

What is Represented in the Brain? Representation 1

Discussion Question

You use the word “table” to refer to the object in front of you. How do you know your word refers to a table, and not something else in a different world to which you have been transported (without your awareness) and in which you function just fine?

- A. I don't. Only the scientist examining me could determine that
- B. It is just obvious to me that by “table” I am referring to a table
- C. I engage in a rich set of interactions, including the use of many words, with my environment. Within that framework, I can characterize how I use “table” to refer to table
- D. Other

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Issues Concerning Representations in the Mind/Brain

- What is a representation?
- Is it useful to construe the mind/brain as a representational system?
- How can we identify representations in the mind/brain?
- Do brain processes represent, or is this simply a gloss provided by theorists?
- If they represent, what do they represent?

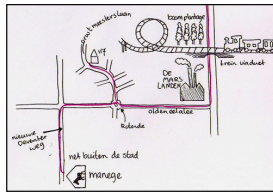
Representation in Information Processing Theories

- Representations are entities that stand in for something external and are used instead of that for which they stand in
 - A picture can be used to tell us what someone looks like
 - A map can stand in for the actual world as we plan a route
 - A name can stand in for the person in sentences we use to make inferences about the person
- Cognitive theories are distinguished from behaviorist theories not just by "going in the head"
 - But by construing mental activity as operations performed on representations
- Neuroscientists as well often characterize brain activity as representing something outside the brain
 - Marr's Representation and Algorithm level



What Makes a Map a Representation?

- While snooping at a friend's house you encounter the drawing to the right. It looks like a map, but is it?
 - It could just be some doodling someone did while bored
- What would it take to show that it is a map?
 - That it happens to be isomorphic to some location in the world?
 - That could be mere coincidence
 - That it was drawn by someone in response to their experiences of particular locations?
 - That it was drawn for the purpose of guiding someone to locations?
- Common view: representations are entities that stand in and carry information about something and enable the system that possesses them to direct its behavior with respect to that thing



Intentionality: The Content of Representations

- Brentano introduced the term *intentionality* to refer to the ability of representations to represent things, even things that don't actually exist
 - A photograph of a person represents that person
 - A diagram is about a phenomenon or mechanism shown
 - A noun or verb in a text refers to a thing or what it does
 - A belief represents some putative fact
- Since Brentano introduced the concept of *intentionality* the connection between the representation and what it represents has been mysterious
 - Especially since the represented thing may not exist at all or, if it does exist, not as it is represented
- A common strategy has been to appeal to how representations carry information by being causally dependent on what they represent
 - In the case of the brain, representations are connected to what they represent via the senses
- What about representations that misrepresent?

Discussion Question

Where are the representations in the HBK model?

- A. Listen to Chimero—the model explains without using representations
- B. The system that adheres to the equation represents the equation and the various terms in it
- C. The model only describes behavior—the representations are in the brain
- D. Other

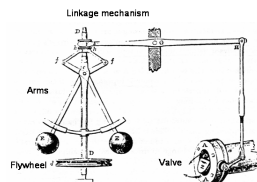
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The Dynamical Approach

- Chemero describes his preferred method for explaining behavior
 - “First, observe patterns of macroscopic behavior; then seek collective variables (like relative phase) and control parameters (like rate) that govern the behavior; finally, search for the simplest mathematical function that accounts for the behavior”
- This approach has been applied to a broad range of behavioral and neural phenomena
- Note: the approach is non-mechanistic: there is no attempt to decompose a system into its component parts and operations and to show how they together generate the phenomenon
 - The mathematical function explains the dynamic behavior to which it gives rise

Doing Without Representations?

- Watt faced a challenge in utilizing the steam engine--appliances (e.g. sewing machines) need to be driven at a constant speed, but as different appliances go on and off line the speed will change if the steam supply is kept constant
 - Watt developed a governor in which, as the engine ran faster, arms attached to a spindle would rise by centrifugal force
 - Through a linkage connection, steam valve would be closed
- Van Gelder argued that
 - Watt's governor contains no representations
 - Its behavior is described by a differential equation
- The governor thus provides a model for how the mind/brain can work without representations

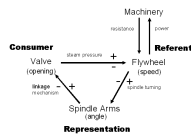


$$\frac{d^2\theta}{dt^2} = (n\omega)^2 \cos\theta \sin\theta - \frac{g}{l} \sin\theta - r \frac{d\theta}{dt}$$

Is the Watt Governor Devoid of Representations?

• My first attempt to defend representations in the governor: the angle of the spindle arms carry information about the speed of the engine and is used to regulate the opening of the valve

- Van Gelder's response: angle of the spindle arms lags behind the actual speed of the engine
- So it typically doesn't correspond to the actual speed
 - My response: Is this really a problem? Representations should be able to misrepresent



- Nielsen's revision: solve the equation for ω
 - The engine speed is represented in the angle arms, but only if we take into account the angle (ϕ) and its first and second derivatives
 - Lesson: representations may be harder to detect than we initially thought, but they can be found
 - But we should expect them in control systems
 - Such as the brain

$$\omega = \frac{\sqrt{\frac{d^2\phi}{dt^2} + \frac{g}{l} \sin \phi + r \frac{d\phi}{dt}}}{\cos \phi \sin \phi} n$$

Clicker Question

What, according to Egan, is the role of characterizing computational processes in terms of representations with content?

- It provides a literal view of what the computational system is doing—it is manipulating representations
- When a representational account generates correct predictions, then it has to be representing that about which it is making predictions
- It is a mistake. It results in a false account of how the computational system works
- It provides a useful gloss by the neuroscientist on what the computational system is used to do

A Theorist's Gloss?

- Egan: the processes appealed to in cognitive explanations are mathematical functions
 - they use constants and variables, but these are not in themselves about any content
 - rather, it is the researcher who glosses them as having content for the researcher's convenience
- Egan draws inspiration from Chomsky
 - the brain is a syntactic engine—it processes its internal states (representations) in virtue of their intrinsic properties
 - it has no access to what they supposedly represent
 - and it doesn't need such access to do its job
- In linguistics, this position is referred to as the autonomy of syntax

What Does a Gloss Do?

- Chomsky: reference to the meaning of words provides an informal way of picking out words
 - but the brain mechanism that processes doesn't have access those meanings
- Egan: reference to contents of representations enables the researcher identify the problem for which the computational process is the solution. This is *crucial*:
 - “content ascription plays a crucial explanatory role: it is necessary to explain how the operation of a mathematically characterized process constitutes the exercise of a cognitive capacity in the environment in which the process is normally deployed.”
 - But it does not require imputing content to the mathematically characterized process

A Similar Argument: Searle's Chinese Room



Clicker Question

What response would you offer to Searle's Chinese Room Argument

- A. Searle's wrong--the person in the room really does understand Chinese
- B. The person in the room doesn't understand Chinese, but the whole room (person, instructions, writing paper) does
- C. Searle's right--such a representation-processing system would not understand. When we understand something, something else is going on in us than just following an algorithm
- D. Other (be prepared to specify your response)
