

## 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

2

---

---

---

---

---

---

---

---

### 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?

---

---

---

---

---

---

---

---

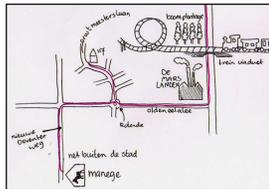
## Representation in Information Processing Theories

- 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

13

---

---

---

---

---

---

---

---

## 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

---

---

---

---

---

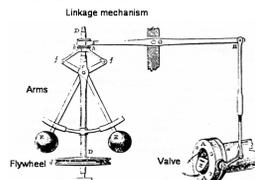
---

---

---

## 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



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

---

---

---

---

---

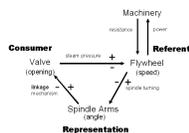
---

---

---

## 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  $\omega$ 
  - The engine speed is represented in the angle arms, but only if we take into account the angle ( $\phi$ ) 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

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

## 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

17

## 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)

---

---

---

---

---

---

---

---