Infant Cognition 2: Nativism vs. Constructivism

Micah B. Goldwater, PhD

University of Sydney

Cognitive Development:
A note before beginning

- A bias in the field: we are incentivized to claim infants and children are quite sophisticated at surprisingly young ages
    - This gets high-impact publications, popular press attention, etc.

- My own bias: because of these incentives, I am extremely skeptical of any such claim.
    - I have the minority view. Right now, the trend is to argue that infants and children are genius scientist moral philosophers. I don't really buy it.

Infant Cognition: Readings

- Nativist:

Carey, S. (2011). The Origin of Concepts: A précis. *Behavioral and Brain Sciences, 34*, 113-123. (it goes further with peer commentary)

  o This is relevant for both infant cognition and concepts and reasoning.

  o Reading the section on the development of scientific theories is not necessary

- Constructivist:

Cohen, L. B., & Cashon, C. H. (2006). Infant Cognition. In W. Damon & R. M. Lerner (Series Eds.) & D. Kuhn & R. S. Siegler (Vol. Eds.), *Handbook of child psychology: Vol. 2. Cognition, Perception, and Language* (6th ed., pp. 214-251). New York: Wiley.

  o Feel free to skip sections on: object exploration and sequential touching, deferred imitation, object individuation, complex causal scenes, complex event sequences, connectionist models, perceptual vs. conceptual categories, infant face processing, animate-inanimate distinction,

Where does knowledge come from?

Nativism vs. Constructivism

- What is the debate really about?
- Everything has a genetic component, every domain involves learning.

- Innate knowledge of specific domains, with domain-specific learning mechanisms vs. no innate knowledge but innate domain-general learning mechanisms.

Nativism often means cognitive modularity

- Information Encapsulation
- Sensitive to specific inputs
- Given the specific perceptual inputs, then the module takes over

Nativism: Domain-Specific Learning Mechanisms & Core Knowledge

- MODULES: specialized capabilities
  - Perhaps specialized brain tissue
- Designed to 'pick up' certain kinds of information from the sense organ
- Given particular perceptual input, modules are activated and apply their <u>Core Knowledge</u>
  - e.g., given certain cues, infant will interpret a percept as an object and make certain inferences, such as still existing while out of sight.
- Learns specific things about domains
  - e.g., the properties of particular categories of objects: size, shape, etc.

Anti-Piagetian

Constructivism: Domain-General Learning Architectures (see Cohen & Cashon, 2006)

- Some Key Principles
- Innate domain general information processing system that detects low-level featural information, such as color, motion
- Higher-level units formed from relationships among these.
- Higher-level units formed from these units. Learning is hierarchical & constructive
  - Cohen & Straus (1979): Older infants better able to perceive the higher-level generalizations.
- This is critical for all expertise. Infants start with the physical and social world.

Neo-Piagetian

Where does knowledge come from?
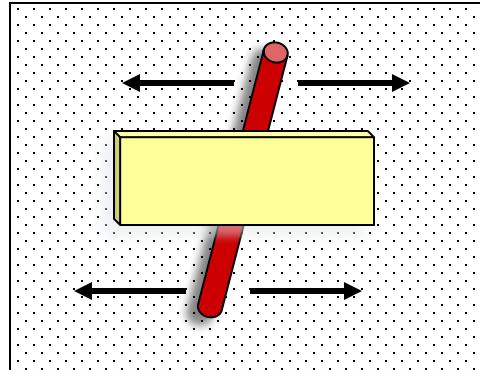
- Object knowledge

Where does knowledge come from?

- Object knowledge
- Object Unity: Do infants represent parts of objects that they cannot see?
- Object Permanence: Do infants understand that objects exist that they cannot see?
- Piaget said infants do not start out with this ability. Cohen & Cashon agree.
- Core knowledge theorizers (e.g., Carey, Spelke, Baillargeon) argue that they do start with object knowledge

Kellman & Spelke (1983): Perception of object unity in 4 month-olds
## Moving rod condition
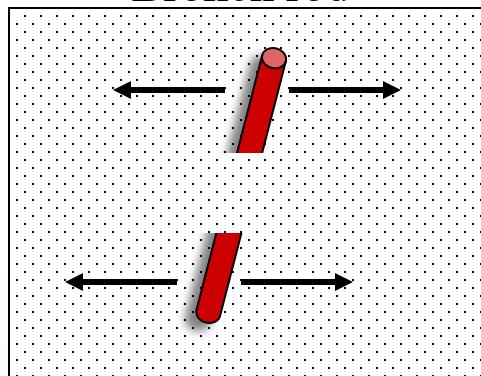
Partly-occluded rod
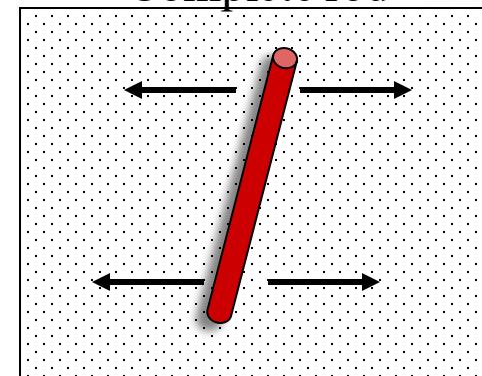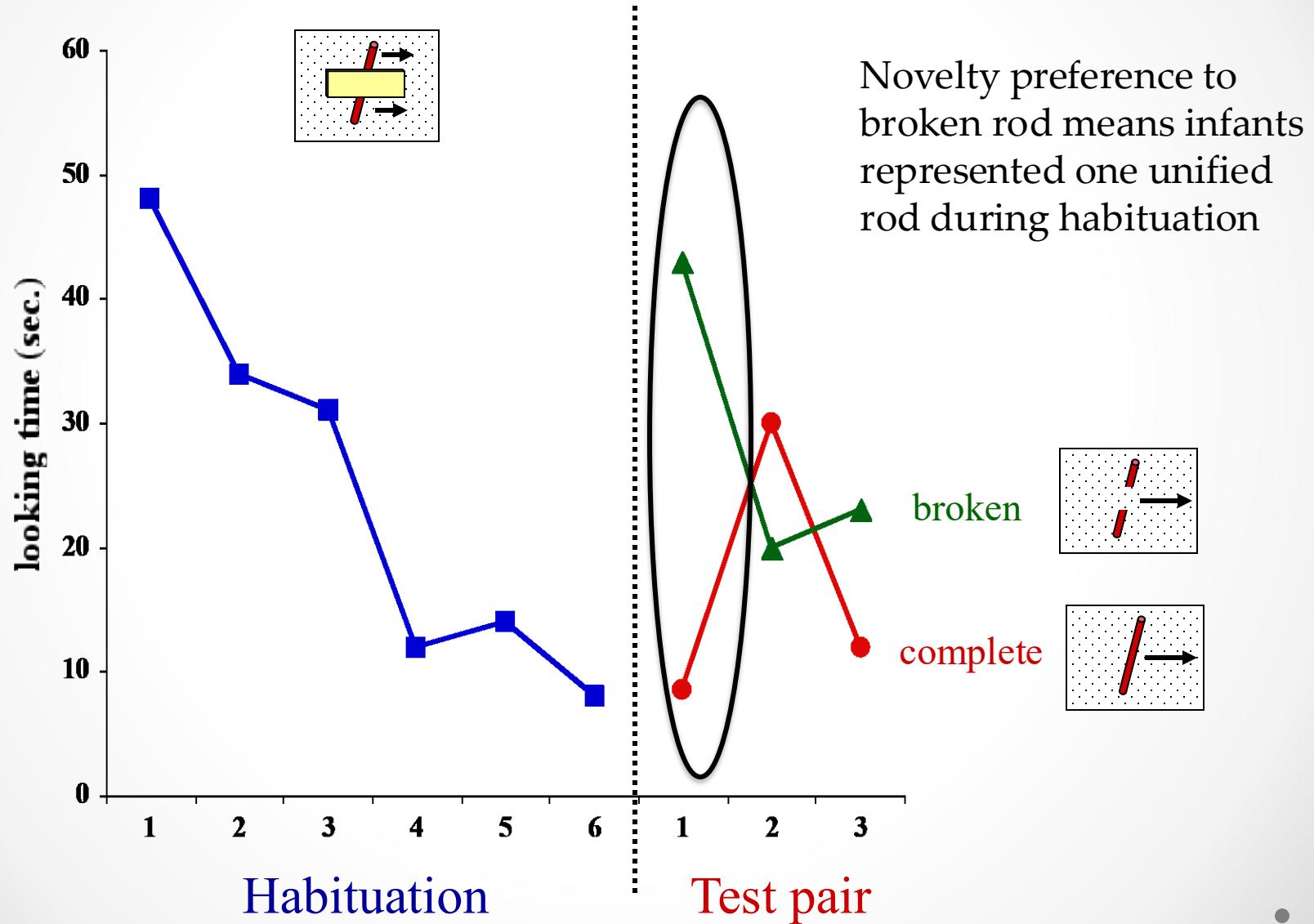
Habituation stimulus:

Test stimuli:

Broken rod

Complete rod

Kellman & Spelke (1983): Perception of object unity in 4 month-olds
## Moving rod condition

Novelty preference to broken rod means infants represented one unified rod during habituation

looking time (sec.)

Habituation

Test pair

broken

complete

Kellman & Spelke (1983): Perception of object unity in 4 month-olds
Stationary rod condition control

Partly-occluded rod

Habituation stimulus:

Test stimuli:

Broken rod

Complete rod

Kellman & Spelke (1983): Perception of object unity in 4 month-olds
Stationary rod condition control

No novelty preference, so no evidence of perceived unity

Co-motion is thought to be input to object module, and without such input, infant does not apply core object knowledge

broken

complete

looking time (sec.)

Habituation

Test pair
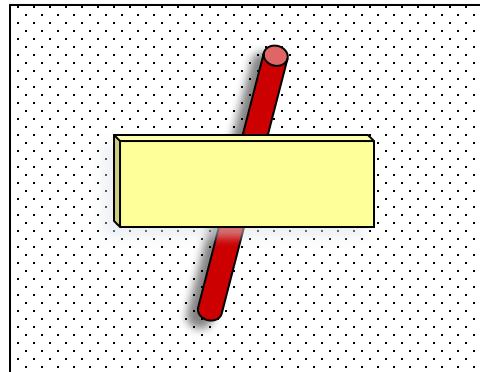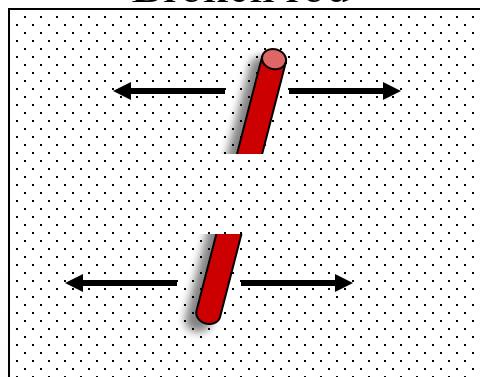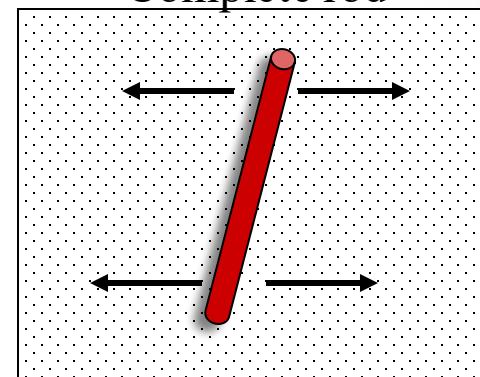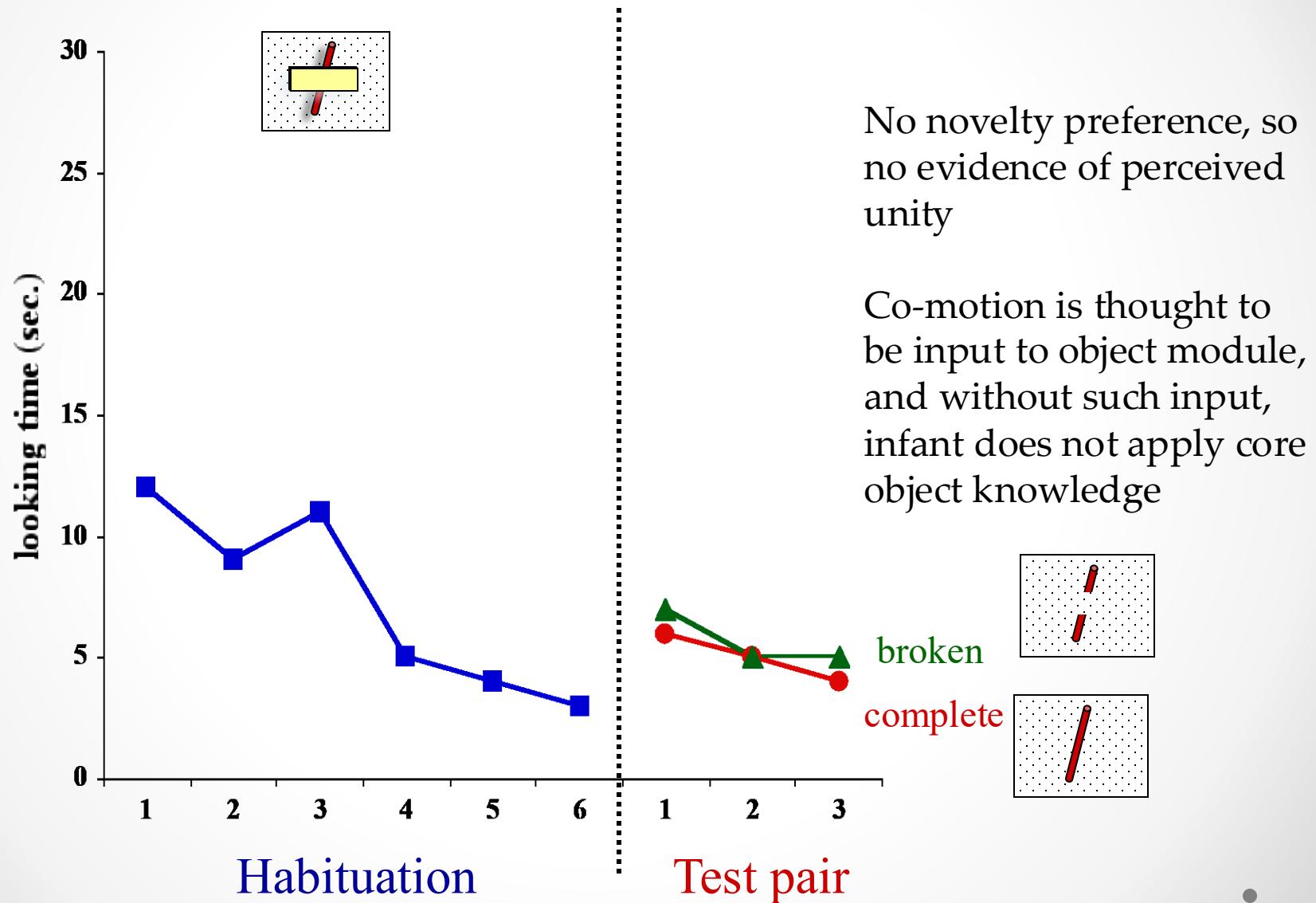
Constructivism: Domain-General Learning Architectures (see Cohen & Cashon, 2006)

- How to explain perception of object unity?
- Perceive object unity from similar surfaces moving together because those are relationships that exist in the world.
- Suggests there will be developmental changes in the first 4 months.
  - Changes in ability to construct a object percept from visual input

Constructivism: Domain-General Learning Architectures (see Cohen & Cashon, 2006)

- Johnson & Aslin (1998): 2 month olds see rod as unified only when a greater area of the rod is visible
  - 2 month olds look longer to whole rod unless there is just a little bit occluded during habituation
- Slater, Johnson, Brown, & Badendoch (1996): Newborns show preference for whole rod.

The Reply from Core Knowledge (Carey, 2011).

Fourth, success at some task provides support for some target representational capacity needed to perform it, whereas failure is not necessarily good evidence that the target capacity is lacking. Some other capacity, independent of the target one, may be needed for the task and may not yet be available (not yet learned or not yet matured). *TOOC* provides several worked-out examples of successful appeals to performance limitations masking putatively innate competences. For example, the A/not B error made by infants between ages 7 and 12 months is at least in part explained by appeal to immature executive function. For another example, infants' failure until 2 months of age to create representations of a complete rod partially hidden behind a barrier when they are shown the protruding ends undergoing common motion is at least partly explained by their failure to notice the common motion across the barrier. Thus, they lack the critical input to the putatively innate computation.

Object Unity

- Constructivists point to gradual development as gradual development of object unity.

- Nativists say that development is the developing ability to perceive motion, allowing object core knowledge to be applied.

Object Permanence

- Piaget claimed object permanence was not achieved to 8-9 months of age; was still quite fragile until 12 months.
- Looking time measures are more sensitive
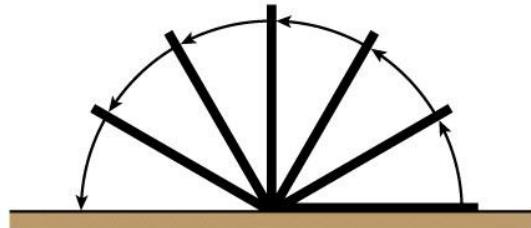
Violation of Expectation Paradigm

- Habituate/familiarize to some event, & two critical test trials:
1. Perceptually more familiar but physically impossible
2. Perceptually novel by physically possible
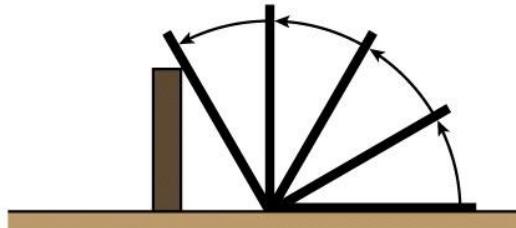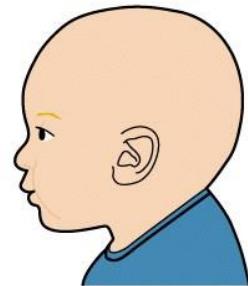
Violation of Expectation Paradigm
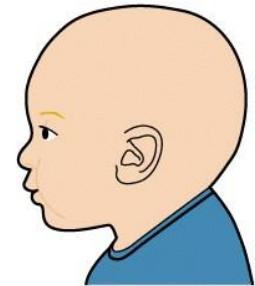
Baillargeon, 1987
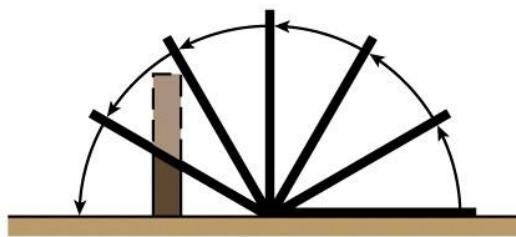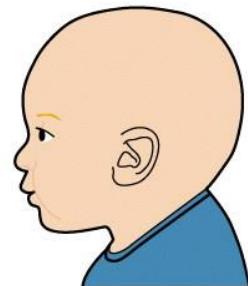
(a) Habituation
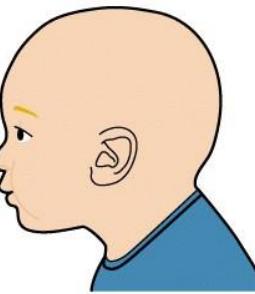
(b) Placing the box

(c) Possible event

(d) Impossible event

4.5-monh-olds show "surprise" to the impossible event

Violation of Expectation Paradigm

- Complete board lowering is perceptually familiar but with the object there, it is impossible (but only if infants represent the occluded object)

- Claim is that if infants show novelty preference from perception alone, they should be surprised by the partial movement. But they are not, suggesting they represent the physical object

- However….
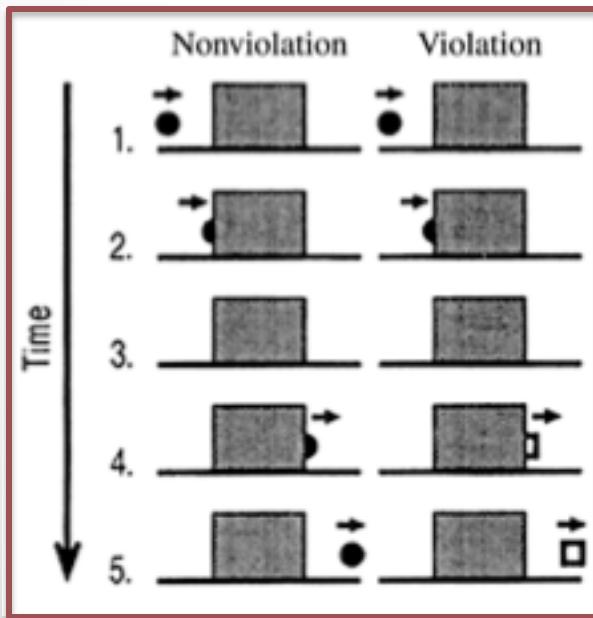
Violation of Expectation Paradigm

- Could it really just be a familiarity preference?
  - Baillergeon included infants in the analysis who did not fully habituate. Remember Hunter & Ames? Infants who aren't fully habituated often show familiarity preferences.
- Or general preference for more complex/rich complete drop? (more motion)
  - Hunter & Ames say more complexity has even longer familiarity preference
- Constructivists have argued this (see Cohen & Cashon, 2006), but the evidence is mixed/jury is out
  - well, most people agree with Baillargeon

Object Memory vs. Object Permanence

- Meltzoff & Moore (1998) consistent with constructivism
- Perception mismatching memory can be surprising without understanding object permanence
- 5 and 9 month olds show suprise to shape change, suggesting perception-memory mismatch
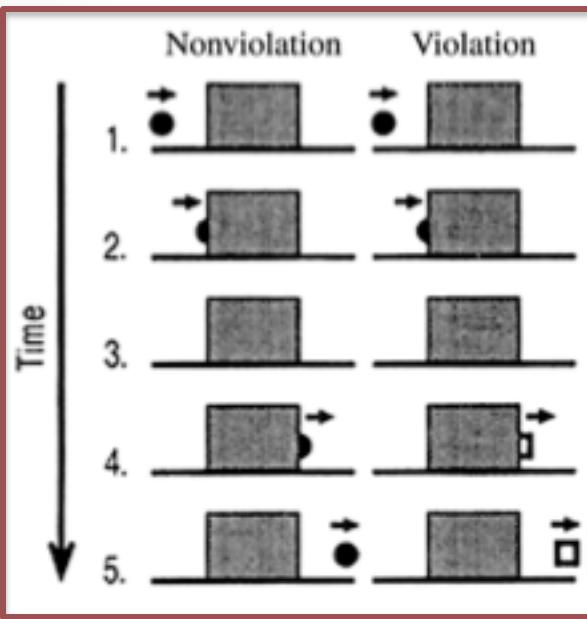
Memory task
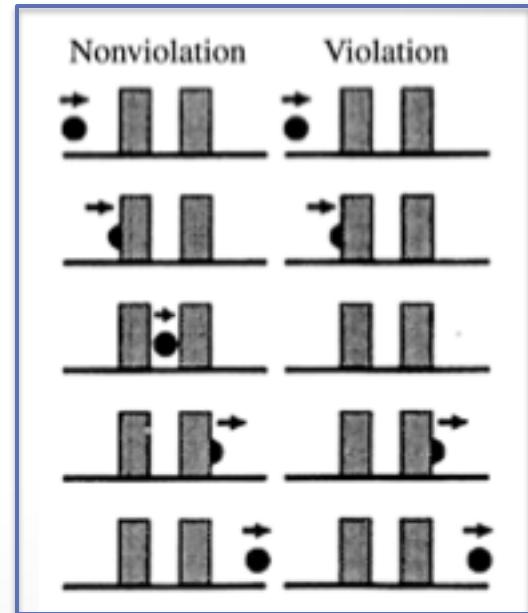
Object Memory vs. Object Permanence

- Meltzoff & Moore (1998) consistent with constructivism
- Understanding permanence means also realizing objects should re-appear when no longer occluded, as shown by surprise to violation in permanence task.
- 9 month-olds but not 5 month-olds show such surprise

Memory task

Permanence task

Object Unity & Object Permanence

- Both aspects of object knowledge appear to have a piecemeal development consistent with constructivism.

- Object unity: increases in the amount of object occluded the infant can infer with increasing age.

- Object permanence: memory for specific object features pre-dates a more complete understanding of permanence.

An advantage for posting innateness? Carey (2011)

- Given gradual development of unity and permanence, what explanatory value does innateness hold?

- Innate does not mean present at birth and 0 development
- One key prediction is that different aspects of a whole system of core cognition (e.g., object knowledge) will come online simultaneously
- For example, understanding of object unity co-develops with some abilities to differentiate two occluded objects from each other using spatial temporal cues, as well as understanding how an object being solid constrains it's paths of motion.
    - Carey (2011) reviews how evidence of these different abilities at the same ages.

Where does knowledge come from?

- Object knowledge

- Object Unity: Infants representing parts of objects that they cannot see, unifying whole objects

- Object Permanence: Infants understanding that objects exist when they cannot be seen.

- Constructivist or nativist?: evidence for both sides

Key learning outcomes:

- You can write strong arguments for both nativist and constructivist accounts of the development of object knowledge
    - There will be more on this next lecture as well you should be able to integrate with what is here

- These arguments need to link theories, methods, and data