

9.85 Cognition in Infancy and Early Childhood

Lecture 6: The object concept

Hearing

- Newborns recognize their mother's voice -- suck at rate that will permit hearing mother's voice over alternative.
- Neonatal audition -- Cat in the Hat study (Casper and DeSpence, 1986).
- Recognition even when story read by a stranger.

Hearing

- Preference for
 - the human voice over other sounds of similar pitch and intensity
 - for sounds within the human voice range to sounds outside the human voice range
 - for female voices over male voices
 - their own language from other languages
 - infant-directed over adult-directed speech

Hearing

- Until approximately 8-months of age, infants can hear phonemic distinctions in other languages not present in their own.
- Phonemic distinctions are categorical.
- Not species specific -- other animals can hear them too.
- Not domain specific -- non-linguistic acoustic stimuli are also heard categorically.
- Brief exposure “keeps the window open” for babies (but only if it’s interactive).

Hearing

- Infants also develop a sensitivity to prosody -- English-speaking 9-month-olds (but not 6-month-olds) have a preference for **strong**/weak accents (**baby**, **mommy**) over weak/**strong** on novel words.
- Also by 9-months prefer “possible” words in their own language (zw and vl are legal in Dutch not English; English-speaking babies prefer English words).

Touch/Smell/Taste

- Tactile stimuli
 - Neonates and pain?
 - Anesthesia in infancy (Anand & Hickey, 1992)
 - Air puffs (more sensitive than adult)

Smell

- At five days will turn towards a pad soaked with breast milk.
- At eight days will selectively turned towards mother as opposed to another mom.

Cross-modal integration

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Please see:

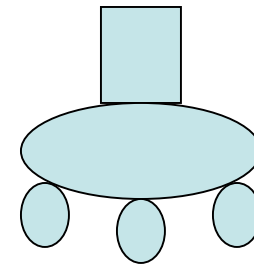
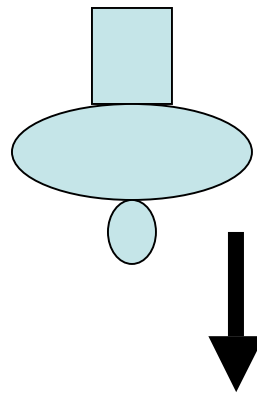
Meltzoff A. N., and M. K. Moore. "Imitation of facial and manual gestures by human neonates." *Science* 198, no. 4312 (October 7, 1977): 74-8.

Meltzoff & Borton article

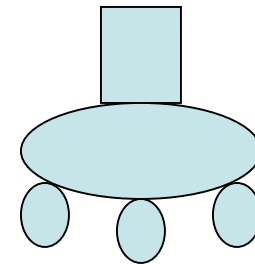
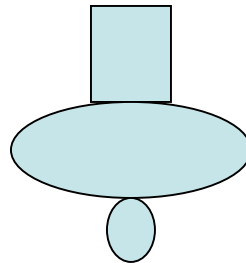
- What did they do?
- What are the findings?
- Could it have been learned from prior experience?
- How would you find out if modal invariants are learned better than any arbitrary association?

Cross-modal integration

Sucking without seeing



Looking time preference



Cross-modal integration

- 3.5-month-old infants match visual and audible impacts on the basis of temporal synchrony
- In contrast, infants do not detect the association between the color/shape of an object and its pitch until seven months of age.
- Both 4- and 6-month-old infants can make visual-tactual matches but that only 6-month-olds can associate color or pattern with shape

Reflexes/motor milestones

- Rooting
- Sucking
- Grasping (Babinski)
- Startle (Moro)
- Stepping
- Plantar
- Largely disappear within first three months

Reflexes/motor milestones (legs/body)

- Head raise -- soon after birth
- Push up to chest -- 1-2 months
- Sit up alone -- 5-months
- Use hands while sitting, rock on all fours -- 7 months
- Crawling -- 8-10 months
- Cruising -- 9-11 months
- Walking -- 11-15 months

Reflexes/motor milestones (arms/hands)

- Grasp reflex weakens -- 2-3 months
- Objects to mouth -- 3-4 months
- Well-controlled reaching -- 4-5 months
 - Can get it at 14 days but uncontrolled
 - Even at 7-months trouble reach across midline.
- Good use of thumb, feeding -- 6-7 months

“What’s it like to be a baby?”

- Babies as Martians
 - Big heads
 - Big eyes
 - Strange ways of seeing
 - Exercise mind control over us

“What’s it like to be a baby?”

- “The fact that we cannot ever expect to accommodate in our language a detailed description of Martian or bat phenomenology should not lead us to dismiss as meaningless the claim that bats and Martians have experiences fully comparable in richness of detail to our own ... (Nagel, Psych Review, 1974)

The object mystery

- Sensory input is continuous
- But we operate on individuals
 - We count them
 - We name them
 - We represent spatial relations among them
 - We represent causal relations among them
 - We have preferences, goals and beliefs about them

The object mystery

- Might think an object is just the sum of its parts:
 - An apple is its skin and its stem and its seeds and its fruit ...
- But ...

Philosophical puzzles

- “The ship ... was preserved by the Athenians down even to the time of Demetrius Phalereus, for they took away the old planks as they decayed, putting in new ... timber in their place, insomuch that this ship became a standing example among the philosophers, for the logical question of things that grow; **one side holding that the ship remained the same, and the other contending that it was not the same.**” (Plutarch, Vita Thesei)

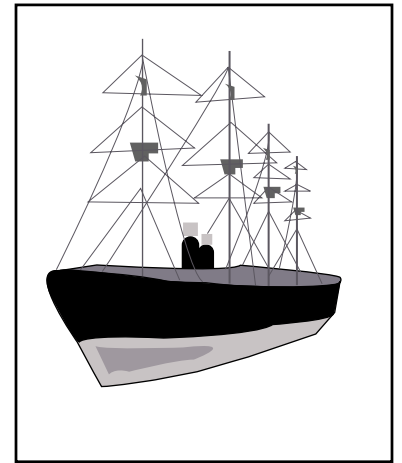


Illustration by MIT OCW.

Puzzle of object identity

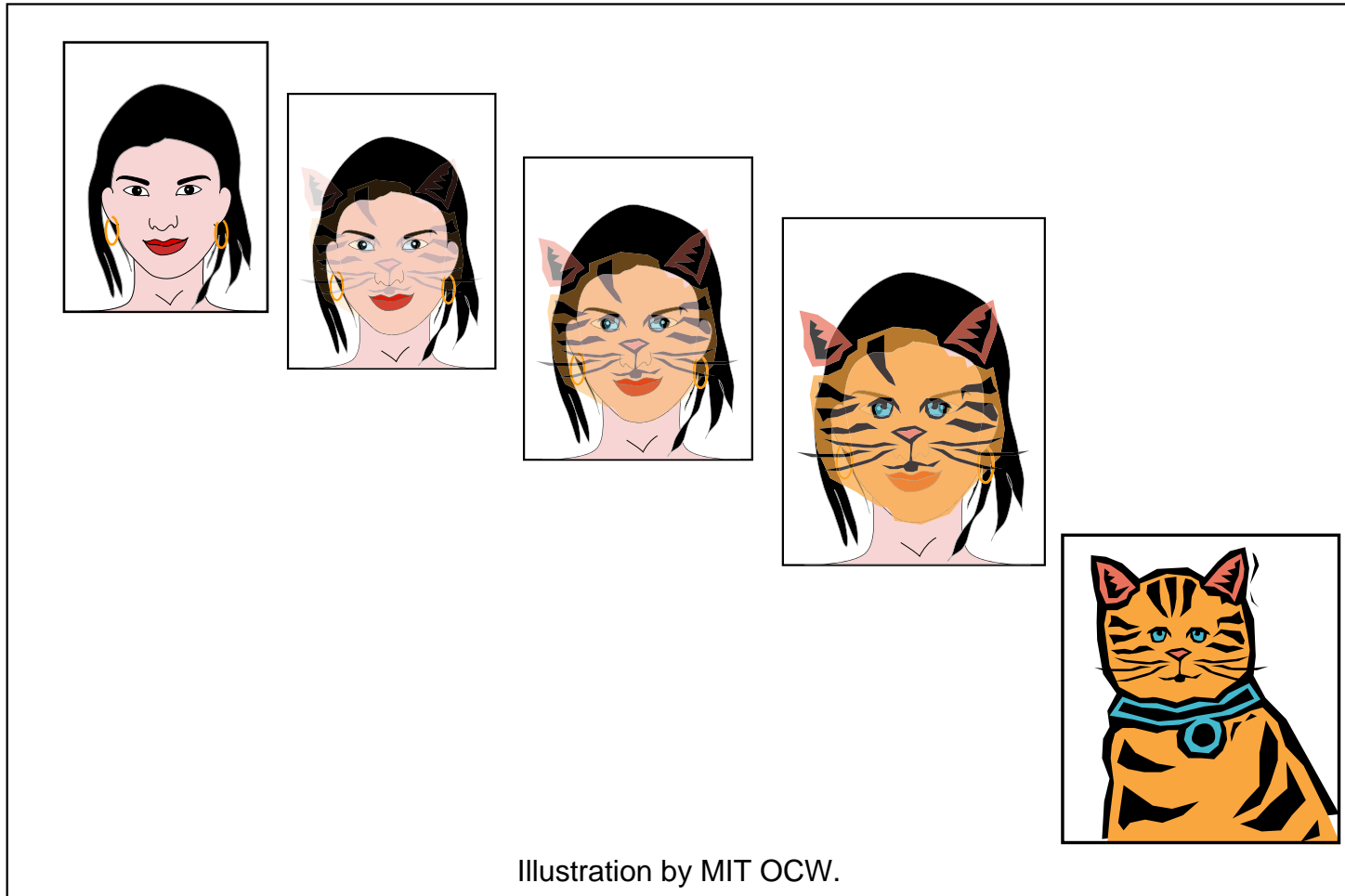
- Objects can change many (all?) of their constituent parts.
- Are they still the same object or not?
 - Metaphysical questions about identity
 - But also an epistemological question -- how do we identify something as one and the same object?

Spatiotemporal continuity

- Maybe an “object” is not the sum of its parts.
- Maybe an “object” is anything that traces a continuous path through space and time.

Spatiotemporal continuity

- But even if the change were gradual, we might still be tempted to call two things with quite different properties different objects.



Two representational systems

- Argues for a distinction between
- Processes that individuate and track objects through time ... **Spatiotemporal object individuation** (Mid-level visual processing)
- Processes that bind representations of features to individuals -- **Kind-based object individuation**

Spatiotemporal object individuation - object unity

Figure removed due to copyright restrictions.

Please see:

Fig 1.10. in Bremner, Gavin, and Alan Fogel, eds. *Handbook of Infant Development*. Malden, MA: Blackwell Pub., 2001.
ISBN: 0631212345.

Spatiotemporal object individuation

- Newborns look longer at the single rod than two
- Four-month-olds look longer at the two rods than the one.
 - But only when they are moving, not when they are still.
 - Gestalt principle of “common fate”

Spatiotemporal object individuation

- 2-month-olds? No preference.
 - But if there are slits on the occluder, or the occluder is smaller
 - Do perceive object unity -- look longer at two rods than one.

Figure removed due to copyright restrictions.

Please see:

Fig 1. in Kuhlmeier V. A., P. Bloom, K. Wynn. "Do 5-month-old infants see humans as material objects?" *Cognition* 94, no. 1 (November 2004): 95-103. (Comment -105-7) (Discussion -109-12)

Spatiotemporal object individuation

- Five-month-olds expect two objects when the motion is discontinuous
- One object when the motion is continuous.
- Is it object specific?

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Please see:

Fig 2. in Kuhlmeier V. A., P. Bloom, K. Wynn. "Do 5-month-old infants see humans as material objects?" *Cognition* 94, no. 1 (November 2004): 95-103. (Comment -105-7) (Discussion -109-12)

Object individuation

- What if you eliminate spatiotemporal cues and just provide property-kind information?

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Please see:

Fig 3a. in Xu F., S. Carey. "Infants' metaphysics: the case of numerical identity." *Cognit Psychol.* 30, no. 2 (April 1996): 111-53.

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Please see:

Fig 3b. in Xu F., S. Carey. "Infants' metaphysics: the case of numerical identity." *Cognit Psychol.* 30, no. 2 (April 1996): 111-53.

Xu and Carey, 1996

10-month-olds
failed to
overcome
preference for
2 objects in
property/kind
condition only;
12-month-olds
succeeded in both
cases

Figure removed due to copyright restrictions. Please see:
Fig 4 in Xu F., S. Carey. "Infants' metaphysics: the case of numerical identity."
Cognit Psychol 30, no. 2 (April 1996): 111-53.

Spatiotemporal cues v. property kind cues

- Suggests that processes involving object individuation may be different from processes involving object identification.
- But what if it's just about memory?

Spatiotemporal cues v. property kind cues

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Please see:

Fig 1 in Xu, F., S. Carey, J. Welch. "Infants' ability to use object kind information for object individuation." *Cognition* 70, no. 2 (Mar 1, 1999):137-66. Comment in: *Cognition* 74, no. 3 (Mar 14, 2000): 255-84.

- Again, 12 but not 10-month-olds differentiated based on property/kind (Xu, Carey, & Welch, 1999).

Object labels help: “Look at the ball”; “Look at the duck”

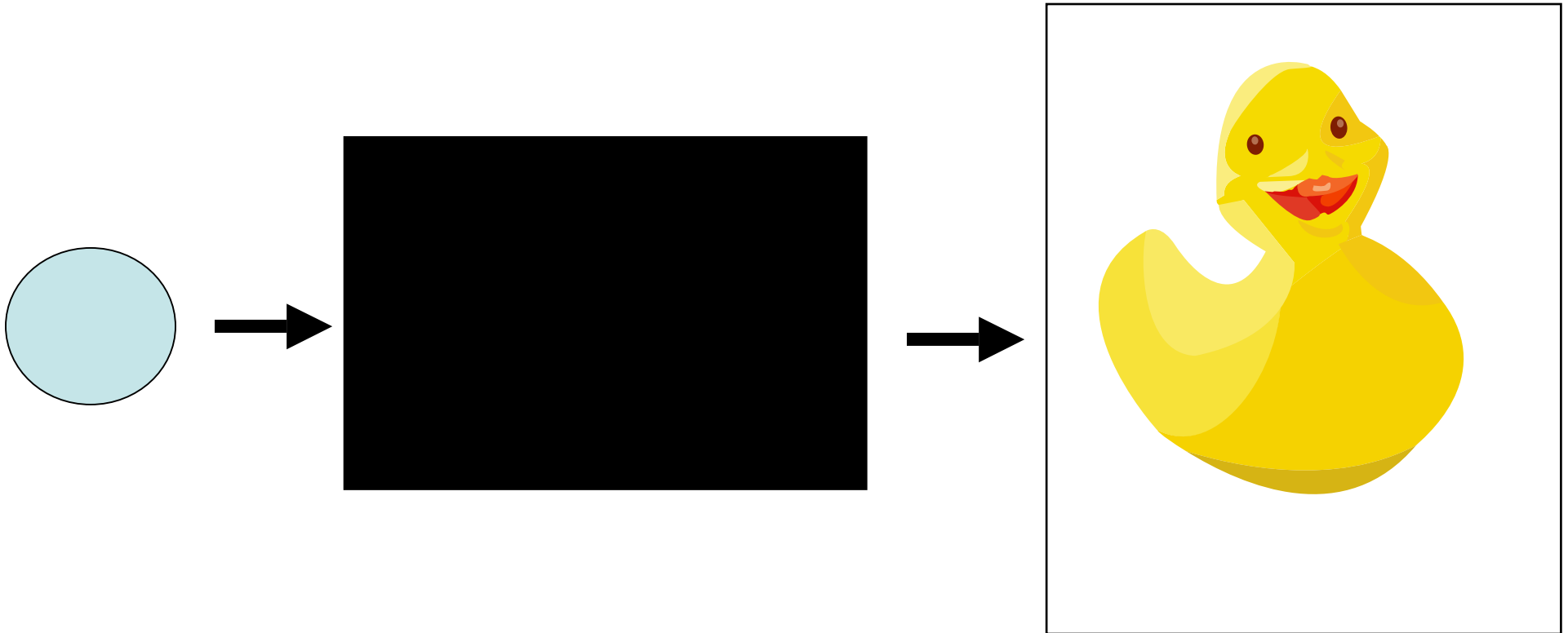
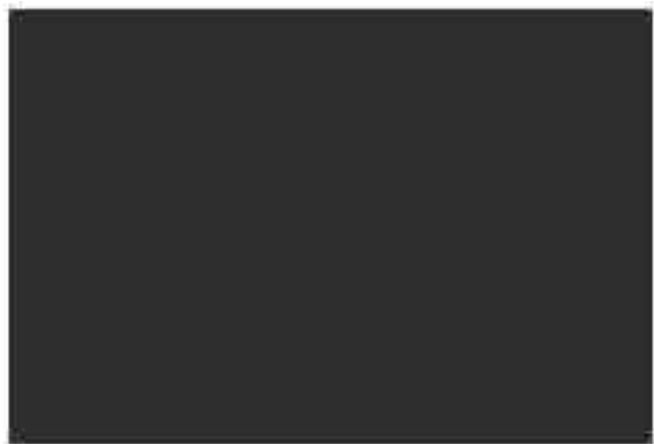
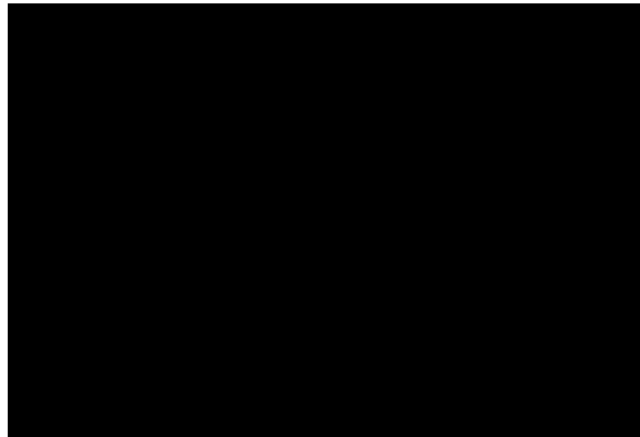


Illustration courtesy of MIT OCW.



“Look at the toy”; “look at the
toy”



Spatiotemporal v. property/kind cues

- One system for spatiotemporal individuation (Plyshyn's FINST; Treisman's object files; Leslie, et al., object indexes)
- Another for object identification.
- Updates (Liz)