

Topology versus shape in children's representations of object kinds

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Background

Children extend labels of novel objects to other objects that share same shape, suggesting that from early on shape is prioritized over other features, like texture, color and size, in representations of object categories. However, research on infants, adults and even bees suggests that topological properties (i.e., whether an object has a hole or not) are more fundamental than shape for determining whether an object is parsed, recognized or tracked. We therefore tested whether topological properties compete with shape in formation of representations of object kinds.

Research Question

Does topological class compete with metric shape in children's and adults' representations of object kinds?

Experiment 1: Pit topology and shape against each other in a name generalization task

Participants: 66 2-8-year-olds

Stimuli: Cardboard cut-outs

Data Collection: In-person at Museum of Science, Boston

Children completed 4 trials (2 in which the standard had a hole, two in which the standard did not have a hole). Each trial used a novel label.

Look at this. It's a [Toma]. See, it's a [Toma]. This is a [Toma]

See these? Which one is also a [Toma]?

Trial	Standard	Shape match	Topology match	Distractor
toma				
blicket				
ziff				
wug				

Experiment 2: Equate topology but change figure/ground relations across objects

Participants: 21 2-8-year-olds

Stimuli: Cardboard cut-outs

Data Collection: In-person at Museum

Standard	Shape match	Feature match	Distractor

Experiment 3: Explicitly ask about kind membership

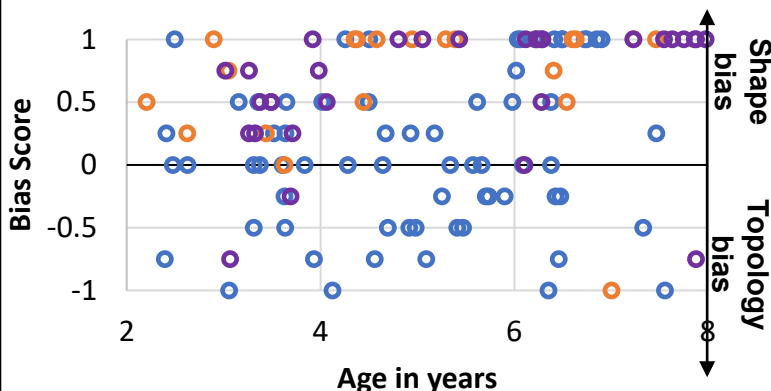
Participants: 30 3-7-year-olds + 25 adults

Stimuli: Animated cartoons of stimuli from Exp. 1 – study conducted ONLINE

Objects were not labeled. Instead, we asked which is the same KIND as the standard.

Results and Discussion

● Experiment 1 ● Experiment 2 ● Experiment 3



- Children prioritize topological properties similar to shape when extending novel labels to other objects (**Experiment 1**)
- Children's extension of novel labels to objects with the same topology is driven by the objects' hole/lack of hole, not figure/ground relations (evidenced by children's shape bias in **Experiment 2**)
- When asked explicitly about kind membership (**Experiment 3**), topological properties did not drive children's choices (adults, not shown in figure, also showed a strong shape bias). However, stimuli were animated, and participants completed the task at home (rather than in a controlled environment with an experimenter), which may have impacted responses. We plan to replicate the study 3 by collecting the data online (via zoom) using real objects.
- Age did not impact choices across experiments.