Informatics 1 Cognitive Science

Lecture 1: Course Overview

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Overview

What is Cognitive Science?

Course Overview

Course Organisation

Starting with a Short Survey

We will do a short survey on WooClap:

1. Which degree are you studying for?
2. Which year are you in?

Your Course Staff

Matthias Hennig

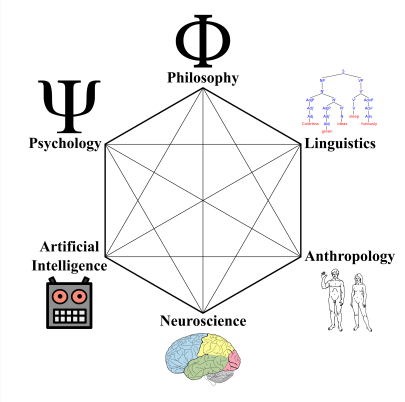
Maithilee Kunda

Jordan Watts (TA)

What is Cognitive Science?

What is Cognitive Science?

Cognitive science is the scientific study of the human mind. Highly interdisciplinary:



Aim: to characterise the nature of human knowledge, and how that knowledge is used, processed, and acquired.

What is Cognitive Science?

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- A mental representation is a description of information in the mind.
- A mental process is a procedure for translating:
  - sensory information into representations;
  - representations into other representations; and
  - representations into actions/behavior.

What is Cognitive Science?

We will look at the overall landscape of cognitive science:

- what kind of questions cognitive scientists ask;
- what type of data they collect to answer these questions;
- what theories they build based on these data;
- what computational models they use to implement these theories.

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Computational modeling can be used to evaluate theories, generate new hypotheses, guide the collection of new data.

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2. Could we still deal with quantities if we didn't have any numbers?

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What is Cognitive Science?

Let's look at a few examples of questions we might ask about human cognition:

1. Does our brain get physically bigger when we learn something new?
2. Could we still deal with quantities if we didn't have any numbers?
3. Can computers learn anything we can learn?

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   More on neural throughout the course.

References:

1. Maguire, E. A., Gadian, D. G., Johnsrude, I. S., Good, C. D., Ashburner, J., Frackowiak, R. S., & Frith, C. D. (2000). Navigation-related structural change in the hippocampi of taxi drivers. *Proceedings of the National Academy of Sciences,* 97(8), 4398–4403.
2. Frank, M. C., Everett, D. L., Fedorenko, E., & Gibson, E. (2008). Number as a cognitive technology: Evidence from Pirahã language and cognition. *Cognition,* 108(3), 819–824.
3. LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. *Nature,* 521, 436–444.

Continuing with the Short Survey

1. What do you find most exciting about Informatics 1 Cognitive Science?
2. What is your biggest worry about the course?

Give your answers on WooClap!

Course Overview

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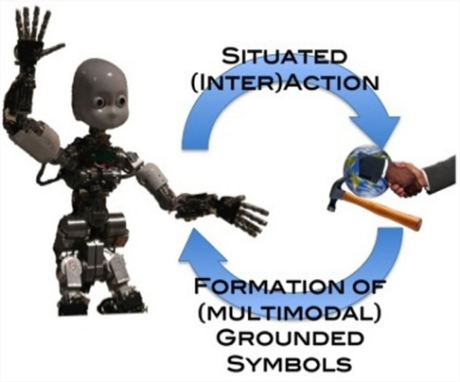
This course provides an introduction to cognitive science from a computational perspective. We cover several areas of cognition, including:

- connectionist models (neural networks)
- vision
- language and categories
- learning and memory
- comparative cognition and social cognition
- reinforcement learning

We will introduce important problems, data, theories in the field (some of this may be familiar from Introduction to Cognitive Science or from Psychology 1A).

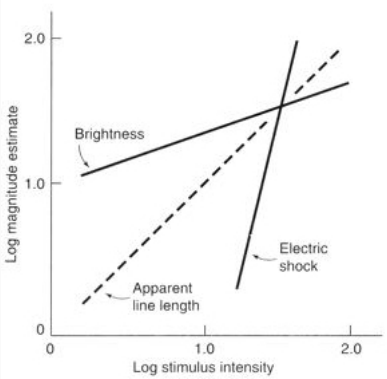
Here the focus will be on the computational modeling of these problems, data, theories. You will learn to design, implement, and test cognitive models.

Modeling in Cognitive Science



- People often use "model" and "theory" interchangeably;
- here theory specifies the goal of the computation;
- a model is a instantiation of a theory;
- modeling can have physical, mathematical and computational aspects to it.

Modeling in Cognitive Science



$$P = k\,S^n$$

P : perceived magnitude
S : stimulus intensity
k : constant

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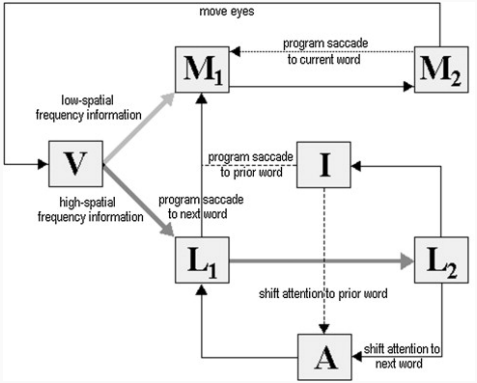

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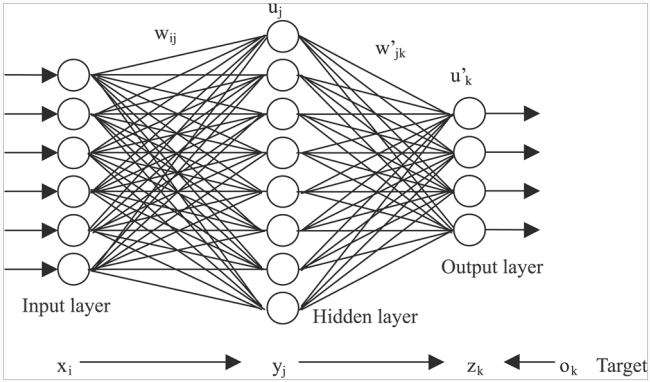

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Required Background

This course is suitable of outside students. But bear in mind:

- the assignments require programming in Python;
- Introduction to Cognitive Science provides relevant background; Introduction to Computing is also useful;
- there will be some maths (probability, linear algebra, calculus).

The labs are designed to provide help with programming.

Continuing with the Short Survey

1. Have you ever used Python before?
2. Do you have experience with another programming language?
3. How comfortable are you with maths?

Provide your answers on WooClap!

Course Organisation

Lectures

Three lectures per week:

- All the lectures of this course will be in person. However, they will also be live-streamed and recorded. Details on the course website.
- All the material for a given week will be released on the previous Friday. This will include a list of tasks for that week.
- This includes self-study (reading) and preparation for labs.

Advice #1: Try to keep up with the lectures and the weekly course tasks (rather than trying to binge-watch all the videos later . . .).

Lectures, continued

Advice #2: Try to come to lectures in person, if you can! Did you know:

- Routine can help you learn.
- Context (i.e., where you are) can help you learn.
- Your brain responds differently to watching someone live versus a recording.
- Does this matter for learning? Maybe! At least some studies have found this, though some studies find no difference.
  - "Exam marks were positively correlated with the number of lectures attended and negatively correlated with the number of recordings viewed." *Simcock et al. (2017). A survey of first-year biology student opinions regarding live lectures and recorded lectures as learning tools. Advances in Physiol. Edu., 41, 69-76.*
  - "Students in the two clusters with high lecture attendance achieved, on average, higher marks in the module." *Howard et al. (2018). Live lectures or online videos: students' resource choices in a first-year university mathematics module. Int. J. Mathematical Education in Science and Technology, 49, 530-553.*

Tutorials

Tutorials are one-hour small-group sessions led by a tutor:

- They cover the material from the lectures with some new twists.
- They help you think about the material in new ways, and practice and apply it.
- They will give you opportunities to discuss and ask questions.
- Tutorials are good as preparation for the exam.
- They will also help you meet your classmates, and (hopefully) have fun!

Tutorials start in Week 2 (next week).

- You will be automatically enrolled for a tutorial group.
- Change your group on MyEd if the day/time is not suitable.

Tutorials, continued

We are revamping the tutorials completely this year, to make them more interactive and more valuable for your learning.

- Tutorials will reflect lecture material from the previous week.
- There is no preparation needed for the tutorials. Just bring yourself!
- Each section will be a team, with a team name. (You'll get to pick your team name during the first tutorial next week.)
- Each tutorial will involve completing an activity as a group. Each group will submit their answers online.
- Each team's answer will earn points, and there will be a leaderboard to compete for the most awesomest tutorial team.
- The team with the most points at the end of term will get... absolutely nothing :-D

Labs

The labs are two-hour practical sessions:

- labs will help you with programming and prepare you for the assignment;
- the first three labs are designed to get you up to speed with Python; the following labs will provide support for the assignment;
- the labs will use Notable notebooks (in Python); they are linked from the Learn site of the course;
- you work through the notebooks independently during the lab, but a demonstrator is on hand to help;
- labs start in week 2;
- the labs are drop-in: you don't need to enroll, just show up to a lab session that's convenient for you.

Assessment

The assessment for this course consists of an assessed assignment, worth 20% of the overall mark, five assessed quizzes, each worth 4% of the overall mark, and a final exam, worth 60% of the overall mark.

The assignment is practical; it requires programming in Python and uses Notable. The labs are there to support the assignment.

There is also an unassessed assignment (Assignment 0). It has already been issued, deadline in week 3. Solutions will be discussed in a lab session.

The assessed quizzes are untimed, will be online from Friday to Monday, and should take less than 30 minutes to complete.

Issue dates, hand-in deadlines, and marking deadlines for assignment and quizzes are on the course website.

How We Communicate

The most important sources of information for the course are:

- the Course Website: contains all course materials.
- the Learn page of the course: contains links the Noteable environment for labs and assignment.
- announcements from the lecturers and TAs through the Learn page of the course.

We will use a Piazza forum for the course:

- you can use it to post questions about the course content, including tutorials, labs, and assignment;
- the main purpose is peer support: students discuss course material and help each other;
- lecturers and TAs moderate the discussion and contribute;
- link is on Learn, all currently enrolled students should be signed up.