INTRODUCTION TO COGNITIVE SCIENCE

Mary ET Boyle, Ph.D.
Department of Cognitive Science
UCSD
What is COGNITIVE SCIENCE?
Cognitive science is: the INTERDISCIPLINARY scientific study of mind and its processes.
How is information processed?

- emotion
- language
- memory
- perception
- reasoning
How is information transformed and represented?
Neuroscience

Philosophy

Computer science

Linguistics

The Mind
The Mind
Deduction

“I am a thing that thinks.”

Thought experiment

Brain transfer

General theorizing

materialism, dualism, functionalism
Theor of mind

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
Artificial Intelligence

Pitts  Artificial Neural Nets
McCulloch  Models of computation
Turing  Turing Test
von Neumann  Architecture
Chomsky  Generative Grammar
Minsky  Formal characterization of thought
Linguistics

- Judgments of grammaticality
- Syntax
- Data Theory
- Semantics, Pragmatics
- Computational Models
- Theorizing - processes

Linguistics
Language

Acquisition: Innate or Learned?
Abstraction: Representation
Pragmatics: Meaning from context
Chomsky: Formal grammar
Pinker: It is all in the genes
Elman: Experience based learning
Neuroscience

Learning

Memory

Perception

Behavior

Imaging

Disorders

Nature v Nurture

Representation in brain

Sensory input → perceive

Represents brain output

Visualize brain activity

Understanding of system
PERCEPTION * ACTION * THINKING
Decision Making

Chip Implants

COGNITIVE SCIENCE IS EVERYWHERE

Virtual Reality Therapy

Brain Computer Interface
How do we select an appropriate action, given our goals?
Brain Computer Interface

Bionic hands? 2016
Robot with rat brain.

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

<table>
<thead>
<tr>
<th>Topics</th>
<th>Central to Cognitive Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Language, Mental Representation, Intentionality</td>
<td></td>
</tr>
<tr>
<td>• Development, Disorders, Computational Modeling</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lectures</th>
<th>Cognitive Science Faculty</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Introduction to area of study</td>
<td></td>
</tr>
<tr>
<td>• Introduction to research in the department</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Readings</th>
<th>Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Each lecture will have assigned reading.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sections</th>
<th>Weeks 2-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Quiz on previous week’s material – (lectures and readings.)</td>
<td></td>
</tr>
<tr>
<td>• Clarify and explain material presented.</td>
<td></td>
</tr>
<tr>
<td>• Required.</td>
<td></td>
</tr>
</tbody>
</table>
COURSE LINKS

Website  Click on “COGS1”

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

TritonED  Repository for all grades

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

Extra Credit  Experiment participation – sign-up

• SONA
<table>
<thead>
<tr>
<th>COURSE GRADING SCHEME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examinations</strong></td>
</tr>
<tr>
<td>• Midterm1 – tentatively scheduled for Monday week 5</td>
</tr>
<tr>
<td>• Midterm2 – tentatively scheduled for Monday week 8</td>
</tr>
<tr>
<td>• Midterm3 – tentatively scheduled for Friday week 10</td>
</tr>
<tr>
<td><strong>Quizzes</strong></td>
</tr>
<tr>
<td>• No make-up quizzes</td>
</tr>
<tr>
<td>• Drop lowest quiz grade</td>
</tr>
<tr>
<td>• If needed, attend a different section (advise your TA/IA)</td>
</tr>
<tr>
<td><strong>Extra Credit</strong></td>
</tr>
<tr>
<td>• Experiment participation 4 hours maximum</td>
</tr>
</tbody>
</table>