

Cognitive Science 207

Introduction to Cognitive Modeling

Wrapping Up

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Overview

- Administrative stuff
- Where we've been
- Where to go next

Administrative stuff

- Course Evaluations will be done on-line
 - Please don't forget to fill them out
 - Link from the class website
- Final Exam Friday, December 10, 12-2pm.

What is mind?

- One of the deepest questions humanity has asked
- Many fields have tried to answer it
 - Philosophy
 - Psychology
 - Linguistics
 - Biology (evolutionary, neuroscience, ...)
 - ...

It's probably a computation

- A key insight
- Productive, since it raises many questions
 - What's a computation?
 - What kind of computation?
 - Operating over what kinds of data?
 - On what sort of system is it being carried out?

Artificial Intelligence

- Goal: To understand the nature of intelligence
 - In whatever kind of system can exhibit it, including people
- Early successes inspired (and inspired by) comparison with human cognition
 - Solving problems, playing chess, parsing sentences, seeing in simple scenes, ...

Cognitive Science

- Born out of the computational insight
 - Computation could provide a new theoretical language for cross-discipline communication
- Meeting ground for fields traditionally concerned with studying cognition
 - *Multidisciplinary* field
 - Each field has theoretical constructs to share
 - Each field has its own empirical methods for testing ideas
 - Deeper insights come out of their interactions

What is cognitive modeling?

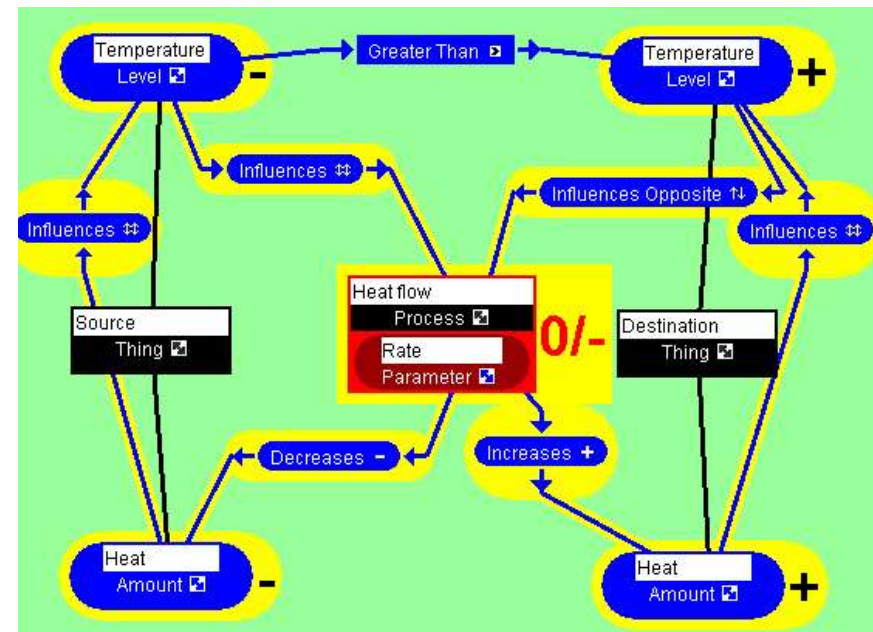
- Turing test as proposal for how to judge whether something is intelligent
- Marr's level of explanation for cognitive phenomena
- Minsky's examination of people's folk theories of intelligence

Knowledge Representation

- Overview of what they are and how they work
 - Markman's chapter
 - Why use logic? tutorial
- Logic, predicate calculus, and knowledge base organization
 - Cyc 101 tutorial materials

Qualitative Reasoning

- Representing common sense knowledge of the physical world
- Qualitative process theory
 - Vmodel concept map descriptions & software



Natural Language Processing

- Why it is complicated
- DMAP model of parsing and understanding

Emotions

- Taxonomy of emotion types
- Different levels of processing: reactive, routine and reflective
- Attractive things work better
 - Environment influences on mind

Analogy and Similarity

- Comparison a key operation in cognition
 - Assessing similarity and differences
 - Analogical reasoning and learning
- Brief introduction to Gentner's structure-mapping theory of analogy and similarity
- Using tables to describe analogies

Learning and Education

- Computational models of skills and learning can be used to develop better educational software
 - Teaching something is easier when it can be articulated
- Anderson's ACT-R theory of skills
- Example: Koedinger et al's PUMP intelligent tutoring system for algebra

Consciousness

- Different approaches
 - Chalmers: Easy/Hard problem: add consciousness as a fundamental object in ontology.
 - Searle: Neurobiological problem: look for Neural Correlates of Consciousness (NCC).
 - Dennett: “Consciousness is what consciousness does”: unified functional approach.

Where next?

- Introductory sequence represents first steps in exploring Cognitive Science
 - Can be taken in any order
- Pick several fields to explore, one or two in serious depth

AI courses

- Entry points:
 - CS 325: Artificial Intelligence Programming
 - CS 348: Introduction to Artificial Intelligence
- Lots of advanced courses
 - CS 337: Introduction to semantic information processing
 - CS 344: Design of Computer Problem Solvers
 - Courses on Robotics, Intelligent Information Systems, Knowledge Representation, ...

Programming

- Something everyone in Cognitive Science should be familiar with
 - Computation is why the field was started!
 - Procedural thinking and a deep understanding of representation are key theoretical tools for cognitive scientists
- Options
 - CS 110: Very traditional intro programming course
 - CS 111: Non-traditional, designed for CS majors, may be better for cognitive science majors

CogSci Courses

- CogSci 210: Language and the Brain, Spring
 - The biological basis of language.
- CogSci 211: Introduction to Cognitive Science: Learning, Representation and Reasoning.
 - Cognitive Psychology.
- CogSci 366: Cognitive Science Proseminar

Psychology

- PSYCH 333 The Psychology of Thinking
- PSYCH 334 Psychology of Language
- PSYCH 360 Human Memory and Cognition
- PSYCH 461 Reasoning and Representation
- PSYCH 466 Analogy and Similarity
- ... and more

Others

- ANTHRO 360 Language and Culture
- PHIL 325 Philosophy of the Mind
- MUS THRY 351 Music Cognition
- LING 346 Introduction to Computational Linguistics
- BIOL SCI 302 Fundamentals of Neuroscience
- LRN SCI 403 Learning in Context: Cognitive Science Foundations of the Learning Sciences

Get involved in research

- C99's in various departments
 - Nothing makes courses more relevant than being involved in research at the same time!
- Summer jobs
- Cognitive Science summer fellowships

Email me if you are interested in any of the above.

A golden age for Cognitive Science

- Claim: 100 years from now, this period will be viewed as the time when it all came together
 - The ideas are getting mature enough
 - The fields are collaborating enough
 - The machines are fast enough
- You can be part of this