Foundations of Mind

Objects, Part IV

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Slide 1

Where Are We?

- Core knowledge of objects, present very early in humans & immediately in other species
- Objects exist continuously, are solid, require support...

Q: Does core knowledge of objs ever change?
A: Yes, in at least 3 different ways:

1) Fine-tuned with experience (Baillargeon support studies)
2) New capacities emerge (Xu & Carey individuation studies)
3) Some early beliefs can be overturned via instruction (McCloskey naïve physics studies)

Slide 2

Individuation by Infants

The problem of individuation:

How do we know how many objects are present in a scene?
How do we know whether an object is the same object we saw earlier?

Slide 3

Individuation by Infants

Spelke, Kestenbaum, Simons, & Wein (1995): 4 month olds- Spatiotemporal

Habituation: Continuous event
Habituation: Discontinuous event

Test: 1-object display
Test: 2-object display
Individuation by Infants

Conclusion: By 4 mos, infants use spatiotemporal information to individuate objects i.e., to determine how many objects are in a scene.

Question: Can infants also use property or kind information to individuate objects?

Individuation by Infants

Can infants use property/kind information to individuate?

Task 1: Measure infants’ reaches to see how many objects they represent in the box (Van de Walle et al., 1999)

Result: 12 mos: reach once 10 mos: reach once

Result: 12 mos: reach twice 10 mos: reach twice

Individuation by Infants

Conclusion from box reaching task:

12-month olds can use properties to individuate, but 10-month olds can’t…

Maybe it’s a competence/performance problem again (like w/ obj permanence).

Try making the task easier…

Individuation by Infants

Xu & Carey (1996): 1-Object Condition

Sample habituation trial

Test: 1 object

Test: 2 objects

Results: 10 & 12 month olds show no preference between these (or slight bias to look at 2)
Individuation by Infants

Xu & Carey (1996): 2-object Condition

Sample habituation trial

Test: 1 object

Test: 2 objects

Results: 12 month olds look longer at unexpected 1-obj outcome
10 month olds show no preference

Individuation by Infants

Xu & Carey (1996): 2-object Spatiotemporal Condition

Sample habituation trial

Test: 1 object

Test: 2 objects

Results: Both 10- and 12-month olds look longer at unexpected 1-object outcome

Individuation by Infants

Conclusions:

• Reaching and looking time studies confirm a change between 10- and 12-months

• Until 12 mos, infants fail to use property/kind information to individuate objects; just use spatiotemporal info

• So what changes???

Individuation by Infants

Susan Carey

What changes is how infants are representing the objects

Adults: “A duck. A car.”
12 month olds: “A duck. A car.”
Individuation by Infants

Role of linguistic concepts in individuation?

“Look, a duck!”

“Look, a car!”

“Look, a duck!”

and so on...

JUST the 10-month olds who know “duck” & “car” succeed

10-month olds fail, as usual

Individuation by Infants

Role of linguistic concepts in individuation?

“Look at that!”

“Look at that!”

10-month olds fail, as usual

Individuation by Infants

Adding to core knowledge in infancy:

- Infants have core knowledge of objects
  (object = 3-dimensional solid form, must obey certain physical principles)

- Babies can use spatiotemporal info to individuate long before can use property/kind info

- 10- to 12- month change:
  principles of core knowledge still apply, but now greater representational flexibility (here, individuation by properties)

- Importantly, core representations not “overwritten!”

Spatiotemporal info still trumps property info, even for adults!

Spatiotemporal vs. Property Info for Apparent Motion
We perceive:
First Half of Lecture

- Infants add to core knowledge, become able to use property information to represent & individuate objects

- However, primacy of spatiotemporal information remains constant throughout the lifespan

- Core knowledge not overturned, just added to

Naïve Physics

Revision of core knowledge in adults

DEMO
Naïve Physics

McCloskey:

Many people’s beliefs about object behavior governed by a set of intuitive principles which do not adhere to (learned) Newtonian laws of physics

Beliefs not random… Impetus theory
**Naïve Physics**

**Impetus Theory**

1) Medieval theory of object motion

2) All motion of any object is caused by a force acting on that object

3) An object put into motion by contact absorbs impetus, which continues to cause it to move

4) Impetus dissipates with time (or as a result of contravening forces)

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**Newton**

- An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by an unbalanced force

**Impetus Theory**

- An object acquires an internal force which can be exhausted over time or by another force (an object “runs out of gas”)

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**Quotes from subjects:**

In describing the trajectory of a projectile:

“(It is) a force that has been exerted and put into the ball so this ball now that it’s traveling has a certain amount of force.”

In describing the trajectory of the ball on the string:

“…you’ve got a force going around, and (after the string breaks, the ball) will follow the curve you’ve set it on until the ball runs out of the force within it that you’ve created by swinging.”
Naïve Physics

Is this just a matter of the way subjects describe motion?

NO: Impetus theory guides actions, too!

Naïve Physics

Easy to dispel?

NO: About 25% of students receiving 1 year explicit instruction in physics continue to give answers consistent with Impetus Theory

What’s the barrier to understanding?

1) Sleeping in class???
2) Lack of representational resources (e.g., calculus)???
3) Different entrenched theory that is radically different from Newtonian Mechanics (Impetus Theory)???

By 3-4 months, infants “surprised” to see an object stop moving abruptly or start moving when no contact has been applied
Is reasoning about object support more gradually refined because it’s hard to observe gravity?

Monkeys’ Expectations about Object Trajectories

Pssst, Adam… Objects are continuous, solid, and require support!
Naïve Physics

- Young infants & monkeys have expectations about object motion (Support (gravity), no motion without contact…)
- Suggests innate component to understanding object motion
- This core knowledge may be building block for Impetus Theory (which is cross-culturally widespread)
- Makes it hard to overturn….
  But can be overturned with explicit instruction, leads radical conceptual change (in individual lifetime, in history of science)

3 Types of Changes to Core Knowledge of Objects

1) Fine tuning (Baillargeon support studies)

2) Acquisition of new abilities
   (use of property info in addition to spatiotemporal info when individuating objects)

3) Revision of core principles
   (naïve physics studies)

Monday:
MIDTERM #1

QALMRI due in section on Tuesday