A Philosophical Introduction to Perception

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What is Perception?

stuff in the world
What is Perception?

- extracting information via the senses
- forming *internal representations* of the world
Outline for today:

1. Philosophy:
   • What philosophical perspectives inform our understanding and study of perception?

2. General Examples
   • why is naive realism wrong?
   • why is perception worth studying?

3. Principles & Approaches
   • modern tools for studying perception
Epistemology = theory of knowledge

• Q: where does knowledge come from?

Answer #1: Psychological Nativism

• the mind produces ideas that are not derived from external sources
Epistemology = theory of knowledge

• Q: where does knowledge come from?

Answer #1: Psychological Nativism
• the mind produces ideas that are not derived from external sources

Answer #2: Empiricism
• All knowledge comes from the senses
Proponents: Hobbes, Locke, Hume
• newborn is a “blank slate” (“tabula rasa”)
Epistemology = theory of knowledge

- Q: where does knowledge come from?

Answer #1: Psychological Nativism

vs.

Answer #2: Empiricism

- resembles “nature” vs. “nurture” debate
- extreme positions at both ends are a bit absurd

(See Steve Pinker’s “The Blank Slate” for a nice critique of the blanks slate idea)
Let’s grant (at least some) claims of Empiricism (i.e., knowledge comes to us through our senses)

**Q:** what is the relationship between “things in the world” and “representations in our heads”?
1. Naive Realism (or “common sense realism”)

- We perceive the world “as it is”
- Our minds have direct access to reality
2. Idealism

- The only reality is that of mind / ideas
- There is no evidence for / reason to believe in an external world
René Descartes (1596–1650)

“Meditations On First Philosophy”, 1641

• undertook a program of “radical skepticism”
• discard any idea that can be doubted

• senses can be fooled
• all sense data could be caused by an “evil demon”
• concluded that the only thing he *could* be certain of was that he existed. (“cogito ergo sum”)
René Descartes (1596–1650)

“Meditations On First Philosophy”, 1641

- undertook a program of “radical skepticism”
- discard any idea that can be doubted

- eventually convinces himself that God exists
- God wouldn’t trick us, so external world also exists
- arrives at a “dualist” theory of reality: matter and mind are the two kinds of stuff that exist
2. Idealism

Descartes’ supposition:
2. Idealism

Bishop Berkeley (1685–1753)
- idealist, empiricist
Modern variants:

• Brain in a vat
“What is real? How do you define real? If you’re talking about what you can feel, what you can smell, what you can taste and see, then real is simply electrical signals interpreted by your brain. This is the world that you know.”

—Morpheus in *The Matrix*, 1999
Early Philosophy of Perception

Plato and “The Allegory of the Cave”
Early Philosophy of Perception

Plato and “The Allegory of the Cave”

- Actually used by Plato to argue *against* empiricism

- True nature of reality is (platonic) “forms”, perceivable directly with the mind, not the senses.
3. Representative Realism

- We perceive the external world indirectly & imperfectly, via intermediary “sense data”
Note: idealism could never be tested or disproved

• science can’t “prove” that the external world exists
• or that we have any kind of access to it

We need some pragmatic assumptions to get started:
• there is an external world
• we have (indirect) access to it via our senses
Final issue: what kind of “stuff” is there in the world?

Descartes: “Dualism” - there are two kinds of stuff
- mental stuff (non-spatial, non-physical)
- physical stuff (possesses no mental properties)

Problem: how can the physical and mental stuff interact?
Modern versions of dualism

“homunculus” - little man

The person who sits inside our head and is responsible for “perceiving” what we see.

Prevalent conception, even in neuroscience today.
Alternative theory: “Monism” - only one kind of stuff

Specifically: “Materialism” - physical matter and energy is all that exists

- challenge is to come up with a story that explains how physical stuff can have “mental” properties (consciousness, awareness, etc)
Philosophical position of this course:

- **Empiricism** - knowledge from senses (obviously!)
- **Representative Realism** - indirect knowledge of world, via the senses
- **Materialism** - only one kind of stuff (matter)
- **Functionalism** - understanding the “function” of the sensory systems is all that we need to know to “understand” them.
From Philosophy to Framework

stimuli (input)

environment

you

action (output)
“you” = an Information Processing Machine

by definition, an IPM takes input and performs operations on that input to produce an output
In this course, “understanding” perception means:

1. We can write down an algorithm for how a perceptual task is performed (i.e., we could use it to design a robot to perform the same task)

2. Knowing where and how the algorithm is implemented in the nervous system.
Next:

“General examples”

or

“why naive realism is wrong”

or

“why perception is interesting to study”
perceptual acuity test
change blindness
Lightness illusion
Comparison patch

A

B
“Argument from Illusion”

- The fact that we are sometimes mistaken in our sensory perceptions indicates that we do not directly perceive the world
- (Naive realism is false!)
Hermann-Hering Illusion
Hermann variant
Eye movements

• we aren’t aware of them, but they are essential for vision
• if you stabilize the eye, you become blind within several seconds
Color perception
Color perception

- Is not absolute: depends on the specific mechanisms in the eye (photoreceptors) and subsequent processing in the brain
Face and Object recognition
(prosopagnosia and object agnosia)

- Giuseppe Arcimboldo
Neurological deficits

• Another important source of information about perceptual mechanisms

• “If you can lose function A but not function B, then A and B must rely on distinct perceptual mechanisms”
McGurk Effect
Illusions from conflicting information

- Brain sometimes comes up with interesting percepts in response to conflicting sensory cues
Algorithms for perception

• if we truly understand perceptual mechanisms, we can replace neural processing with computer processing
Cochlear implants
(using a “different computer” to transduce auditory signals)
Direct neural control of movement
- Wessberg etal, Nature 2000
Summary

• Empiricism vs. Psychological Nativism

• Naive Realism vs. Idealism vs. “Representative Realism”

• Descartes’ doctrine of “radical skepticism” (brain in a vat, or The Matrix)

• Dualism vs. Monism; Materialism

• Homunculus (little man) - perceiver of our reality

• Functionalism - algorithms are what matter
extra credit take-home problem: 2 points
Figure 1.9 Berkeley’s exploration of how vision works