Cognitive & Linguistic Sciences

♦ What is cognitive science anyway?
♦ Why is it interdisciplinary?
♦ Why do we need to learn about information processors?
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Education:
- BA: University of California, Santa Barbara (Psychology & Spanish)
- MA/Ph.D.: State University of New York, Stony Brook (Experimental Psychology)
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- Third year graduate student in Cognitive & Linguistic Sciences
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Course Objectives

◆ Introduce the foundational assumptions of Cognitive Science
◆ Expose students to research examples that illustrate the interdisciplinary nature of Cognitive Science
◆ Show students how the foundational assumptions of Cognitive Science affect its research practices
Required Texts


Evaluation

- Two short papers (12% each)
- Two preliminary exams (20% each)
- One comprehensive (essay) final (36%)
UCSD’s Definition

“The Department of Cognitive Science emphasizes three main areas of study: brain—the understanding of neurobiological processes and phenomena; behavior—the experimental methods and findings from the study of psychology, language, and the sociocultural environment; and computation—the powers and limits of various representational formats, coupled with studies of computational mechanisms. This approach involves a multidisciplinary study of cognition with emphasis on computer science, linguistics, neuroscience, psychology, and related aspects of anthropology, biology, mathematics, philosophy, and sociology.” (from UCSD’s web site)
The Rutgers Definition

“The approach in cognitive science, in contrast with the approach taken by other investigators interested in similar issues, is essentially computational. The goal is to understand such aspects of intelligent performance as perception, language processing, planning, problem solving, reasoning, and learning, in terms of the computational processes that underwrite these skills, as well as the computational mechanisms (be they silicon hardware or neural tissue) that may instantiate them. The pursuit is essentially multidisciplinary and involves techniques and knowledge drawn from experimental psychology, computer science, neuroscience, philosophy, linguistics, mathematics, and engineering.” (from the Rutgers web site)
“One of the most important intellectual developments during the last four decades has been the realisation among researchers in psychology, computer science, linguistics, philosophy and neuroscience that they were asking the same questions about the nature of the human mind and its relationship to brain (‘mind/brain’). The term cognitive science provides an overall framework within which researchers in one area can adopt approaches and solutions from other areas in an effort to shed light on the mind/brain questions. … Cognitive science is the science of the mind. Cognitive scientists seek to understand perceiving, thinking, remembering, understanding language, learning and other mental processes and phenomena involving awareness and cognition.” (from Exeter’s web site)
Brown’s Definition

“The cognitive and linguistic sciences offer a multidisciplinary study of the mind or what might be called "natural intelligence." Cognitive science seeks an understanding of such mental abilities as perception, recognition, categorization, memory, reasoning and problem-solving, motor control, speech, language, and communication. Linguistics focuses on the nature of human language, its theoretical, descriptive, and behavioral bases. It also serves as a window into human cognition. The approaches of a variety of disciplines, including cognitive psychology, linguistics, artificial intelligence, neuroscience, philosophy, and anthropology, are all brought to bear on common problems of mind, brain, and language.” (from Brown’s web site)
Pros and Cons of Definitions

- The definitions accurately reflect the interdisciplinary nature of cognitive science, as well as some of its content areas.
- The definitions do not say why cognitive science is interdisciplinary, nor do they distinguish cognitive science from its component disciplines.
- This is because the definitions focus on content areas, not on foundations.
- The foundations of cognitive science matter...a lot!
An Editorial Comment

✦ One problem with being trained in psychology is that we are mostly exposed to content areas, and not to foundational assumptions. Indeed, a department like psychology may not have any foundational assumptions to be shared.

✦ In contrast, cognitive science permits diverse researchers to communicate with one another because they share foundational assumptions!
A Shared Foundation

- The Information Processing Hypothesis: The human mind is a complex system that receives, stores, retrieves, transforms and transmits information.

- Importantly, as soon as we adopt this hypothesis, we are committed to adopting additional views of how to study cognition.
A Discussion Topic

A cognitive scientist adopts the foundational assumption that “cognition is information processing”.

On the basis of this assumption, what can we expect a typical research program to look like?
A Digression: Metaphor

- A metaphor consists of two components, the *topic* and the *vehicle*.
- In the metaphor “The butcher is a surgeon”, *butcher* is the topic, and *surgeon* is the vehicle.
- The idea behind a metaphor is that we learn new things about an unknown (the topic) by seeking out similarities between it and a known (the vehicle).
Information Processing as Metaphor

“Cognition is information processing” can be thought of as a metaphor (though some would disagree).

However, if we don’t know much about the vehicle of this metaphor, it isn’t very helpful.

So, for much of the early part of this course, we must learn about information processing to gain the most from this metaphor.
Three Questions to Answer

- Clearly, explaining information processors requires us to answer three different kinds of questions.
- What information processing problem is being solved?
- What steps are being carried out to solve this problem?
- What physical properties are actually used to carry out these steps?
All three questions must be answered!

Importantly, all three questions must be answered because complete understanding at one level (e.g., at the implementational level) may not be enough to fully explain an information processor of interest.