



TWIGS
 What is Human Cognition?
 Sherol Chen
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Abstract

- The study of cognition and philosophy of mind constructs models for approaches in believability of computer agents and narrative environments. Three considerations of cognition pertinent to narrative agents are discussions in social cognition (how an agent interacts and acknowledges other agents), extended cognition, and transcranial cognition (what is the mind, and how far does it extend outside of the object it has influence over). Models of cognition can help to explain what it means to be a believable computer agent, and more fundamentally, what it means to be human.

Outline

- **Introduction** to Philosophy of Mind
 - Functionalism: Turing
 - Objections to Turing: Searle, French, & Block
 - Objections to Searle: Copeland
- **Believability** and Narrative Intelligence
 - Emergent Phenomena
 - Procedural v.s. Instancial
- **Social** Cognition
 - Theory of Mind: Caruthers
 - Simulation Theory: Gallese
 - Interactive Theory: Gallagher & Glenberg
- **Extended** Cognition
- **Transcranial** Cognition
- **Conclusion** on Believability and Cognitive Models

What is Human Cognition?

- Is it the grey matter in our head?
- Is it the observable phenomena?
- Is it the finite number of instructions?
- Is it the emergent properties of biology?
- Is it the result of supernaturalism?
- Is it the result of instancial priming?
- Is it the result of procedural physiology?

Introduction

- 1600 – Second Meditation (Descartes)
- 1940 – Imitation Game (Turing)
- 1960 – Functionalism (Putnam)
- 1960 – Thinking Machines (Dreyfus)
- 1980 – Chinese Room (Searle)
- 1980 – Chinese Nation (Block)
- 1990 – Flugblog (French)
- 2000 – Hypercomputing (Copeland)



Descartes

Meditation II - Concerning the Nature of the Human Mind

- We only have access to the world of our ideas; things in the world are only accessed indirectly.
- These ideas are understood to include all of the contents of the mind, including perceptions, images, memories, concepts, beliefs, intentions, decisions, etc.
- The ideas represent things that are separate from themselves.
- These represented things are many times "external" to the mind.
- It is possible for these ideas to constitute either accurate or false representations.



Turing Machines

- 1920 – Imitation Game
- 1940 – Functionalism
 - “Empirical Computational Theory of Mind”
 - Hilary Putnam & Jerry Fodor



Chinese Rooms & Blockheads

- 1960 – Dreyfus
 - “As a goal for those actually trying to construct thinking machines, and as a criterion for critics to use in evaluating their work, **Turing’s test** was just what we needed.”
- 1980 – Chinese Room
 - Searle
- 1980 – Chinese Nation
 - Block



Functionalism?



- Putnam – Twin Earth thought experiment
 - H₂O & XYZ
 - When an earthling, say Oscar, and his twin on Twin Earth say 'water' do they mean the same thing?
 - “Semantic Externalism”
 - a result of causal history
- Searle – Constitutionally Different
 - Water is not a rigid designator for Oscar and Toscar
 - Instead of functionalism, the processes of the mind is a result of emergent properties of complex systems. Similar to freezing being an emergent property of water.

Flugblog

- 1990 – French
 - “What we have is thus not a test for intelligence at all, but rather a test for intelligence as practiced by a human being.”
 - “Associative Priming”
 - A computational impossibility



Rating Game

- ‘Flugbogs’ as a name Kellogg’s would give to a new breakfast cereal
- ‘Flugbogs’ as the name of a new computer company
- ‘Flugbogs’ as the name of big, air-filled bags worn on the feet and used to walk on water
- ‘Flugly’ as the name a child might give its favourite teddy bear
- ‘Flugly’ as the surname of a bank accountant in a W. C. Fields movie
- ‘Flugly’ as the surname of a glamorous female movie star

Hypercomputing



- 2000 – Copeland
 - Turing never made such strong claims about intelligence
 - Functionalism, which was formalized after Turing, is an imposed association
 - Basically, Turing was proposing the seagull test for human intelligence just as French had described
 - Showing that computers could feign human intelligence, artificial intelligence
- Hypercomputing = super-Turing computation
 - Infinite instructions in finite amounts of time
 - Computing the non-computable

Hypercomputer Proposals

- A Turing machine that can complete infinitely many steps
- Zeno machine - perform infinitely long computations whose steps are enumerated by potentially transfinite ordinal numbers
- Ability to measure a real-valued physical value to arbitrary precision despite thermal noise and quantum effects
- Fair nondeterminism or unbounded nondeterminism may allow the computation of noncomputable functions
- The use of closed timelike curves (CTC)

Thinking Machines?

- Impossible, according to many philosophers
- There isn't even an agreed upon definition of what constitutes cognizance
 - Blind Sight
- Believability
 - Seagull test
 - Turing test

Artificial Intelligence, A Modern Approach

Believability is something from the movies and not beneficial to the study of Artificial Intelligence in Computer Science. Why be believably human when there can be more efficient ways of doing the same thing?

-Russell & Norvig



Believability



- Interactive-Narrative Experience can be scripted, emergent, or generative at varying degrees
- Scripted – instancial and has very little intelligence, if at all (data driven)
- Emergent – procedural, a complex system that arises from fairly simple rules
- Generative – originality of replayability

Dramatically Compelling Experience Test

- Not saying that **experiences** are functionalistic, but functionally, we can simulate **experiences**



TURING TEST EXTRA CREDIT:
CONVINCE THE EXAMINER
THAT HE'S A COMPUTER.

YOU KNOW YOU MAKE
SOME REALLY GOOD POINTS.
I'M... NOT EVEN SURE
WHO I AM ANYMORE.



Social Cognition

- Theory of Mind aka Theory Theory
 - Theory of Mind Module (ToMM)
- Simulation Theory
 - Reflective Inferences
- Interactive Theory
 - Mirrored Neurons



(These can be modeled through multi-agent interactions in Multi-Agent Systems)

Extended Cognition

- **Embodiment Theorists** – The body is constituent of the mind (Glenberg)
- **Mild** – the body connects the mind to the world
- **Radical** – the mind extends into the body
- He claims the data strongly supports meaning as dependent on action and that modalists would have no account for such results



Extended Cognition

- Action & Meaning –
 - Say the color *not* the word

YELLOW	BLUE	ORANGE
BLACK	RED	GREEN
PURPLE	YELLOW	RED
ORANGE	GREEN	BLACK
BLUE	RED	PURPLE
GREEN	BLUE	ORANGE

Radical Extended Cognition

- **Extended Mind Theorists** – Sensory data is directly perceived, and that perception is the “direct pickup of invariant properties” (Glenberg)
- **Establishment Theory** – information processing view as opposed to direct perception (Fodor & Pylyshyn)
- **Indexical Hypothesis**, which “proposes that meaning is based on action.” Affordances are properties which allow particular actions and are derived from perceptual symbols; therefore direct perception of these invariant affordances enable direct coupling between action and meaning

Extended Mind Theorists and Embodiment Theorists

- They are not the same, nor is one wholly inclusive of another
- **Embodiment** theorists believe that you must have a body to have a mind
- **Extended Mind** theorists believe that anything that impacts a cognitive process is part of the cognitive process, regardless of how external
- Inga & Otto (Clark & Chalmers)
- Filofax & Calculators & Rotation
- **Functional Externalism & Internalism**
Data Abstraction (Ableson & Sussman)
 - generic procedures
 - data directed programming
 - type-tags
 - message passing



Transcranial Cognition

- **Coupling Constitution Contingency Fallacy (2007)**
 - Adams & Aizawa
- **Coupling Constitution Contingency Fallacy Fallacy**
 - Menery
- When does the mind stop and the world begin? (Bounds of Cognition)

Models of Cognition and Believability

- When creating a narrative world, there exists no form of intelligence that is there to be merely believable or merely intelligent. Every character agent is named, identifiable, and created with a purpose. Levels of simulated cognition, however, may vary.
- Without a definitive “mark of the cognitive (Adams & Aizawa 2006),” it is difficult to say how a computer agent could be cognitive versus what would not be a cognitive agent. It is not to say that cognition is defined or even possibly re-creatable, rather that purposeful human cognition can be reasonably feigned for narrative environments.



Conclusion

Conclusively, believable AI or simulated cognition, at this point in research, requires some sort of purpose. Without a formal definition of cognition, it is difficult to move from one well established fact to another. How can human cognition be computable or not, if there is no formal definition for cognition? Even if it were possible to know whether human cognition is a result of hypercomputing or complex arrangements of Turing machine operations, it would still necessarily be proven that human intelligence is established with or without purpose. An agent cannot be created for the sake of it being functionally human until we can answer the question of what it means to be human. For now, it is accurate to say that computer agents of all sorts exist to suite a purpose. Concurrent dialog in modeling human cognition, although inconclusive, serve as interpretations of these virtual realities



Thank You

- What does it mean to be human?

