

9.85 Cognition in Infancy and Early Childhood

Lecture 10: Identity, Essences and Transformation

Recap

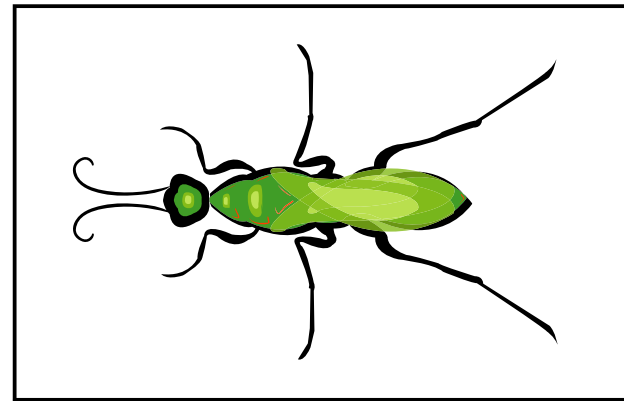
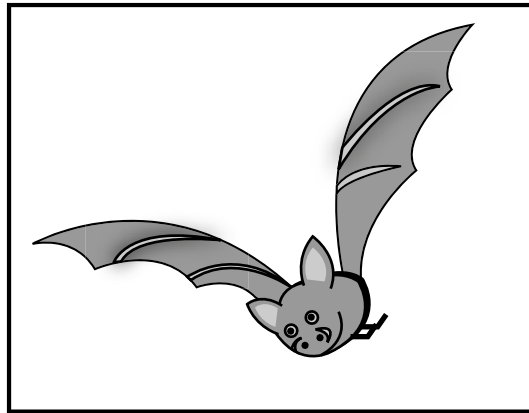
- Classical view: categories as lists of necessary and sufficient defining features.
- Prototype/exemplar views: categories as distance from a prototype or exemplar

Recap

- Both of these are similarity-based models
- Category membership is determined by similarity to a feature list or similarity to a prototype/exemplar.

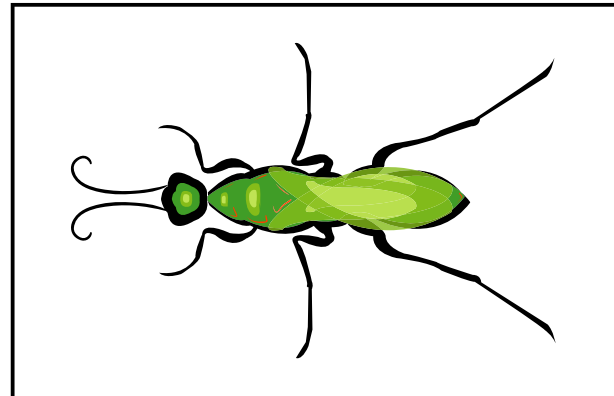
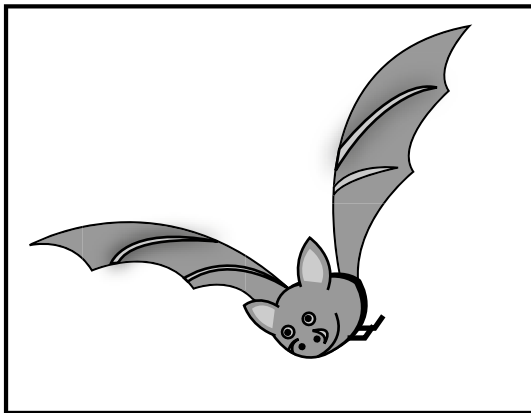
Challenges

- Similar with respect to what?



Challenges

- The similarity of any two entities depends on what properties you're looking at ...
- And context determines how you weight the importance of similar attributes.



Challenges

- The similarity of any two entities depends on what properties you're looking at ...
- And context determines how you weight the importance of similar attributes.
- And the same feature can be central to one concept and peripheral to another.



Challenges

- What constrains similarity?
- What determines which features are peripheral to a concept and which features are essential to the concept?
- What binds features together and makes some sets of features easier to learn than others?

*Causal
knowledge*

Theory theory view of concept learning

- Causal knowledge is critical to concept learning in at least three ways:
 - Causal knowledge helps us decide which features are relevant to category membership
 - Causal knowledge helps us decide which features are central and which peripheral.
 - Causal knowledge affects our intuitions about when category members will retain their identity and when they will be transformed.

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Causal knowledge and identifying relevant features

- Samantha has **low self-esteem** which causes her to be **depressed**.
- June has been drinking which causes her to be **depressed**.
- Marie has **low self-esteem** which causes her to be defensive.

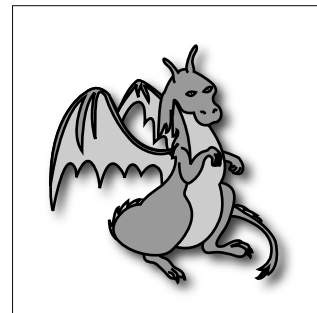


Causal knowledge and identifying relevant features

- Causal knowledge makes some correlations more important than others.
 - Classify birds as Type A or Type B
 - Children classified big brain/good memory birds together and small brain/poor memory together.
 - Ignored equally correlated relationships between round hearts and pointy beaks.

Causal knowledge and identifying relevant features

- Wugs v. Gillies
 - “Features condition”: Gillies are really cute. Gillies have big ears, wings and a monkeylike tail. See? Gillies have big ears, wings and a monkeylike tail.
 - “Feature description condition”: Gillies are really cute. Gillies have big ears to listen to music, wings to fly and monkeylike tail to pick up sticks.
 - “Causal condition”: Gillies hide from predators so they have big ears to listen to predators, wings to fly up into a tree and a monkeylike tail for good grip.
- Both immediately and after a 24-hour delay, children categorized new animals more accurately when given causal information than in other conditions.



Causal knowledge and identifying relevant features

- Causal knowledge determines how children weight features for categorization.
 - When described as animals, children sorted by habitat (e.g., is found in the mountains) and physical adaptations (has thick wool)
 - When described as artifacts, children sorted by function (can crush rocks)

Causal knowledge and identifying relevant features

- Causal knowledge determines how children weight features for prediction.
 - Wooden pillows
 - Will be hard not soft
 - But will be in the bedroom not the shed
 - Glass frying pans
 - Will break
 - But will be in the kitchen not the living room

Causal knowledge and identifying relevant features

- Blicket detector
- Categorization task:
 - A is a blicket -- lights up the toy. B doesn't; C does; D doesn't.
 - “Show me what else is a blicket.”
- Induction task:
 - A is a blicket -- lights up the toy. B isn't a blicket. C is a blicket; D isn't a blicket.
 - “Show me what else will light up the toy.”

Causal knowledge and identifying relevant features

- Blicket detector
 - Control task -- identical except the blicket was held over the toy and experimenter made the toy go.

Causal knowledge and identifying relevant features

- Even 2's were influenced by causal information in the categorization and induction conditions. (Used only perceptual information in the control.)
- By 3, children were as likely to use causal information as perceptual information for categorization ...
- and more likely to rely on causal than perceptual information for induction.

Theory theory view of concept learning

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Causal knowledge and feature centrality

- These are lake Victoria shrimp.
- They have high levels of ACH neurotransmitter.
- ACH neurotransmitter (D) causes a “flight” response (F1) which triggers an accelerated sleep cycle (F2) which promotes weight gain (F3).
- $D \rightarrow F1 \rightarrow F2 \rightarrow F3$

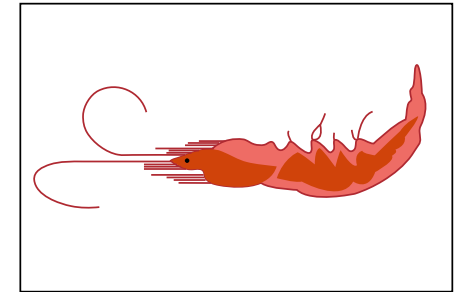


Illustration courtesy of MIT OCW.

Causal knowledge and feature centrality

- Here's a creature with high levels of ACH neurotransmitter.
- Here's a creature with a "flight" response.
- Here's a creature with an accelerated sleep cycle.
- Here's a creature with high weight gain.
- How confident are you it's a Lake Victoria shrimp?
- $D > F1 > F2 > F3$

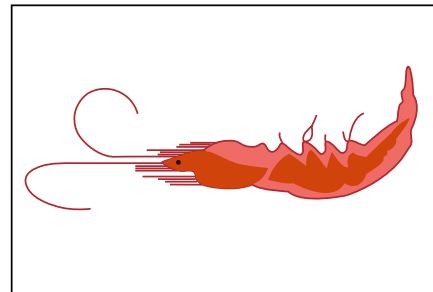


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Causal knowledge and feature centrality

- CAUSAL CONDITION: ‘Taliboos have something called promicin in their nerves. Promicin in their nerves makes taliboos have thick bones and large eyes’ So what does the promicin in their nerves do?’
- FEATURE LIST: Taliboos have something called promicin in their nerves. They have promicin in their nerves, they have thick bones, and they have large eyes. So Taliboos have promicin in their nerves. What else do they have?

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Figure 1 in Ahn, W., S. A. Gelman, J. A. Amsterlaw, J. Hohenstein, and C. W. Kalish.

"Causal status effect in children's categorization." *Cognition* 76, no. 2 (August 14, 2000): B35-43.

Causal knowledge and feature centrality

- Which one is the taliboo?
- Children (7-9 year-olds) in the causal condition chose A (74% of children chose the one with promicin)
- Children given only a feature list chose at chance (44% chose the one with promicin)

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Causal knowledge and feature centrality

- “Causal status effect”
- Causal features are weighted more heavily than effect features.

Theory theory view of concept learning

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Causal knowledge, identity and transformation

- You might think that dogs bark, have four legs, and have fur or that tigers are fierce, striped, jungle animals.
- You might think that a mute, 3-legged, furless dog was an atypical dog.
- Or that a tame, albino, suburban tiger was an atypical tiger.
- But you wouldn't think it was a "quasi-dog" or "quasi-tiger".

Causal knowledge, identity and transformation

- In many domains, both adults and children seem to assume that category membership is determined by stable, nonobvious (e.g., unobservable), internal (e.g., not caused by people or outside events) causes.
- “Essentialism”

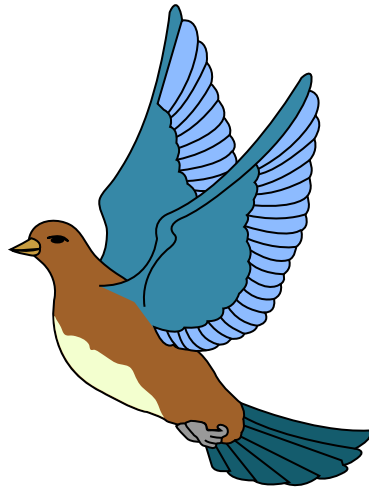
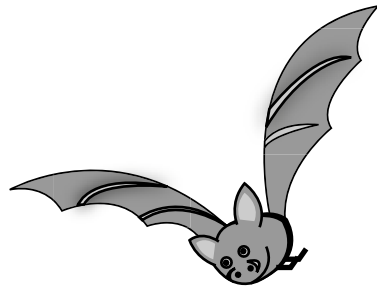
Causal knowledge, identity and transformation

- In essentialized domains inductive inferences are extended on the basis of assumed essences, rather than on the basis of observable features.

Causal knowledge, identity and transformation

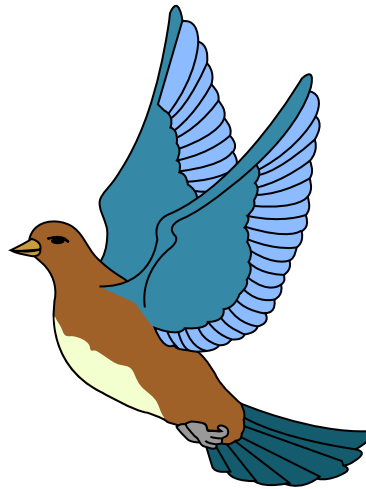
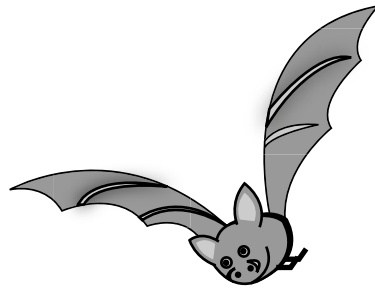
- In **essentialized** domains (*natural kinds as opposed to artifacts or arbitrary groupings*) **inductive inferences** (*e.g., about growth, inheritance, and change*) are extended on the basis of assumed **essences** (*stable, unobserved, internal causes*) features, rather than on the basis of observable features.

Causal knowledge, identity and transformation



- This bird's legs get cold at night.
- This bat's legs stay warm at night.
- This is a bird. Do you think it's legs stay warm at night like this one or get cold at night like this one?

Causal knowledge, identity and transformation

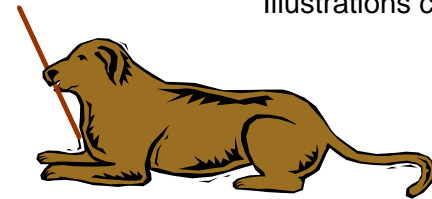


- Inductive inference about non-obvious properties goes with category label not with perceptual match.

Causal knowledge, identity and transformation

What about younger children?

- Cat --> play with yarn
- Dog --> play with stick
- Ambiguous (but looks more like a cat)



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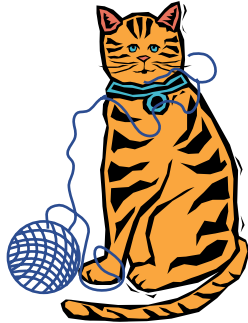


Illustration courtesy of MIT OCW.

- No label -- chose string; with label (dog) chose stick.

Causal knowledge, identity and transformation

Even for 24-month-olds ...

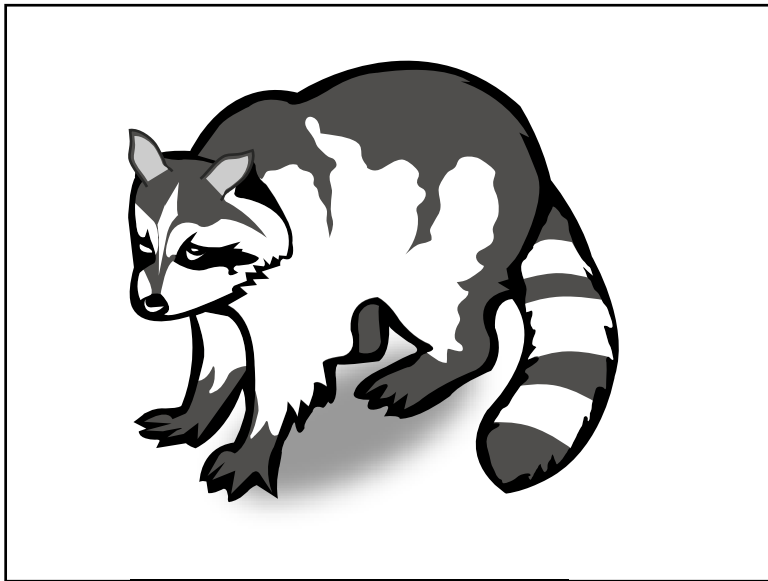


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- ... inductive inference about non-obvious properties goes with category label rather than appearance.

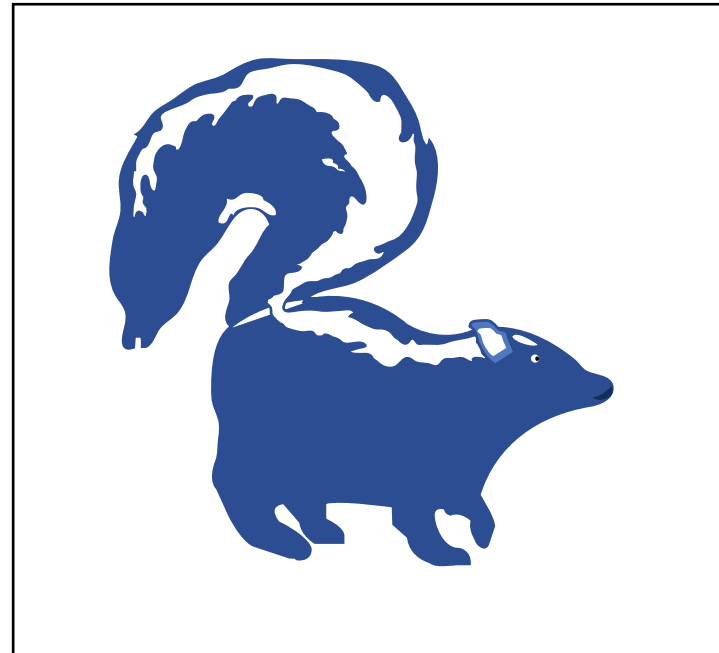
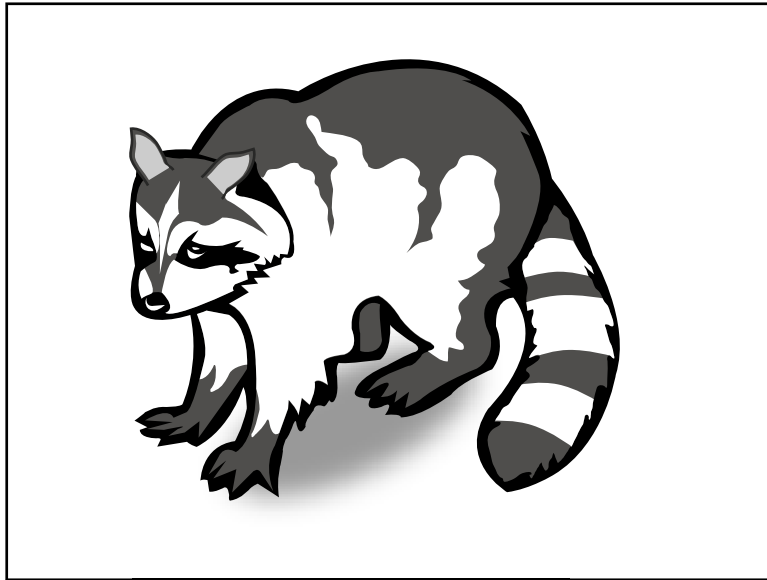
Causal knowledge, identity and transformation

- Here's a raccoon -- suppose that we paint it black and white and put a smelly sac inside it. Is it a raccoon or a skunk?



Causal knowledge, identity and transformation

- By 7, children insist that it's a raccoon, no matter what it looks like.
- Its raccoon “essence” hasn't changed.



Causal knowledge, identity and transformation

- Even younger children believe that a cat wearing a dog mask is still a cat.
- Its cat “essence” hasn’t changed.

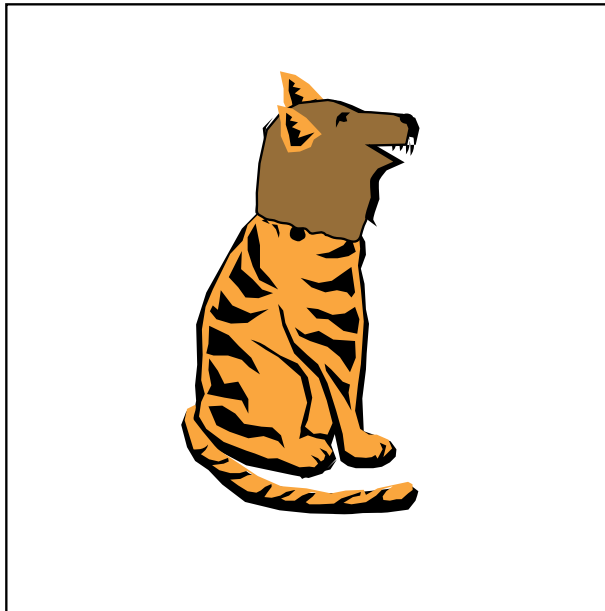
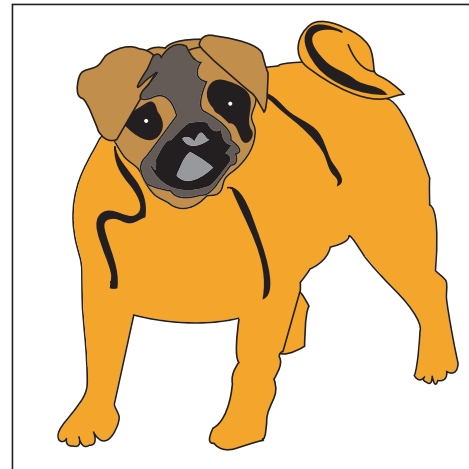
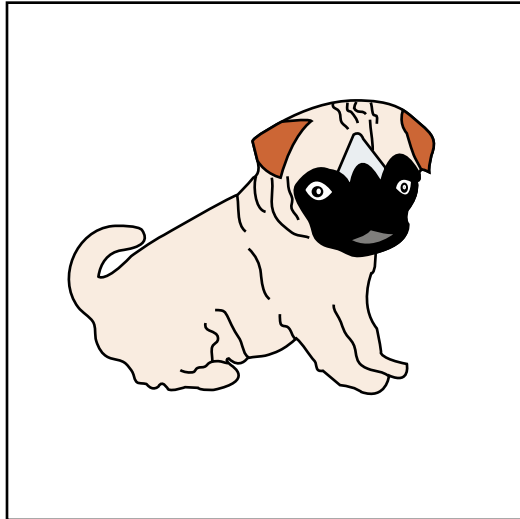


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Causal knowledge, identity and transformation

- And believe that no transformation can cross the animate/inanimate divide.



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Causal knowledge, identity and transformation

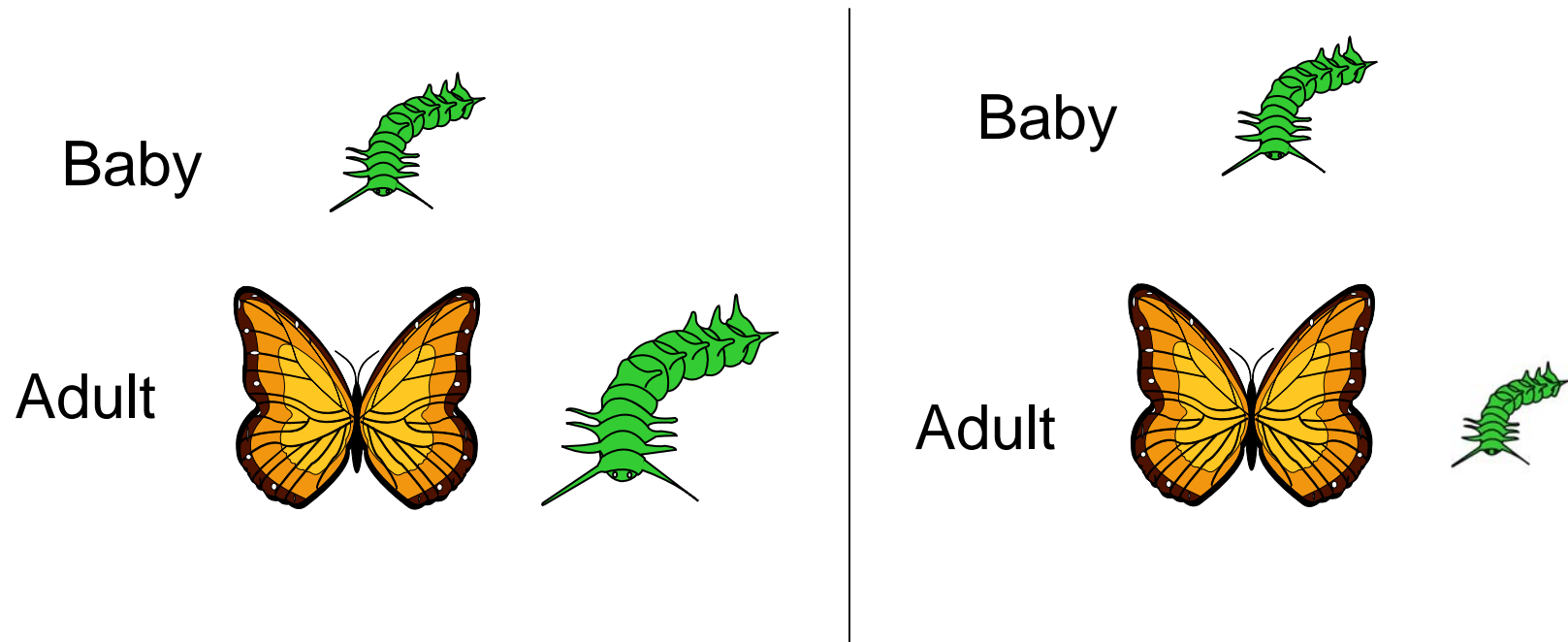
- However, this only holds for natural kinds, not artifacts.
- Children believe that a coffeepot can be turned into a bird feeder.
- Artifacts don't have “essences”.



Illustration courtesy of MIT OCW.

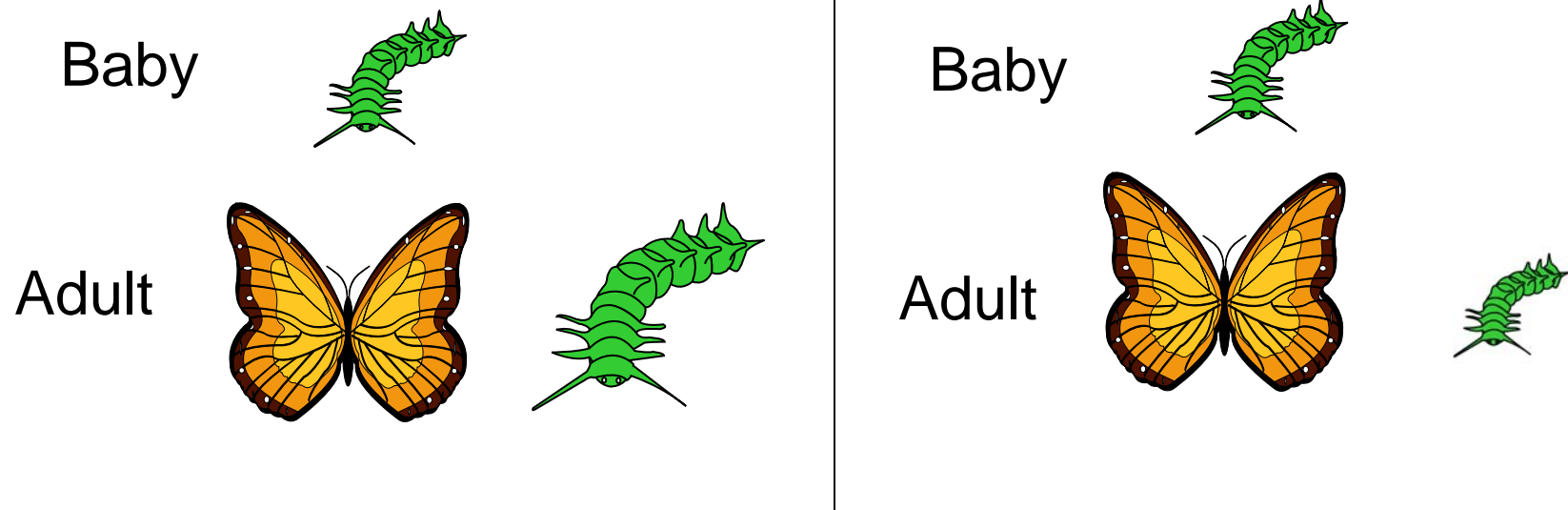
Causal knowledge, identity and transformation

- What about natural transformations -- like growth?



Causal knowledge, identity and transformation

- Children believe things can substantially change their features and yet retain their identity.

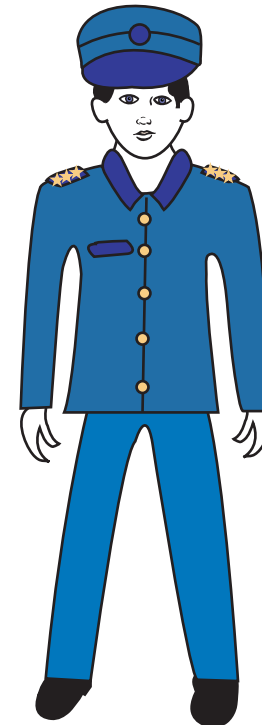


Causal knowledge, identity and transformation

- Children make essentialist assumptions about both social and natural kind concepts (race, gender and species).
- They think there are unobserved, inherent causes of these properties that stay constant across transformations like growth and inheritance.

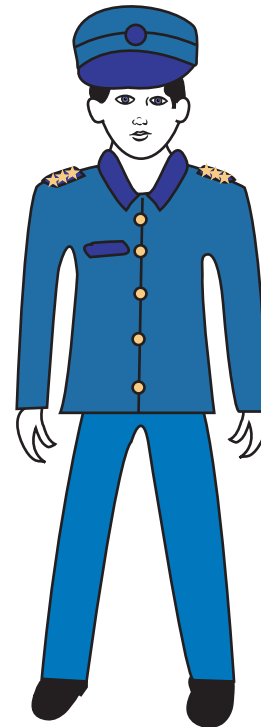
Causal knowledge, identity and transformation

- This is John. He's a policeman.
- What did John look like when he was a child? (Growth)



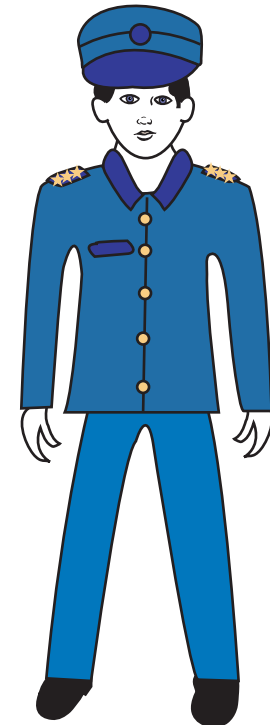
Causal knowledge, identity and transformation

- This is John. He's a policeman.
- What does John's child look like?
(Inheritance)



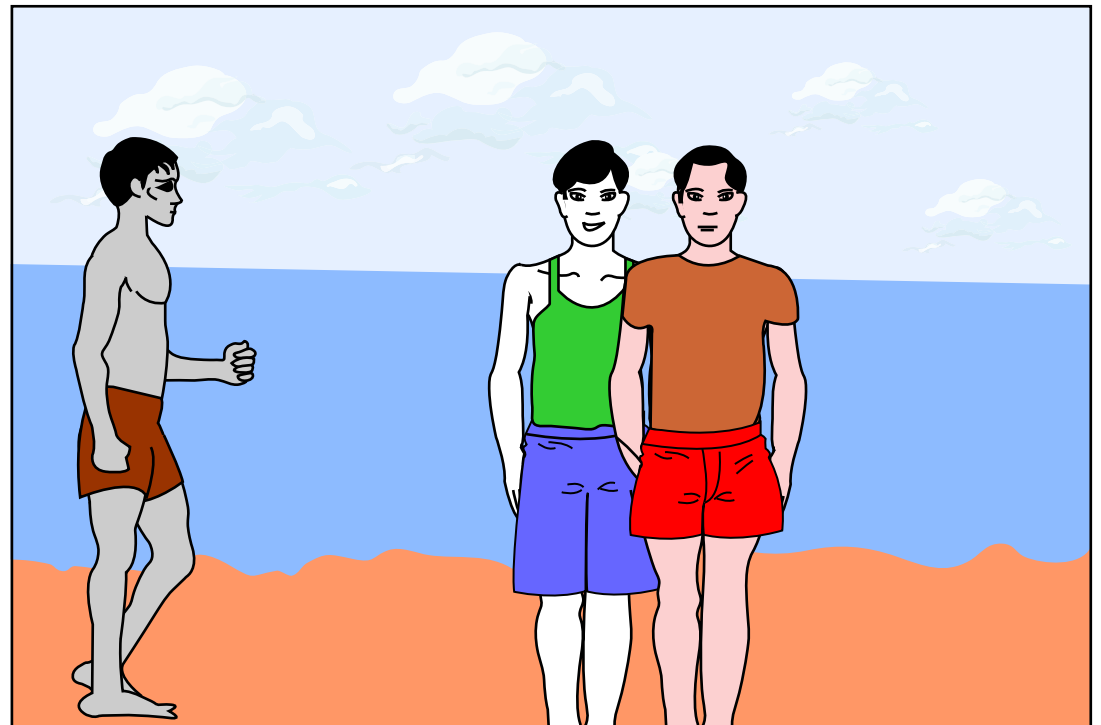
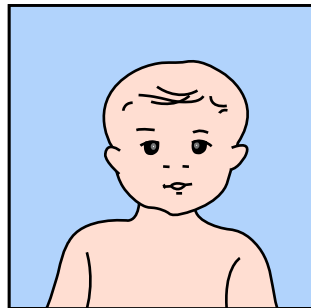
Causal knowledge, identity and transformation

- If this newborn baby is raised with this family, what will he look like when he's grown-up?



Causal knowledge, identity and transformation

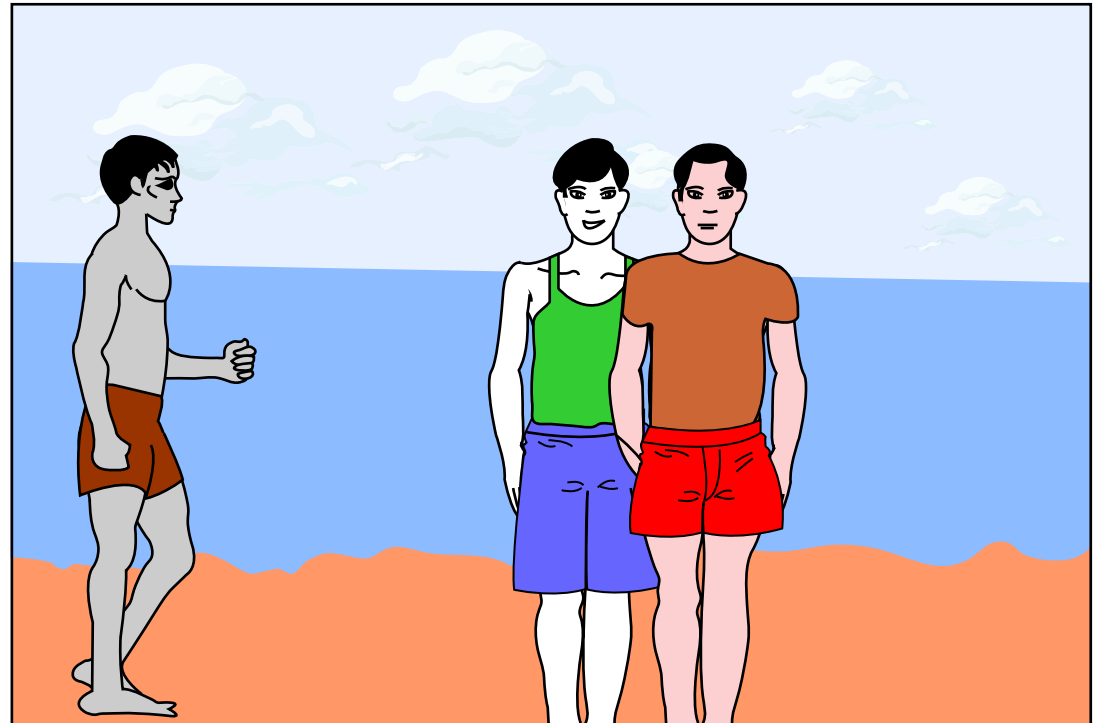
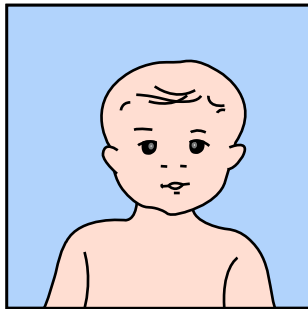
- Young children are also essentialist about gender.
- If this baby girl is raised on an island with only boys and men ...



Illustrations courtesy of MIT OCW.

Causal knowledge, identity and transformation

- If this baby girl is raised on an island with only boys and men ...

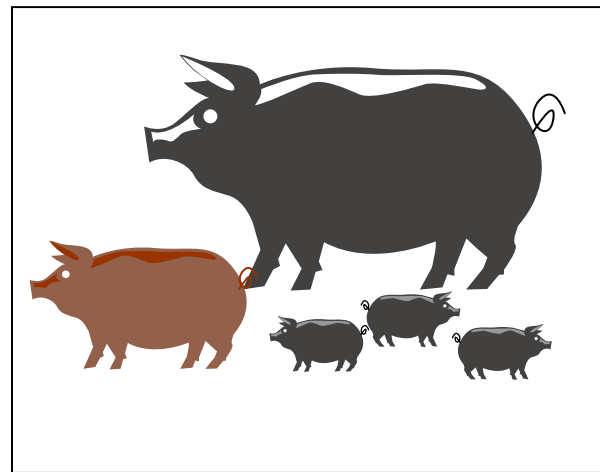
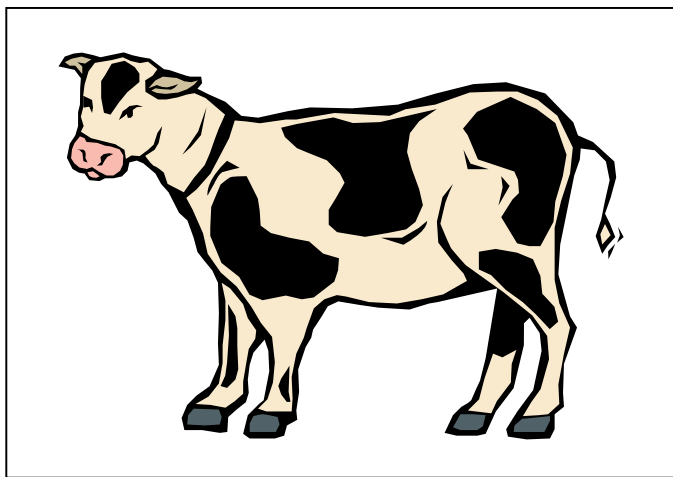


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- Will she have girl blood or boy blood?
- Will she wear a dress or a football shirt? Grow up to be a nurse of a firefighter? Play with a tea set or a toy truck?
- On Girl Island they play fan-tan; On Boy Island they play chuck-luck. If she's raised on Boy Island what will she play?

Causal knowledge, identity and transformation

- If I raise this baby calf with pigs will it grow up to have a straight tail like a cow or a curly tail like a pig
- Will it moo or say oink?



Causal knowledge, identity and transformation

- But maybe the children are just sticking with traits they already believe babies have (race, gender preferences, straight tails).
- If traits only emerge in adulthood -- do children still think they are an essential part of category membership or do they think they are subject to change?

Causal knowledge, identity and transformation

- If I put an apple seed in a flowerpot will it grow up to look like this or like this?



Causal knowledge, identity and transformation

- Children treat natural kind concepts and many social kind concepts as arising from unobservable, stable, internal causes.
- In essentialized domains inductive inferences are extended on the basis of these causal essences, rather than on the basis of observable features.

Theory theory view of concept learning

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Theory theory view of concept learning

- Critically, these effects of causal knowledge are apparent even in very young children.
- Despite a widely held belief that young children are most influenced by perceptual properties ...
- There is little evidence for a “shift” from judgments based on perceptual similarity to essentialist judgments ...
- Rather even the youngest children seem to consider causal relations in their conceptual judgments.
- There are no “theory-neutral” concepts.

Theory theory view of concept learning

- “One of the things that theories do is to embody or provide causal linkages from deeper properties to more superficial or surface properties.” (Medin, Concepts and Conceptual Structure)

Theory theory view of concept learning

- “Human beings are theory builders; from the beginning we construct explanatory structures that help us find the deeper reality underlying surface chaos” (Carey, Conceptual Development in Childhood)