Welcome to….

Psychology 85
Introduction to Cognitive Science
Summer 2020

Instructor: Sean McAuliffe

Reasons this class is sometimes different from most psych classes

"I seek not to know the answers, but to understand the questions."
Kung Fu (TV Show in 1970s)

Instructor will not always have a definitive answer
(e.g. "Do we have free will?")

We will consider what is theoretically possible which is very different from what is practically possible

More interactive than typical psychology course

Students tend to be more intelligent and more motivated

Cognitive Science:

The scientific study of the mind.

How do we recognize a mind?

- A rock
- A virus
- An amoeba
- A dog
- A chimpanzee
- Professor McAuliffe
- Yourself

Does it have a mind? Why or Why Not?

Cognitive Science:

The scientific study of the mind.

How do we recognize a mind?

- Perception / Response
- Learning / Memory
- Abstract Reasoning
- Emotion?
- Language?
- Consciousness?

What does a mind do?

What does a mind do?

IT COMPUTES

Takes inputs and maps them to outputs

Receives/stores Information

Transforms Information

Outputs Information

Computing: What minds do

Example: Recognizing a chair

Input: Light reflected off 3-d chair

Processed through 2-d projection on retina

Output: “It’s a chair”

This is a very complicated function from shape of 3-d object to “chair”

Computing: What minds do

Example: Feel sad when your puppy is sick

Input: Sick puppy

Processed through perception and cognition

Output: “sad” feeling

This is a very complicated function from sick puppy to feeling of “sad”

Computing: What minds do

Inputs can vary, and output can become inputs

One day you realize that your puppy will grow up some day and leave you when he goes to puppy university

You feel sad…

Which makes you go to the internet to feel better…

It's all computing…

How Do Minds Compute?

They use representations

1) **Symbols in the mind (neurons, binary code, etc.)**
2) **Referents (usually in physical universe)**
3) **Mapping between 1 and 2 (intentionality = ‘directed at object’)**

Computing: Representations

Symbol: $

Referent: Dollar bill

Mapping can get very fuzzy…

Symbol: Beauty

Referent: Physical Beauty, Natural Beauty, Intellectual Beauty, etc.

Tri-Level Hypothesis (Marr)

Computation:

In the most abstract mathematical form, what is the *function* being computed? What is the abstract relationship between *input* and *output*?

Addition
Subtraction

Representation & Algorithm:

What is the actual procedure that is being used in order to accomplish the computation, and how are the input and output represented?

Binary?
Decimal?

Physical Implementation:

What is the physical mechanism that is being used to carry out the computation?

Electronic Calculator?
Mechanical Cash Register

Gauss's Problem

Computation:

What is the sum of integers from 1 to 100?

What is the sum of integers from 1 to X?

Representation & Algorithm (R&A):

1+2+3+…+X

(X^2+X)/2

Physical Implementation:

Use brain

Use Starburst Fruit chews,paper and brain

Tri-Level Hypothesis Criticisms

Physical Implementation Constrains R&A

Neurons are computationally limited

Alternative: Structural Level of Analysis

Molecules

Synapses

Neurons

Neural Networks

Brain Regions

How Do We Study The Mind?

Structure?

Function?

Development?

Interdisciplinary Approach

Philosophical
Psychological
Cognitive
Linguistic
Evolutionary
Comparative Cognition
Neuroscience
Artificial Intelligence

Ignored: Emotional and Social