salleb-Aouissi | 3.00 | 0/180
COMS 4701 | 002/11235 | T Th 11:40am - 12:55pm Room TBA | Ansaf Salleb-Aouissi | 3.00 | 0/180
COMS 4701 | V01/17097 | | Ansaf Salleb-Aouissi | 3.00 | 0/99

Spring 2023: COMS W4771
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
COMS 4771 | 001/12850 | T Th 1:10pm - 2:25pm 501 Northwest Corner | Nakul Verma | 3.00 | 1/100
COMS 4771 | 002/12861 | T Th 2:40pm - 3:55pm 451 Computer Science Bldg | Nakul Verma | 3.00 | 62/110
COMS 4771 | 003/18029 | F 1:10pm - 3:40pm 501 Northwest Corner | Nakul Verma | 3.00 | 67/150
COMS 4771 | V01/18061 | | Nakul Verma | 3.00 | 9/99

Fall 2023: COMS W4771
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
COMS 4771 | 001/11240 | T Th 1:10pm - 2:25pm 451 Computer Science Bldg | Daniel Hsu | 3.00 | 0/110
COMS 4771 | 002/11241 | T Th 2:40pm - 3:55pm 451 Computer Science Bldg | Daniel Hsu | 3.00 | 0/110

Spring 2023: COMS W4705
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
COMS 4705 | 001/12839 | M W 1:10pm - 2:25pm 417 International Affairs Bldg | Daniel Bauer | 3.00 | 248/250
COMS 4705 | 002/18033 | F 10:10am - 12:40pm 301 Pupin Laboratories | Daniel Bauer | 3.00 | 158/175
COMS 4705 | V01/18058 | | Daniel Bauer | 3.00 | 22/99

Fall 2023: COMS W4705
Course Number | Section/Call Number | Times/Location | Instructor | Points | Enrollment
--- | --- | --- | --- | --- | ---
COMS 4705 | 001/11236 | M W 1:10pm - 2:25pm Room TBA | Daniel Bauer | 3.00 | 1/220
COMS 4705 | 002/11237 | M W 2:40pm - 3:55pm Room TBA | Zhou Yu | 3.00 | 0/100
COMS 4705 | 032/16894 | W 7:00pm - 9:30pm Room TBA | Andrei Simion | 3.00 | 0/80
COMS W4772 Advanced Machine Learning. 3 points.
Lect: 3.
Prerequisites: (COMS W4771) or instructor's permission; knowledge of linear algebra & introductory probability or statistics is required. An exploration of advanced machine learning tools for perception and behavior learning. How can machines perceive, learn from, and classify human activity computationally? Topics include appearance-based models, principal and independent components analysis, dimensionality reduction, kernel methods, manifold learning, latent models, regression, classification, Bayesian methods, maximum entropy methods, real-time tracking, extended Kalman filters, time series prediction, hidden Markov models, factorial HMMS, input-output HMMs, Markov random fields, variational methods, dynamic Bayesian networks, and Gaussian/Dirichlet processes. Links to cognitive science.

ECON GU4020 ECON OF UNCERTAINTY # INFORMTN. 3.00 points.
Prerequisites: ECON UN3211 and ECON UN3213 and STAT UN1201
Prerequisites: ECON UN3211 and ECON UN3213 and STAT UN1201
Topics include behavior uncertainty, expected utility hypothesis, insurance, portfolio choice, principle agent problems, screening and signaling, and information theories of financial intermediation

ECON GU4840 BEHAVIORAL ECONOMICS. 3.00 points.
Prerequisites: ECON UN3211 and ECON UN3213
Prerequisites: ECON UN3211 and ECON UN3213 Within economics, the standard model of behavior is that of a perfectly rational, self interested utility maximizer with unlimited cognitive resources. In many cases, this provides a good approximation to the types of behavior that economists are interested in. However, over the past 30 years, experimental and behavioral economists have documented ways in which the standard model is not just wrong, but is wrong in ways that are important for economic outcomes. Understanding these behaviors, and their implications, is one of the most exciting areas of current economic inquiry. The aim of this course is to provide a grounding in the main areas of study within behavioral economics, including temptation and self control, fairness and reciprocity, reference dependence, bounded rationality and choice under risk and uncertainty. For each area we will study three things: 1. The evidence that indicates that the standard economic model is missing some important behavior 2. The models that have been developed to capture these behaviors 3. Applications of these models to (for example) finance, labor and development economics As well as the standard lectures, homework assignments, exams and so on, you will be asked to participate in economic experiments, the data from which will be used to illustrate some of the principals in the course. There will also be a certain small degree of classroom ‘flipping’, with a portion of many lectures given over to group problem solving. Finally, an integral part of the course will be a research proposal that you must complete by the end of the course, outlining a novel piece of research that you would be interested in doing

LING GU4202 COGNITIVE LINGUISTICS. 3.00 points.
Prerequisites: LING UN3101 previously or concurrently.
Reading and discussion of scholarly literature on the cognitive approach to language, including: usage-oriented approaches to language, frame semantics, construction grammar, theories of conceptual metaphor and mental spaces; alongside of experimental research on language acquisition, language memory, prototypical and analogous thinking, and the role of visual imagery in language processing

LING GU4206 ADV GRAMMAR AND GRAMMARS. 3.00 points.
Prerequisites: LING UN3101 LING W3101.
An investigation of the possible types of grammatical phenomena (argument structure, tense/aspect/mood, relative clauses, classifiers, and deixis). This typological approach is enriched by the reading of actual grammars of languages from Asia, Africa, Australia, and the Americas in which grammatical descriptions are read with an eye to important notional concepts of grammar: reference and categorization, case and role of arguments with predicates (ergativity), tense/aspect/mood. Discussion of meaning is combined with attention to expression (that is, morphology), which yanks our attention towards language change (grammaticalization)
PHIL UN3840 The Nature and Significance of Animal Minds. 3 points.
Humans have a complicated relationship with other animals. We love them, befriend them and save them. We hunt, farm and eat them. We experiment on and observe them to discover more about them and to discover more about ourselves. For many of us, our pets are amongst the most familiar inhabitants of our world. Yet when we try to imagine what is going on in a dog or cat's mind—let alone that of a crow, octopus or bee—many of us are either stumped about how to go about this, or (the science strongly suggests) getting things radically wrong. Is our thought about and behavior towards animals ethically permissible, or even consistent, Can we reshape our habits of thought about animals to allow for a more rational, richer relationship with the other inhabitants of our planet? In this course, students will reflect on two closely intertwined questions: an ethical question, what sort of relationship ought we to have with animals?; and a metaphysical question, what is the nature of animal minds? Readings will primarily be from philosophy and ethics and the cognitive sciences, with additional readings from literature and biology.
There are no prerequisites for this class—it will be helpful but certainly not necessary to have taken previous classes in philosophy (especially ethics and philosophy of mind) or in cognitive science.

PHIL GU4495 PERCEPTION. 3.00 points.
This course addresses the fabulously rich range of issues about the nature of perception, including: perceptual mental representation and its content; computational explanation; justifying beliefs; knowledge and thought about perception; and perception of music. Perception is an interdisciplinary subject par excellence. Readings will be drawn from philosophy and psychology, aesthetics, and artificial intelligence.

PHIL GU4660 PHILOSOPHY OF MIND. 3.00 points.
PSYC BC2107 PSYCHOLOGY OF LEARNING - LEC. 3.00 points.
Prerequisites: BC1001 Introduction of Psychology or permission of the instructor. Enrollment limited to 72 students.
Prerequisites: PSYC BC1001 Introduction to Psychology or COGS UN1001 Introduction to Cognitive Science or permission of the instructor. Lecture course covering the basic methods, results, and theory in the study of how experience affects behavior. The roles of early exposure, habituation, sensitization, conditioning, imitation, and memory in the acquisition and performance of behavior are studied. The following Columbia University course is considered overlapping and a student cannot receive credit for both the BC course and the equivalent CU course: PSYC UN1440 Experimental: Learning and Motivation
PSYC BC2129 DEVELOPMENTAL PSYCHOLOGY-LEC. 3.00 points.
Prerequisites: BC1001 or permission of the instructor.
Prerequisites: PSYC BC1001 Introduction to Psychology or COGS UN1001 Introduction to Cognitive Science or permission of the instructor. Lecture course covering cognitive, linguistic, perceptual, motor, social, affective, and personality development from infancy to adolescence. Note that this lecture can be taken without its affiliated lab, PSYC BC2128, however, if a student completes this lecture, she cannot enroll in the lab in a later semester. The following Columbia University course is considered overlapping and a student cannot receive credit for both the BC course and the equivalent CU course: PSYC UN2280 Introduction to Developmental Psychology

PSYC BC2163 Human Learning and Memory. 3 points.
Prerequisites: BC1001 and at least one psychology lab course, or permission of the instructor. Enrollment limited to 20 students. Survey of contemporary theories and empirical research on human memory. Topics will include sensory, short term and long term memory, levels of processing, organization, forgetting, and encoding specificity. Special topics include eyewitness testimony, amnesia, implicit memory, and false memory.

PSYC BC3164 PERCEPTION AND LANGUAGE. 4.00 points.
Prerequisites: BC 1001 and one of the following: BC2106/2107, BC2109/2110, BC2118/2119, BC2128/2129, or permission of the instructor. Enrollment limited to 20 students. Psychological investigations of spoken communication from a listener’s perspective. Topics include perception and sounds of speech and the apprehension of meaning from words and utterances; the perceptual basis for rhyme and rhythm in speech; and the natural history of vocal communication.

PSYC BC3369 Language Development. 4 points.
Not offered during 2023-2024 academic year.
Prerequisites: BC1001, one Psychology laboratory course, one of the following: PSYC W2240, BC1128/1129, BC1129, or LIN BC V1101, and permission of the instructor. Enrollment limited to 15 students. Examines the acquisition of a first language by children, from babbling and first words to complex sentence structure and wider communicative competence. Signed and spoken languages, cross-linguistic variation and universalities, language genesis and change, and acquisition by atypical populations will be discussed.

PSYC BC3372 Comparative Cognition. 4 points.
Not offered during 2023-2024 academic year.
Prerequisites: BC1001 and one additional course in psychology. Or permission of the instructor. Enrollment limited to 20 students. Review and critical evaluation of current empirical research investigating cognitive processes in both human and non-human species. Topics include comparisons in episodic memory, metacognition, theory of mind, self-awareness, and language abilities.

PSYC BC3381 Theory of Mind and Intentionality. 4 points.
Not offered during 2023-2024 academic year.
Prerequisites: BC1001 and one other Psychology course, or permission of the instructor. Enrollment limited to 15 students. Survey and critical analysis of the developmental and neurological research on theory of mind - the attribution of mental states like belief, desire, and knowledge to others - in humans and nonhuman animals. Emphasis on the role of intentionality, stages of acquisition, neurological and genetic bases, and deficits in theory of mind.

PSYC BC3384 Social Cognition. 4 points.
Not offered during 2023-2024 academic year.
Prerequisites: BC 1001 and one of the following: BC1138/1137 Social Psychology, BC1115/1114 Cognitive Psychology, or permission of the instructor. Survey of research from the field of social cognition, exploring cognitive processes involved in social functioning. Topics include attention, interpretation, evaluation, judgment, attribution, and memory processes. Both controlled and automatic processes will be considered, and the roles of motives, goals, and affective variables will be discussed.

PSYC BC3390 CANINE COGNITION. 4.00 points.
Prerequisites: BC1001 and one other Psychology course. Enrollment limited to 15 students. Permission of the instructor is required. An examination of the scientific study of the domestic dog. Emphasis will be on the evolutionary history of the species; the dogs social cognitive skills; canid perceptual and sensory capacities; dog-primate comparative studies; and dog-human interaction.

PSYC BC3394 METACOGNITION. 4.00 points.
Prerequisites: BC1001, and one psychology laboratory course; final enrollment determined on the first day of class Metacognition is one of the latest psychological buzzwords, but what exactly is metacognition? Metacognition enables us to be successful learners, problem solvers, and decision makers, and as often been used synonymously with words such as language, awareness, and consciousness. In this seminar, we will examine various components of metacognition, including its role in learning and memory, and its existence in various non-human populations. In addition, we will explore the fragility of metacognition, including illusions of confidence and harmful control strategies that people use. Readings will include classic and important recent papers in the field, looking at metacognition as a higher-level cognitive process, and as knowledge individuals use to guide behavior.
PSYC BC3399 HUMAN AND MACHINES. 4.00 points.
Prerequisites: (PSYC BC1001) and Instructor approval
Prerequisites: (PSYC BC1001) and Instructor approval This course will examine the social psychology of Human-Machine interactions, exploring the idea that well-established social psychological processes play critical roles in interactions with non-social objects. The first half of the seminar will examine the social psychology of perception across distinct sensory modalities (shape, motion, voice, touch), whereas the second half will focus on social psychological processes between humans and non-human entities (objects, computers, robots)

PSYC UN2250 Evolution of Cognition. 3 points.
CC/GS: Partial Fulfillment of Science Requirement
Prerequisites: PSYC UN1001 or PSYC UN1010 or the instructor’s permission.
A systematic review of different forms of cognition as viewed in the context of the theory of evolution. Specific topics include the application of the theory of evolution to behavior, associative learning, biological constraints on learning, methods for studying the cognitive abilities of animals, levels of representation, ecological influences on cognition, and evidence of consciousness in animals.

PSYC UN2280 Developmental Psychology. 3.00 points.
CC/GS: Partial Fulfillment of Science Requirement
Enrollment may be limited. Attendance at the first two classes is mandatory.
Prerequisites: PSYC UN1001 or PSYC UN1010 or the equivalent.
Prerequisites: PSYC UN1001 or PSYC UN1010 or the equivalent. Introduction to the scientific study of human development, with an emphasis on psychobiological processes underlying perceptual, cognitive, and emotional development

PSYC UN3270 COMPUT APPROACHES-HUMAN VISION. 3.00 points.
This course will be offered in Fall 2016.
Prerequisites: some background in psychology and/or neurophysiology (e.g., PSYC UN1001, PSYC UN1010, PSYC UN2230, PSYC UN2450; BIOL UN3004 or BIOL UN3005) is desirable. See instructor if you have questions about your background. Some background in mathematics and computer science (e.g., calculus or linear algebra, a programming language) is highly recommended.
Prerequisites: some background in psychology and/or neurophysiology (e.g. PSYC UN1001, PSYC UN1010, PSYC UN2230, PSYC UN2450; BIOL UN3004 or BIOL UN3005) is desirable. See instructor if you have questions about your background. Some background in mathematics and computer science (e.g. calculus or linear algebra, a programming language) is highly recommended. Study of human vision—both behavioral and physiological data—within a framework of computational and mathematical descriptions. Please contact Prof. Graham by e-mail (ngv1@columbia.edu) if you are interested in this course

PSYC UN3290 Self: A Cognitive Exploration (Seminar). 4 points.
Not offered during 2023-2024 academic year.
Prerequisites: PSYC UN1001 or PSYC UN1010, or the equivalent, plus the instructor’s permission.
What does it mean to have a sense of self? Is it uniquely human? Taking a cognitive perspective, we will discuss these questions as well as self-reflective and self-monitoring abilities, brain structures relevant to self-processing, and disorders of self. We will also consider the self from evolutionary, developmental, neuroscience, and psychopathological perspectives.

PSYC UN3445 THE BRAIN AND MEMORY. 4.00 points.
Prerequisites: (PSYC UN1010) or Equivalent introductory course in neuroscience or cognitive psychology and the instructor’s permission
Prerequisites: (PSYC UN1010) or Equivalent introductory course in neuroscience or cognitive psychology and the instructor’s permission
This seminar will give a comprehensive overview of episodic memory research: what neuroimaging studies, patient studies, and animal models have taught us about how the brain creates, stores, and retrieves memories

PSYC UN3450 Evolution of Intelligence, Animal Communication, # Language. 3.00 points.
Prerequisites: PSYC UN1001 or PSYC UN1010, and the instructor’s permission.
Prerequisites: PSYC UN1001, and the instructors permission. A systematic review of the evolution language covering the theory of evolution, conditioning theory, animal communication, ape language experiments, infant cognition, preverbal antecedents of language and contemporary theories of language

PSYC GU4202 Theories of Change in Human Development. 4.00 points.
What are the agents of developmental change in human childhood? How has the scientific community graduated from nature versus nurture, to nature and nurture? This course offers students an in-depth analysis of the fundamental theories in the study of cognitive and social development

PSYC GU4222 The Cognitive Neuroscience of Aging (Seminar). 4 points.
Prerequisites: courses in introductory psychology and cognitive psychology, and the instructor’s permission.
Comprehensive overview of various conceptual and methodologic approaches to studying the cognitive neuroscience of aging. The course will emphasize the importance of combining information from cognitive experimental designs, epidemiologic studies, neuroimaging, and clinical neuropsychological approaches to understand individual differences in both healthy and pathological aging.
PSYC GU4223 MEMORY # EXEC FUNCT: LIFESPAN. 4.00 points.
Prerequisites: the instructor’s permission, plus PSYC UN1001 or PSYC UN1010, or the equivalent. Optimal preparation will include some background in experimental design and statistics.
Prerequisites: the instructors permission, plus PSYC UN1001 or PSYC UN1010, or the equivalent. Optimal preparation will include some background in experimental design and statistics. Memory and executive processing are critical cognitive functions required for successfully navigating everyday life. In lifespan studies, both exhibit relatively long developmental trajectories followed by stasis and then relative decline in old age. Yet, neither memory nor executive function is a unitary construct. Rather, each is comprised of separable components that may show different developmental trajectories and declines or maintenance at older ages. Moreover, memory is malleable and is a reconstruction of past experience, not an exact reproduction. We will discuss a range of topics related to the development, maintenance and potential decline in memory and executive function from infancy through old age.

PSYC GU4225 CONSCIOUSNESS # ATTENTION. 4.00 points.
Prerequisites: the instructor’s permission; some basic knowledge of cognitive science and neuroanatomy is desirable, but not necessary. Modern theories attempt to characterize the human mind in terms of information processing. But machines that process information do not seem to feel anything; a computer may for instance receive inputs from a video camera, yet it would be hard to imagine that it sees or experiences the vividness of colors like we do. Nobody has yet provided a convincing theory as to how to explain the subjective nature of our mental lives in objective physical terms. This is called the problem of consciousness, and is generally considered to be one of the last unsolved puzzles in science. Philosophers even debate whether there could be a solution to this problem at all. Students in this course may be recruited for participation in a voluntary research study. Students who choose not to participate in the study will complete the same course requirements as those who do, and an individual’s choice will not affect their grade or status as a student in the course.

PSYC GU4229 ATTENTION AND PERCEPTION. 4.00 points.
CC/GS: Partial Fulfillment of Science Requirement
Prerequisites: (PSYC UN1010 or Equivalent introductory course in neuroscience or cognitive psychology
Prerequisites: (PSYC UN1010 or Equivalent introductory course in neuroscience or cognitive psychology This seminar aims to provide an in-depth overview of neuroscientific knowledge regarding two critical cognitive functions: attention and perception. For each topic, results from behavioral studies are combined with those from recent neurocognitive approaches – primarily neuropsychological and functional brain imaging studies – that reveal the underlying neural networks and brain mechanisms.
PSYC GU4270 COGNITIVE PROCESSES. 3.00 points.
Prerequisites: For undergraduates: one course in cognitive psychology or cognitive neuroscience, or the equivalent, and the instructor’s permission.

Prerequisites: For undergraduates: one course in cognitive psychology or cognitive neuroscience, or the equivalent, and the instructors permission. Metacognition and control processes in human cognition. Basic issues include the cognitive mechanisms that enable people to monitor what they know and predict what they will know, the errors and biases involved in self-monitoring, and the implications of metacognitive ability for peoples self-determined learning, behavior, and their understanding of self

Spring 2023: PSYC GU4270
Course Number Times/Location Instructor Points Enrollment
PSYC 4270 001/14100 T 12:10pm - 2:00pm 405 Schermerhorn Hall Janet Metcalfe 3.00 13/12

PSYC GU4280 CORE KNOWLEDGE. 4.00 points.
Prerequisites: For undergraduates: courses in introductory psychology, cognitive or developmental psychology, and the instructor’s permission.
Prerequisites: For undergraduates: courses in introductory psychology, cognitive or developmental psychology, and the instructors permission. Core Knowledge explores the origins and development of knowledge in infants and children, with an additional emphasis on evolutionary cognition. In this course, we will examine evidence from cognitive psychology, developmental psychology, comparative psychology, neuroscience, and linguistics to look at the childs conception of objects, number, space, language, agency, morality and the social world. We will look at which aspects of knowledge are uniquely human, which are shared with other animals, and how this knowledge changes as children develop

Spring 2023: PSYC GU4280
Course Number Times/Location Instructor Points Enrollment
PSYC 4280 001/14101 W 2:10pm - 4:00pm 405 Schermerhorn Hall McCrink 4.00 14/16

PSYC GU4281 The Psychology of Curiosity. 4.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: PSYC UN1001 or equivalent introductory psychology course
Prerequisites: PSYC UN1001 or equivalent introductory psychology course What is curiosity and how do we study it? How does curiosity facilitate learning? This course will explore the various conceptual and methodological approaches to studying curiosity and curiosity-driven learning, including animal and human studies of brain and behavior

Fall 2023: PSYC GU4281
Course Number Times/Location Instructor Points Enrollment
PSYC 4281 001/10912 Th 12:10pm - 2:00pm Room TBA Caroline Marvin 4.00 13/14

PSYC GU4287 DECISION ARCHITECTURE. 4.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (PSYC UN2235) or an equivalent course on judgment and decision making, AND the instructor’s permission
Prerequisites: (PSYC UN2235) or an equivalent course on judgment and decision making, AND the instructors permission. This course will review current theories in the domain of decision architecture: the application of research in cognitive and social psychology to real-world situations with the aim of influencing behavior. This seminar will discuss recent and classic studies, both of decision theory and of applied decision research, to explore the effectiveness—as well as the limitations—of a selection of these behavioral “nudges.”

Spring 2023: PSYC GU4287
Course Number Times/Location Instructor Points Enrollment
PSYC 4287 001/14102 W 12:10pm - 12:00pm 405 Schermerhorn Hall Glassman 4.00 11/12

PSYC GU4289 THE GAMES PEOPLE PLAY: PSYCH OF STRAT DEC. 3.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (PSYC UN2235) or equivalent course on judgment and decision-making
Prerequisites: (PSYC UN2235) or equivalent course on judgment and decision-making. A seminar course exploring strategic decision making (also known as behavioral game theory). This course examines the psychology underlying situations in which outcomes are determined by choices made by multiple decision makers. The prime objective will be to examine the use of experimental games to test psychological theories

PSYC GU4430 Learning and the Brain (Seminar). 4 points.
Prerequisites: courses in introductory psychology and/or neuroscience, and the instructor’s permission.
What are the neural mechanisms that support learning, memory, and choices? We will review current theories in the cognitive neuroscience of human learning, discuss how learning and decision making interact, and consider the strengths and weaknesses of two influential methods in the study of human brain and behavior—functional imaging and patient studies.

PSYC GU4435 NON-MNEMONIC FUNC OF MEMORY SYSTEMS. 4.00 points.
CC/GS: Partial Fulfillment of Science Requirement

Prerequisites: (PSYC UN1010) or equivalent introductory course in neuroscience or cognitive psychology
Prerequisites: (PSYC UN1010) or equivalent introductory course in neuroscience or cognitive psychology. The past decade has produced an extraordinary amount of evidence that challenges the classic view of a “medial temporal lobe memory system”, namely, the idea that the medial temporal lobe plays a necessary role in long-term memory but not other cognitive functions. This course will introduce these challenges to the traditional perspective by exploring functions of the so-called memory system in domains outside of long-term memory
SOAR AV4000 SOUND: Music, Math, and Mind. 3.00 points.
This course is a detailed and hands-on (ears-on) exploration of the fundamental physical, physiological, and psychological aspects of sound. Topics covered include sound waves and their physical nature, the propagation and speed of sound in different mediums, geological and other non-living sound sources, animal and insect sound generating strategies, sound perception mechanisms and abilities in different species, the physiology of human hearing and the structure of the human ear, psycho-acoustics and human sound perception, sonic illusions and tricks of the ear. In-class experiments and research make up the majority of the class. Each student will design and lead at least one experiment/demo session. Students also respond to creative weekly prompts about sound topics on courseworks. We also have visits with a number of special guests during the term.

Fall 2023: SOAR AV4000

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<th>Course Number</th>
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<tr>
<td>SOAR 4000</td>
<td>001/10677</td>
<td>Th 6:10pm - 8:00pm</td>
<td>David Sulzer</td>
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<td>320h Prentis Hall</td>
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