9.85 Cognition in Infancy and Early Childhood

Lecture 2: Theoretical perspectives in developmental psychology: Piaget

Today

- CI-M instructors:
- Partner lectures
- Piagetian theory and stages
- Challenges to Piaget
- Class assignments (TA's)
- Methods practicum

Background

- From the beginning of Western philosophy: two competing traditions.

- **Rationalism** -- Some knowledge is innate. (Plato)
- **Empiricism** -- "Nothing is in the intellect which was not first in the senses." (Aristotle)

Behaviorism

- Behaviorism as the pinnacle of empiricist thought.
- All learning could be deterministically predicted, explained, and controlled by variations in the environment.

What happened next ...

- Demise of behaviorism
  - Turing made talk about representations and cognitive processes scientifically respectable
  - Tolman showed that rats learned information that wasn't explicitly reinforced
  - Garcia showed that some associations were learned more readily than others
  - Chomsky showed that language could not be learned by "mere association" (poverty of the stimulus)
  - Piaget argued that learning depended on both the structure of the environment and the structure of the mind.
- Rise of cognitive science

Piaget

- Child prodigy (albino sparrows -- age 10)

- Background in biology (mollusks)

- Early concern with whether categories were "out there" or in the mind. ("Vanity of nomenclature" -- age 16)

- Brief flirtation with poetry …

Image: Wikimedia. Public Domain.

Hymn to the Idea (1916)

"The Idea surges from the depths of our being. The Idea overthrows kings and priests,

raises the masses, decides the outcome of battles, guides the whole of humanity.

Everything is Idea, comes from the Idea, returns to the Idea. The Idea is an organism,

is born, grows, and dies like organisms, renews itself ceaselessly …"

Piaget

- Went to work with Binet on intelligence testing.

- Became more interested in patterns of errors than successes.

Piagetian revolution

- Wanted to bridge two different traditions:
- Rationalism and empiricism
- But also epistemology and biology.

Piaget

- Critical questions:
  - How can the processes that support knowledge be both
    - flexible (allow learning from experience)
    - and accurate (converge on the truth about the world)?
  - How can abstract, logical structures emerge from biological processes?

Piaget

- Founded a field he called "genetic epistemology"
- Looking for biological processes that could support the growth of knowledge.

Piagetian mechanisms

- Assimilation: Incorporate new knowledge into existing cognitive structures.

- Accomodation: change cognitive structures to accommodate new evidence.

- Together, Piaget referred to assimilation and accommodation as Adaption.

- He believed Adaptation in response to Equilibriation/Disequilibriation was the primary mechanism of cognitive development

Piagetian mechanism of cognitive development

- Adaptation
  - Assimilation
  - Accommodation

Image: Wikimedia. Istvan Takacs. CC BY-SA.

Mechanism of cognitive development

- Adapting simple schemes to a structured world would result in structured representations.

Not simple empiricism

- Structure of existing knowledge shapes access to new knowledge.

- Disputed the idea that experience imposes itself "without the subject having to organize it"

Not simple empiricism

- "To explain these successive generalizations by the simple action of associations would explain nothing at all because the problem is precisely to know why these associations are formed and not others among the infinity of combinations possible"

Not simple empiricism

- Anti-prevailing behaviorist ideas.
- Between 1932 and 1950 not a single one of Piaget's books was translated into English.

Not simple nativism either

- Cognitive development is
- A) universal and
- B) biologically constrained
- But: Driven by adaptation not maturation.
- Cognitive structures are not inherited but develop through functioning on the environment.
- (Differed also from Kant in this respect)

Not simple nativism either

"That which is inevitable does not have to be innate."

(in response to Chomsky and Fodor)

Piagetian stages

- Sensorimotor (birth-12 months)

- Intelligence is centered on action

- Stage **ends** with beginning of abstract representations, symbolic thought.

Example of "sensorimotor" thought

- Object permanence

- http://www.youtube.com/watch?v=NjBh9ld_yIo&NR=1

Object concept

- Why is it a big deal?

- Because it suggests the onset of representational thought.

- Infant must respond to a mental representation of the object, not the percept.

Piagetian stages

- **Pre-operational** (12 months - 7 years)

- Capable of pretend play, symbolic representations, imitation (in short, of representing the unseen world).

- Incapable of representing operations that respect logical transformations (perspective taking, part whole relations, conservation, causal relations, etc).
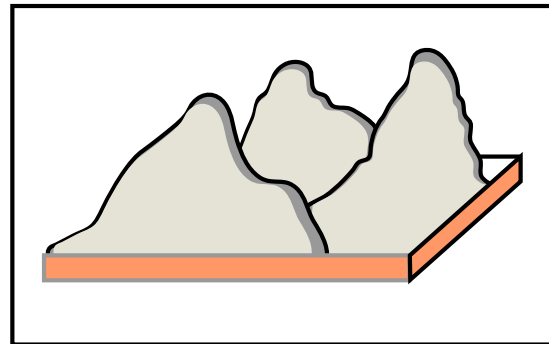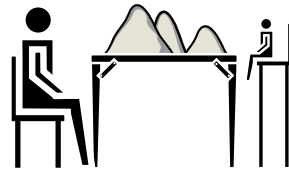
Piagetian egocentrism

Image by MIT OpenCourseWare.

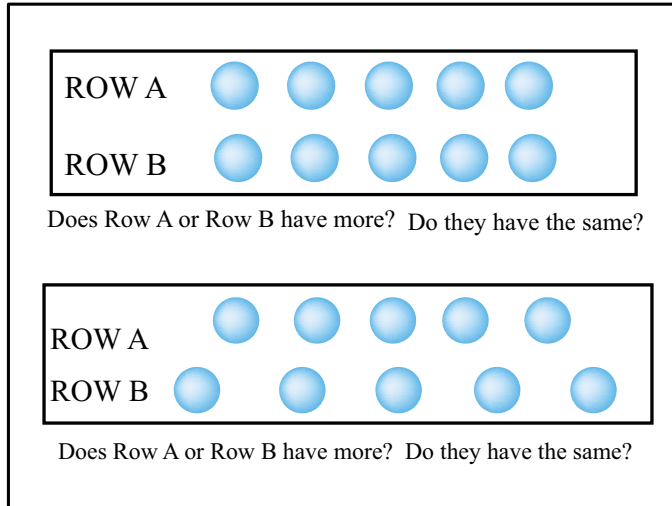# Conservation experiments -- classic example of pre-operational, thought

- http://www.youtube.com/watch?v=B65EJ6gMmA4

ROW A ●●●●●
ROW B ●●●●●

Does Row A or Row B have more? Do they have the same?

ROW A ●●●●●
ROW B ●●●●●

Does Row A or Row B have more? Do they have the same?

Image by MIT OpenCourseWare.

A   B

Does A have more clay than B, or does B have more clay than A? Or do they both have the same amount?

A   B

Does A have more clay than B, or does B have more clay than A? Or do they both have the same amount?
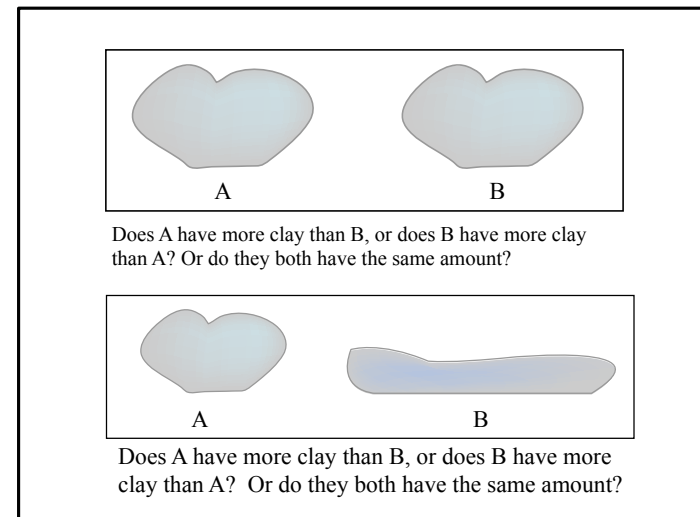
Image by MIT OpenCourseWare.

Why do children fail conservation?

- Failures of reversibility (they don't understand that operations can be undone)
- Failures of compensation (they don't understand that changes in one dimension compensate for changes in another)
- Failures of identity (they don't understand that it's the same stuff)

A term you might get on the GRE

- Horizontal decalage -- discontinuities of conceptual development within a stage
  - conservation of number before conservation of liquid
- Vertical decalage -- discontinuities of conceptual development between stages
  - May be able to understand reversible transformations among objects but not abstract quantities (adding and subtracting number)

Piagetian stages

- Pre-operational (12 months - 7 years)

- Capable of pretend play, symbolic representations, imitation (in short, of representing the unseen world).

- Incapable of representing operations that respect logical transformations (perspective taking, part whole relations, conservation, causal relations, etc).

Although no one has come up with a better account of failures of conservation ...

Piagetian stages

- Concrete operations (7-11)
- Children became capable of logical operations that are also true of the world
- not yet capable of formal reasoning: reasoning only on the basis of logical rules
- http://www.youtube.com/watch?v=YJyuy4B2aKU&feature=related
- Formal operations (12-on)
- Full logic, hypothetico-deductive reasoning, etc.

Challenges to Piaget

- **Questioning of experimental methodologies**
- **Discovery of early competencies**
  - Flavell: visual perspective-taking, appearance reality
  - Spelke, Baillargeon: object permanence by 3-months
  - Meltzoff: early imitation
  - Markman: parts/wholes
  - Gopnik, Gelman, Wellman: causal reasoning
- **Difficulties with stage theory**
- **Frustration with adaptation and disequilibrium as a learning mechanism.**

Post-Piaget ...

- The specifics of many Piagetian experiments have been called into question. Piaget mistook deficits in performance for deficits in competence.

- The stage theory is largely obsolete.

To reiterate:

- **Infants do have abstract representations, make inferences about causal relations, do differentiate agents from actions, can imitate.**

- **Preschoolers don't confuse appearance and reality, can take others' perspectives, don't confuse parts and wholes and don't confuse psychological and physical causality.**

- **No evidence for 'stages' of reasoning (qualitative shifts in how reasoning occurs).**

Nonetheless:

- Piagetian theory continues to be the dominant view of children outside of academia.
- And Piaget shaped the scope of the field: space, time, number, probability, morality, intentional action, causality, etc.
- The idea that children actively construct knowledge by applying their current conceptual understanding to evidence is still enormously influential.

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