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

Week 2: Introduction + Categorization I (Resemblance Theory)

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

2.1 An Overview of Cognitive Science (CogSci)

2.1.1 Background / 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.

2.1.2 Theoretical Constucts 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

2.1.3 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.

2.1.4 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. Thus, generic nominalsim describes the idea that cognitive science is simply a name for the disciplines involved in studying the mind. 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. It is important to note that this vision is generally not accepted in third generation cognitive science.

The 'cognitive sciences':

- Artificial Intelligence
- Cognitive Psychology
- Philosophy of Mind
- Cultural Anthropology
- Neuroscience
- Semiotics and Linguistics

Related Ideas:

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. The level at which discplines collaborate can be described with the analogy of an interfaith

dialogue. People are tolerant of multiple ideas, but there is little to no attempt to contribute to 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,

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: Interactive Entertainment,

Synoptic Integration (Lowest level)

- The strongest definition of CogSci.
- If you are able to communicate back and forth between the involved cognitive science disciplines, you reach perfect integration.
- CogSci, under this model, is a unique discipline. Doing CogSci is deliberate.

2.2 Naturalistic Imperative

Core Ideas: Humans have innate desire to learn about natural world, Philosophers are trained in navigating the abstract, The Naturalistic Imperative is in a sense part of the philosophical enteprise as well

The Naturalistic Imperative is a term coined by John Vervaeke. It is a term used to describe sciences' goal of 'natrualizing' our understanding of the universe. It comprises of three parts. Analysis, Formalization, and Mechanization.

To understand the naturalistic imperative it is useful to look at previous scientific revolutions.

Philosophers are trained in the abstract problems of trying to work out language and questions to a really high degree of percision. 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.

2.2.1 Analysis - The Presocratics (469 B.C - 4 B.C)

What does it mean to analyze? To break down concepts in its most fundamental parts.

Main idea: 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.

Key Proponents: Thales of Miletus

Note: Pay more attention to the WAY thinkers of the past thought rather than the validity of the theory. It is more useful to understand HOW a past thinker reaches 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?

2.2.2 Formalisation - Scientific Revolution

Key Proponents: Rene Descartes

Main idea: - Take all that wisdom... And convert it into percise terms. - The origins of the scientific method. - Descartes invented cartesian graphing. This

Cartesian graphing

We are attempting to convert

Questions?

1. What role does the scientific method play in the naturalistic imperative?

2.2.3 Mechanisation - Computational Revolution

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?

2.3 Introuction to Categorization

Naive model - We look at things and decide based off similarity whether things belong in the same category. One of these things belong together and on of these things do not. Rely on your perception and judgement to form categories.

This naive model (common sense assumption) holds up at first glance. One of the problems with this is that (as nelson goodman points out) if we are treating similarity as a question of partial identity of terms, then things have an infinite amount of similarity of dissimilarity. This is not very plausible since humans have a limited amount of cognitive power.

2.3.1 The Resemblance Theory

Name coined by Lance Ribs

Family of resemblance...

Family analogy

defenses: well ok. Every member of a cateogry are equally representative of the cateogry. criticsms: if similarity judgments are supposed to drive similarity judgements Purpose: Set the stage for providing visions of cognitive sceince, introduce sub disciplines, briefly describe key events in cognitive science.