COGS 200: Foundations in cognitive science

Mon 12:30-2:30 AQ 5014, Wed 12:30-1:30 BLU 10031

Contact Information

Instructor:	John Alderete	Webpage:	www.sfu.ca/~alderete
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Office Hours:	M 2:30-3:30, Tues 1:30-2:30	Prerequisite:	COGS 100, or by consent

Course description:

This course is an in-depth introduction to some of the important empirical 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 and connectionist theories of cognitive processes, or 'macro' and 'micro' structure theories used below in the Lectures section. We will also tend to concentrate on certain core problems in cognitive science, like language acquisition, object processing, and concept learning. With these foundations, additional topics and theories will be introduced, like human rationality and cognitive processes as Bayesian inference.

Required texts:

- *What is cognitive science?*, Edited by Ernest Lepore and Zenon Pylyshyn, 1999, Blackwell Publications
- *Cognitive science: An introduction to the science of the mind*, José Luis Bermúdez, 2010, Cambridge University Press.
- Supplemental readings (see references) available electronically free from the library.

Course requirements and weightings of assignments

Attendance/participation:	10%
Write-ups of two readings:	30%
Homeworks (three):	30%
30 minute quizzes (three):	30%

Quizes

Feb. 1, Mar. 7, Apr. 4

Missed quizzes: Please put these dates in your calendar. If you miss a quiz for medical reasons, please bring a doctor's note so I can confirm the justification for the absence and excuse the absence. Excused absences will have the result that the missed quiz will not factor in your grade. Unexcused absences will result in a zero.

Course philosophy and the assignments

Discussion-oriented lectures The course is really built on class discussion. Each class has a topic area and a set of questions to start us off, and the answers, 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! 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 engage, however, so don't be worried if you are not the first one to answer a question in class discussion. Active listening is also extremely important. You can provide evidence of active listening by incorporating discussion points from class in your write ups and other written work. Active participation also includes: engaging with the instructor in office hours, supporting your project partners or homework partners in different ways (this can be registered in your written work if you choose to), and asking questions over email. If you find yourself getting stuck, or that there are obstacles to your participation in the class, please come and talk to the instructor about this. A good goal is to try to at least ask a question each class, even if it is something like, 'Can you restate that last point—it doesn't make sense to me?' That is participating!And by the way, attendance is taken on random dates and factors in the participation grade too.

Assignments

Write-ups The readings are tremendously important because they fuel the course discussions. For this reason, students will write 2-3 page 'write-ups' that break down and analyze two of the core readings, Scholl and Leslie 1999 and McClelland & Rumelhart 1985. See Cogs 200 Write up Guide on the Teaching Page for specific format and also a model write-up.

Homeworks For some readings, homework problems are a better way to learn. They will have a specific structure and due date. You may collaborate with your colleagues in teams of up to four students. Each team submits a single solution for the entire team, listing the names of all those in the team.

Lateness policy: all 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. Assignments are due in class, at the beginning of class.

Lectures and assigned readings

The lectures will follow the sequence shown below. The readings for each lecture are given and should be read prior to the lecture. JLB = the Bermúdez textbook 'Cognitive Science', and WISC = 'What is Cognitive Science', from the required readings. All other readings in parentheticals (see References section) are available free from the online resources in the library; see the eBook and eJournal tools on the library website.

Introduction
The cognitive revolution, review JLB chap. 1
Macrostructure: generative syntax fragment [class notes]
Microstructure: spreading activation in speech production [class notes]
Different domains of cognition [class notes]
The intregration challenge, JLB chap. 4 overview

The organization challenge, JLB chap. 10 overview

Cognition and macrostructure
Physical symbol systems, JLB 145-156
The language of thought, JLB 156-165
Chomskyian modularity, JLB 17-19
Fodorian modularity, JBL 293-302
Massive modularity, JBL 303-310
Evolutionary psychology, JBL 101-108
Rationality and modularity, Samuels et al. 1999 in WISC
Object permanence, JBL 262-270
Object processing and FINST, Scholl & Leslie 1999 in WISC
Introduction to language acquisition, JBL 247-253
Optimality Theory, (Prince & Smolensky 1997)
Grammar learning in OT, Tesar et al. 1999 in WISC
Introduction to concepts, (Markman 1991), chap. 1
Concept taxomonies and prior knowledge, (Markman 1991) chap. 2

Cognition and microstructure
Motivating micro-structure [class notes]
Computational modeling and the brain, JBL 71-77
Simple connectionist networks, JBL 222-232
Two level English past tense, JBL 254-261
Multi-layer connectionist networks, JBL 233-238
Recurrent network dynamics [class notes]
Concept learning in neural networks, (McClelland & Rumelhart 1985)
Object processing in neural networks, JBL 270-277
Neural computation and neuroscience, Hanson 1999 in WISC

Relating micro- and macro-structure
Levels of explanation, JBL 47-54, 127-133
Integrated connectionist/symbolic cognitive architecture, (Smolensky 2006)
Hybrid architecture: ACT-R, JBL 314-320
Concept learning (via words) with Bayesian inference, (Tenenbaum & Xu 2000)
Dynamical systems and situated cognition, JBL 413-431

References

Markman, Ellen. 1991. Categorization and naming in children Cambridge, MA: The MIT Press.

McClelland, James L. & David Rumelhart. 1985. Distributed memory and the representation of general and specific information. Journal of Experimental psychology: General 114.159-88.

Prince, Alan & Paul Smolensky. 1997. Optimality: From neural networks to Universal Grammar. Science 275.1604-10.

Smolensky, Paul. 2006. Harmony in linguistic cognition. Cognitive Science 30.779-801.

Tenenbaum, Josh & Fei Xu. 2000. Word learning as Bayesian inference. Proceedings of the 2000 annual meeting of the Cognitive Science Society.