

An object's skeleton supports one-shot category learning in infants

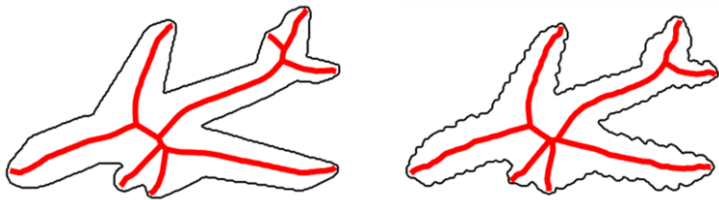
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Introduction

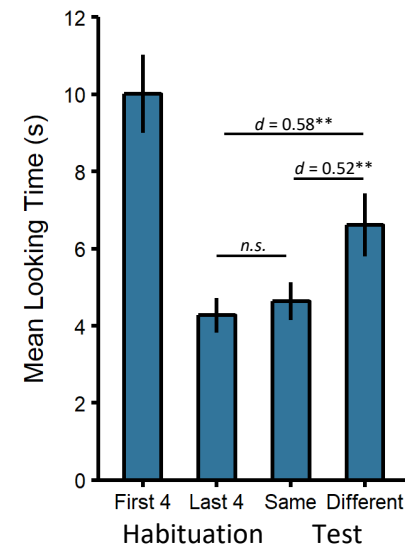
- Unlike convolutional neural networks (CNNs), humans rapidly learn new object categories^{1,2}
- Indeed, even infants categorize never-before-seen objects from few examples³
- However, it's unknown whether *one-shot* category learning is possible in absence of extensive 'labeled' category experience⁴
- We tested whether infants accomplish one-shot categorization by relying on a perceptually tolerant skeletal structure⁵



Experiment 1

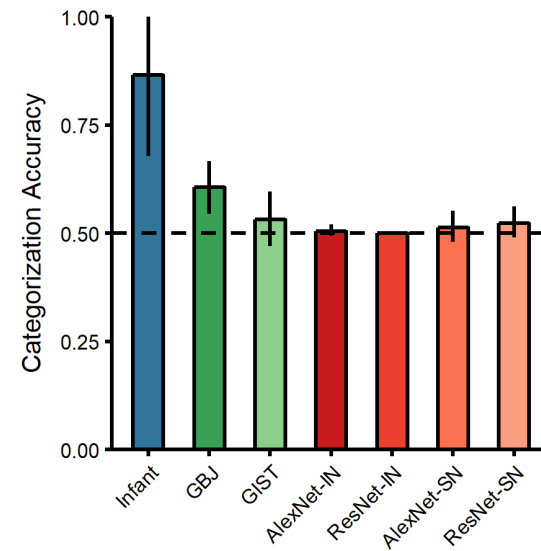
Can infants categorize objects by their skeletal structure from one exemplar?

Habituation/dishabituation results



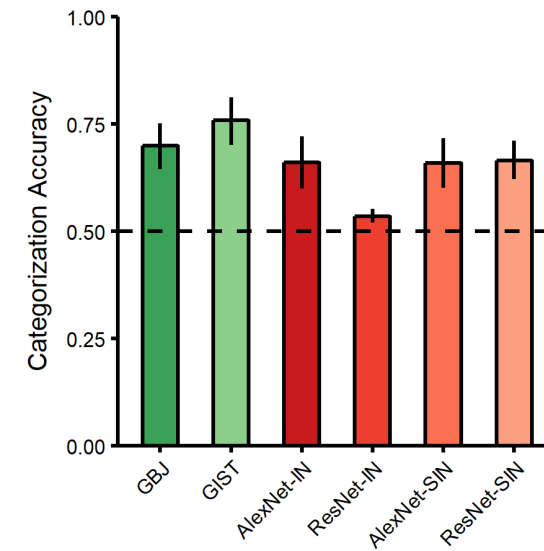
Infants dishabituated to the different, but not the same skeleton

One-shot categorization in infants and models



Infants outperformed other models of vision, including CNNs

Multi-exemplar categorization in models



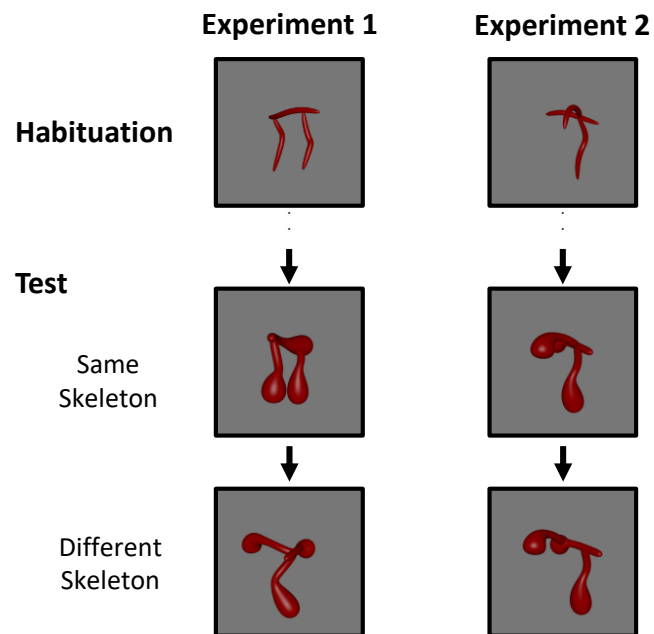
Models succeeded when the classifier was trained with multiple exemplars

Conclusion

- With exposure to just *one* exemplar infants categorized never-before-seen objects by their skeletons
- Infants generalized across changes to the object's image-level properties and component parts
- Importantly, infants categorized by the object skeleton even when coarse spatial relations were held constant
- By contrast, other models of vision required multiple exemplars to successfully categorize novel objects
- These results suggest that shape skeletons may be a powerful mechanism by which humans accomplish one-shot category learning

Procedure

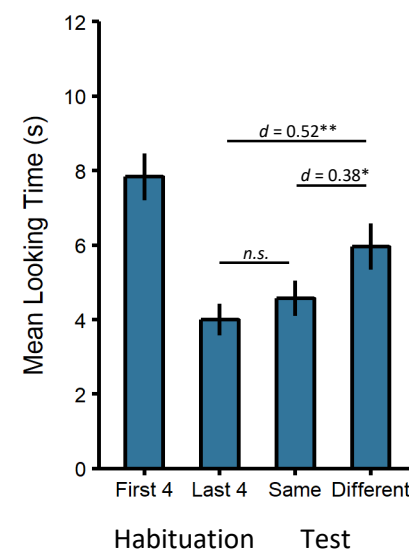
Infants ($N = 92$, $M_{age} = 9.32$ months) were habituated to one exemplar, and tested with novel objects with the same or different skeleton



Experiment 2

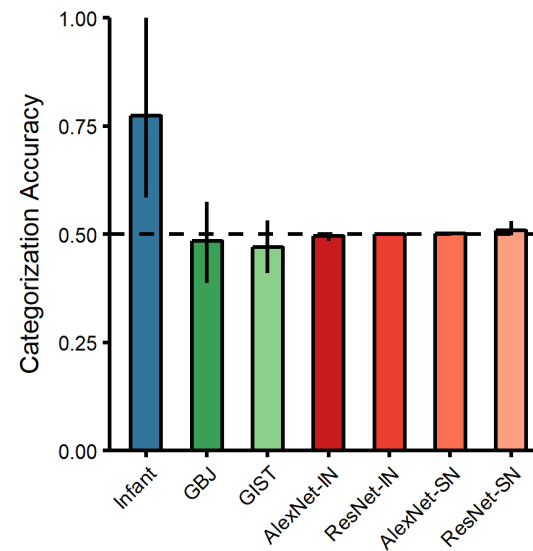
Do infants categorize using a skeletal structure or coarse spatial relations?

Habituation/dishabituation results



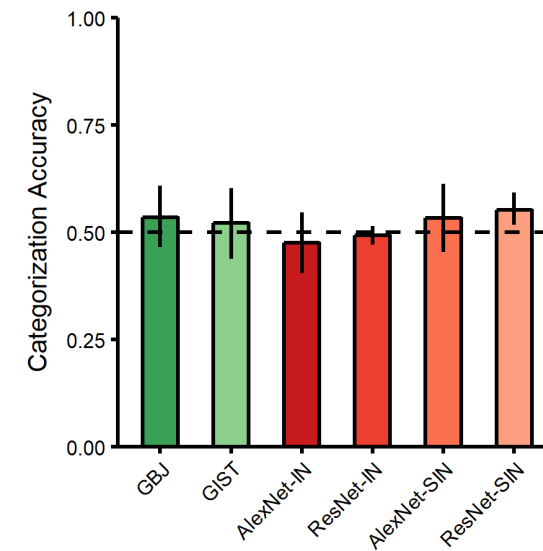
Infants dishabituated to the different, but not the same skeleton

One-shot categorization in infants and models



Only infants could categorize objects from one exemplar

Multi-exemplar categorization in models



ResNet-SIN succeeded when the classifier was trained with multiple exemplars

References

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