

LSci 51/CogS 56L: Acquisition of Language

Lecture 11
Lexical & morphological
acquisition II

Announcements

Be working on review questions for lexical & morphological acquisition

HW4 due 8/26/25

The course of early lexical acquisition



From 0 to 50 words: The first 10



Wordbank

An open database of children's vocabulary development



<https://wordbank.stanford.edu>

Frank, Braginsky, Yurovsky & Marchman 2017

Similar words appear in the **first 10 words** across languages, consisting primarily of **important family members** (*mommy, daddy, grandma*), **social routines** (*hi, bye, peekaboo*), and **sounds** (*yum yum, vroom, woof woof*).



From 0 to 50 words: The first 10

<https://www.sciencedaily.com/releases/2022/04/220407145515.htm>

Amalia Skilton on Skilton 2022:

“The early use of [demonstrative] words like ‘this’ and ‘that’ has been documented in widely spoken languages such as English, Spanish and Mandarin...similar patterns among 45 Ticuna speakers in Peru...demonstratives that call others' attention to objects -- such as 'this/that' and 'here/there' -- at extremely young ages, when they know very few other words... one of the main tools for directing what linguists call **joint attention**, which allows us to label objects with names, coordinate our actions and cooperate.”



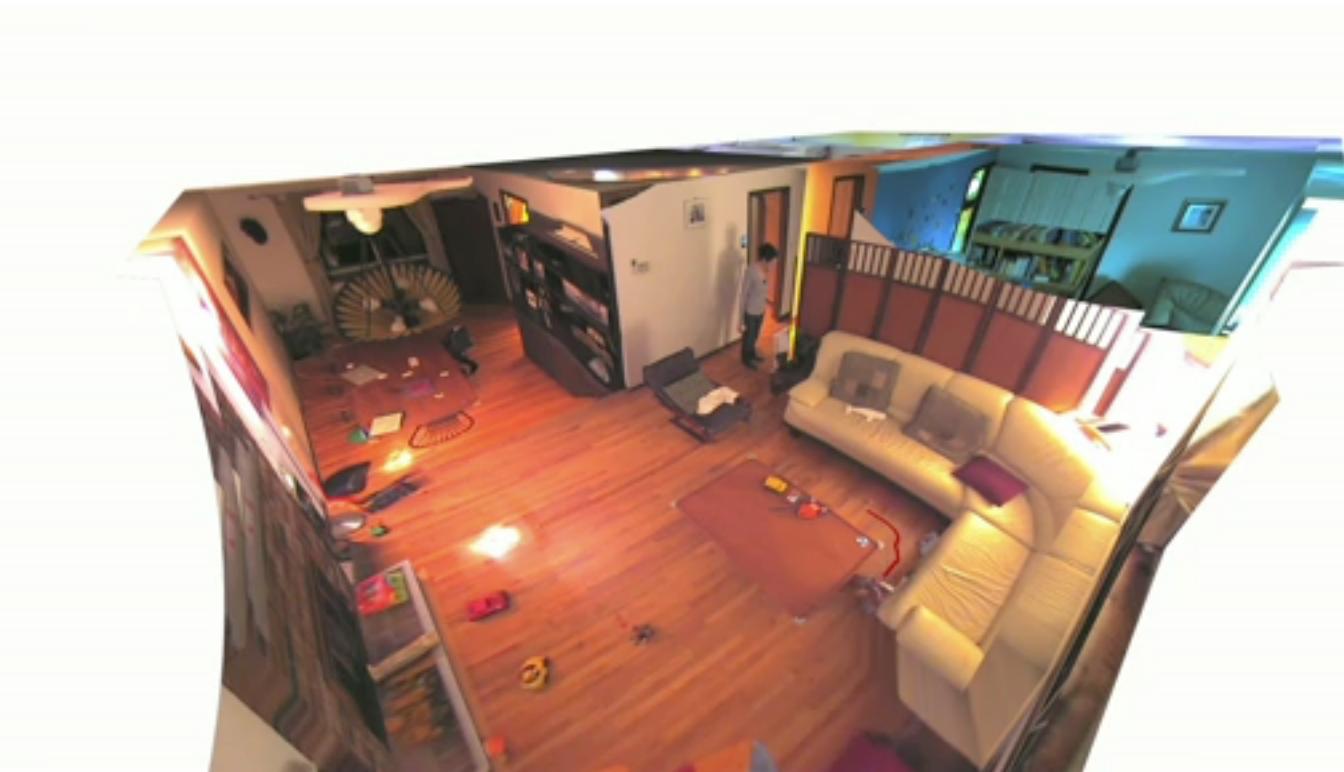
First words

[Extra]

First words video & why might these words be learned earlier

http://www.ted.com/talks/deb_roy_the_birth_of_a_word.html

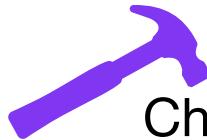
(~5:45 through ~11:00 of 19:52)



First words

10-15 months: first words produced that actually sound like the words the child is trying to approximate (and they have a fixed meaning, as opposed to being sound sequences the child likes to say)





Children build language knowledge all the time



Note: Very young children know a lot about words even before they say any!



Children understand more than they say



Bergelson & Swingley (2012, 2014, 2015) show that 6- to 9-month-olds understand familiar concrete object words like “nose” and “cookie”.



Children understand more than they say

Bergelson & Swingley (2013) show that 10- to 13-month-olds understand words like “all gone”, “hug”, “bye”, and “wet”.

Nomikou, Rohlfing, Cimiano, and Mandler (2018) show that 10-month-olds understand verbs like “eat”, “sleep”, and “read”.



Children understand more than they say

Skarabela, Ota, O'Connor, & Arnon (2021) show that 11- to 12-month-olds, who may not yet be saying even single words, can understand multiword phrases like “clap your hands”.



<https://www.sciencedaily.com/releases/2021/03/210330121242.htm>

Children understand more than they say



Bergelson & Aslin (2017) show that 6-month-olds recognize words as **more related** (“car” and “stroller”) and **less related** (“car” and “juice”).

[https://www.sciencedaily.com/
releases/2017/11/171120174513.htm](https://www.sciencedaily.com/releases/2017/11/171120174513.htm)



Words as referential

<https://www.sciencedaily.com/releases/2015/09/150902093259.htm>

Marno, Farroni, Dos Santos, Ekramnia, Nespor, & Mehler 2015: **4-month-olds** expect speech sounds uttered by a human who's looking at them to refer to something in the world (i.e., be referential).

“This suggests that infants at this early age already have some knowledge that **language implies a relation between words and the surrounding physical world.**

Moreover, they are also ready to find out these relations, even if they don't know anything about the meanings of the words yet. Thus, a good advice to mothers is to speak to their infants, because infants might understand much more than they would show, and in this way their attention can be efficiently guided by their caregivers.” — Hanna Marno



First words

First words tend to be **context-bound**:

ex: “car” said when looking at cars out of apartment window, but not when looking at cars up close or when seeing a picture of a car



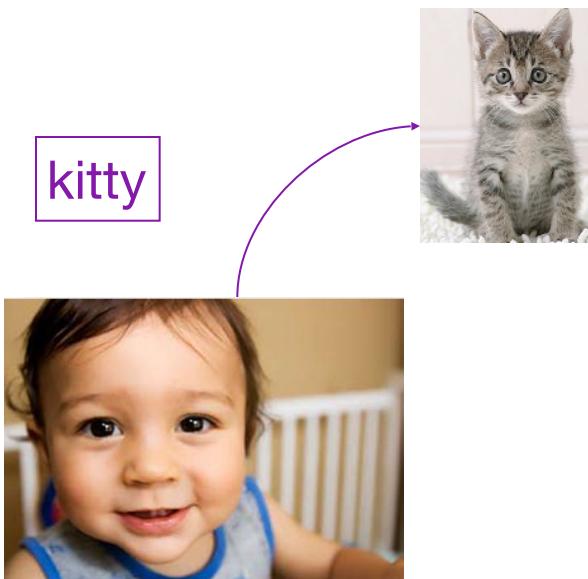
Children’s usage: have simply identified one particular event in the context of which it’s appropriate to use that word, but haven’t realized its more abstract coverage

First words

Even if children realize a word has more extended use, they still may not realize it has the meaning that adults have for it

Ex: “more” = request for more, not general comparison

Often, first words are parts of routines or language games. Children must then realize that these words can be extended.

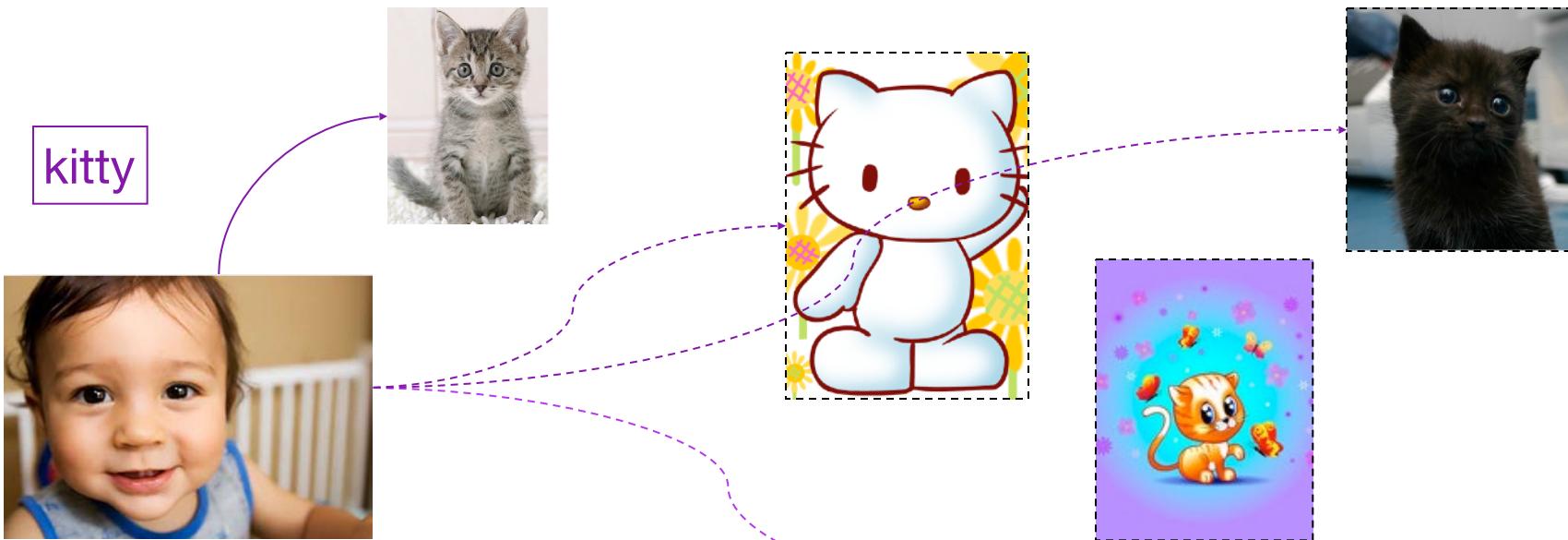


First words

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First words

In general, it's *not* because children don't hear these words in different contexts. Their parents used the words in many different contexts.

So what's the problem?

It's not an easy task to extract the common meaning from different contexts.



kitty = ?

First words

In general, it's *not* because children don't hear these words in different contexts. Their parents used the words in many different contexts.

So what's the problem?

It's not an easy task to extract the common meaning from different contexts.



cute = ?

First words

So what's the problem?

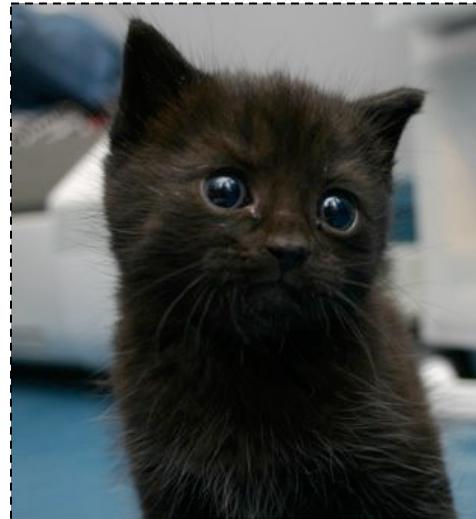
It's even harder if you're just looking at a single instance at a time.

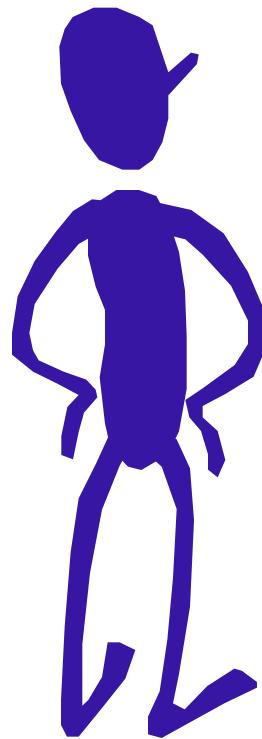
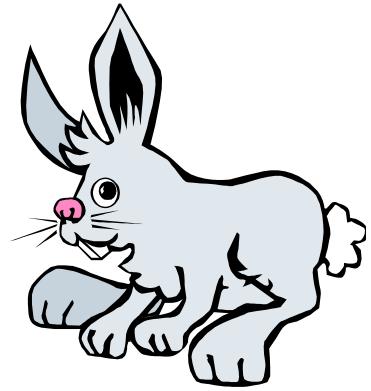
sad?

fuzzy?

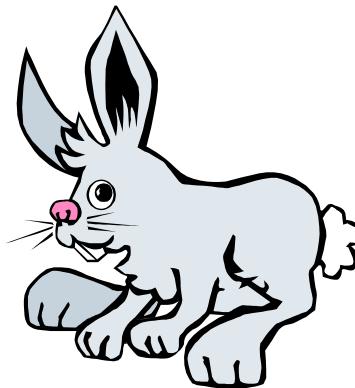
kitty?

cute?





What does “gavagai” mean?



Gavagai!

What does “gavagai” mean?

Rabbit?

Mammal?

gray rabbit?

Animal?

Carrot eater?

vegetarian?

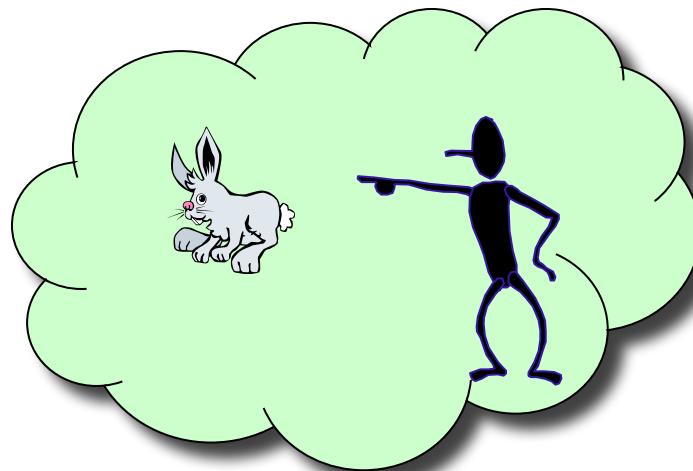
Ears?

Long ears?

Is it gray?

Fluffy?

What a cutie!



Thumping
Hopping
Scurrying

Stay!
Look!

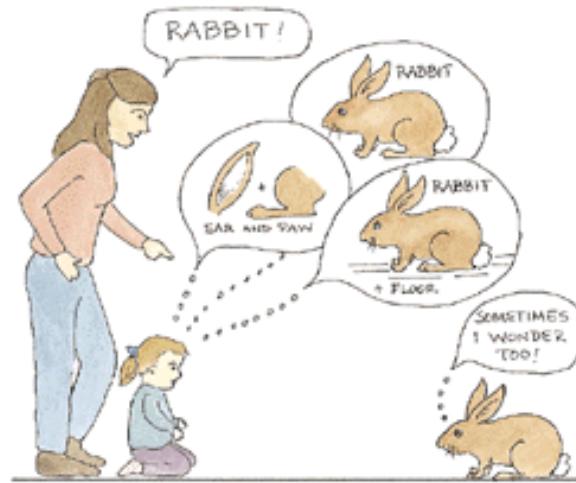
Meal!
Rabbit only until eaten!

Cheeks and left ear!

That's not a dog!



Same problem the child faces



The mapping problem

Even if something is explicitly labeled in the input (“Look! There’s a goblin!”), how does the child know what *specifically* that word refers to? (Is it the head? The feet? The staff? The combination of eyes and hands? Attached goblin parts?...)

Quine (1960): An infinite number of hypotheses about word meaning are possible given the input the child has. That is, the input underspecifies the word’s meaning.

Poverty of the stimulus

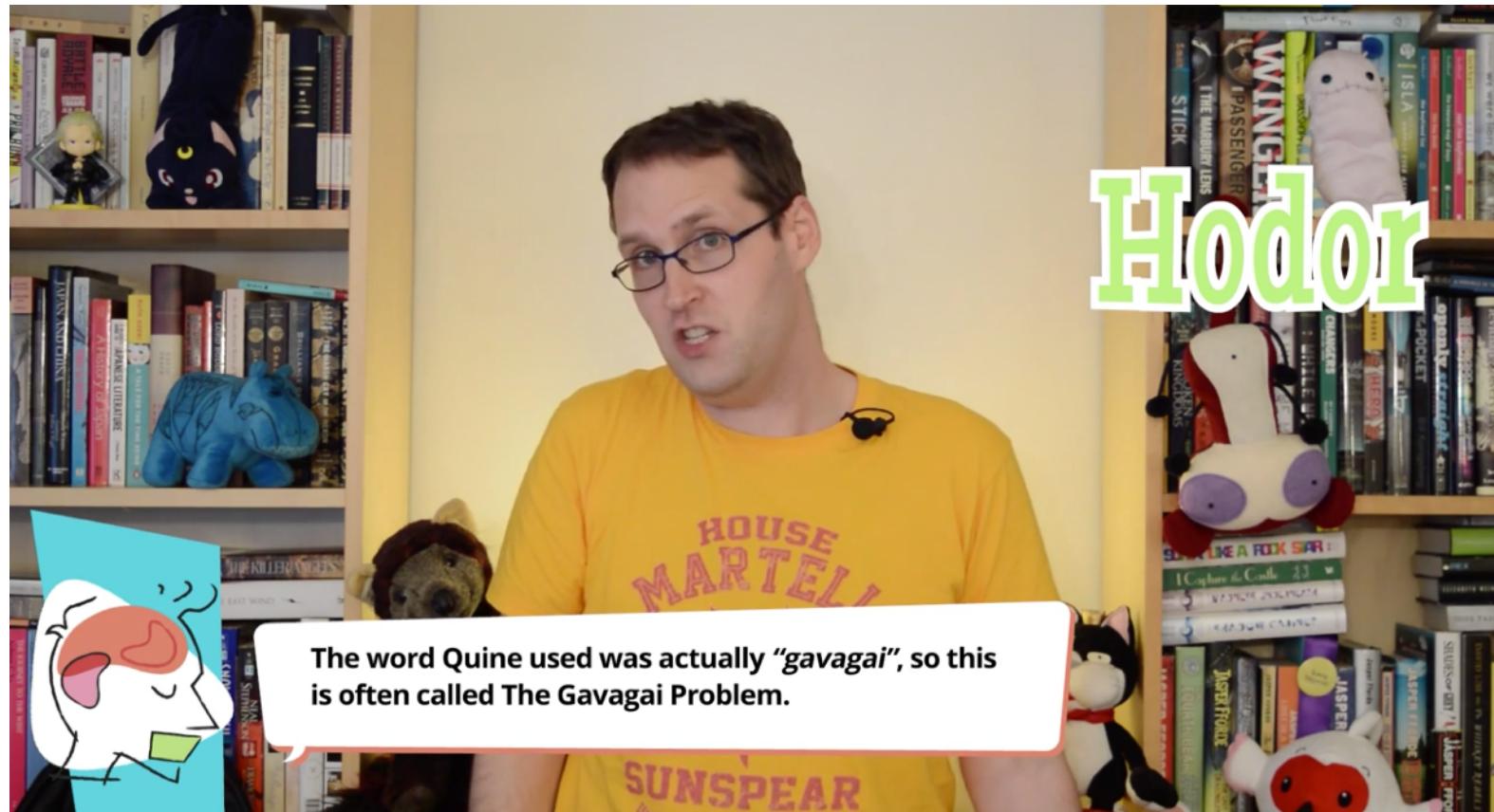


[Extra]
The mapping problem

<http://www.thelingspace.com/episode-35>

<https://www.youtube.com/watch?v=Ci-5dVVvf0U>

2:04 - 2:32



Common mistakes children make with meaning

Once children figure out that words are referential, they have to figure out **what range of concepts** words apply to. This isn't so easy.

Underextension: using words in a narrower range.

Ex: Only siamese and Persian cats are cats.

kitty



Not kitty



Common mistakes children make with meaning

Once children figure out that words are referential, they have to figure out **what range of concepts** words apply to. This isn't so easy.

Overextension: using words in a wider range. (more common)

Ex: All fuzzy creatures are cats.



kitty



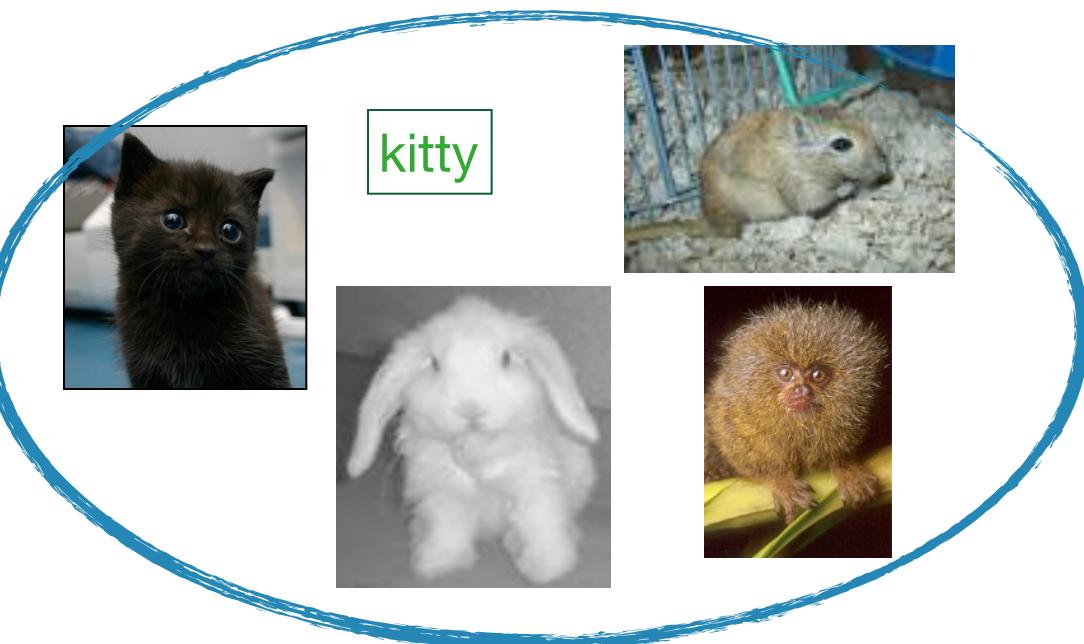
Not kitty



Common mistakes children make with meaning

Once children figure out that words are referential, they have to figure out **what range of concepts** words apply to. This isn't so easy.

Sometimes **overextension** and **underextension** can happen at the same time.

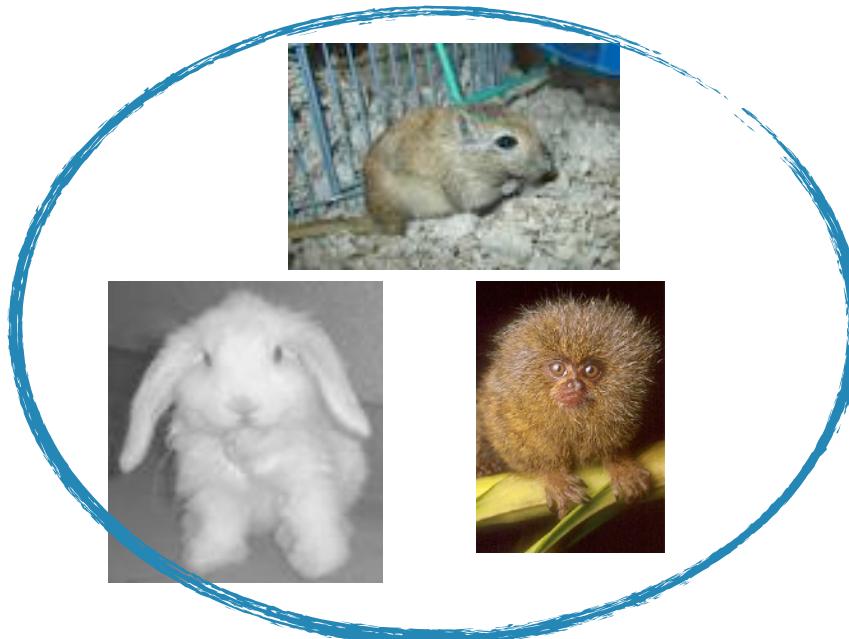


Causes of extension errors

Underextension: perhaps the child is conservatively extending the hypothesis about what word refers to; correctable from experience with word's usage by adults.

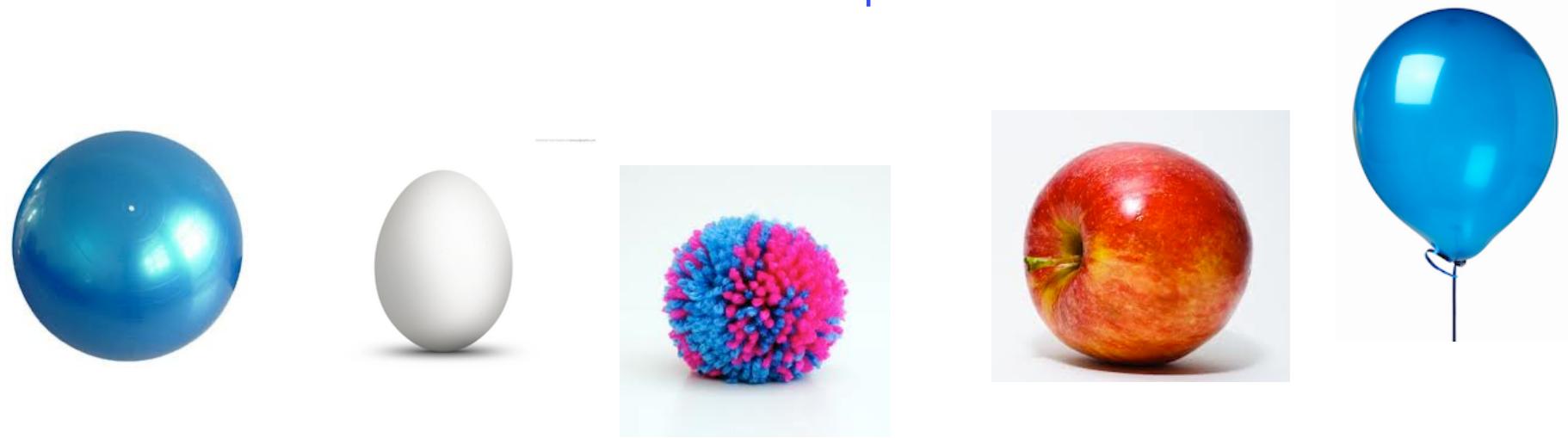


Overextension: Likely to simply be because the child doesn't know appropriate word and uses one that's known. Overextensions tend to have some aspect of meaning in common, though. Corrected as children learn appropriate words for meanings they want to express.



Some more overextension examples

Ball = ball, balloon, marble, apple, egg, wool pom-pom, spherical water tank
common feature = “round-ish shape”



Cat = cat, cat's usual location on top of tv when absent
common feature = “associated with kitty”



Some more overextension examples

From two or three years olds



“heavy”

About a bookbag she can't
lift, and a bottlecap she
can't unscrew:

“It's too **heavy**”



About a shoebox she can't open:
“This is too **heavy**”

common feature = “**difficult**”

Some more overextension examples

Moon = moon, half-moon-shaped lemon slice, circular chrome dial on dishwasher, ball of spinach, wall hanging with pink and purple circles, half a Cheerio, hangnail

common feature = “crescent or round-ish shape”

+ a memory retrieval error?



What clues do kids get about what a word means?

Or in other words, how can kids solve the mapping problem?

Poverty of the stimulus



Making the guess: Fast mapping

Children begin by making an initial **fast mapping** between a new word they hear and its likely meaning. They guess, and then modify the guess as more input comes in.

Experimental evidence of fast mapping by young children (as young as 3 months old): Carey & Bartlett 1978, Dollaghan 1985, Mervis & Bertrand 1994, Friedrich & Friederici 2011, Medina, Snedecker, Trueswell, & Gleitman 2011, Friedrich & Friederici 2017, Bohn et al. 2021, Saksida & Langus 2024

ball



bear



kitty



“Can I have the ball?”

[unknown]



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bear



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“Can I have the zib?”

[unknown]



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ball



bear



kitty



[unknown]



“Can I have the zib?”

20 months



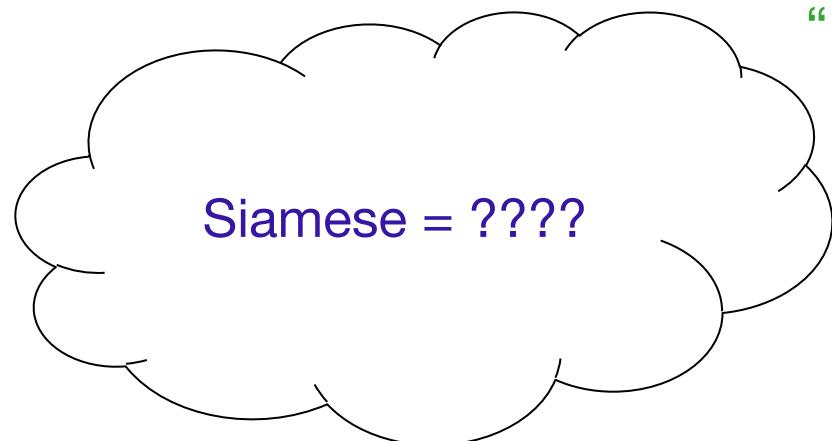
Some clues

Some clues from the input + child-internal clues

He & Arunchalam 2017

Social Cues

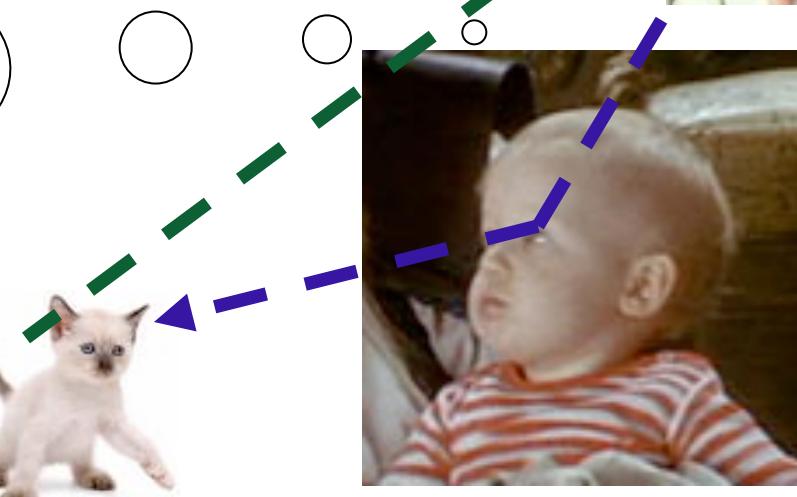
Speakers will look at the novel thing they're talking about: children assume the new word refers to object of speaker's gaze. Children do this by 18 months (Baldwin 1991), though the ability to successfully use a speaker's eye gaze develops over the first five years (Yurovsky, Wade, Kraus, Gengoux, Hardan, & Frank 2021).



"Look at the *siamese*!"



Known as "kitty"



Some clues from the input + child-internal clues

He & Arunchalam 2017

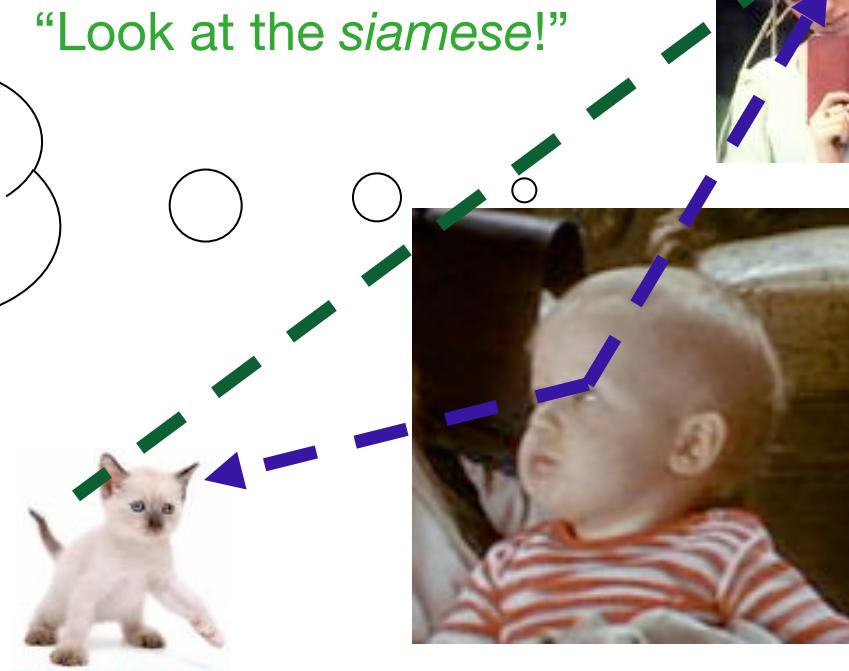
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Known as “kitty”

“Look at the *siamese*!”



Some clues from the input

He & Arunchalam 2017

Social Cues

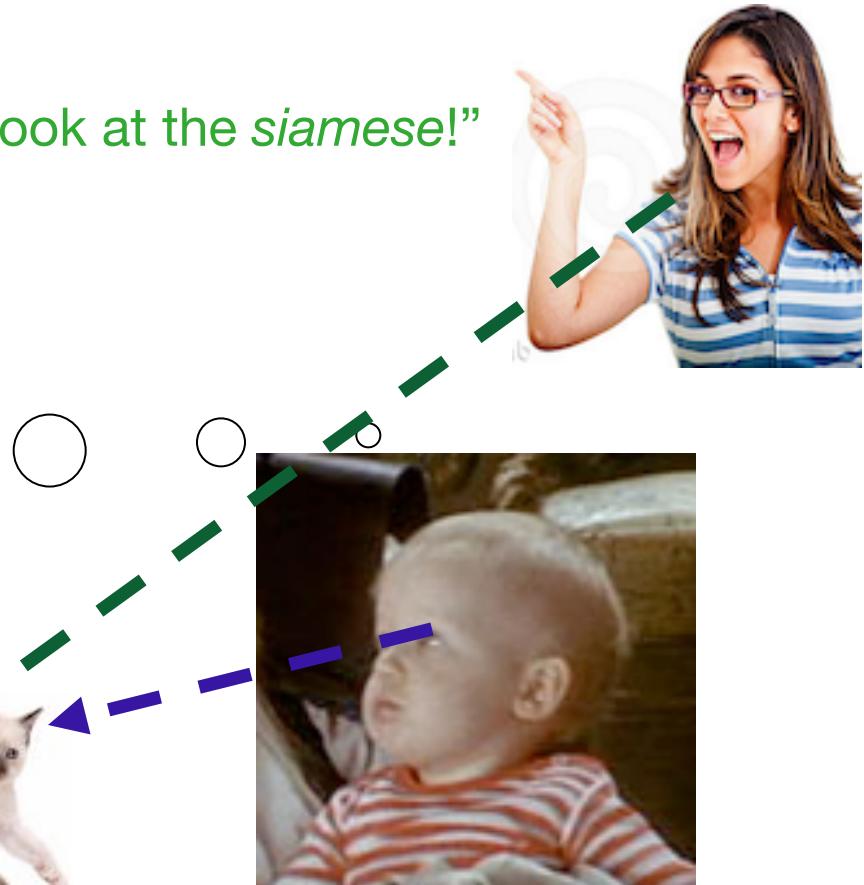
Pointing is an even better cue about the intended referent (Frank, Tenenbaum, & Fernald 2012).



Known as “kitty”



“Look at the *siamese*!”

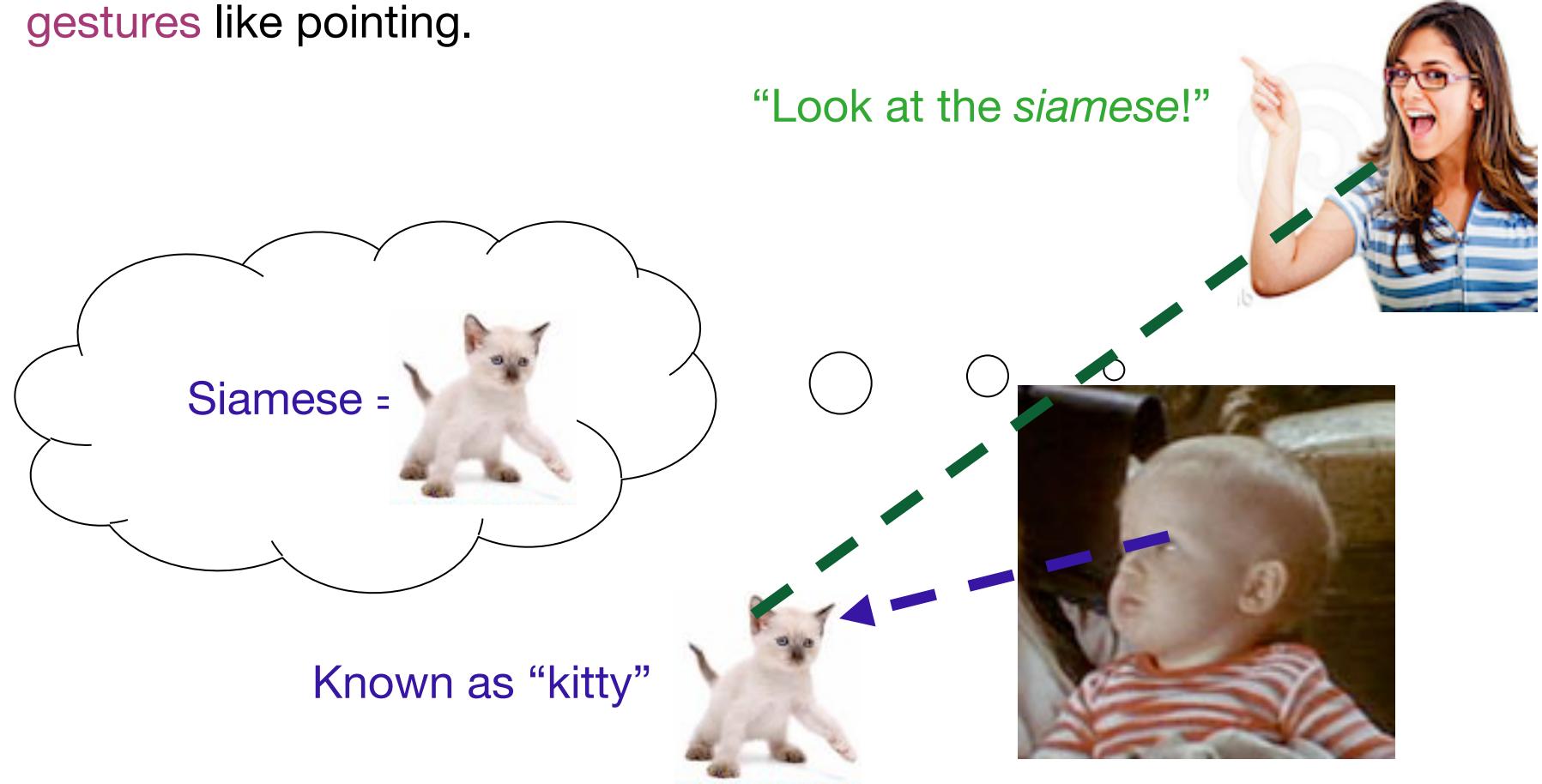


Some clues from the input

He & Arunchalam 2017

Social Cues

...though Iversen, Capirci, Longobardi, & Caselli (1999) found that **only 15% of parental utterances were accompanied by referential gestures like pointing.**



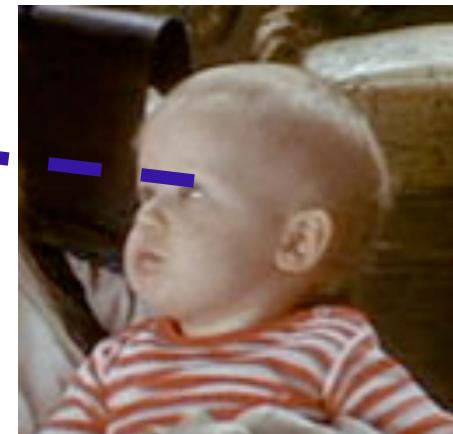
Some clues from the input + child-internal clues

He & Arunchalam 2017

Social Cues

Speaker social cues are important: Children tend pay attention to things that are in their mother's hands—this simple **attentional bias** can often lead them to choose items that have recently been manipulated, offered or touched.

(Yu & Smith 2013, Deák, Krasno, Triesch, Lewis, & Sepeta 2014)



Some clues from the input + child-internal clues

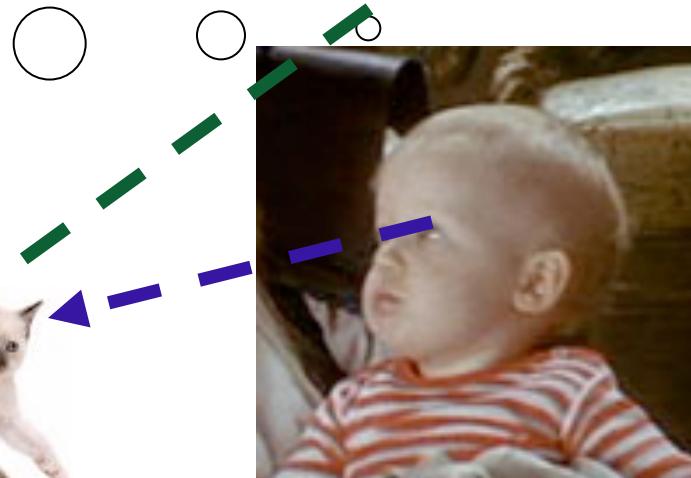
Young children prefer **discourse continuity**, where a label for an object is embedded between utterances about the same object (Horowitz & Frank 2013) and they learn novel object labels better this way (Schwab & Lew-Williams 2017).



Known as “kitty”



“How cute he is!
Do you see the *siamese*?
Look at his soft fur.”



Some clues from the input + child-internal clues

Young children prefer discourse continuity

Speakers generally talk to children about the here and now (Quine's problem is not nearly so serious in child-directed speech)

“Look at the *siamese!*”



(Not “I just took her to the vet yesterday. Poor thing’s been sick all of last week.”)

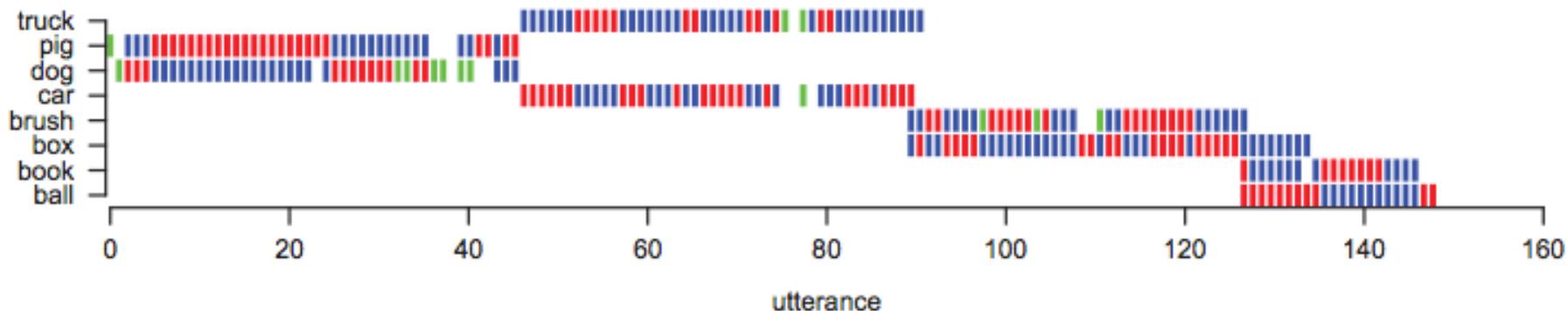
Some clues from the input + child-internal clues

Young children prefer discourse continuity

Speakers generally talk to children about the here and now (Quine's problem is not nearly so serious in child-directed speech). Also, they tend to talk about the same thing for awhile.

Frank, Tenenbaum, & Fernald 2012

Sample interaction between caretaker and child



Blue = object present but not mentioned

Green = object mentioned but not present

Red = object present and mentioned

Some clues from the input + child-internal clues

Discourse cues + Joint attention

These extended discourses result in toddlers and parents exhibiting greater sustained attention on objects, and greater coordination between their behaviors.

Suanda, Smith, & Yu 2016



Some clues from the input + child-internal clues

Non-linguisic cues + Joint attention

Highly informative environments, where it's easy for humans to guess the intended referent of the word **just from non-linguistic information**, involve "joint attention...and **clear visual signatures....especially temporal cues indicative of causation.**"

Yang 2019

temporal cues indicative of causation =
an agent causes something to happen at a particular time



Some child-internal clues

Whole-object assumption: new word refers to entire object, rather than some subset of it



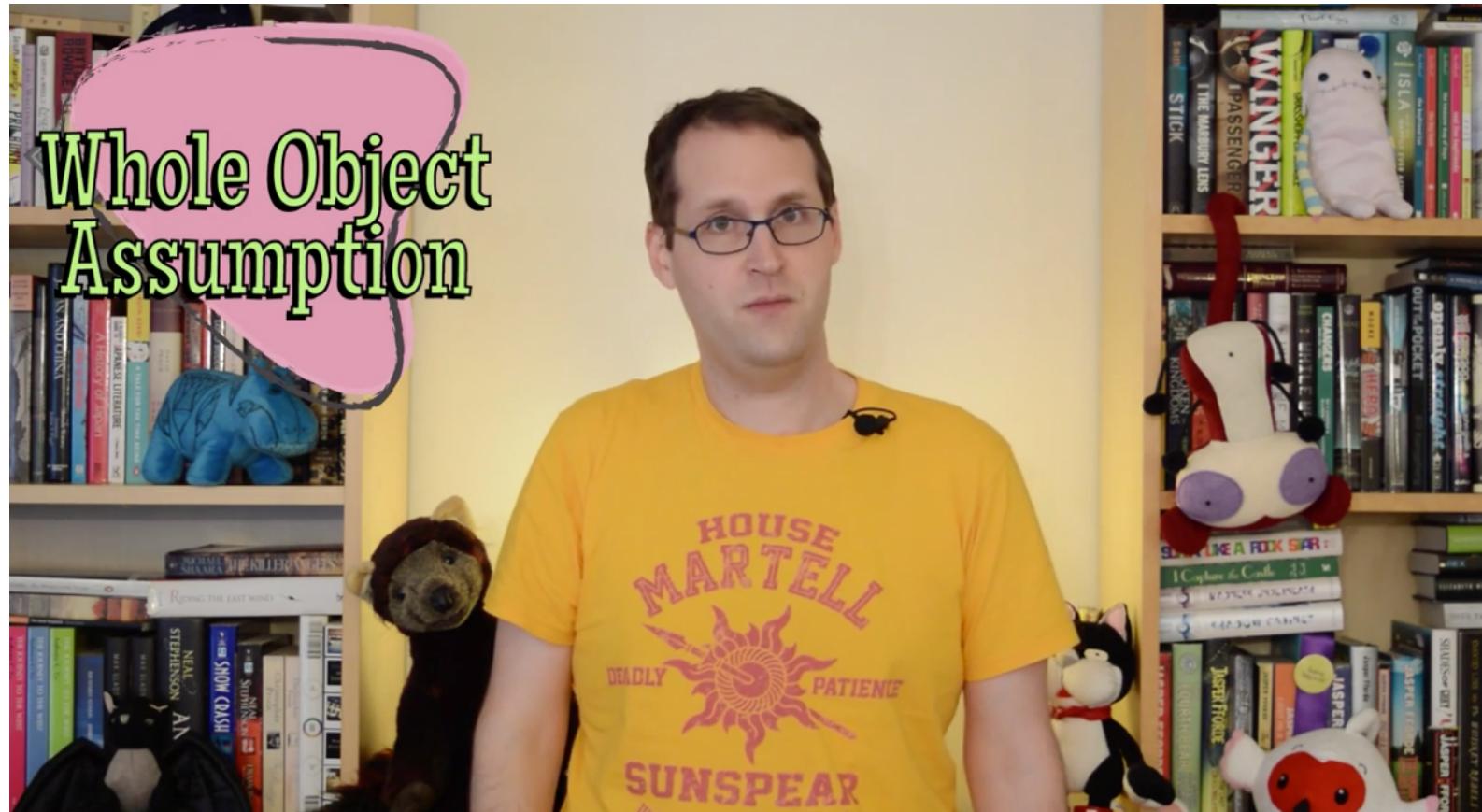
Whole-object assumption

[Extra]

<http://www.thelingspace.com/episode-35>

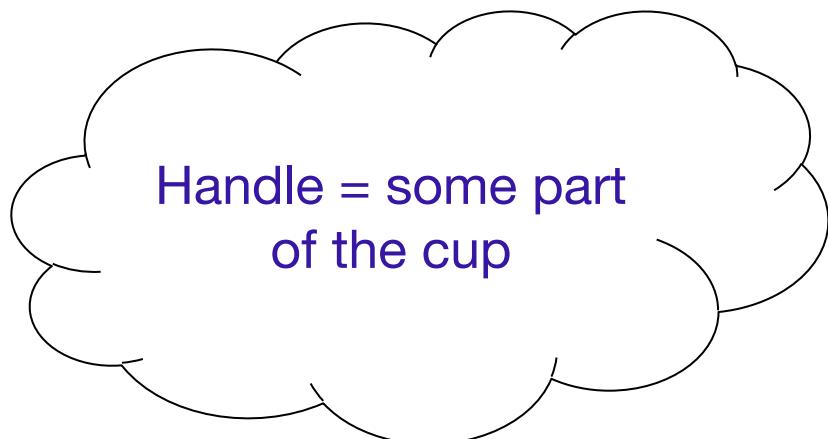
<https://www.youtube.com/watch?v=Ci-5dVVvf0U>

2:33 - 2:58



Some child-internal clues

Mutual-exclusivity assumption: assume new word does not overlap in meaning with known word (can be used to overcome whole-object assumption)



Known: cup



"Look! You can see the *handle*!"



Mutual-exclusivity assumption

[Extra]

<http://www.thelingspace.com/episode-35>

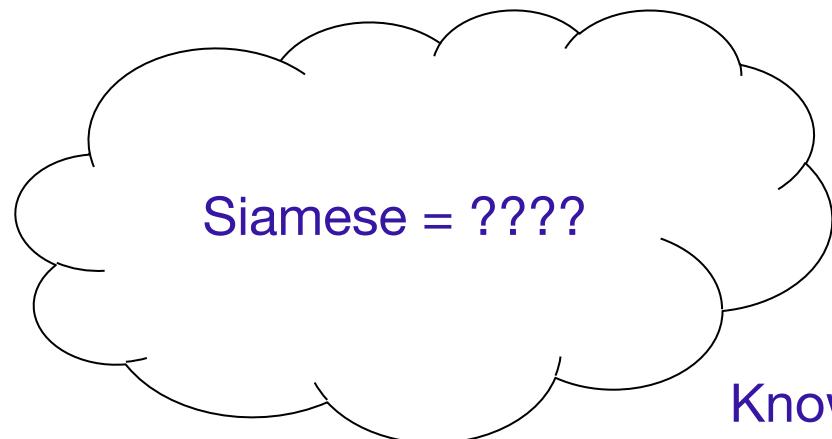
<https://www.youtube.com/watch?v=Ci-5dVVvf0U>

4:14 - 5:06



Some child-internal clues

Mutual-exclusivity assumption: assume new word does not overlap in meaning with known word (can be used to overcome whole-object assumption)...not without its own problems (overlapping labels for the same referent)



Known: kitty



"Look at the kitty! He's a *siamese*!"



Some child-internal clues

He & Arunchalam 2017

Social Cues

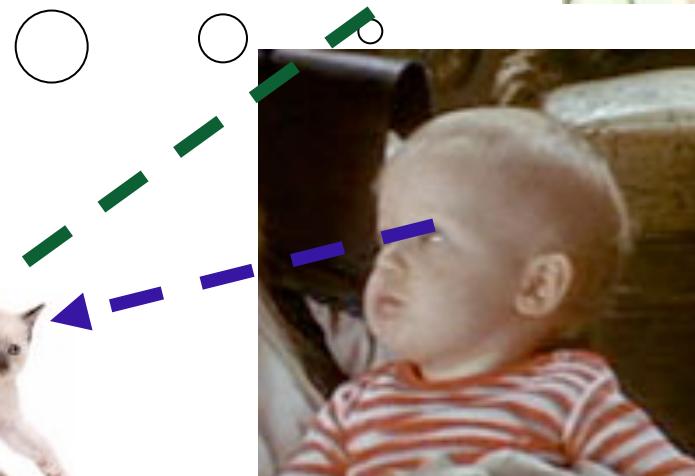
Speaker social cues are important: 4 and 5-year-olds will override mutual exclusivity when a speaker is pointing and having their gaze alternate between the child and the object - but not if those social cues aren't present (Kalashnikova, Mattock, & Monaghan 2015).



Known as “kitty”



“Look at the siamese!”



Some child-internal clues

Brody, Feiman, & Aravind 2024

Focus: A major clue to mutual exclusivity

"Focus" refers to the way we *emphasize* or *stress* certain words to signal some kind of contrast. "...when hearing the new word **spoken with focus**, [2-year-olds] thought it must refer to a new object 87 percent of the time."

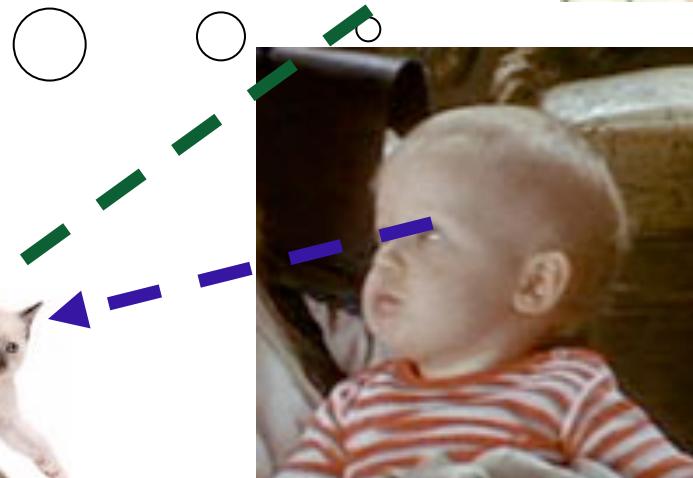
<https://www.sciencedaily.com/releases/2024/11/241121225852.htm>



Known as "kitty"



"Look at the *siamese*!"



Are humans the only ones who can guess word meaning this way?

No! Fast mapping is not unique to humans. Other animals, such as dogs, are capable of doing this too.



Fast mapping in non-humans: Border collies

Dogs can fast-map too.

Border collie fast mapping



[~4 minutes, up through 1:50 for demonstration of fast mapping]
(ABC News special)

<http://www.youtube.com/watch?v= 6479QAJuz8>

Border collies vs. humans

However, border collies don't generalize the same way some humans do
(van der Zee, Zulch, & Mills 2012, Jara-Ettinger et al. 2022).

For instance, English children and adults have a **shape bias** (van den Zee et al. 2012, Jara-Ettinger et al. 2022), where they prefer to extend the meaning of new nouns based on shape first.

If object 1 is a *dax*, objects 2, 3, 4, and 5 will be *daxes* too, but objects 6 and 7 will not be.

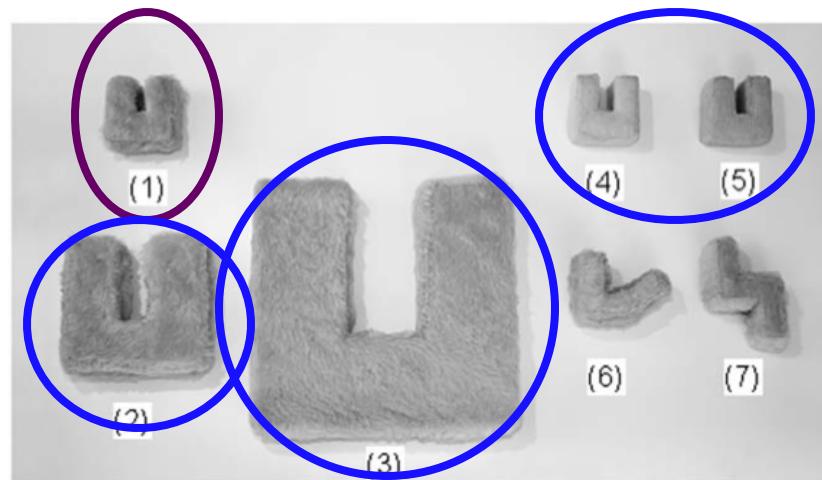


Figure 2. Objects used in experiments 2 and 4. Gable learnt to link the word *dax* with standard object 1: the DAX object (furry light blue 7.6 cm wide). He was asked to select a DAX from pairs of objects including the DAX, size changes 2 (15.2 cm) and 3 (30.4 cm), texture changes 4 (smooth) and 5 (rough), and shape changes 6 and 7.
doi:10.1371/journal.pone.0049382.g002

Border collies vs. humans

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(van der Zee, Zulch, & Mills 2012, Jara-Ettinger et al. 2022).

Border collies seem to have a **size bias**, where they extend the meaning of new nouns based on size first if they've only just learned the new noun.

If object 1 is a *dax*, objects 4, 5, 6, and 7 will be *daxes* too, but objects 2 and 3 will not be.

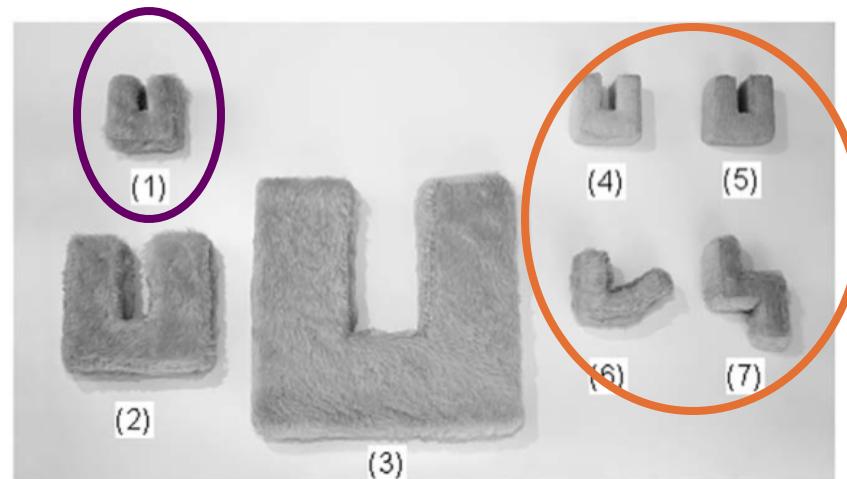


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Border collies vs. humans

However, border collies don't generalize the same way some humans do
(van der Zee, Zulch, & Mills 2012, Jara-Ettinger et al. 2022).

Border collies also seem to have a **texture bias**, where they extend the meaning of nouns based on texture first if the nouns are familiar.

Setup: Border collie has been trained that object 1 is a *dax* for 39 days, so this word is now familiar.

If object 1 is (a) *dax*, objects 2, 3, 6, and 7 will be *dax(es)* too, but objects 4 and 5 will not be.

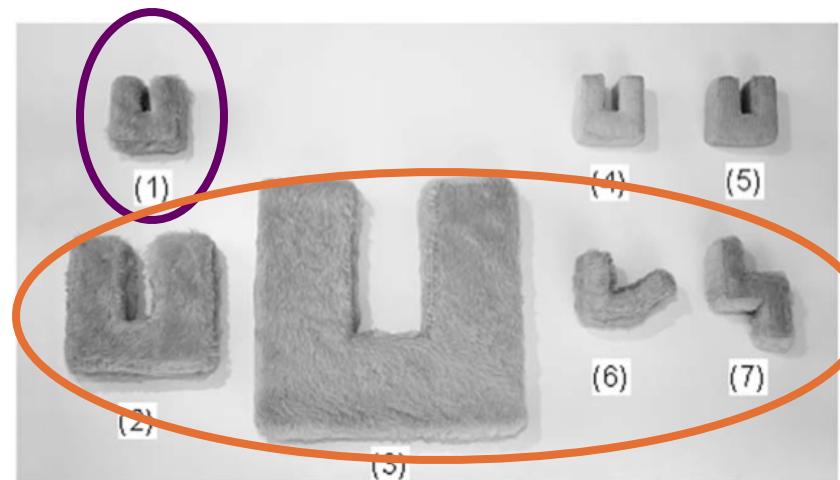


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What kinds of words
do kids figure out
the mapping for first?



From 0 to 50 words

Vocabularies of children with 50 or less words are heavily concentrated on experiences child has: names for people, food, body parts, clothing, animals, household items.

(In general, a lot of nouns = noun bias).



Braginsky, Yurovsky, Marchman, & Frank 2015, Frank, Braginsky, Yurovsky & Marchman 2017: large-scale analysis over tens of thousands of children in multiple languages confirming an “over-representation of nouns” in early vocabularies.



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Adults and older children have more variety, including more abstract nouns, as well as other syntactic categories like **prepositions** (*with, from*), **determiners** (*the, a*), and **adjectives** (*silly*).



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Vocabularies of children with 50 or less words are heavily concentrated on experiences child has: names for people, food, body parts, clothing, animals, household items.

(In general, a lot of nouns = noun bias).

But...there *is* some cross-linguistic variation in the preference for nouns over verbs in the early lexicon.

Korean, Japanese, and Mandarin children show less of a noun bias, though there still is something of a noun bias (Fernald & Morikawa 1991, Choi & Gopnik 1995, Tardif 1996, Tardif et al., 1999, Kim et al. 2000; Chan et al., 2011, Frank et al., 2021, Fitch et al. 2024).



From 0 to 50 words

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But...there *is* some cross-linguistic variation in the preference for nouns over verbs in the early lexicon.

Korean, Japanese, and Mandarin

These languages have several ways of making verb information more salient to learners: verbs appearing sentence-final (very prominent for children), nouns optionally omitted, verbs used more frequently overall, verbs used in ways that makes their meaning more apparent (“referential transparency”).



From 0 to 50 words

Vocabularies of children with 50 or less words are heavily concentrated on experiences child has: names for people, food, body parts, clothing, animals, household items.

(In general, a lot of nouns = noun bias).

Why might there be a preponderance of nouns in very early vocabularies?

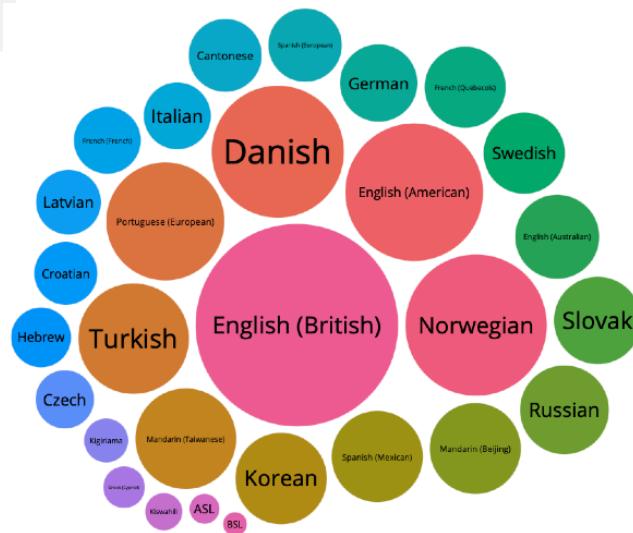


The preponderance of nouns

One idea: Due to “a shared core of concepts – e.g., social routines, important people, and some early foods and household animals – that are perhaps especially important for communication independent of their linguistic realization...there are certain semantic categories that are quite common in children’s earliest language.”



Essential meaning = learned earlier



The preponderance of nouns

One idea: Due to “a shared core of concepts – e.g., social routines, important people, and some early foods and household animals – that are perhaps especially important for communication independent of their linguistic realization...there are certain semantic categories that are quite common in children’s earliest language.”

But why nouns, instead of other word types that seem like they might be important for communication (e.g., verbs denoting actions like eat, help, give, want or go)?



The preponderance of nouns

One idea: the meaning of nouns is easier to identify than the meaning of other words, like verbs



kitty = ?



give = ?

Why nouns

There's a strong correlation between the first words children learn and how often the **objects** these words refer to appear in children's environments (**visual availability**).

Clerkin, Hart, Rehg, Yu, & Smith 2016

<https://www.sciencedaily.com/releases/2016/12/161206111633.htm>

“...suggests **visual experience** is doing the heavy lifting in very early word learning.”



Why nouns

Often there may **only be a few objects in clear view of the child**, as opposed to all the different potential referents an adult sees.

Pereira Smith & Yu 2014,
Zhang & Yu 2016, Samuelson
& McMurray 2017

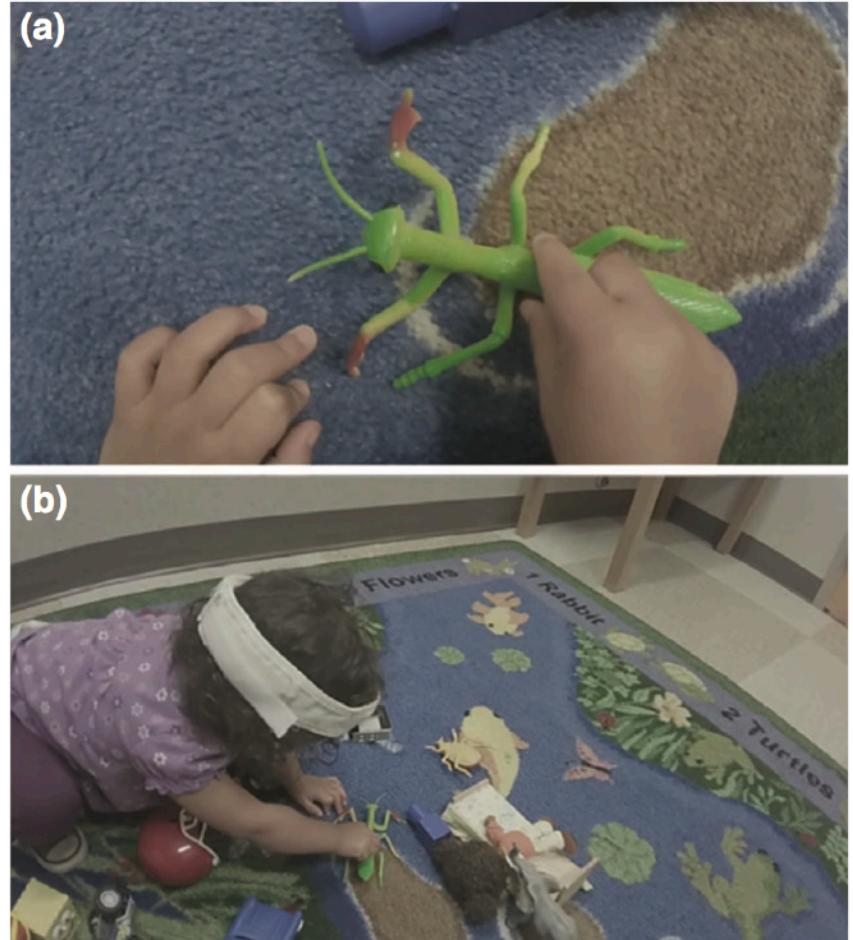
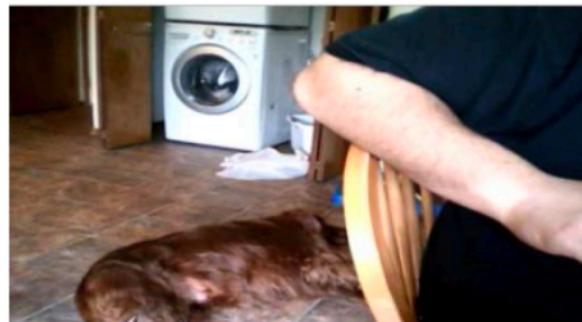


FIGURE 2 | Differences in the number of namable objects in view from the child's (a) and parent's (b) perspective.

Why nouns

Clerkin & Smith 2019



Also, children seem to learn the names of things that are often visually present earlier.

shirt spoon
table toy
dog

Why nouns

Referential certainty...and other helpful properties

Swingley & Humphrey 2017 (on things children can see and touch):

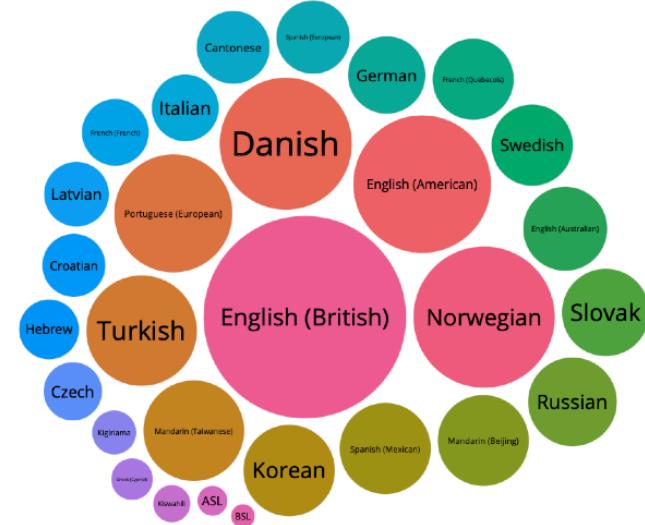
Comprehension (at 12 and 15 months) and production (15 months) were predicted by frequency, frequency of occurrence in one-word utterances, **concreteness**, utterance length, and typical duration.



Why nouns

Referential certainty...and other helpful properties

Frank, Braginsky, Yurovsky, & Marchman 2017, Tan, Loukatou, Braginsky, Mankowitz, & Frank 2024 (on **things children can see and touch**): Across languages, words are likely to be understood and produced by more children if they are more frequent, **more concrete**, more associated with babies, shorter, and appear in shorter utterances.



The preponderance of nouns

How do we test if it's true that the meaning of nouns is easier to learn from observation than other word types, like verbs?

Snedeker, Gleitman, & Brent (1999) asked adult speakers (who are presumably “cognitively mature”) to view scenes of what mothers are saying to their children and see which words they could learn.



Experiment with English speakers (Snedeker, Gleitman, and Brent 1999)

Stimuli preparation

1. Videotape English speaking mothers playing with their 18- to 24-month-old children
2. Transcribe video tape for mothers' 24 most frequent nouns and 24 most frequent verbs.
3. For each of the most frequent words, randomly select 6 uses of the word.
4. Edit each instance for 40 second clips. Audio was removed and a beep is sounded at instant word uttered.

Subject's Task: Identify the “mystery word” represented by the beep.



watch clip #1
Guess word.



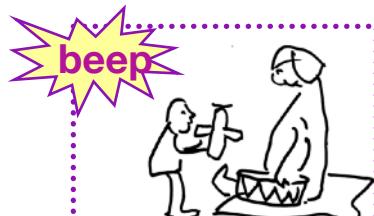
watch clip #2
Guess word again.



watch clip #3
Guess word again.



watch clip #4
Guess word again.



watch clip #5
Guess word again.



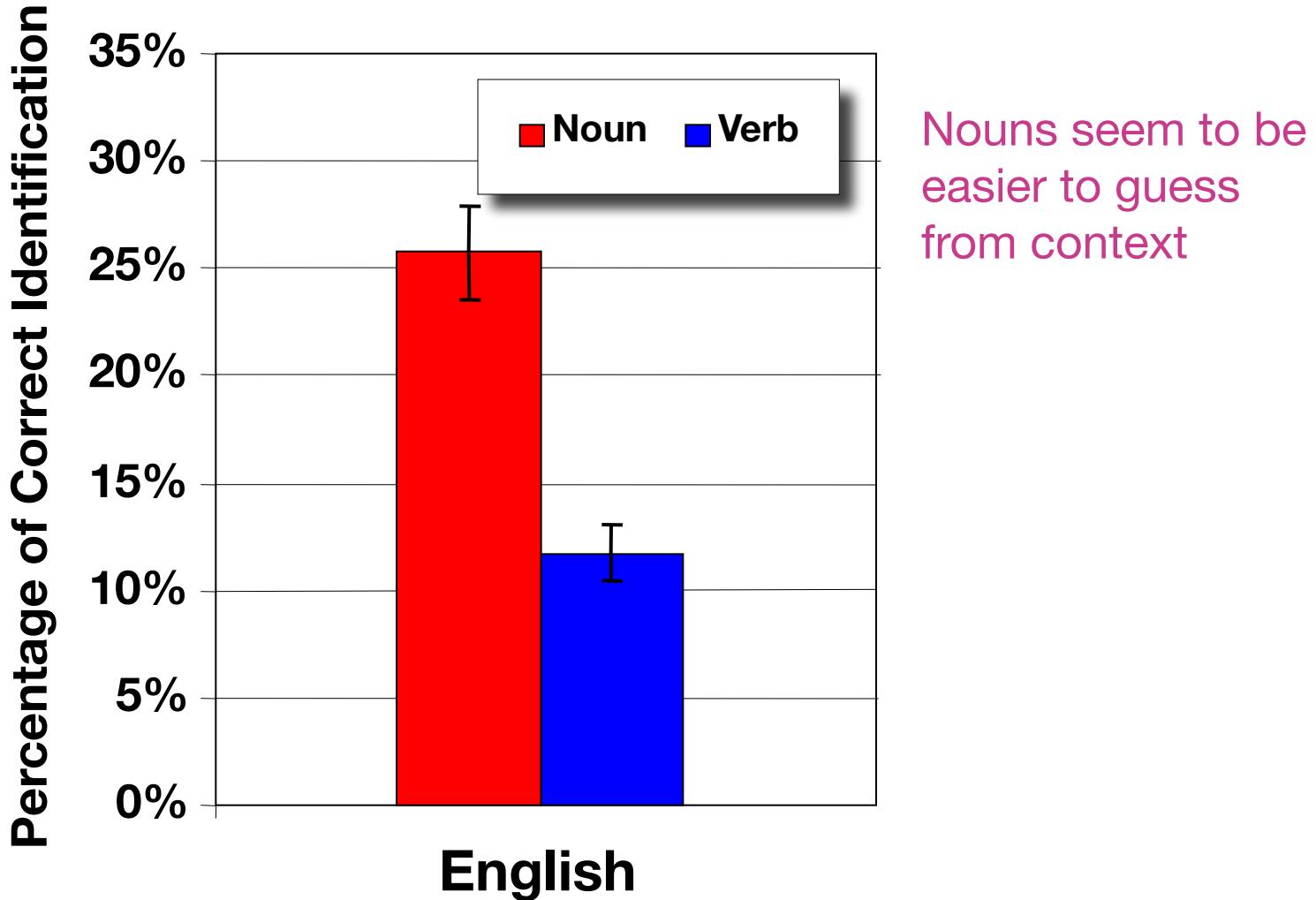
watch clip #6
Guess word again.

Final guess

On to next mystery word

Percent correct identification in English

Snedeker, Gleitman, and Brent (1999)



Recap: Children's lexical development

Children understand more than they say.

Children face a mapping problem: how to connect a spoken form (like a word) to its intended meaning. The context often underspecified the meaning.

Often, children make mistakes by either assigning a narrower or wider meaning to a word than adults do. Eventually, through experience with the language, they home in on the correct meaning.

Children have a variety of biases that help them guess word meanings from context.

Children across languages typically have more nouns in their early vocabularies, This may be due to how easy it is to infer a noun's meaning from the context.

Questions?



You should be able to do up through question 15 on HW4, and up through question 18 on the lexical & morphological acquisition review questions.