AS.050 (COGNITIVE SCIENCE)

AS.050.102. Language and Mind. 3 Credits.
Introductory course dealing with theory, methods, and current research topics in the study of language as a component of the mind. What it is to 'know' a language: components of linguistic knowledge (phonetics, phonology, morphology, syntax, semantics) and the course of language acquisition. How linguistic knowledge is put to use: language and the brain and linguistic processing in various domains.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.105. Introduction to Cognitive Neuropsychology. 3 Credits.
When the brain is damaged or fails to develop normally, even the most basic cognitive abilities (such as the ability to understand words, or perceive objects) may be disrupted, often in remarkable ways. This course explores a wide range of cognitive deficits, focusing on what these deficits can tell us about how the normal brain works. Topics include brain anatomy and causes of brain damage, reading and spelling deficits, unilateral spatial neglect, hemispheric disconnection, cortical plasticity, and visual perception of location and orientation. Students read primary sources: journal articles that report deficits and discuss their implications.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.107. Language and Advertising. 3 Credits.
Advertising pervades our culture; interactions with advertising are an unavoidable fact of modern life. This class uses tools from linguistics and cognitive science to analyze these interactions, and understand the impact of advertising on its viewers. A central theme is to treat ads as communicative acts, and explore the consequences -- what can theories of communication (from linguistics, psychology, and philosophy) tell us about ads? How do ads use central features of human cognition to accomplish their aims? Do ads manipulate, and if so, how successfully? The theories of communication we explore include Gricean pragmatics, theories of speech acts, linguistic theories of presuppositions, and more. Students will collect, analyze, and discuss advertisements in all mediums.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.116. Visual Cognition. 3 Credits.
How do humans make sense of the visual world around them? This course will provide an introductory survey of current research, methods, and theories in visual cognition. We will draw upon topics in cognitive psychology, cognitive neuroscience, cognitive neuropsychology, and artificial intelligence.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.121. Freshman Seminar: Theory of Mind and the Science of "Mindreading". 3 Credits.
Fundamental to nearly all of human social behavior – including the use of language, the development of complex societies and cultures, pretending and storytelling – is the understanding that others have their own thoughts, beliefs, and intentions guiding their behavior. This capacity for "mindreading" is known as theory of mind. This course will explore what it means to have a theory of mind. Are humans born with a theory of mind? Does theory of mind interact with other aspects of cognition? How and why did theory of mind evolve in humans? Are humans unique amongst animals in having a theory of mind? The course will examine basic concepts of the mind and intention in philosophy and psychology, and review research from psychology, cognitive science, and neuroscience on topics including the development of theory of mind in children, the relationship between language and theory of mind, neurological correlates of theory of mind, links between theory of mind and autism, and theory of mind in non-human animals.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.201. Language and Mind Honors Section. 1 Credit.
This honors section, open to selected students concurrently enrolled in AS.050.102 Language and Mind, will introduce more advanced material in theoretical linguistics through instruction and guided problem solving. Content areas will include sound patterns, word formation, sentence structure, meaning representation, as well as processing and acquisition evidence bearing on the mental nature of language. Prior linguistics or cognitive science coursework is not required; weekly attendance and assignments will be mandatory.
Corequisite(s): Students must be enrolled in AS.050.102.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.202. Introduction to Computational Cognitive Science. 3 Credits.
How does the mind work? Cognitive science addresses this question from a multidiscliplinary perspective, drawing upon methods and ideas from psychology, neurophysiology, neuroscience, philosophy, linguistics, and computer science. Within this framework, computational cognitive science has two related goals. The first is to create computational models of human cognition, computer programs that simulate certain aspects of the mind. The second is to understand how to produce intelligent behavior in machines, taking cues from humans. The computational frameworks we will discuss include symbolic structured representations, probabilistic inference and artificial neural networks, as applied to concept learning, language and vision. While this class does not have formal prerequisites, some programming experience (e.g., AS 250.205 Introduction to Computing or equivalent) and mathematical preparation (e.g., AS.110.107 Calculus II or equivalent) are essential.An optional, hands-on lab (AS.050.212) is offered to supplement this course. It is highly recommended that students with less extensive computational and mathematical experience register for this lab.
Area: Quantitative and Mathematical Sciences

AS.050.203. Neuroscience: Cognitive. 3 Credits.
This course surveys theory and research concerning how mental processes are carried out by the human brain. Currently a wide range of methods of probing the functioning brain are yielding insights into the nature of the relation between mental and neural events. Emphasis will be placed on developing an understanding of both the physiological bases of the techniques and the issues involved in relating measures of brain activity to cognitive functioning. Methods surveyed include electrophysiological recording techniques such as EEG, ERP, single/multiple unit recording and MEG; functional imaging techniques such as PET and fMRI; and methods that involve lesioning or disrupting neural activity such as cortical stimulation, animal lesion studies, and the study of brain-damaged individuals.It's strongly recommended that students have background in one of the following courses: AS.050.101 OR AS.050.105 OR AS.200.141.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.206. Bilingualism. 3 Credits.
Do children get confused when they grow up exposed to more than one language? Is it possible to forget one's native language? Are the first and second language processed in different areas of the brain? How does brain damage impact the different languages of a polyglot? Does knowing a second language affect non-linguistic cognitive processing? This course will address questions such as these through an exploration of mental and neural processes underlying bilingual and multilingual language processing. Also offered as AS.050.606.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.212. Introduction to Computational Cognitive Science Lab. 0.5 Credits.
This course is a hands-on lab supplement for Introduction to Computational Cognitive Science. While this lab is optional, it is highly recommended to students with less extensive computational and mathematical experience.
Corequisite(s): Must be registered for AS.050.202 in order to register for this optional lab.

AS.050.240. World of Language. 3 Credits.
This hands-on course exposes students to the fascinating variety – and uniformity – to be found among the world's 6000 languages through group lectures on a variety of topics as well as actual linguistic fieldwork conducted in small groups with a native speaker of a language unknown to the participants. This course is a good preparation for upper-division linguistics courses.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.311. Written Language: Normal Processing and Disorders. 3 Credits.
This course surveys both the historical development of written language as well as current cognitive theories that account for the manner in which the written language is represented and processed by readers/writers of a language. Issues regarding the relationship between the written and spoken language, the neural bases of written language, the acquisition of written language skills, as well as acquired and developmental disorders of reading and writing will be examined.
Prerequisite(s): AS.050.102 OR AS.050.105 OR AS.050.203 OR AS.080.203
Area: Natural Sciences, Social and Behavioral Sciences
Writing Intensive

AS.050.315. Cognitive Neuropsychology of Visual Perception: The Malfunctioning Visual Brain. 3 Credits.
When we think about our ability to see, we tend to think about our eyes, but in fact vision happens mostly in the brain. This course explores the remarkable perceptual deficits that occur when the visual regions of the brain are damaged or fail to develop normally, focusing on what these perceptual malfunctions tell us about normal visual perception. Topics include visual system anatomy and physiology; functional specialization in the lower visual system as revealed by cerebral achromatopsia (color blindness resulting from brain damage) and akinetopsia (impaired motion perception); cortical plasticity in the visual system; spatial deficits in perception and action; and the implications of high-level visual deficits, including prosopagnosia (impaired face recognition), Charles Bonnet syndrome (complex visual hallucinations in blind areas of the visual field), blindsight (accurate responding to visual stimuli despite apparent inability to see them), and aphantasia (lack of visual imagery).
Prerequisite(s): AS.050.105 OR AS.050.203 OR AS.080.203 OR AS.050.101 OR AS.200.110 OR AS.200.211 or instructor's permission.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.317. Semantics I. 3 Credits.
This is an introduction to the study of meaning in natural language. We address the conceptual and empirical issues in semantic theory and introduce some formal machinery that has been developed to deal with such problems. After discussing foundational questions, we turn to formal semantics and pragmatics, as well as their interfaces with syntax and the lexicon. Specific topics include presupposition, type-driven composition, quantification, lexical aspect, argument structure, and lexical representations of meaning.
Prerequisite(s): AS.050.107 OR AS.050.102 or AS.050.240 or instructor's permission.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.318. Practicum in Language Disorders- Community Based Learning. 2 Credits.
This course provides the opportunity to learn about adult aphasias, language disorders which are one of the most common consequences of stroke. You will receive training in supportive communication techniques and work as a communication partner with an individual with aphasia for two hours per week. Three class meetings for orientation and reading assignments will be held on campus; training and practicum will be conducted at a local aphasia support center. Independent mode of transportation required. Co-listed as AS.080.400 in Neuroscience. Find out more about the practicum site at https://www.leagueforpeople.org/scale.
Prerequisite(s): A- or Better in AS.050.105 OR AS.050.203 OR AS.080.203 OR AS.050.311 or instructor's permission.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.320. Syntax I. 3 Credits.
Introduces the basic methods and means of analysis used in contemporary syntax investigations, practicing with data from different languages. Also offered as AS.050.620.
Prerequisite(s): AS.050.102 OR AS.050.240 or equivalent/see instructor.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.325. Phonology I. 3 Credits.
An introduction to the basic principles underlying the mental representation and manipulation of language sounds and their relation to human perception and vocal articulation: how units of sound are both decomposable into elementary features and combined to form larger structures like syllables and words. The role of rules and constraints in a formal theory of phonological competence and in accounting for the range of variation among the world's languages. Also offered as AS.050.625.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.326. Foundations of Cognitive Science. 3 Credits.
This course explores general issues and methodologies in cognitive science through the reading of classic works (from Plato and Kant through Skinner and Turing) and recent research articles to begin construction of a coherent picture of many seemingly divergent perspectives on the mind/brain. Recent brain-based computational models serve to focus discussion. Also offered as AS.050.626.
Area: Natural Sciences, Social and Behavioral Sciences
Writing Intensive

AS.050.332. Developmental Cognitive Neuroscience. 3 Credits.
In-depth examination of the current literature on cognitive development in the context of developmental cognitive neuroscience. Please see course prerequisites. Meets with AS.050.632.
Prerequisite(s): AS.050.101 OR AS.050.339 OR AS.200.132 OR AS.050.105 OR Instructor's Permission.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.333. Psycholinguistics. 3 Credits.
This course provides a broad survey of current research on language processing in adult native speakers and language learners. Topics include speech perception, word recognition, and sentence production and comprehension. We will discuss the nature of representations that are being constructed in real-time language use, as well as how the mental procedures for constructing linguistic representations could be studied by various behavioral and physiological measures. Also offered as AS.050.633.
Prerequisite(s): AS.050.102 OR AS.050.240 OR AS.050.317 OR AS.050.320 OR AS.050.325 or instructor's permission.
Area: Natural Sciences, Social and Behavioral Sciences
Writing Intensive

AS.050.339. Cognitive Development. 3 Credits.
This is a survey course in developmental psychology designed for individuals with some basic background in psychology or cognitive science, but little or none in development. The course is strongly theoretically oriented, with emphasis on issues of nature, and development psychology as well as relevant empirical evidence. The principle focus will be early development, i.e., from conception through middle childhood. The course is organized topically, covering biological and prenatal development, perceptual and cognitive development, the nature and development of intelligence, and language learning.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.346. Decoding the Brain: Multivariate Analysis in Cognitive Neuroscience. 3 Credits.
Neural decoding through Machine Learning has become an ever-important tool for neuroscientists to understand how the brain processes information. This course introduces students to this exciting field with seminar-style lectures and hands-on practice sessions. The course will be organized around a number of corner-stone applications of neural decoding in Cognitive Neuroscience, topics include face recognition, concept knowledge representation, and bridging language model and the brain. In the practice sessions, students will learn to analyze actual neuroimaging data and replicate the published findings with off-the-shelf software. By the end of the course, students will be familiar with the basic methods of neural decoding, and acquire hands-on experience of data analysis. Prior programming knowledge is not required and programming skill per se is not part of the evaluation, yet students are expected to familiarize themselves with the scripting interface and understand the basics through the practice sessions. If an interested student has taken a statistics course comparable to one of the listed prerequisite courses, contact the instructor and include the course number and description.
Prerequisite(s): EN.553.111 OR EN.553.112[OR EN.550.111 OR EN.550.112 OR EN.550.230 OR EN.550.310 OR EN.550.311 OR Instructor Permission
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.348. First Language Acquisition. 3 Credits.
This course provides an introduction to the fields of first and second language acquisition by looking at questions such as the following: Can the grammar of a native language be learned solely on the basis of noticing statistical correlations among words? How does native language acquisition explain — or is explained by — the universal properties, shared by all languages, of words and grammars? How does being exposed to multiple languages from birth affect language acquisition and what happens when a child is not exposed to any language early in life? Does the same cognitive mechanism guide language learning in children and adults? What factors account for individual differences in ease and ultimate attainment when a second language is learned later in life? Is it possible to become indistinguishable from a native speaker in a foreign language? What changes take place in the brain when a new language is learned? Also offered as AS.050.648.
Prerequisite(s): (AS.050.240 OR AS.050.320 OR AS.050.325) AND (AS.050.102 OR AS.050.206)
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.349. Second Language Acquisition. 3 Credits.
First language acquisition is natural and seemingly effortless. The situation is reversed when one tries to learn another language. This course discusses in what ways first and second language acquisition (SLA) differ and how individual differences of the learners as well as external factors contribute to the variability observed in rates and ultimate proficiency of second language learning in children and adults. We will discuss such topics as Universal Grammar access in early and late SLA, first language influence, critical periods, possibility of native-like attainment, and language attrition.
Prerequisite(s): (AS.050.240 OR AS.050.320 OR AS.050.325) AND (AS.050.348 OR AS.050.102 OR AS.050.206)
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.358. Language & Thought. 3 Credits.
Have you ever wondered about the relationships between language and thought? Philosophers, linguists, psychologists, evolutionary theorists and cognitive scientists have too and this course will survey the current thinking on this matter. Classical papers such as those by Whorf and Sapir, more recent philosophical papers by people such as Fodor and Dennett, and recent empirical work by linguists and psycholingists on the relationship between language and thinking in development and in adults will be covered. Discussions will focus on the theoretically possible relationships between language and thought and the empirical data that speak to these. Juniors and seniors only. Freshmen and sophomores by permission of instructor only.
Prerequisite(s): AS.050.102 OR AS.050.320 OR AS.050.325 or instructor permission.
Area: Humanities, Natural Sciences, Social and Behavioral Sciences

AS.050.360. Computational Psycholinguistics. 3 Credits.
How do we understand and produce sentences in a language we speak? How do we acquire the knowledge that underlies this ability? Computational psycholinguistics seeks to address these questions using a combination of two approaches: computational models, which aim to replicate the processes that take place in the human mind; and human experiments, which are designed to test those models. The perspective we will take in this class is that the models and experimental paradigms do not only advance our understanding of the cognitive science, but can also help us advance artificial intelligence and language technologies. While computational psycholinguistics spans all levels of linguistic structure, from speech to discourse, our focus in this class will be at the level of the sentence (syntax and semantics). The course will assume familiarity with programming and computational modeling frameworks in cognitive science, as covered by Introduction to Computational Cognitive Science or equivalent. Also offered as AS.050.660.An optional, hands-on lab (AS.050.361) is offered to supplement this course. It is highly recommended that students with less extensive computational and mathematical experience register for this lab.
Prerequisite(s): (AS.050.102 OR AS.050.240 OR AS.050.317 OR AS.050.320) AND (AS.050.202 OR EN.601.465) or Instructor Permission.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.361. Computational Psycholinguistics Lab. 0.5 Credits.
This course is an optional hands-on lab supplement for Computational Psycholinguistics. While this lab is optional, it is highly recommended to students with less extensive computational and mathematical experience.
Corequisite(s): Must be registered for AS.050.360 or AS.050.660 in order to register for this optional lab.

AS.050.365. Cracking the code: Theory and modeling of information coding in neural activity. 3 Credits.
One of the most foundational concepts in neuroscience is the idea that neural activity encodes information about an animal's sensory environment and internal mental states. This idea is closely connected to the concept of mental representation in cognitive science and philosophy, whereby the mind is proposed to contain internal symbols that represent things in the external world. There have been many fascinating discoveries about how neural signals encode information, but we are still far from a comprehensive theory of neural representation. Recent major developments in neuroscience and machine learning have opened up a new world of possibilities for investigating the underlying principles of information coding in the brains of humans and other animals.
In this course, we will discuss primary research articles on neural representation and information processing, and students will implement computational analyses that address issues in these domains. We will mostly focus on vision as a system that illustrates broader principles of information processing in the human brain. The reading material will include work from philosophy, neuroimaging, electrophysiology, and computational modeling. The topics covered include mental and neural representation, neural tuning, population coding, information theory, encoding and decoding models, dimensionality reduction, computational models, deep learning, and other applications of machine learning in neuroscience. Enrollment is limited to Juniors and Seniors. While this class does not have formal prerequisites, programming experience (e.g., AS 250.205 Introduction to Computing) and mathematical preparation (e.g., AS.110.107 Calculus II) are essential. It is also highly recommended that students have previously taken introductory courses in cognitive or systems neuroscience (e.g., AS.050.203 Neuroscience: Cognitive) and machine learning or neural network modeling (e.g., AS.050.372 Foundations of Neural Network Theory).
Area: Natural Sciences, Quantitative and Mathematical Sciences

AS.050.370. Mathematical Models of Language. 3 Credits.
This course will be devoted to the study of formal systems that have proven useful in the cognitive science of language. We will discuss a wide range of mathematical structures and techniques and demonstrate their applications in theories of grammatical competence and performance. A major goal of this course is bringing students to a point where they can evaluate the strengths and weaknesses of existing formal theories of cognitive capacities, as well as profitably engage in such formalization, constructing precise and coherent definitions and rigorous proofs. Also offered as AS.050.670.
Prerequisite(s): AS.050.102 OR AS.050.202
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.371. Bayesian Inference. 3 Credits.
This course introduces techniques for computational modeling of aspects of human cognition, including perception, categorization, and induction. Possible topics include maximum likelihood and Bayesian inference, structured statistical models (including hierarchical and graphical models), nonparametric models. The course emphasizes the close connections among data analysis, theory development, and modeling, with examples drawn from language and vision. Also offered as AS.050.671.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.372. Foundations of Neural Network Theory. 4 Credits.
Introduction to continuous mathematics for cognitive science, with applications to biological and cognitive network models: real and complex numbers, differential and integral multi-variable calculus, linear algebra, dynamical systems, numerical optimization. Also offered as AS.050.672.
Area: Natural Sciences, Quantitative and Mathematical Sciences

AS.050.375. Probabilistic Models of the Visual Cortex. 3 Credits.
The course gives an introduction to computational models of the mammalian visual cortex. It covers topics in low-, mid-, and high-level vision. It briefly discusses the relevant evidence from anatomy, electrophysiology, imaging (e.g., fMRI), and psychophysics. It concentrates on mathematical modeling of these phenomena taking into account recent progress in probabilistic models of computer vision and developments in machine learning, such as deep networks.Required Background: Calculus I and experience in a programming language (Python preferred).
Prerequisite(s): AS.110.106 OR AS.110.108
Area: Quantitative and Mathematical Sciences

AS.050.501. Readings in Cognitive Science/Freshmen. 1 - 3 Credits.
Assigned readings on current topics in cognitive science. Instructor approval required. Letter-graded.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.502. Readings in Cognitive Science-Freshmen. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.503. Research in Cognitive Science/Freshmen. 1 - 3 Credits.
Research current topics in cognitive science. Instructor approval required. Graded S/U.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.504. Research Cognitive Science-Freshmen. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.505. Readings in Cognitive Science/Sophomores. 1 - 3 Credits.
Research current topics in cognitive science.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.506. Readings Cognitive Science-Sophomores. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.507. Research in Cognitive Science/Sophomores. 1 - 3 Credits.
Research current topics in cognitive science. Instructor approval required. Graded S/U.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.508. Research Cognitive Science - Sophomores. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.509. Cognitive Science Internship. 1 Credit.
Research current topics in cognitive science.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.511. Readings in Cognitive Science/Juniors. 1 - 3 Credits.
Assigned readings on current topics in cognitive science. Instructor approval required. Letter-graded.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.512. Readings Cognitive Science-Juniors. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.513. Research in Cognitive Science/Juniors. 1 - 3 Credits.
Research current topics in cognitive science. Instructor approval required. Graded S/U.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.514. Research Cognitive Science - Juniors. 1 - 3 Credits.
Permission Required,
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.515. Readings in Cognitive Science/Seniors. 1 - 3 Credits.
Assigned readings on current topics in cognitive science. Instructor approval required. Letter-graded.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.516. Readings Cognitive Science - Senior. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.517. Research in Cognitive Science/Seniors. 1 - 3 Credits.
Research current topics in cognitive science. Instructor approval required. Graded S/U.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.518. Research Cognitive Science - Seniors. 1 - 3 Credits.
Permission Required.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.599. Research-Cognitive Science. 0 - 3 Credits.
Prerequisite(s): You must request Independent Academic Work using the Independent Academic Work form found in Student Self-Service: Registration > Online Forms.

AS.050.606. Intro to Bilingualism.
Do children get confused when they grow up exposed to more than one language? Is it possible to forget one's native language? Are the first and second language processed in different areas of the brain? How does brain damage impact the different languages of a polyglot? Does knowing a second language affect non-linguistic cognitive processing? This course will address questions such as these through an exploration of mental and neural processes underlying bilingual and multilingual language processing. Also listed as AS.050.206.

AS.050.617. Semantics I.
Also offered as AS.050.317. This is an introduction to the study of meaning in natural language. We address the conceptual and empirical issues in semantic theory and introduce some formal machinery that has been developed to deal with such problems. After discussing foundational questions, we turn to formal semantics and pragmatics, as well as their interfaces with syntax and the lexicon. Specific topics include presupposition, type-driven composition, quantification, lexical aspect, argument structure, and lexical representations of meaning.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.620. Syntax I.
Introduces the basic methods and means of analysis used in contemporary syntax investigations, practicing with data from different languages. Also offered as AS.050.320.

AS.050.622. Semantics II.
Co-taught with AS.050.322. This course extends the material in AS.050.317 to cover advanced but central topics in semantic and pragmatic theory, focusing on intensional semantics (especially possible world semantics and situation semantics). Empirical domains of interest in this class include modality, tense, grammatical aspect, conditionals, attitude and speech reports, questions, and free choice phenomena. Three core theoretical issues addressed in this class are the nature of a compositional account of the above intensional phenomena, the representations of possibilities involved, and the role of the syntax/semantics/pragmatics interface in such an account.
Prerequisite(s): AS.050.617
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.625. Phonology I.
An introduction to the basic principles underlying the mental representation and manipulation of language sounds and their relation to human perception and vocal articulation: how units of sound are both decomposable into elementary features and combined to form larger structures like syllables and words. The role of rules and constraints in a formal theory of phonological competence and in accounting for the range of variation among the world's languages. Also offered as AS.050.325.
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.626. Foundations of Cognitive Science.
Also offered as AS.050.326. This course explores general issues and methodologies in cognitive science through the reading of classic works (from Plato and Kant through Skinner and Turing) and recent research articles to begin construction of a coherent picture of many seemingly divergent perspectives on the mind/brain. Recent brain-based computational models serve to focus discussion.
Area: Natural Sciences, Social and Behavioral Sciences
Writing Intensive

AS.050.632. Developmental Cognitive Neuroscience.
In-depth examination of the current literature on cognitive development in the context of developmental cognitive neuroscience. Meets with AS.050.332.

AS.050.633. Psycholinguistics.
Also offered as AS.050.333. This course provides a broad survey of current research on language processing in adult native speakers and language learners. Topics include speech perception, word recognition, and sentence production and comprehension. We will discuss the nature of representations that are being constructed in real-time language use, as well as how the mental procedures for constructing linguistic representations could be studied by various behavioral and physiological measures.
Writing Intensive

AS.050.639. Cognitive Development.
Also offered as AS.050.339. This is a survey course in developmental psychology designed for individuals with some basic background in psychology or cognitive science, but little or none in development. The course is strongly theoretically oriented, with emphasis on issues of nature, and development psychology as well as relevant empirical evidence. The principle focus will be early development, i.e., from conception through middle childhood. The course is organized topically, covering biological and prenatal development, perceptual and cognitive development, the nature and development of intelligence, and language learning.

AS.050.648. First Language Acquisition.
This course provides an introduction to the fields of first and second language acquisition by looking at questions such as the following: Can the grammar of a native language be learned solely on the basis of noticing statistical correlations among words? How does native language acquisition explain — or is explained by — the universal properties, shared by all languages, of words and grammars? How does being exposed to multiple languages from birth affect language acquisition and what happens when a child is not exposed to any language early in life? Does the same cognitive mechanism guide language learning in children and adults? What factors account for individual differences in ease and ultimate attainment when a second language is learned later in life? Is it possible to become indistinguishable from a native speaker in a foreign language? What changes take place in the brain when a new language is learned? Recommended background: An introductory course in a linguistic course such as world of language, phonology, or syntax as well as a linguistics course such as language and mind or bilingualism. Also offered as AS.050.348.

AS.050.649. Second Language Acquisition.
First language acquisition is natural and seemingly effortless. The situation is reversed when one tries to learn another language. This course discusses in what ways first and second language acquisition (SLA) differ and how individual differences of the learners as well as external factors contribute to the variability observed in rates and ultimate proficiency of second language learning in children and adults. We will discuss such topics as Universal Grammar access in early and late SLA, first language influence, critical periods, possibility of native-like attainment, and language attrition. Recommended background in AS.050.102 Language and Mind, AS.050.348 Language Acquisition, AS.050.206 Bilingualism or equivalent.

AS.050.658. Language & Thought.
Have you ever wondered about the relationships between language and thought? Philosophers, linguists, psychologists, evolutionary theorists and cognitive scientists have too and this course will survey the current thinking on this matter. Classical papers such as those by Whorf and Sapir, more recent philosophical papers by people such as Fodor and Dennett, and recent empirical work by linguists and psycholingists on the relationship between language and thinking in development and in adults will be covered. Discussions will focus on the theoretically possible relationships between language and thought and the empirical data that speak to these.

AS.050.660. Computational Psycholinguistics.
How do we understand and produce sentences in a language we speak? How do we acquire the knowledge that underlies this ability? Computational psycholinguistics seeks to address these questions using a combination of two approaches: computational models, which aim to replicate the processes that take place in the human mind; and human experiments, which are designed to test those models. The perspective we will take in this class is that the models and experimental paradigms do not only advance our understanding of the cognitive science, but can also help us advance artificial intelligence and language technologies. While computational psycholinguistics spans all levels of linguistic structure, from speech to discourse, our focus in this class will be at the level of the sentence (syntax and semantics). The course will assume familiarity with programming and computational modeling frameworks in cognitive science, as covered by Introduction to Computational Cognitive Science or equivalent. Also offered as AS.050.360.An optional, hands-on lab (AS.050.361) is offered to supplement this course. It is highly recommended that students with less extensive computational and mathematical experience register for this lab.

AS.050.665. Cracking the code: Theory and modeling of information coding in neural activity.
One of the most foundational concepts in neuroscience is the idea that neural activity encodes information about an animal's sensory environment and internal mental states. This idea is closely connected to the concept of mental representation in cognitive science and philosophy, whereby the mind is proposed to contain internal symbols that represent things in the external world. There have been many fascinating discoveries about how neural signals encode information, but we are still far from a comprehensive theory of neural representation. Recent major developments in neuroscience and machine learning have opened up a new world of possibilities for investigating the underlying principles of information coding in the brains of humans and other animals.
In this course, we will discuss primary research articles on neural representation and information processing, and students will implement computational analyses that address issues in these domains. We will mostly focus on vision as a system that illustrates broader principles of information processing in the human brain. The reading material will include work from philosophy, neuroimaging, electrophysiology, and computational modeling. The topics covered include mental and neural representation, neural tuning, population coding, information theory, encoding and decoding models, dimensionality reduction, computational models, deep learning, and other applications of machine learning in neuroscience. Enrollment is limited to Juniors and Seniors. While this class does not have formal prerequisites, programming experience (e.g., AS.250.205 Introduction to Computing) and mathematical preparation (e.g., AS.110.107 Calculus II) are essential. It is also highly recommended that students have previously taken introductory courses in cognitive or systems neuroscience (e.g., AS.050.203 Neuroscience: Cognitive) and machine learning or neural network modeling (e.g., AS.050.372 Foundations of Neural Network Theory).

AS.050.670. Mathematical Models of Language.
This course will be devoted to the study of formal systems that have proven useful in the cognitive science of language. We will discuss a wide range of mathematical structures and techniques and demonstrate their applications in theories of grammatical competence and performance. A major goal of this course is bringing students to a point where they can evaluate the strengths and weaknesses of existing formal theories of cognitive capacities, as well as profitably engage in such formalization, constructing precise and coherent definitions and rigorous proofs. Recommended background in language and mind or computational cognitive science. Also offered as AS.050.370
Area: Natural Sciences, Social and Behavioral Sciences

AS.050.671. Bayesian Inference.
Also offered as AS.050.371. This course introduces techniques for computational modeling of aspects of human cognition, including perception, categorization, and induction. Possible topics include maximum likelihood and Bayesian inference, structured statistical models (including hierarchical and graphical models), nonparametric models. The course emphasizes the close connections among data analysis, theory development, and modeling, with examples drawn from language and vision.
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AS.050.672. Foundations of Neural Network Theory.
Introduction to continuous mathematics for cognitive science, with applications to biological and cognitive network models: real and complex numbers, differential and integral multi-variable calculus, linear algebra, dynamical systems, numerical optimization. Recommended course background in Calculus I. Also offered as AS.050.372.

AS.050.675. Probabilistic Models of the Visual Cortex.
The course gives an introduction to computational models of the mammalian visual cortex. It covers topics in low-, mid-, and high-level vision. It briefly discusses the relevant evidence from anatomy, electrophysiology, imaging (e.g., fMRI), and psychophysics. It concentrates on mathematical modelling of these phenomena taking into account recent progress in probabilistic models of computer vision and developments in machine learning, such as deep networks.Also offered as AS.050.375.

AS.050.690. Directed Readings in Cognitive Science.
Directed readings on current topics in cognitive science. Instructor approval required.

AS.050.801. Research Seminar in Cognitive Neuropsychology.
Participants in this graduate seminar will read and discuss current research articles in cognitive neuropsychology of vision or language, and present their own research.

AS.050.802. Research Seminar in Cognitive Processes.
Permission required. Current issues and ongoing research on human cognition are discussed.

AS.050.806. Research Seminar in Cognitive Neuroscience and Machine Learning.
Participants in this seminar will read and discuss current research articles in the fields of cognitive neuroscience, computational neuroscience, machine learning, and artificial intelligence. The seminar will focus on research that provides insights into the representations and algorithms of the human brain, with an emphasis on vision and natural semantic understanding.

AS.050.809. Research Seminar in Computational Cognitive Science.
This seminar is on computational models for vision and its interaction with language. For Cognitive Science, computational models, like Deep Nets, offer the possibility of developing computational theories which can be tested on natural, or realistically synthetic images. But Deep Nets by themselves are unable to capture the richness and flexibility of human perception, so we will discuss other classes of model with more compositional structure and ability to represent the physical properties of the 3D world. These will be related to, and motivated by, behavioral and electrophysiological experiments.

AS.050.811. Research Seminar in Language & Cognition.
A specialized research seminar for individuals researching language acquisition, cognitive development and the interface between language and cognition. Students must actively carry out empirical or theoretical research in these areas. Permission required.

AS.050.812. Research Seminar in Computational Cognitive Neuroscience.
This seminar will discuss papers and ongoing research in the areas of computational cognitive neuroscience, with a focus on different areas of visual and social perception.

AS.050.814. Research Seminar in Computer Vision.
This seminar is based on topics in computational vision with the option of attending additional subgroup meetings on specific topics.

AS.050.817. Research Seminar in Semantics.
A critical analysis of current issues and debates in natural language semantics. Discussion of on-going research. Permission required.

AS.050.818. Research Seminar: AcqLab Meeting.
Participants in this graduate seminar will read and discuss current research articles in language development and present their own research. Permission required.

AS.050.819. Research Seminar in Psycholinguistics.
Discussion of current computational and experimental research on human language processing.

AS.050.822. Research Seminar Syntax.
A critical analysis of current issues and debates in theoretical syntax. Discussion of on-going research.

AS.050.825. Research Seminar in Optimality Theory.
A specialized research seminar on constraint based theories of human language, including Optimality Theory, Harmonic Grammar, and Maximum Entropy models.

AS.050.826. Research Seminar in Formal Approaches to Cognitive Science.
Readings and research presentations on varying topics in mathematics, computation, and formal linguistics with bearing on cognitive science.

AS.050.827. Research Seminar in Language Acquisition.
Focus is on current research in acquisition of syntax.

AS.050.829. Research Seminar on Formal Theory in Cognitive Science.
Topics range from mathematical analysis of neural networks to computational studies of linguistic structure. Focus is ongoing research and current literature.

AS.050.839. Research in Cognitive Science.
Current topics in any area of cognitive science, including language and vision, with discussion of recent developments in theory, experimental study, and computational modeling.

AS.050.849. Teaching Practicum.
Permission required. Essential for Teaching Assistants.

AS.050.860. Professional Seminar in Cognitive Science.
Instructor permission required.Addresses professional issues such as research ethics, success on the job market and in an academic career, teaching and mentoring and differing professional standards in the sub-disciplines of cognitive science.

AS.050.870. Dissertation Research.
Independent study. Intended for graduate students who have completed all degree requirements except for their dissertation but must remain or return to residency status in order to fufill other obligations. Advisor or department approval required