Mapping people's conceptions of sentient beings: Judgments about the relative capacities of animals, humans, & technology

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Background

Which is more likely to think, a robot or an insect? How does a baby compare to a dog in its capacity for hunger, or emotions? Such comparisons have revealed the "dimensions of mind perception" that adults use in reasoning about mental entities, from humans and animals to robots and God (Gray et al., 2007; see also Carey, 1985).

Young children also use information about specific capacities and experiences (e.g., emotion, perception, and autonomous behavior) when they reason about the sentience or animacy of unknown entities (Weisman et al., 2015). **But what distinctions might children make between *different kinds* of mental capacities or phenomenal experiences? How do children's distinctions compare to adults'?**

These questions are particularly relevant today, due to the increasing sophistication of "social" and "intelligent" technologies. Interactions with non-living "beings"—such as smartphones, entertainment robots, and autonomous vehicles—are rapidly becoming part of everyday life in the US and other urban societies. **What capacities or experiences are people willing to extend to sophisticated technologies?**

Methods

The procedure was modeled on Gray et al. (2007), probing intuitions about **3 different capacities** (presented within-subjects in blocks of 7-8 trials). On each trial, participants saw 2 entities and were asked:

- **Hunger**: *Which one is more likely to **get hungry**?*
- **Feelings**: *Which one is more likely to **have feelings**?*
- **Thinking**: *Which one is more likely to **think**?*

Pairs of entities were drawn from a set of photos of **humans** (*grownup, kid, baby*), **animals** (*dog, bear, bug*), **technologies** (*robot, computer, car*), and a familiar **inert object** (*stapler*). Participants responded on a 5-point scale.

Which one is more likely to have feelings: the kid, the robot, or are they both the same? [A lot more, or a little more?]

We conducted 2 parallel studies:

- **Study 1: 60 adults** with US IP addresses on Amazon Mechanical Turk
- **Study 2 (ongoing): 50 US children** (83% of planned sample) ages 4;6–5;6 (*M* = 4;10) at a university preschool or a children's museum

References and Acknowledgements

Carey (1985). *Conceptual Change in Childhood*. Cambridge, MA: MIT Press

Gray, Gray, & Wegner (2007). Dimensions of mind perception. *Science, 315*(5812), 619.

Weisman, Dweck, & Markman (2015). Reasoning about sentience and animacy: Children's and adults' inferences about the properties of unseen entities. *Proceedings of the 37th Annual Meeting of the Cognitive Science Society*. Pasadena, CA.

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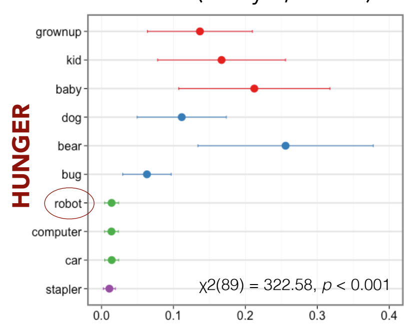
Analysis #1: Estimated Ratings

Elimination-by-aspects analyses generated **estimated ratings of each individual entity's capacities for hunger, feelings, & thinking**. (X-axis: utility scale value. Error bars: 95% CIs.)

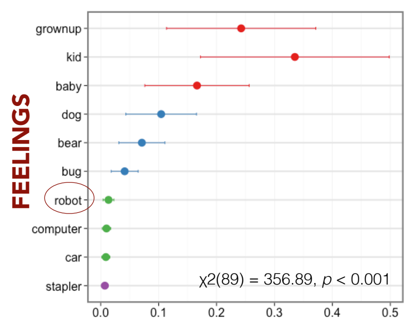
HUMANS
ANIMALS
TECHNOLOGY
CONTROL

Adults (Study 1, *n* = 60)



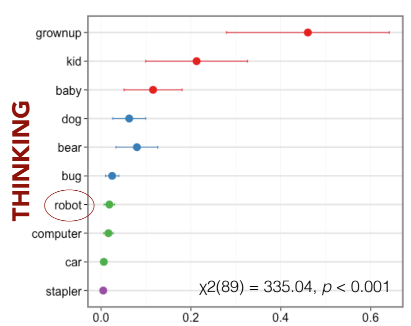
Findings:

- **Gaps**: large gap between most animals (except *bug*) and non-animals
- **Distribution**: mostly high or low utility values (except *bug*)
- **Rank order**: dominated by stereotypes (hungry baby, hungry bear); all animals > all non-animals
- **Robot < bug**



Findings:

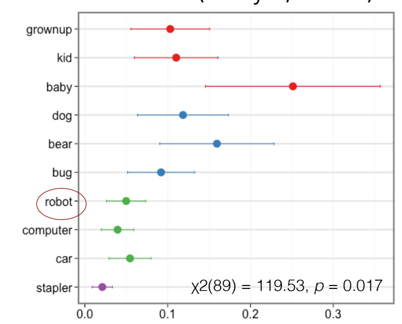
- **Gaps**: very small gap between animals and non-animals
- **Distribution**: entities span the full range of values
- **Rank order**: humans > non-human animals > all non-animals
- **Robot < bug**



Findings:

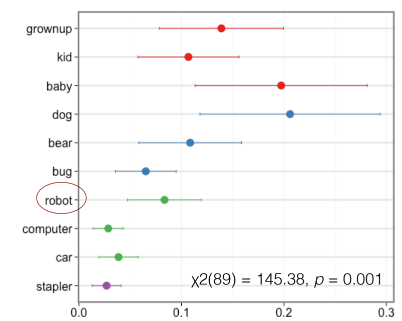
- **Gaps**: no clear gap between animals and non-animals
- **Distribution**: entities span the full range of values
- **Rank order**: humans > non-human animals > tech > control
- **Robot = bug**

Children (Study 2, *n* = 50)



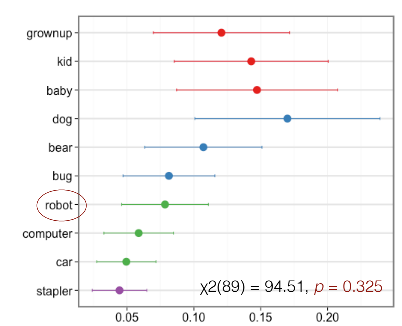
Findings:

- **Gaps**: no clear gap between animals and non-animals
- **Distribution**: entities span the full range of values
- **Rank order**: dominated by stereotypes (hungry baby, hungry bear); all animals > tech > control
- **Robot < bug**



Findings:

- **Gaps**: small gap between animals (plus robot) and non-animals
- **Distribution**: entities span the full range of values
- **Rank order**: most humans > most animals > most tech > control
- **Robot > bug (!)**



Findings:

- **Gaps**: no clear gap between animals and non-animals
- **Distribution**: entities span the full range of values
- **Rank order**: all humans > most animals > all tech > control
- **Robot = bug**

Analysis #2: Conceptual Space

Multidimensional scaling analyses generated **conceptual "maps" of entities**, considering relative capacities for hunger, feelings, & thinking separately. (Axes: derived dimensions.)

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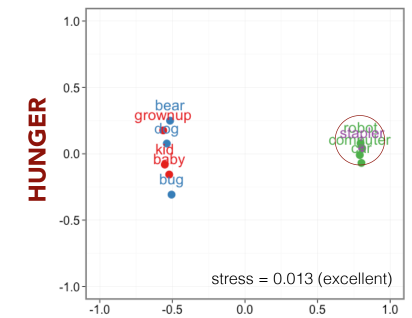
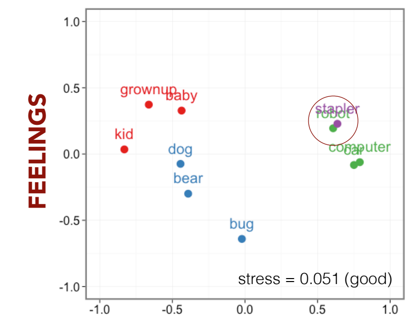
Adults (Study 1, *n* = 60)



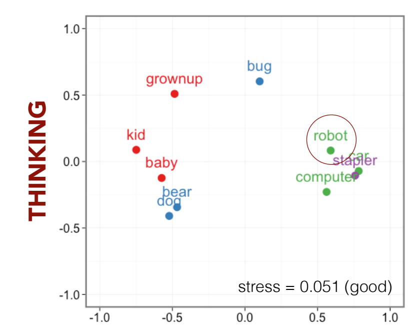
Findings:

- **Clusters**: 2 distinct, tight clusters: animals vs. non-animals
- **Variability**: modest variability among animals; no variability among non-animals
- **Robot**: indistinguishable from other non-animals



Findings:

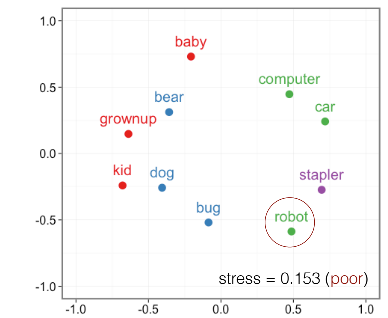
- **Clusters**: 2 loose but distinct clusters: animals vs. non-animals
- **Variability**: high variability among animals; modest variability among non-animals
- **Robot**: indistinguishable from other non-animals



Findings:

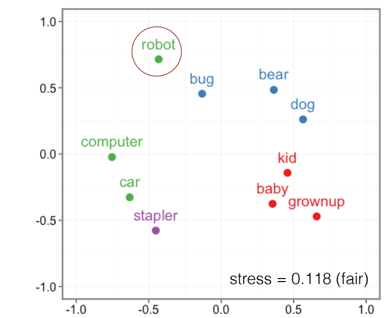
- **Clusters**: very loose clusters: animals vs. non-animals
- **Variability**: high variability along multiple dimensions (especially among animals)
- **Robot**: clearly grouped with non-animals, but some hint of approaching *bug*

Children (Study 2, *n* = 50)



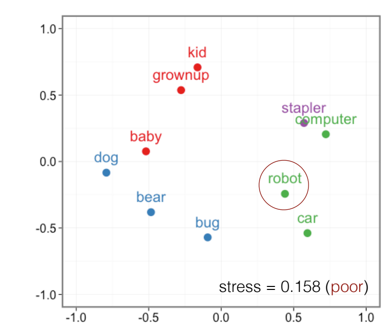
Findings:

- **Clusters**: very loose clusters (almost indistinguishable)
- **Variability**: high variability along multiple dimensions
- **Robot**: at the edge of the animal cluster, approaching *bug*



Findings:

- **Clusters**: 2 loose but distinct clusters: animals vs. non-animals
- **Variability**: high variability among animals; modest variability among non-animals
- **Robot**: grouped with animals (!)



Findings:

- **Clusters**: very loose clusters (almost indistinguishable)
- **Variability**: high variability along multiple dimensions (among both animals and non-animals)
- **Robot**: grouped with non-animals, but some hint of approaching *bug*

Preliminary Results: Developmental Continuities and Differences

Overall:

- **Different capacities have distinct profiles.** Both children and adults made distinctions between different aspects of mental life, rather than reasoning about a unitary concept of "mind."
- **Robots are granted some degree of mental (but not biological) life.** Both adults and children attributed some amount of **thinking** to a robot, to a similar degree as to a bug. Children indicated that a robot is actually more likely than a bug to have **feelings**.

Conceptual structure:

- **For adults, hunger is simple; feelings & thinking are more complex.** Adults (mostly) seemed to believe that a capacity for **hunger** is categorically present or absent; attributions of **feelings** & **thinking** revealed more complex, continuous conceptual structures.
- At this point in data collection, **attributions of feelings seem to reveal the simplest structure among children.**

Categorical vs. continuous reasoning:

- **Adults treated some capacities as categorical and others as continuous**, reflecting a belief that some aspects of biological/mental life (e.g., **hunger**) are either present or absent, while others (e.g., **thinking**) might be present to varying degrees.
- At this point in data collection, **children appear to demonstrate elements of both categorical reasoning (clusters) and continuous reasoning (linearity) for all three capacities tested.**

General takeaway: At least some attributions of mental life do not map directly onto a naive understanding of biological life—especially among children. "Social" and "intelligent" technology provides an interesting test case for charting how reasoning about cognitive abilities and emotional experiences might occur outside of the framework of lay biology.