Children's use of lexical flexibility to structure new noun categories

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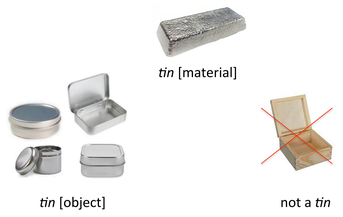
Introduction

Prior work shows that children use heuristics and constraints to guess the meanings of entirely new words (Clark, 1990; Markman, 1990; Landau, Smith & Jones, 1988).

Most of the meanings that children learn are not new words, but since words are often polysemous, children will often be learning new word senses (e.g., children know "tin" [material] and learn "tin" [object]).

Sense learning is easier than word learning, because first-learned senses can constrain guesses about subsequent senses, explaining why polysemy is so prevalent (Srinivasan and Rabagliati, 2015).

Here we test: Does knowledge of an existing word sense constrain children's learning of subsequent senses (Experiments 1 & 2);
What is the cognitive mechanism supporting these constraints (Experiment 3).



General Method

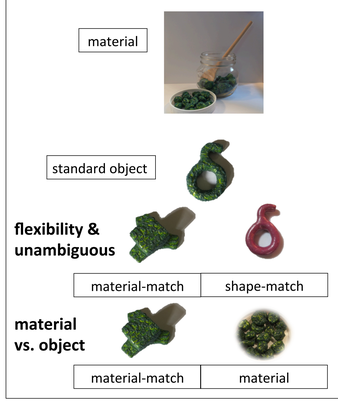
Prior work has shown that children follow a ***shape bias*** when learning new nouns (e.g., Landau, Smith, & Jones, 1988).

However, this *shape bias* can be overridden by additional context (e.g., Booth & Waxman, 2002; Kemler Nelson, 1995).


(Reprinted from Smith, 2001)

We test whether knowledge of a prior word sense causes children to override the *shape bias* when learning a new word sense.

Experiment 1: Two-alternative forced choice task (2AFC)



Material:
This stuff is called *gup* [flexibility] / *zev* [unambiguous]

Standard Object:
This thing is call a *gup.*

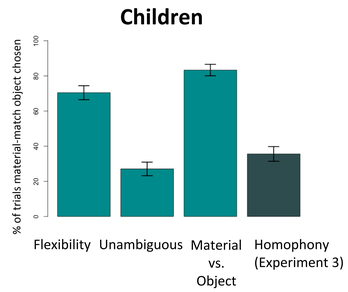
2AFC task:
I want another *gup*.
Can you point to a *gup*?

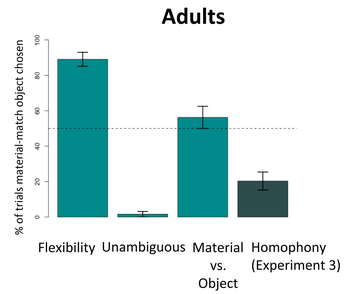
Sorting task:
Can you put all of the *gups* into this box and all of the other things into this bowl?

Experiment 2: Sorting task

Experiment 1: Two-alternative forced choice task

n = 100 children; n = 48 adults
Children: age range: 3;0 – 4;11; mean 4;0
Three conditions: Flexibility, Unambiguous, Material vs. Object





Children in *flexibility condition* override *shape bias* and extend to material-match on 70% of trials (*SE* = 4%), reliably more than in the *unambiguous condition* (27%; *SE* = 4%; β = −1.86, *SE* = 0.27, $p < .001$) Children in *material vs. object* condition select object more often than chance (83%, *SE* = 3%), suggesting that they learned distinct material and object senses.

Adults in *flexibility condition* override *shape bias* and extend to material-match on 89% of trials (*SE* = 4%), reliably more than in the *unambiguous condition* (2% of trials, *SE* = 2%; β = −6.24, *SE* = 1.08, $p < .001$). However, adults in *material vs. object* condition select object at chance (56%, *SE* = 6%), suggesting that they may not have learned distinct material and object senses.

Experiment 2: Open-ended sorting task

n = 32 children; n = 33 adults
Children: age range: 4;0 – 4;11; mean 4;6
Two conditions: Flexibility, Unambiguous

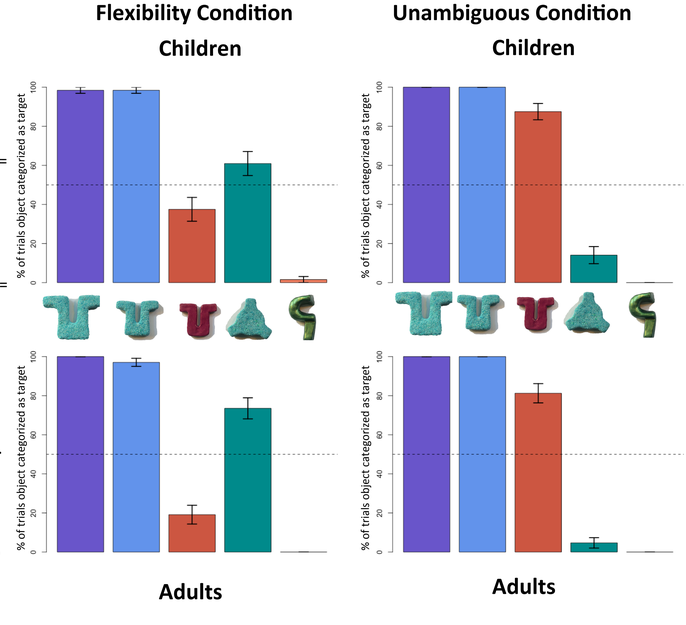
Results:
Children and adults in *flexibility condition* show a material bias, and in the unambiguous condition show a *shape bias*.

Children:
+Material/-Shape object: Flexibility condition 61% (*SE* = 6%) > unambiguous condition 14% (*SE* = 4%; β = −2.25, *SE* = 0.44, $p < .001$.

–Material/+Shape object: Unambiguous condition 88%, (*SE* = 4%) > flexibility condition 38%,(*SE* = 6%; β = 2.46, *SE* = 0.46, $p < .001$)

Adults:
+Material/-Shape object: Flexibility condition 74%, (*SE* = 5%) > unambiguous condition 5% (*SE* = 3%; β = −4.03, *SE* = 0.65, $p < .001$) .

–Material/+Shape object: Unambiguous condition 81%, (*SE* = 5%) > flexibility condition 19%, (*SE* = 5%; β = 2.91, *SE* = 0.44, $p < .001$)



Experiment 3: Homophony vs. polysemy

Are children's choices based on attentional learning, or theory-based induction?

Children extend existing words that label novel objects based on the extension pattern of the original word (Yoshida and Smith, 2003).

The *attentional learning account* suggests if homophones were used in Experiment 1, participants would still extend based on material.

If children are using theory-based Induction, then material-based extensions should be reduced in this *homophony condition.*

Results: 3- and 4-year-olds (n = 33) and adults (n = 16) were far less likely to choose the material-match object (children: 36%, *SE* = 4%; adults: 20%, *SE* = 5%) compared to participants in the *flexibility condition* of Experiment 1, and instead behaved similarly to the participants in the *unambiguous condition*.

Conclusions and Implications

Children can use a word's prior meaning to learn about the structure of its new meaning.

Two experiments demonstrated that when children and adults learned that a substance name could be used flexibly to also label an object, they were less likely to extend the name according to shape, and instead privileged material.

Consistent with Srinivasan & Rabagliati (2015), lexical flexibility may play an important role in language development by facilitating the acquisition of the lexicon.

Our findings suggest that lexical flexibility shapes conceptual development more broadly: children understand that labels can pick out items from distinct, but related categories.

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