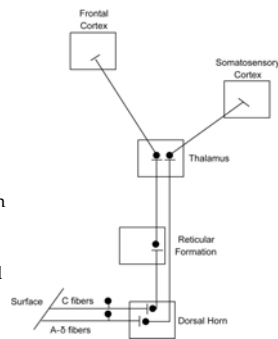


CONSCIOUSNESS 2

Pain and Subjectivity

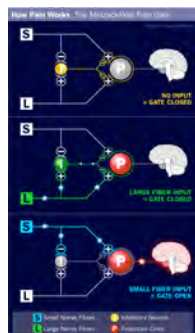
CLASSICAL TWO PAIN PATHWAYS

- A-δ fibers project via the thalamus to somatosensory cortex, providing information about the location of the pain stimulus on the body, its intensity, duration, and nature
 - Myelinated fibers that send information quickly
- C fibers project via different layers in the thalamus directly to motor control areas, providing information about the unpleasantness of the stimulus
 - Unmyelinated fibers that respond slowly



MELZACK AND WALL

- In the 1950s Melzack and Wall advanced a gate-control theory of pain
- Small (C) fibers and Large (A δ) both project onto inhibitory interneurons (I) and projection cells (P) which go up to cortex
 - When large fibers fire without small fibers, the Inhibitory neuron blocks activation of the projection fiber
 - When small fibers fire, they inhibit the Inhibitory neuron, and the gate is open for transmission to the brain
- If, after a pain stimulus, you rub the spot, the large fibers can close the gate



PHILOSOPHICAL ACCOUNTS

- Eliminativist: pain doesn't exist (Paul Churchland, Dennett)
- Behaviorism (Wittgenstein): pain is a form of behavior, not an inner experience
- Pains are located in the affected tissue (Armstrong, Newton)
 - Asked what hurts, we name the affected part of our body
 - Makes pain appear as a type of perceptual process--just as we report on objects we see, we report on pain
- Pains are purely subjective and inherently conscious (Grahek, McGinn)
 - People report pains without damage in tissues
 - Pain is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (International Association for the Study of Pain)
 - People cannot be mistaken about their pains

Clicker Question

A major thrust in Hardcastle's paper is that we should view pain as a product of a pain processing system that is comparable to other perceptual systems. What does she think will follow from this?

We will recognize the eliminativists are right—there is no such thing as PAIN

We will recognize that each of the philosophical views only focuses on some of the features of the pain system

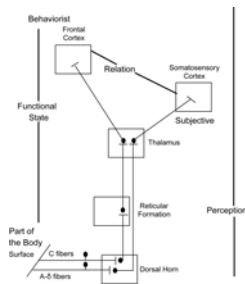
We will recognize the objective nature of pain—that it really is not tied to subjective experience

We will recognize the conscious experience of pain is the most basic feature of pain

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HARDCASTLE'S DIAGNOSIS OF PHILOSOPHERS' MISTAKE

- The pain system should be viewed as a perceptual system, like the visual system, which has many parts that can be affected in many different ways
- Each of the philosophical views focuses only on one part of the pain mechanism
- The various parts of the pain system each contribute to "our ability to . . . track what is happening to our tissues. . . . In short, it appears we have a complex but well-defined sensory system which monitors our tissues in order to promote the welfare of our bodies"
- But does it stay well-defined in the brain?

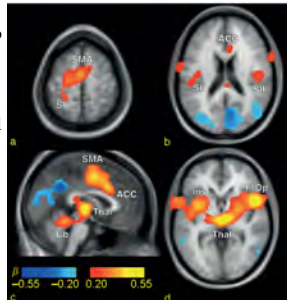


CORTEX AND PAIN

- Traditional puzzle
 - Most cortical lesions do not seem to affect the ability to experience pain
 - Most stimulations administered to cortex do not seem to produce pain experience
 - But single-cell recording in animals has identified areas that seem to be involved in pain processing
- Is cortex involved in pain experience?

NEUROIMAGING REVEALS DISTRIBUTED CORTICAL PAIN

- Somatosensory cortex (SI, SII)
 - While it is difficult to find individual SI cells that respond to pain stimuli, SI shows increased activity, as does SII
- Anterior cingulate shows activity both in response to pain stimuli and analgesia
- Anterior insula and prefrontal cortex also show pain responses
- Reduced activation in the default network (posterior cingulate, precuneus, and ventromedial prefrontal cortex)



Clicker Question

What does Hardcastle conclude from reporting on several attempts to identify brain regions active in pain experiences?

That there is a central brain region that serves as the pain center. Lesions to it eliminate all pain experience

That pain processing is performed by a separate system that is independent from perceptual, cognitive, and affective systems

That pain processing is highly integrated with perceptual, cognitive, and affective systems and cannot be disentangled

LATERAL VERSUS MEDIAL CORTICAL PAIN SYSTEMS

- Lateral pain system projects from lateral thalamus to somatosensory areas
 - And seems quickly to engage motor areas
- Medial pain system projects from medial thalamus to prefrontal cortex and anterior cingulate
 - More concerned with affective response than motor response
- Note parallels with the ventral and dorsal visual streams

DISSOCIATION OF PAIN

- Dissociation of the two pathways
 - Morphine or frontal lesions leave awareness of damage but removed the “hurtfulness” of pain
 - “The pain no longer bothers me”
 - Fentanyl leaves the hurtfulness in place but inhibits the ability to discriminate what tissue is damaged
- Dissociation of peripheral and central processes
 - Brain processes involved in pain experience can be activated without damage to bodily tissue
 - Tissue can be damaged but brain processes suppressed

WHAT IS PAIN?

- Recall the philosophical alternatives:
 - Pain is a state of the damaged tissue
 - Pain is a subjective response
- Why are so many brain areas involved in pain responses?
 - Is pain itself a complex phenomenon?
 - It typically does involve damage to a tissue
 - This requires both input from tissue and a representation of where the tissue is in the body
 - It typically does involve subjective, including emotional, responses
 - This requires coordination with other neural processes
- Can the consciousness experience of pain be further decomposed?
 - Are there other brain processes that contribute to the conscious experience of pain?

PHANTOM PAIN

- Pain attributed to a part of the body that has been amputated or is no longer sending signals
 - Widespread in amputees: 82% with arm amputation, 54% with leg
- Drawing upon the fact that phantom pain was more common if the patient had experienced paralysis prior to amputation, Ramachandran developed the mirror box treatment
- What, if anything, do phantom pains tell us about pain experience?
 - Perhaps they serve to highlight the engagement between sensory processing and motor activity
 - Experience depends in part on what we do



MANDIK'S QUEST: ACCOUNT FOR THE SUBJECTIVITY OF EXPERIENCE

- Conscious experience is perspectival or from a point of view
 - You don't just see a dog—you necessarily see it from a specific perspective of point of view
- Whereas your knowledge of dogs is objective—it doesn't have a viewpoint:
 - "The domestic dog (*Canis lupus familiaris*) is a subspecies of the gray wolf (*Canis lupus*), a member of the Canidae family of the mammalian order Carnivora. The term "domestic dog" is generally used for both domesticated and feral varieties. The dog was the first domesticated animal and has been the most widely kept working, hunting, and pet animal in human history. The word "dog" can also refer to the male of a canine species, as opposed to the word "bitch" which refers to the female of the species."



Clicker Question

Which of the following plays a central role in Mandik's proposed account of the perspectival nature of experience?

- Representations
- A third-person perspective
- The homunculus
- Consciousness

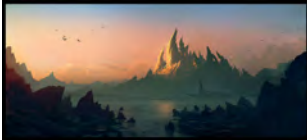
REPRESENTING THE WORLD FROM A POINT OF VIEW

- Mental representations are subjective insofar as they involve a point of view
- Photographs are always from a point of view
 - They specify where the viewer is with respect to what is photographed
 - Albeit not precisely



AERIAL PERSPECTIVE

- Distant objects are portrayed as fainter, hazier, and bluer than those closer
- Provides information about where one is with respect to what is represented

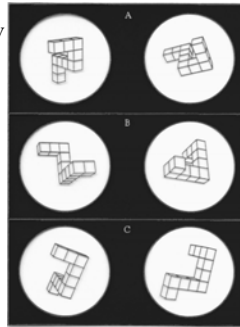


EGOCENTRIC MENTAL REPRESENTATIONS

- Mental representations, like photographs, can specify a viewpoint
 - When we represent something in vision we represent it from a perspective
 - When we imagine seeing something, we imagine it from a perspective
- We can also represent objects allocentrically
 - You can describe an object's features without saying how you are situated with respect to it
 - My computer has a silver case, 13 inch screen, 2 USB connections, one audio connection, has an Intel processor, Has 4GB memory, etc
 - That is not perception, but knowing

SHEPARD'S MENTAL ROTATION STUDIES

- Shepard and Cooper argued that people employ visual mental representations by showing that the time it took people to answer the question whether two objects were the same depended on the amount they were rotated
- Mandik treats this as evidence that viewers represent things from points of view
 - And can modify their point of view by, e.g., rotating the object in one's imagination



Discussion Question

You have just arrived in a confusing foreign city (e.g., Mexico City, Beijing) that you have never been to before. You have to meet a friend in two hours at a location about three miles from where you are. Your friend will send you one (JUST ONE) of the following. Which do you want? Be prepared to say why.

A accurate map with your location and destination clearly marked

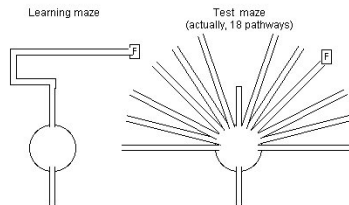
A set of very detailed verbal directions with reference to your own motions (walk straight for two blocks; just after the Starbucks, make a sharp right turn)

A set of very detailed verbal directions with reference to objective directions (walk north 200 feet; just after the Starbucks, turn to the east)

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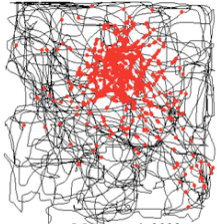
ALLOCENTRIC VERSUS EGOCENTRIC NAVIGATION

- If a normal rat learns the maze on the left and then is placed in the start box of the one on the right, it will pursue the most direct route to the target
- But a rat with a hippocampal lesion will try to follow the same route
- Two navigational systems
 - One representing the external layout
 - The other the layout from the organism's point of view



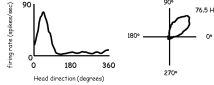
PLACE CELLS AND HEAD-DIRECTION CELLS

- In the hippocampus and surrounding regions, cells have been identified that respond to allocentric place and egocentric head direction



Moser et al., 2008

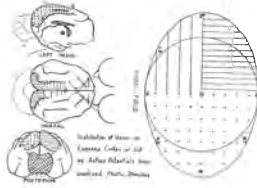
Place cells in the hippocampus



Head direction cells in post-subiculum, entorhinal cortex, thalamus, etc.

MANDIK'S ACCOUNT OF SUBJECTIVITY

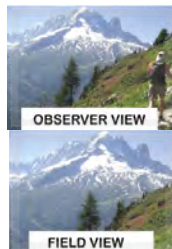
- Mandik characterizes representations as subjective if, in addition to to having the function of carrying information about what is represented, it also has the function of carrying information about the relation of the represented to the subject
 - When run off-line, as in mental imagery, it is the perspective the imaginer takes with respect to what is represented
- Example: Topographical representations in visual areas that preserve (with distortion) relations in the visual field
- Example: recall a past experience
 - Do you see yourself in the experience?
 - Or do you imagine it as you saw it?



Talbot and Marshall, 1941

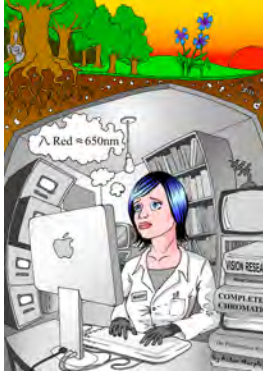
FIELD VS. OBSERVER VIEWS

- Negro and Neisser (1983) found that individuals sometimes recall events from their 1st person, field perspective, and sometimes from a 3rd person, observer perspective
 - Older memories tend to be from an observer perspective and to be less vivid
- Libby and Eibach (2002) found subjects were more likely to remember events inconsistent with their current self concept from a 3rd person, observer view
 - 3rd person view a "distancing mechanism"



REMEMBER MARY

- Mary is a brilliant scientist who is, for whatever reason, forced to investigate the world from a black and white room via a black and white television monitor. She specializes in the neurophysiology of vision and acquires, let us suppose, all the physical information there is to obtain about what goes on when we see ripe tomatoes, or the sky, and use terms like 'red', 'blue', and so on. She discovers, for example, just which wavelength combinations from the sky stimulate the retina, and exactly how this produces via the central nervous system the contraction of the vocal cords and expulsion of air from the lungs that results in the uttering of the sentence 'The sky is blue'. [...] What will happen when Mary is released from her black and white room or is given a color television monitor? Will she learn anything or not?
 - Jackson, 1982, Epiphenomenal Qualia



Discussion Question

Does Mary learn something new when she exits the black and white room and encounters the colored objects of the world?

Yes. She has the sensory experience for the first time and now knows what it is like. This knowledge is not physical

No. With her knowledge, she was able to generate in her imagination what that experience was like

No. She doesn't have new experiences but is able to index those she constructs with situations in the world that would induce it

Yes. There is a subjective point of view that is generated by actually having the experience, but this is a purely physical phenomenon.

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MARY, INDEXICALS, AND PICTORIAL REPRESENTATIONS

- A common response to Jackson's Mary argument is that Mary does not learn any new facts when she experiences color
- She merely learns to pick out the color with a different indexical
 - No different from you only being able to refer to the site of the Egyptian pyramids as *there* until you actually go there. While there you can speak of them as *here*.
- Mandik: Mary has learned a new subjective physical fact
 - A fact about a subjective point of view that can only be represented from that point of view
 - Yet, it is a physical fact about the brain that it can represent things from points of view

