What is Represented in the Brain? Representation 2

Clicker Question

Imagine standing on the beach and someone asks you what you think the temperature is. You reply “It’s hot—probably in the upper 80s.” What is the “traditional view of the senses” (as characterized by Akins) that explains this

A. Our senses act like thermometer, reporting the temperature in a servile manner
B. Our senses are poor indicates of temperture, as illustrated by illusions
C. Our senses are good indicators but generally less reliable than thermeters, reporting only values such as *too hot*, *too cold*
D. Our senses typically only report changes in temperature, not the actual temperature

Traditional View of Sensory Representations

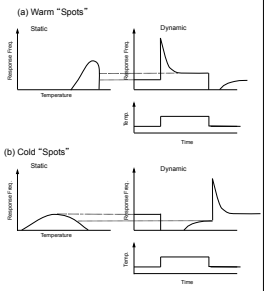
- The brain only accesses the world via representations provided by the senses
  - Without them, the brain is a solipsist
- Assumptions
  - There is a reliable correlation between what is represented and the representation
  - The structure of the phenomenon represented (relations between different temperatures) is preserved in the representations
  - The senses offer servile reports--they do not impose their own interpretation
- This does not require that the senses function perfectly, but error should not be widespread
  - For only if sensory representations satisfy these conditions will the brain acquire the information needed to operation in the world
    - And avoid solipsism

Narcissistic Sensory Systems

- Narcissists focus primarily on themselves
  - Interpret everything in terms of its significance to themselves
- Narcissism with respect to thermoreception
  - Receptors are not in the business of objectively reporting what is in the world, but only what the organism needs to know
  - Two temperature receptors, one for warm and another for cold
  - Two pain receptors for extreme hot and cold
- Different parts of the body have different concentrations of warm and cold receptors and so are more sensitive to one or the other

Warm and Cold Receptors

- The "static" function of the warm and cold spots is its response frequency at different temperatures
  - The non-linear relations shown on the left
- Also have "dynamic" responses to changes in temperature
  - For the warm spot
    - When the temperature increases, the response first spikes, then gradually drops back to the new static response
    - When the temperature drops, the response drops before gradually returning to the new static response
    - Size of spike depends on size of change
  - Reverse for the cold spots

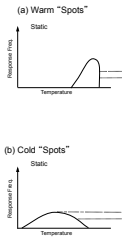


Reports Temperature as it Matters to the Organism

- The organism is narcissistic: what it needs to know is not how the world is, but how the world is affecting it
  - Hot and cold receptors are reporting changes in temperature that might matter
  - What matters most is how things are changing
- If temperature is changing differently for different parts of the body, they report the same stimulus differently
  - Hand initially in warm water reports tepid water as colder than hand initially in cold water

From the Traditional View

- Thermoreception is a poor sensory system if what it is supposed to do is provide accurate information about temperature
  - It reports the same temperature in different ways
    - Depending on how many receptors are in a given tissue
  - It gives the same response to different temperatures
    - To stimuli on either side of the maximal response



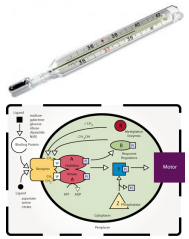
Clicker Question

What is Akins' own assessment of the usefulness of narcissistic sensory systems?

A. They are a serious impediment to our ability to understand the world around us since they generate distortions
B. They aren't very useful and so humans have devised more actuate tools like thermometers
C. They provide exactly the information organisms most need—the information needed to respond effectively
D. They are OK, but they could have been much better designed

Evolutionarily Sensible

- "one realizes that this system is not merely inept, a defective indicator of surface temperature. Rather, the system as a whole constitutes one solution to man's various thermal needs--that he be warned when thermal damage is occurring or before it is likely to occur, when temperature changes are likely to have specific consequences, and so on."
- Would an objectively accurate recording of temperature work better?
  - In order to use such information to plan action, the organism would need to know how to reason with that information
- For many purposes, what the motor system needs to know about is what matters for action
- A bacterium needs to know whether it is moving up or down a chemical gradient
  - It doesn't need to know the actual quantity



Processing Information and Representation

- Akins emphasizes the various types of information organisms must acquire in order to direct motor activity
  - Why do the neural processes involved in processing this information not count as representations?
- At some points Akins seems to acknowledge that they do:
  - "Even our simplest actions, then, involve numerous sources and types of information (here, visual, proprioceptive, and haptic information) and, within a single system such as vision, specialized information (about shape, position using a variety of reference frames, rotation, movement, and so on) which requires diverse **representational schemes**."
- Her objection seems not to be to the occurrence of representations in the brain, but to the nature of those representations
  - They don't represent objective features of the external world
    - Rather, they represent narcissistic information
- But elsewhere she speaks of neural sensory systems as "nonrepresentational systems"

Akins' Doubts about the Detector Theory

- Akins raises a further objection to the construal of sensory systems as detectors of specific properties (including narcissistic ones)
  - Internal systems in the organism regularly modify the response properties of the senses so that they are not fixed detectors of a given property
    - Example: feedback processes alter the response of muscle spindles to changes in muscle length as the muscle is extended or contracted
- What is wrong with context sensitive detectors--detectors whose sensitivity is calibrated by other activities in the system?
  - Of course whatever utilizes the response of the detector must also be responsive to the way the receptor was calibrated

Intentional Representations of which we are Conscious

- Akins real concern seems to be with the intentional grounding of our conscious cognitive states: believing that the temperature is above 70 F
  - Her contention is that sensory receptors don't ground these states
- But how do we come to have such states?
  - A plausible answer is that we extract them from what is represented by the senses
  - But Akins rejects this answer: "This suggestion, however, amounts to little more than an expression of one's faith in the traditional view. Empirically, there is little reason to think that all sensory systems carry within them the means to "decode" their own responses."
- That doesn't solve the problem. How do we come to have beliefs about temperature?

Discussion Question

An intelligent creature arrives on earth and with a lot of work, you learn to communicate with it. There is one word which they don't seem to understand—"temperature". How would you explain to them what "temperature" means?

A. Show them a thermometer and point out that it shows that it is 37
B. Explain to them that temperature is just a measure of how fast molecules are moving
C. Show them how different states that register on the thermometer correspond to how hot items in the environment seem to be
D. Show them how different states that register on the thermometer correspond to observable differences —ice melting, water boiling.

Discussion Question

You live in a world in which there is no concept of temperature. You and others use language like "cold," "warm," "hot." What could lead to the introduction of temperature as a new concept?

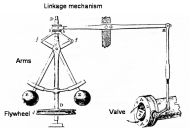
A. Someone discovers that the volume of a metal such as mercury corresponds to your judgments "cold," "hot," etc.
B. Someone assigns numbers to the words "cold" (0), "warm" (5), "hot" (10), etc., and proposes a continuous scale which people start to use
C. Someone figures out the relation between air judged to be "cold" and "hot" and the pressure and volume of a container
D. Someone advances an account in terms of molecules and characterizes the speed with which molecules move and introduces the term temperature for the degree of movement
E. Other?

Temperature: An Invented Concept

- There were lots of practical reasons to develop the concept of temperature
  - beyond just being able to talk about how the world seems to us
    - Many natural processes occur at specific temperatures—water freezes and boils
    - The speed of many natural processes (chemical reactions) depends on temperature
- This gave rise to attempts to create measurement scales: Fahrenheit, Celsius
  - Celsius originally made 100 = water freezing; 0 = water boiling
- This motivated attempts to figure out what instruments were measuring—temperature

A Control Perspective on Representations

- A control mechanism—e.g., the Watt governor—acts on other mechanisms in light of measurements it makes
  - A measurement system assumes a state in response to the variable that it measures
  - The activities the control mechanism performs are determined by the state it assumes due to making a measurement
- Measurement device such as those on a dashboard adopt states in response to the value of the variables they measure
  - What would it take for these instruments to be part of a control system?



Intrinsic Intentionality?

- Searle's Chinese Room argument assumed that when we think a thought/speak words, we know what they mean
  - They have their intentionality intrinsically (not relationally)
- Egan argued, following Chomsky, that states in the mind/brain lack intrinsic intentionality
  - The theorist uses their relational properties to pick them out (provide a gloss)
- On a control perspective, content is relational: it depends on what is being measured and how the measurement figures in control

Egan and Control Theorists: United in Denial

- On the control perspective, components of control mechanisms represent the variables that they measure
  - but there is nothing in the control mechanism itself that specifies its content—it would function the same in any environment in which the same state were produced
  - the content relation is a ***relation*** between the state and what it measures
- Egan and the control perspective
  - agree that brain representations lack intrinsic content
- On the control perspective
  - content assignments are not "mere" glosses
  - but reflect a broader perspective in which representations are parts of control systems

Whither Intrinsic Intentionality?

- Searle: I know the meaning of my words!!!!!!!!
  - I don't have to consult anything else to figure out what my words mean
- Components of a control system don't know what their representations mean
  - They lack intrinsic intentionality
- Does this reflect a fundamental difference between representations we use intentionally and those used by computational systems, etc.?
  - One strategy: deny intrinsic intentionality

Doing Without Intrinsic Intentionality

- Quine: when we interpret the meaning of someone else's words, we use our own language (at face value)
  - If we need to interpret the meaning of our words, we need to use yet another language
  - In Egan's terms, we are giving a gloss to our words
- But what if someone only speaks one language?
  - That language is not a monolith
    - we can use some of our words to interpret other words
- But I only have one mind!
  - Our mind/brains are not monoliths
    - we can use some of our mental/neural activities to interpret others
- Who is the "we" that does this?
  - Just a collective of the diverse neural processes that constitute us?

An Organismic Perspective

- We are not just any collective of diverse neural (and other) processes
- Maturana and Varela: organisms are autopoetic
  - Beyond the components present in the fertilized egg, the organism makes everything that constitutes it
  - This requires extracting matter and energy from its environment and using these to make components
- Moreno and Mossio: organisms are autonomous
  - Auto (self) + noms (law)
  - Organisms direct their own activities
    - They construct their own nervous system/brain and employ its various components to regulate its behaviors
    - If they use representations, they can only appeal to other processes of their own to determine their content
      - there is no intrinsic intentionality

How is Misrepresentation Possible?

- A relational account provides an account of how representations have content
  - they stand in relations to the things they represent
- But then how could they misrepresent?
  - Won't a representation simply represent whatever it is connected to?
- Causal processes are noisy
  - The measurement process can go wrong—the speedometer stops measuring speed
  - The output device of the control mechanism doesn't produce the optimal response
    - The driver treats the product of the measurement in ways not appropriate for the content