Object Representation Lecture 1:

Intro & Piaget

General Course Concerns:

You should know the argument.
An example test question:
For Berkeley, the "primary idea" that gives an individual direct and perfect information about depth is:
A. from touch
B. from visual cues
C. from texture gradients
D. from convergence

Challenges of Object Perception

1. Unity and boundaries: what goes with what?
2. Occlusion: what is the complete shape of each object?
3. Persistence: representing the existence and location of things that move out of view.
4. Identity: determining whether a thing seen now is the same object as a thing seen before.
5. Predicting future behavior: where is this thing going? What will it do next?
Challenges of Object Perception

• As with depth, Objecthood does not come for free in the input.

• All that the sensory systems receive is unconnected photons hitting the retina or unconnected pressures touching the skin.

• Is the concept OBJECT innate or learned?

Core Knowledge Questions

What knowledge, internalized in us, allows us, as adults, to perceive and represent objects as enduring & complete?

What are the origins of this knowledge, and how does it grow?

Two answers

A nativist theory of object perception:

-- Gestalt Psychology: Core-knowledge of objects exists in both infants & adults

An empiricist theory of object perception and representation:

-- Mill: The Permanent Possibilities of Perception
-- Piaget: Knowledge of objects is constructed over development much as scientists construct theories

Object Perception

An example: Cezanne’s Plate

In this painting, how do we know that the plate is one continuous object behind the vase?

Object Perception

Mill’s Answer: The knowledge that the plate is complete and enduring comes from experience, learned through the senses. (see Piaget also)

Spelke’s Answer: The knowledge is innate, it is part of our Core-Knowledge of objects. (see Gestalt Psychology also)

What is innate?

Empiricist
1) Basic Sensation
2) The ability to learn from Sensation

Nativist
1) Basic Sensation
2) The ability to learn from Sensation
3) Some basic concepts Core-Knowledge

How is the mind organized?

Light falls on retina

Color

Lines

Bounded Surfaces

Surfaces grouped into objects

The order of visual processing

Attention can pick out up to 4 objects

Relations between two objects (support)

Give a name to an object

What is innate?

Empiricist

Nativist

learned

nativist
Empiricist theory of object perception & representation: Piaget

b• Object perception depends on the construction of a representation of the external world and of the self.
• This construction proceeds slowly and systematically, in stages, over the first 18 months of human life.
• This construction results from the development and coordination of action.

Evidence:
• studies of infants’ action development.
• studies of infants’ search for hidden objects.
• all focused on his own 3 children (w/ Valentine)

Jean Piaget
1896-1980
biologist, psychologist, “genetic epistemologist”

Methods: observation of spontaneous actions
impromptu experiments

(1) splashing the water

(2) getting the toy: Piaget puts a toy on a blanket, out of reach.

Piaget’s interpretation: between 6 and 9 months, actions are coordinated into the first means-ends relationships.

Piaget’s theory of action development (briefly)
Action capacities change qualitatively over infancy (0-18 months)
The changes occur in stages, for example:
Stage 3 (4-8 months): discovery of effective actions by chance (splashing the water, kicking the blanket)
Stage 4 (9-12 months): first systematic means-ends relationships (pulling the blanket to get the toy)
Same stages for diverse actions.
Each stage reflects a different “theory” of the world
stage 3: events happen by magic
stage 4: events are caused by actions on contact with objects.

Piaget on object permanence
Piaget observed infants’ searches for objects that move or disappear from view.
6 stages
Each stage, reflects infants’ changing conceptions of what objects are and how they behave: changing theories of objects.
Over infancy, “a Copernican revolution” in the infant’s understanding of objects occurs. (i.e. deep conceptual change)

Infants’ search for objects
Stage 1 (0-1 mos.): no actions on objects. No object perception, no object concept, no notion of an external world.
Stage 2 (1-4 mos.): visual tracking of objects, repeated grasping & sucking, but no reaching for visible objects.
Objects are part of the child’s actions.
Stage 3 (4-8 mos.): reaching for visible objects but not hidden ones. Objects exist only when visible.

Stage 4 (8-12 mos.): reaching for hidden objects, but with A-not-B error. Associative pairing of objects and actions

Trials 1-5: Object hidden in A, baby searches in A

Trial 6: Object hidden in B, baby searches in A

Stage 4

Stage 5 (12-18 mos.): Correct reaching for hidden objects in the A/B task, but not invisible displacements. A more sophisticated understanding of object motion & action.

Stage 5

Stage 5 (12-18 mos.): Failure to take account of invisible movements of an object.

Stage 6 (18 mos and beyond): Success. An adult-like understanding that hidden objects continue to exist and they can be tracked through space.

Stage 3 (4-8 mos.): reaching for visible objects but not hidden ones. Objects exist only when visible.
Stage 4 (8-12 mos.): reaching for hidden objects, but with A-not-B error. Associative pairing of objects and actions

Piaget’s Empiricist Theory (1952): Summary
Capacities to perceive and represent objects develops in 6 stages from birth to 18 months.
At each stage:
- characteristic patterns of actions on objects
- characteristic patterns of search for objects
- characteristic search errors

Capacities to perceive and represent objects are not part of humans’ innate endowment. They are a hard-won achievement, accomplished by infants as they act on objects, experience the consequences of their actions, and construct general theories of the world.

Mill’s Empiricist Theory (1865): Summary
Capacities to perceive and represent objects develops via experience with an unchanging world
For Mill, the belief that the external world exists, separate from us, and that it causes our experience is a belief that is not innate.
Rather it is constructed via the associative pairing of experiences over time.
This is similar to the story that Piaget constructs, Piaget identified the stages within this associative learning
For Mill, object permanence is a subpart of a constructed belief in the external world