COGS 300
Understanding & Designing Cognitive Systems

Instructors

Theo Rosenfeld
theo@engagedata.ca
Office hours by appointment

Christopher Mole
chris.mole@ubc.ca
Office hours by appointment

Teaching Assistants

Eric Laycock,
Valerie Wyns,
Peter Crout
Cogs300@gmail.com

Goals for COGS 300

To give you an appreciation of key theoretical and methodological issues needed to integrate the multiple disciplinary perspectives of the COGS Program.

To provide you with opportunities to practice synthesizing and applying the concepts encountered in COGS related courses.

Required Materials

All readings will be available for free on Connect.
You will need an iClicker for class participation, and
You will need to contribute $20 towards your lab Arduino kit.

Structure of Classes

This class in designed for active participation by you, the students. To do well you will need to attend class and participate in the activities – in order to participate in the activities you will need to complete assignments on time and read the material before class. In return, we will do our best to make the class more engaging than listening to us lecture you for 13 weeks.

Student Presentations

Some Tuesdays will consist of ~15 minutes of instructor lecture, followed by 3 student presentations (each ~ 12 minutes).

Students will prepare and deliver presentations in groups of 4 or 5. The material presented will focus on one of the readings for that week. Each student will be involved in 1 presentation.

Summaries

Every Tuesday most students – all EXCEPT those who presented that week - will be required to have written a very short (~200 words) summary of one of the readings.

The summary should demonstrate the student read the material and not be longer than 250 words. It should also include the definition of two terms that helped you understand the material, these definitions should be separate from the body of the summary and will not count towards the word limit. Provide a reference to the dictionary you used. Summaries must be submitted to Connect before class begins.

Reading Responses

All students will be assigned to 1 of 2 cohorts (A or B).

On most Thursdays students from 1 cohort will be required to provide a short (~400 word) response to one of the readings. The response should reference at least one other source (does not need to be a reading from this class) and it should 'go beyond' the reading in some way. You can discuss implications of the reading, present applications or examples not covered in the reading, challenge or contest the reading in some way – its up to you how you respond.

In groups, students will spend ~30 mins reviewing and providing feedback on the Responses. Responses will be due for marking 1 week later, it is up to each individual whether they want to incorporate the peer feedback they received.

Each student will be assigned 3 responses and 10 summaries. Each student's final grade will include the best 8 summaries.

Labs

The labs for this course will learning to use Arduino microprocessors and controlling Lego Mindstorms robot components with the Arduinos. Students in each lab section will work in teams of 4. Each student will be required to pay $20 toward their group's Arduino kit. Each group will own their Arduino kits – all Mindstorms components remain property of the COGS program. Each group can keep or resell their Arduino kits however they see fit.

Evaluation

Responses (24%) Every student will be responsible for completing 3 Response assignments as described above.

Exam (24%) There will be a final exam which will test knowledge of material from the readings and lectures, as well as student's ability to integrate and communicate material.

Labs (20%) Students will be responsible to attend labs and work together in groups of 4 or 5. There will be 6 lab assignments.

Summaries (10%) Students will be responsible to write at least 8 short (~200 word) summaries over the course of the term. Each summary will communicate the key points of 1 reading, and include the definition of 2 terms that are important to understanding the reading. Marks from the 8 best summaries will count towards the final grade.

iClicker Questions (8%) Every class we will ask several questions via iClicker. Some of the questions gauge opinion, others will test comprehension of the material.

Exam Questions (8%) Every student will be responsible for submitting a potential exam question, with an example of a correct answer. The questions will be written short-answer questions that combine ideas from at least 2 readings.

Presentation (5%) Students will work in groups of 4 or 5 to present one of the course readings to the rest of the class. Each group will be assigned 1 reading.

Cognitive System of Interest (1%) In the first week of class students will be responsible for introducing themselves on the class discussion board, and describing (at least) one application they are particularly interested in. Be specific, if you're into robots we want to know what sort of robots really excite you (etc.).

Schedule

Unit 1 Understanding Cognition (Biological Intelligence) – Weeks 1:5

We will familiarize us with some foundational concepts that will help us discuss cognitive systems.

Unit 2 Design for Human Cognition Weeks 6:10

I - (Distributed Intelligence) – Weeks 6 & 7
We will turn our attention to the design of tools built to extend human cognitive capacity.

Reading Week – Week 8

II - (Augmented Intelligence) – Weeks 9 & 10
We will look at technologies that blend human and machine intelligence.

Unit 3 Design for Machine Cognition (Artificial Intelligence) – Weeks 11:13

We will complete the term with robots, of course. Lots of robots and some applications of AI.

In the schedule on the next page:

Tuesdays that are marked with white text on a dark background are student presentation days. On those days 3 groups of students will each present 1 of the readings. Students who present are not responsible for any written assignments that same Week.

The cohort indicated on Thursdays will be responsible for bringing a written reading Response to class. The Response assignment will be due for grading the following week – but a finished draft must be brought to class (and submitted to Connect) in order to receive full marks.

More	Topic	Reading	Tues	Thurs	Lab
1			**1/3**	**1/5**	X
2	Complex Systems	Swarm Robotics Minimal Cognition	**1/10**	**1/12** **Cohort A**	Cellular Automata
3	Emergence	Mind in Life	1/17 Swarm Robotics Minimal Cognition Mind in Life I	**1/19**	Connections
4	Ecological Cognition	Affordances Algorithms in Nature	**1/24** Affordances Algorithms in Nature Mind in Life II	**1/26** **Cohort B**	Sensor Reading
5	Irreducibility	Real Patterns	**1/31**	**2/2**	Sensor Reading
6	Cognitive Artifacts	Things that Make Us Smart	**2/7**	**2/9** **Cohort A**	Maze
7	Analytics & Visualization	Visualization Rhetoric Object Perception	2/13 Things Make Us Smart Visualization Rhetoric Object perception	**2/15**	Maze
8	Reading	Break	**2/21**	**2/23**	
9	Augmented Intelligence	Augmented Attention (Un)Serendipity	**2/28**	**3/2** **Cohort B**	Maze
10	Chatbots	Chatbot Agency	3/7 Augmented Attention (Un)Serendipity Chatbot Agency	**3/9** **Cohort A**	Tournament I
11	Ethics	Superintelligence	**3/14**	**3/16**	Tournament I
12	Robots & AI	Robot Cambrian Concept of Cat Face	**3/21**	**3/23**	Tournament II
13	Care robots	Assistive Robots	3/28	**3/30**	Tournament II

			Robot Cambrian Concept of Cat Face Assistive Robots	**Cohort B**	
14	Review		**4/4**	4/6	X

Readings

Week 2

Gerardo, Beni (2005). “From Swarm Intelligence to Swarm Robotics” *Swarm Robotics: Sab 2004 International Workshop, Revised Selected Papers* 1-9

Calvo, P and Baluska F (2015). “Conditions for minimal intelligence across eukaryote: a cognitive science perspective.” *Frontiers in Psychology.* 6:1329 1-4

https://www.theatlantic.com/science/archive/2016/12/the-brainless-slime-that-can-learn-by-fusing/511295/

Week 3

Thompson, Evan (2007). “Autonomy and Emergence” *Mind in Life: Biology, Phenomenology, and the Sciences of Mind* (Ch 3). Harvard University Press. 37-65

http://www.radiolab.org/story/from-tree-to-shining-tree/

Week 4

Navlakha, S and Bar-Joseph, Z (2011). “Algorithms in nature: the convergence of systems biology and computational thinking.” *Molecular Systems Biology*. 7:546 1-11

Gibson, James (1986). “The Theory of Affordances.” *The Ecological Approach to Visual Perception* (Ch 8). Lawrence Erlbaum Associates.

Week 5

Dennett, Daniel C. (1991). "Real patterns." *The Journal of Philosophy* 88.1: 27-51.

Week 6

Norman, Don (1993). “The Power of Representation” *Things that Make Us Smart: Defending human attributes in the age of the machine* (ch 3) Basic Books. 43-75

http://www.theatlantic.com/technology/archive/2016/06/tech-and-other-peoples-problems/488297/

Week 7

Visual object perception paper - tbd

Hullman, Jessica, and Diakopoulos, Nicholas (2011). “Visualization Rhetoric: Framing Effects in Narrative Visualization” *IEEE Transactions on Visualization and Computer* Graphics 17.12: 2231-2241

http://idatassist.com/how-not-to-visualize-like-a-racist/

Week 8

Reading Break

Week 9

Vertegaal, Roel et al. (2006). “Designing for Augmented Attention: Towards a framework for attentive user interfaces.” *Computers in Human Behaviour* 22.4: 771-789

Andre, Paul et al. (2009). "Discovery is Never by Chance: Designing for (Un)Serendipity" *Proceedings from the seventh ACM conference of Creativity and Cognition.* 305-314

Week 10 Guilbeault, Douglas (2016). "Growing Bot Security: An Ecological View of Bot Agency."

Haunted by Data http://idlewords.com/talks/haunted_by_data.htm

Week 11 Bostrom, Nick (2014). "Is the Default Outcome Doom?" *Superintelligence* (Ch 8). Oxford University Press

Week 12 Pratt, Gill (2016). "Is a Cambrian Explosion Coming for Robotics?" *Journal of Economic Perspectives.* 29:13

Taylor, Paul (2016). "The Concept of Cat Face" *London Review of Books.* 38:16 30-32

Week 13 Rabbitt et al. (2015). "Integrating socially assistive robotics into mental healthcare interventions: applications and recommendations for expanded use" *Clinical Psychology Review.*

Plagiarism and other forms of academic misconduct
will not be tolerated
***** UBC policies on these will be enforced *****
(http://www.library.ubc.ca/home/plagiarism/)