What is COGNITIVE SCIENCE?
Cognitive science is: the INTERDISCIPLINARY scientific study of mind and its processes.
What is COGNITION?
Research on how information is processed.
How is the information transformed and represented in behavior?
Cognitive Science consists of multiple research disciplines.
Levels of analysis:

- Low-level learning and decision mechanisms
- High-level logic and planning

The Mind:

- Neuroscience
- Philosophy
- Computer science
- Linguistics

Neural circuitry

Modular brain organization
Aims of Cognitive Science

Theoretical: Explain how thinking works

Applied: Robotics, Education, Design, Mental Illness, etc.
The Mind

What is the nature of the mind?
The Mind

Neuroscience

How does neural activity represent, store information and how does it translate to behavior?

Computer science

Create systems that simulate cognitive processes and output

Philosophy

Defines key questions: What is reasoning, meaning?

Linguistics

How is meaning/information represented and conveyed?
Philosophy

Deduction

Thought experiment

Brain transfer

General theorizing

"I am a thing that thinks."

materialism, dualism, functionalism
<table>
<thead>
<tr>
<th>Theory of mind</th>
<th>Plato</th>
<th>Descartes</th>
<th>Locke</th>
<th>Hume</th>
<th>Kant</th>
<th>Leibniz</th>
</tr>
</thead>
</table>

- **Plato**
  - **Metaphysics**

- **Descartes**
  - **Cogito ergo sum**

- **Locke**
  - **Theory of Mind - consciousness**

- **Hume**
  - **“A Treatise of Human Nature”**
  - **Science of Man**

- **Kant**
  - **“The Critique of Pure Reason”**
  - **Unites reason with experience**

- **Leibniz**
  - **Monads & Symbolic Thought**
  - **Ultimate elements of universe**
Computer science

- Analogy
- Computation and thinking
- Methodological consequence
- Simulations = thinking?
- Theoretical Analyses
- Computational complexity
Linguistics

- Judgments of grammaticality
- Syntax
- Data Theory
- Semantics, Pragmatics
- Computational Models
- Theorizing - processes
<table>
<thead>
<tr>
<th>Language</th>
<th>Acquisition</th>
<th>Innate or Learned?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Abstraction</td>
<td>Representation</td>
</tr>
<tr>
<td></td>
<td>Pragmatics</td>
<td>Meaning from context</td>
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<tr>
<td></td>
<td>Chomsky</td>
<td>Formal grammar</td>
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<tr>
<td></td>
<td>Pinker</td>
<td>It is all in the genes</td>
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<td></td>
<td>Elman</td>
<td>Experience based learning</td>
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</tbody>
</table>
Neuroscience

- Biological Experiments
- Recording the brain
- Visualizing the brain
- PET, fMRI
- Cell recording
- Computational
- Models of the mind
<table>
<thead>
<tr>
<th>Neuroscience</th>
<th>Learning</th>
<th>Nature v Nurture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Memory</td>
<td>Representation in brain</td>
</tr>
<tr>
<td></td>
<td>Perception</td>
<td>Sensory input → perceive</td>
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<tr>
<td></td>
<td>Behavior</td>
<td>Represents brain output</td>
</tr>
<tr>
<td></td>
<td>Imaging</td>
<td>Visualize brain activity</td>
</tr>
<tr>
<td></td>
<td>Disorders</td>
<td>Understanding of system</td>
</tr>
</tbody>
</table>
PERCEPTION * ACTION * THINKING
COGNITIVE SCIENCE IS EVERYWHERE
How do we select an appropriate action, given our goals?
Brain Computer Interface

Bionic hands?
Robot with rat brain.

http://www.youtube.com/watch?v=1-0eZytv6Qk
# COURSE STRUCTURE

## Topics: Central to Cognitive Science
- Language, Mental Representation, Intentionality
- Development, Disorders, Computational Modeling

## Lectures: Cognitive Science Faculty
- Introduction to area of study
- Introduction to research in the department

## Readings: Online
- Each lecture will have assigned reading.

## Sections: Weeks 2-10
- Quiz on previous week’s material – (lectures and readings.)
- Clarify and explain material presented.
- Required.
COURSE LINKS

Website
Click on “COGS1”

• [http://www.cogsci.ucsd.edu/~mboyle](http://www.cogsci.ucsd.edu/~mboyle)

Canvas
Repository for all grades

• [http://canvas.ucsd.edu](http://canvas.ucsd.edu)

Extra Credit
Experiment participation – sign-up

• SONA
## COURSE GRADING SCHEME

### Examinations

**Multiple choice and short answer**

- Midterm 1 – scheduled for Tuesday week 5
- Midterm 2 – scheduled for Tuesday week 8
- Midterm 3 – scheduled for Thursday week 10

### Quizzes

**Administered in section**

- No make-up quizzes
- Drop lowest quiz grade
- If needed, attend a different section (advise your TA/IA)

### Extra Credit

**Use SONA to sign-up**

- Experiment participation 4 hours maximum