COGS 200: Foundations in cognitive science

Wed 9:30-12:20, AQ 5008

Contact Information

Instructor:	John Alderete	Webpage:	www.sfu.ca/~alderete
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Office Hours:	Tues 12-1pm	Prerequisite:	COGS 100, or by consent

Course description:

This course is an in-depth introduction to the methods and theoretical frameworks for exploring the mind. It introduces students to some of the major results in cognitive science and fleshes out several of the foundational debates that have fueled investigations in the past fifty years. Taking an interdisciplinary approach, the course illustrates how a convergence of ideas from psychology, philosophy, linguistics, and computer science has led to deep explanations of human cognitive capacities, as well as clarified some research questions that are being actively investigated today. Because of the expanded nature of the field, we will build foundations by focusing on a few core theories, including symbolic-computational, connectionist and Bayesian theories of cognitive processes. We will also tend to concentrate on certain core problems in cognitive science, like language processing, human rationality, object processing, concepts, and learning in general.

Required texts:

- *Cognitive science: An introduction to the science of the mind*, José Luis Bermúdez, 2014 (2nd Edition), Cambridge University Press.
- Supplemental readings (see Bibliography) available electronically on Canvas

Course requirements and weightings of assignments

Interpretive exercises (several)	10%
Participation (commentaries on Canvas)	10%
Presentation (one):	20%
90 minute exams (two):	60%

Exams: Feb. 21, Mar. 21

Missed exams: Please put these dates in your calendar. If you miss an exam for medical reasons, please bring a certificate of illness (from SFU Health & Counselling) that documents the the illness with your regular health care provider. I will confirm the justification for the absence and excuse the absence. Excused absences will have the result that the missed exam will not factor in your grade. Unexcused absences will result in a zero.

Course philosophy

Discussion-oriented lectures The course is really built on class discussion. Each class has a topic area and a set of questions and exercises to start us off. But the answers to the questions, or at least the next steps towards the answers, are fleshed out in class discussion. It is often the case that class discussion identifies new directions for future investigation and reading.

Participate! Participation is formalized with the Canvas discussion board (see below), but the following general comments are helpful suggestions for your success. Active participation really facilitates learning. The fastest

way to learn the material is to engage fully in the class activities. There are many different ways to participate. Active listening is also extremely important, and can be demonstrated by including points from class discussion in your written work.

Working groups: In the beginning of the semester you will be assigned to work groups of approximately five people. You will work in these groups for various small group activities, including the interpretative exercises.

Reading in detail We use a textbook, but this is really just the beginning of our reading. We also read detailed treatments of selected problems. Some of this reading will be challenging and hopefully thought-provoking to you. If you find yourself getting stuck, or that there are obstacles to your participation in the class, please come and talk to me about this. Don't let small obstacles get in the way of understanding.

Assignments

Interpretive exercises There will be several of these, perhaps one every other week. They are focused questions designed to flesh out the reading or an assignment built around the objective for the week. In "Group Quizzes" you will take a quiz and then work in groups to find consensus answers. Grades are based on the grade for the larger group for the group quizzes and on completion for the extended exercises. The exams are very similar to interpretative exercises, so they are good practice for the exams.

Participation In addition to the textbook readings, there are 13 articles we will read to engage with course concepts. Each of these articles has one or two presenters and a discussion board associated with it on Canvas. For each article, each student is asked to make an extended comment on the reading. An extended comment is approximately a short paragraph, with the goal of making a critical comment, making an observation about a new direction for the research, or simply asking a detailed question about what is actually being said in the article. These commentaries are used by the presenter(s) to form their discussions. These commentaries are a way for you to "get your word in" for the discussion and shape it a way that helps the presenter.

Presentations Each student will give one presentation. The first day of class we will assign the presentation dates to all the students. A presentation is composed of a ten minute summary of the assigned article, plus a 20 minute discussion based on the Canvas commentaries. Some articles are rather long and require two students to cover all the article. In this case, the presentation will have a longer summary and discussion. Presentations are graded on the basis of: clarity, overall organization, skill in guiding the discussion. The general categories are: outstanding in every way (100%), excellent but could be improved (90%), very good (80%), good (70%), poor (60%).

Mechanics: students may use whatever materials they prefer, e.g., powerpoint slides, handouts, etc., but slides usually work best. Please prepare in advance your materials and ways of delivering them (laptops and adaptors for slide presentations). Students are also encouraged to come and talk to me about how to structure your presentation and guide the discussion.

Lateness policy: aAll assignments must be completed to pass the course. Late assignments are accepted, but are marked down by one percentage point for every week day that extends beyond the deadline. You can miss one interpretive exercise, but subsequent missed exercises result in a zero.

Lectures and assigned readings

JLB = the Bermúdez textbook 'Cognitive Science'.
Note: the dates for all exams are given in bold. Presenter spaces are given under the articles.

Jan. 3, Course introduction, assignment of articles
Objective: give a general introduction to the course and symbolic computational architectures.
Setup: symbolic systems toolbox and extended exercises

Jan. 10, Human rationality
Objective: use facts of human rationality as a way of exploring the modularity of mind
JLB: 10.2-10.3 (285-305)
Article: Samuels et al. (1999), Presenter: John Alderete
Setup: general linguistics toolbox and introduction to language acquisition

Jan. 17, Language acquisition and formal learning
Objective: to understand the problem posed by language acquisition with concrete examples and establish a framework for acquisition as a physical symbol system
JLB: 6.1 (141-151)
Article 1: Berko (1958), Presenter _____

Article 2: Lidz et al. (2003), Presenter _____
Setup: language of thought background

Jan. 24, The language of thought
Objective: understand the language of thought as a formal system and how it can be extended to domains beyond language
JLB: 6.2 (151-159)
Article: Camp (2007), Presenters _____ and _____
Setup: object permanence

Jan. 31, Spelke objects
Objective: use the FINST theory of visual indexing to account for both the infant's object concept and adult knowledge of object tracking.
JLB: 9.3 (254-261)
Article: Scholl and Leslie (1999), Presenters _____ and _____
Setup: concept learning and development in categorization

Feb. 7, Concept learning
Objective: understand the nature of learning concepts and how it might be overcome with learning biases
Article 1: Chap. 2 of Markman (1991), Presenter: _____

Article 2: Chap. 4 of Markman (1991), Presenter: _____

Feb. 21, Exam 1, first 90 minutes of class
Setup: toolbox for connectionist networks

Feb. 28, Language acquisition and connectionism
Objective: to reexamine a formal rule at the microstructure level and see how it can account for detailed facts in language development.
JLB: 8.1-8.2 (209-227) and 9.2 (245-254)
Article: McClelland and Rumelhart (1986), Presenters _____ and _____
Setup: distributed representations and more advanced learning techniques

Mar. 7, Connectionism and concept learning
Objective: to understand how a connectionist network learn categories under different learning conditions
JLB: 8.308.4 (227-235)
Article 1: McClelland and Rumelhart (1985), Presenters _____ and _____

Article 2: Hinton (1986), Presenter _____
Setup: introduction to language production

Mar. 14, Connectionism and speech production
Objective: understand how a connectionist network can be couched within a hybrid model with symbolic and numerical computation to explain certain psychological effects in speech errors
Article: Dell (1986), Presenters _____ and _____

Mar. 21, Exam 2, first 90 minutes of class
Setup: toolbox for Bayesian analysis

Mar. 28, Bayesian concept learning
Objective: understand how Bayes's theorem can be applied to concept learning, including the fast-mapping of concepts
Article 1: Tenenbaum and Xu (2000), Presenter _____

Article 2: Xu and Tenenbaum (2007), Presenter _____

Apr. 4, Bayesian language acquisition
Objective: understand how language acquisition can be approached with both statistical tools and symbolic categories
Article: Pearl and Goldwater (2016), Presenters _____ and _____

Bibliography

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