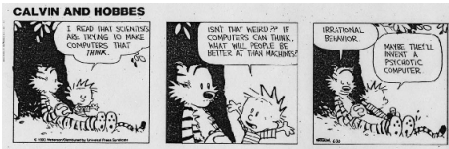


Foundations

- What is Cognitive Psychology?
- How do we study cognition?
- What is an explanation?
 - Levels of explanation



What is Cognitive Psychology?

- The study of human thought
 - What are the abilities common to all people?
 - What do these abilities tell us about individual differences?
- Cognition is all around us
 - That makes it hard to study

An example

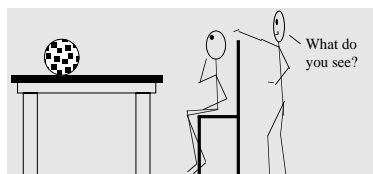
- Imagine making a funny comment at dinner
 - How did you think of it?
 - How did you know it would be funny?
 - How did you decide the right intonation and timing to heighten the humor?
 - Why did(n't) everybody else think it was funny?
 - How did the other people at the table even realize that the sounds coming out of your mouth were speech?
- These are the kinds of things we want to know.

How do we study cognition?

- Application of scientific method to understanding psychology.
- Many approaches are possible
 - The approaches determine what kinds of data are considered.
- Introspection
- Behaviorism
- Information processing
- Cognitive Science

Introspection

- Studying cognitive processes by looking inward.
 - Experimenter may introspect, or may collect thoughts (or think-aloud protocols) from others.



Strengths and weaknesses

- Easy to collect data, and data are often interesting
 - If you want to know what someone is thinking, just ask.
- Not appropriate for many questions
 - Perceptual processes
 - Insight (aha!)
 - Retrieval from memory
 - Many aspects of language
 - Attention
- Some more indirect method is needed

Behaviorism

- Emerged from the positivist movement in philosophy.
 - Only what can be observed is appropriate for study
- What can be observed in psychology?
 - Initial conditions
 - Physical behaviors
 - Actions like movement and speech
 - Constructs for internal states are forbidden
 - Feeling, intention, desire, goal
 - Associations were the main explanatory processes.

Information Processing

- Why was it so bad to propose internal states?
 - The importance of metaphors of the mind.
 - Psychologists did not have a good metaphor
 - Hume and the problem of the homunculus
- The computational view of the mind
 - The mind is like a computer
 - Not built like a computer, but it computes.
 - Processes operating on data structures.
 - Provided a metaphor for thinking about internal states
 - Allowed better understanding of complex processes
 - Language structure and use

Cognitive Science

- An extension of the information processing view
- Many disciplines working together
 - Psychology (of course)
 - Computer Science (to understand computation)
 - Neuroscience (to understand how the brain works)
 - Philosophy (to understand the limits of our theories)
 - Linguistics (to understand the structure of language)
 - Anthropology (to help separate characteristics of the mind from characteristics of culture).
- People often work across these disciplines.

What is an explanation?

- We want to explain thought.
 - What will count as an explanation?
- Imagine a calculator on a table.
 - How does it work?
- Many possible explanations (which is right)
 - It takes in pairs of numbers and returns the sum.
 - It takes in pairs of numbers and represents them in binary notation, and then adds them.
 - It takes in pairs of numbers by allowing the user to press buttons, which changes voltages in various registers inside, which change other voltages and so on until a final set of voltages drives the screen.

Levels of explanation

- Marr; Pylyshyn
- Computational Level
- Algorithmic Level
- Implementational Level
- All of them are used in Psychology

Computational level

- Why is the computation being carried out?
- What is the expected input?
- What is the output given that input?
- What kind of function relates the input to the output?

Algorithmic level

- How are things represented?
- What process manipulates the representation?
- Many different algorithms may be used to perform the same computation
 - What are two algorithms for adding a pair of numbers?

Implementational Level

- How is the system physically realized?
- There may be many possible implementations of the same algorithm
- Human psychology is implemented in the brain.
 - Cognitive neuroscience is a growing area that looks at how the brain works during cognitive processing.

Using these levels

- We will see examples at all levels of explanation.
- Often explanations go from computational to algorithmic to implementational
- There is some feedback
- Keep this in mind as we read about explanations throughout the semester.
