COG250H1: Introduction to Cognitive Science **Fall 2018**

Week 1: Introduction

Lecturer: Anderson Todd *Scribes: Ousmane Amadou*

Note: *LaTeX template courtesy of UC Berkeley EECS dept.*

1.1 Brief Introduction to Cognitve Science

1.1.1 Motivation

Purpose: Set the stage for providing visions of cognitive sceince, introduce sub disciplines, briefly describe key events in cognitive science.

Topic involving cognitive science:

- AlphaGo
- Computer Vision
- High Frequency Trading
- Literacy + Grammar

In cognitive science the problem of the mind is being approached from multiple angles. One of these approaches is characterized by employing **design thinking** to create models of the mind. The brain as a machine is a **metaphor** that you will often see in cognitive science. The fundamental belief is that if science can figure out how to design and construct a mind, then science can figure out how the mind works. This is one of the reasons why the study of artificial intellgience is so intimately connected to the study of the mind.

There are, however, problems with this approach. Many machine learning systems these days are very black box. That is, although we understand the basic principles of how these systems work, they are not fully yet understood.

1.1.2 Theoretical Constructs and Plausibility

A theoretical construct (a.k.a hypothetical construct) is description of an ideal object (an idea) that is not directly observable. Theoretical constructs are judged on how accurately they describe the object.

Streams of evidence.... Converging input and elegant output -> Plausibility

You want your converging input and elegant If your plausibility is deep then you may have a theory that is profound. This is the goal of integrating multiple disciplines.

Example: Attachment Theory and Nueroscience in relation to trust in relationships... What does trust mean in mathematical terms.

A theoretical construct is strong if and only if it is: multi apt, is supported by converging evidence, is elegantly formulated.

More Writing Points: Explain Multi Aptnes, Describe the connection between aptness and metaphor

1.1.3 Metaphor

The word "metaphor" is derived from the greek word metaphori meaning "transfer" or to carry over. Metaphors in cognitive science prodvide a structural backbone for knowledgetransfer between concepts, where knowledge transfer in this sense describes a "carrying over of meaning" from one concept to another.

For example, the phrase "Sam is a pig!" is a metaphor that conveys the understanding T that Sam is a sloppy or disgusting individual.

1.1.4 What is Cognitive Science?

Ironically, one thing science can't account for in scientific explanations is how humans produce scientific explanations. Because of this there is a sense in which we are deeply alienated from the world. That is, there is a **you-shaped hole** in our understanding of it. (notice that you-shaped hole is a metaphor) One of the goals of cognitive science to fill this gap, and complete our understanding of the natural world.

In general, cognitive science seeks to develop a common language for describing **cognitive phenomena** that can be understood through multiple disciplines with its the core considered to be philosophy.

There are three 'visions' for cognitive science.

Generic Nominalism is a broad approach to cognitive science. Nominalism in this context can be best understood as a universal name for a particular idea while generic corresponds to a group or class of related ideas. Generic Nominalism describes the idea that cognitive science is simply a name for the disciplines involved in studying the mind. Thus the following discplines are referred to as the cognitive sciences: Artificial Intelligence, Cognitive Psychology, Philosophy of Mind, Cultural Anthropology, Neuroscience, Semiotics and Linguistics. In other words, the only requirement for doing cognitive science for a generic nominalist is to do something related to the study of the mind. This vision is generally not accepted in third generation cognitive science.

Related Ideas: Natural Philosophy (as a generic name for scientific inquiry), Artificial Intelligence (a generic name for a loosely defined family of technologies),

Interdisciplinary Ecclecticsm is a stronger approach to cognitive science than generic nominalism. This approach posits that cognitive science is a "forum" from which people from different discplines can discuss or share ideas. There is a sense, under this approach, that cognitive science involves collaboration between discplines on some level. This level can be described with the analogy of an interfaith dialogue: People are tolerant of multiple ideas but there is little to no attempt to integrate those ideas to form a unified understanding.

Interdisciplinary Ecclecticsm is typically not a very stable approach to cognitive science. More often than not, it devloves into generic nominalism or evolves into synoptic integration.

Related Ideas: Philosophical Ecclecticsm, Syncreticsm, Clinical Pluralism

Synoptic Integration is the strongest approach to cognitive science. Cognitive science, under this approach is a deliberate and unique discpline whre knowledge from cognitive sciences sister disciplines are perfectly integrated.

The word ”synoptic” comes from the greek word ”sunoptikos” meaning ”seeing everything together”. The use of the term ”synoptic” truly speaks to the nature of this approach. The goal is to achiece a coherent understanindg of cognitive phenomena.

Synoptic integration is about making the right connections, and seeing relationships between disciplines and subjects to study the mind. It is the most widely accepted approach of cognitve science.

Related Ideas: SI in Interactive Entertainment, SI in Information Theory, SI in Music Composition

1.2 The Naturalistic Imperative

Core Ideas: Cognitive Science is influenced by the same naturalism that influences most of modern day science, Humans have innate desire to learn about the world, Philosophers are trained in navigating the abstract,

The philosopher aims to both ask the necessary questions and provide a methodology to answer them. (more on this is in the naturalstic imperative section). This has been the case in multiple discplines including psychology, physics, mathematics and virtually every modern scientific discpline.

1.2.1 Analysis

Peroid: Presocratic Thinkers; 469 B.C - 4 B.C
Key Proponents: Thales of Miletus

Main idea (s): - The Presocratics ushered in the philosophic and scientific mindset that would dramatically alter the course of western civilization. - The concept of rational thought and logos was introduced by presocratic thinkers. - Naturalism

”Analysis means to discover those basic processes in terms of which complex mental phenomena can be comprehensively explained.” - JVs Thesis

Note: Pay attention to the way figures of the past thought rather than the validity of the theory. It often proves more usefel to look at the rationale behind a conclusion rather than the conclusion itself. This applies especially to philosophers from Ancient Times, including Thales.

Fragments from Thales

- ”All is the moist”
  - Basic Idea: Thales claims that everything is made of water.
  - Significance: Thales is the first philosopher to try to answer questions about how the world works by appealing to substance rather than mental properties / supernatural agency. Thales sought to break down things into what they are made of. Him like a lot of other presocratic thinkers sought to understand the world in terms of structure.
  - Why is this profound? Greece was surrounded by water. This theory was plausible at the time.
- ”The lodestone has psyche”
  - Basic Idea: Thales observes that magnets are weird.
  - Significance:

  - Why is this profound?

- "Everything is filled with gods"
  - Basic Idea: Things are complex... Keep looking at stuff nothing is boring.
  - Signifiance: Common Sense explains unfamiliar in terms of the familiar. Science explains familiar in terms of the unfamiliar.
  - Why is this profound?

1.2.2 Formalisation

Time Period: Scientific Revolution; 1550 - 1700 (estimated)
Key Proponents: Descartes, Copernicus, Newton

Main idea (s): - This shift from Cosmos to Universe also marked a transformation from an Organic Worldview to a Mechanical World Picture. - Take all that wisdom... And convert it into percise terms. - The origins of the scientific method. - Descartes invented cartesian graphing. This - Cartesian graphing

1.2.3 Mechanisation

Time Period: Computational Revolution; Early 20th Century
Key Proponents: Alan Turing

Main idea: Once you analyzed and formalized you can feed all that logic into a machine.

Turing Test

Questions?

1. What about mechanisation is so key to the naturalistic imperative?
2. Can you give an example of how mechanisation plays a role in current work in cognitive science... other than Artificial Intelligence?