Ling 51/Psych 56L: Acquisition of Language

Lecture 11

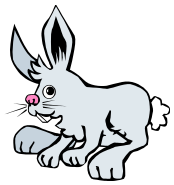
Lexical development III

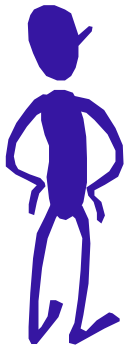
Announcements

Be working on HW4 (due 11/10/16)

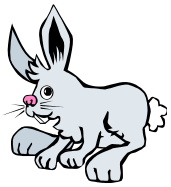
- Note: Remember that working in a group can be very beneficial.

Be working on the lexical development review questions





What does "gavagai" mean?



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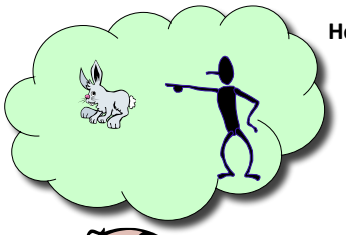
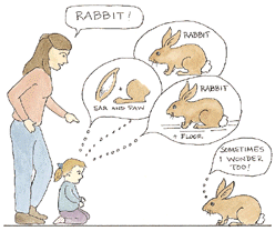


Rabbit?
Mammal?
gray rabbit?
Animal?
Carrot eater?
vegetarian?
Ears?
Long ears?
Is it gray?
Fluffy?
What a cutie!

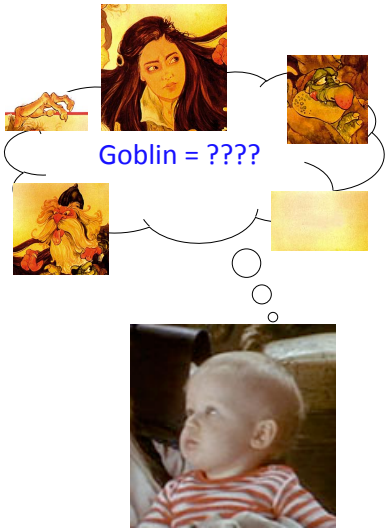
Thumping
Hopping
Scurrying
Stay!
Look!
Meal!
Rabbit only until eaten!
Cheeks and left ear!
That’s not a dog!

Same problem the child faces



A little more context…

“Look! There’s a goblin!”



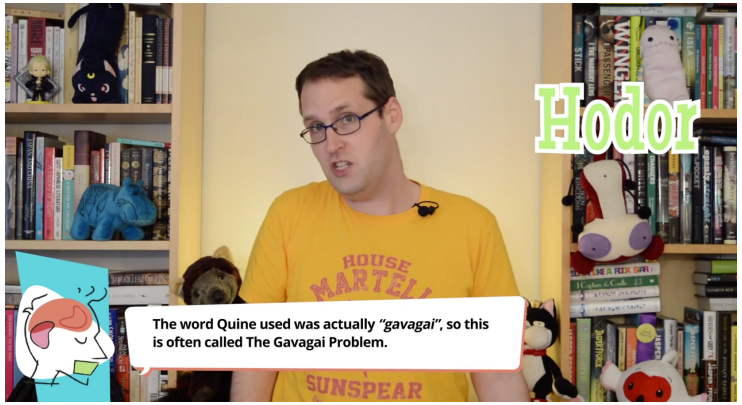
The mapping problem

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.

The mapping problem

http://www.thelingspace.com/episode-35
https://www.youtube.com/watch?v=Ci-5dVVvf0U
2:04 - 2:32



So how do children figure it out? Obviously, they do….

One solution: 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

(Carey & Bartlett 1978, Dollaghan 1985, Mervis & Bertrand 1994, Medina, Snedecker, Trueswell, & Gleitman 2011)

ball

bear

kitty

[unknown]

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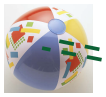
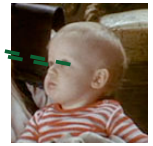
ball 

bear

kitty

"Can I have the ball?"

[unknown]



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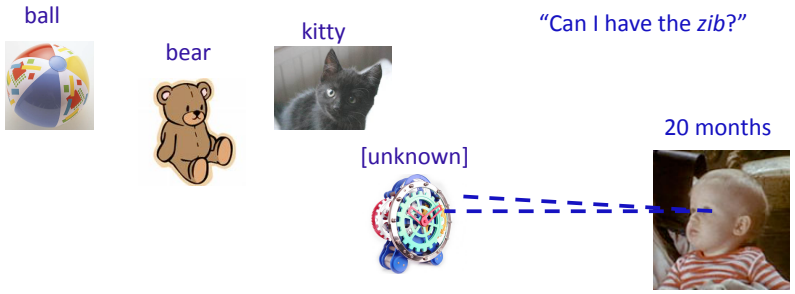


One solution: Fast mapping

However, fast mapping is not something unique to humans. Other animals, such as dogs, are capable of doing this too.

Border collie fast mapping

[~6 minutes, up through 2:15 for demonstration of fast mapping]

(National Geographic video)

http://www.youtube.com/watch?v=D7Tyig9Azlk

[~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

Notably, however, border collies don't generalize the same way humans do (van der Zee, Zulch, & Mills 2012).

Humans have a shape bias, where they 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.

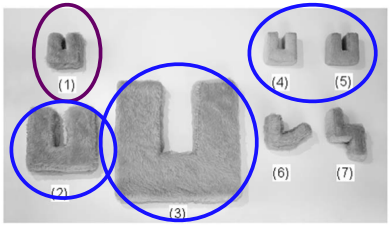


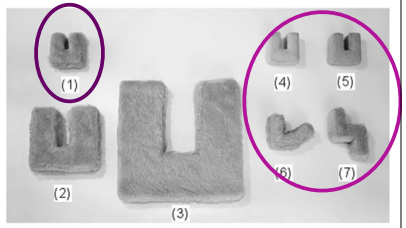
Figure 2. Objects used in experiments 2 and 4. Gable learnt to link the word *dax* with standard object 1: the DAX object (furry light blue 7.6 cm wide). He was asked to select a DAX from pairs of objects including the DAX, size changes 2 (15.2 cm) and 3 (30.4 cm), texture changes 4 (smooth) and 5 (rough),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

Border collies vs. humans

Notably, however, border collies don't generalize the same way humans do (van der Zee, Zulch, & Mills 2012).

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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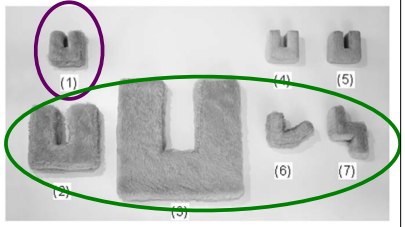
Border collies vs. humans

Notably, however, border collies don't generalize the same way humans do (van der Zee, Zulch, & Mills 2012).

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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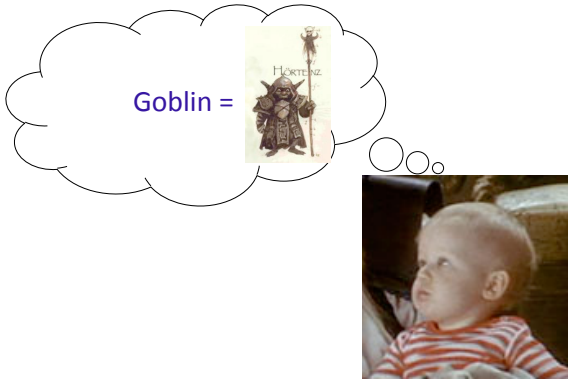
Back to human learning…

Knowing what to guess

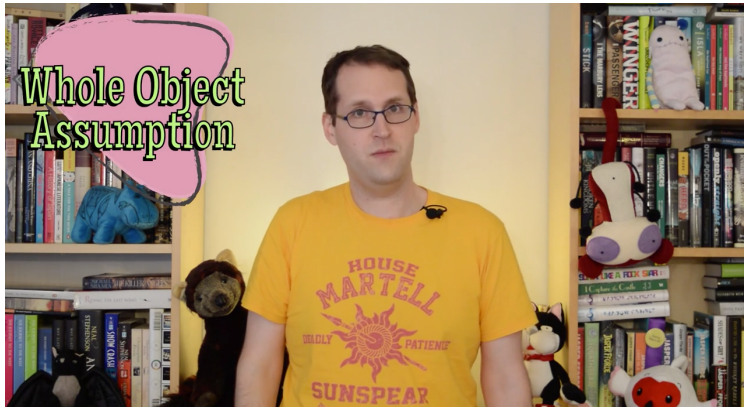
Lexical constraints

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



Whole-object assumption

http://www.thelingspace.com/episode-35
https://www.youtube.com/watch?v=Ci-5dVVvf0U
2:33 - 2:58



Knowing what to guess

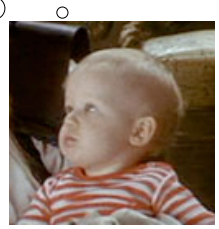
Lexical constraints

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

Handle = some part of the cup

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

Known: cup



Mutual-exclusivity assumption

http://www.thelingspace.com/episode-35
https://www.youtube.com/watch?v=Ci-5dVVvf0U
4:14 - 5:06

Knowing what to guess

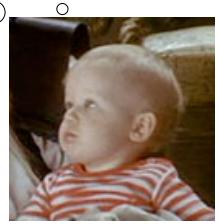
Lexical constraints

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)

Siamese = ????

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

Known: kitty



Knowing what to guess

Lexical constraints

Mutual-exclusivity assumption: Seems to be driven by infant preference to look for novelty (relates to dislike for overlapping meaning, which would be familiar rather than novel). 22-month-olds specifically look for novel objects first when given an unfamiliar label (Mather & Plunkett 2012).

zib =

"Look at the *zib*! It's so pretty!"

Unknown name, but familiar toy

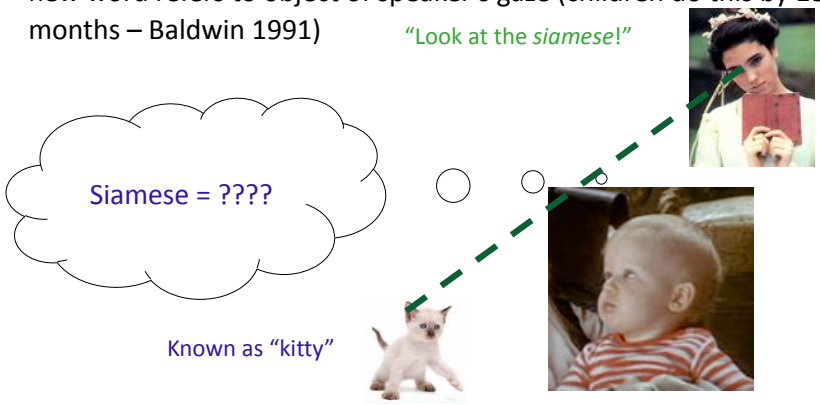
Unknown name & novel

Knowing what to guess

Social Cues

Speakers will look at the novel thing they're talking about: assume new word refers to object of speaker's gaze (children do this by 18 months – Baldwin 1991)

"Look at the *siamese*!"



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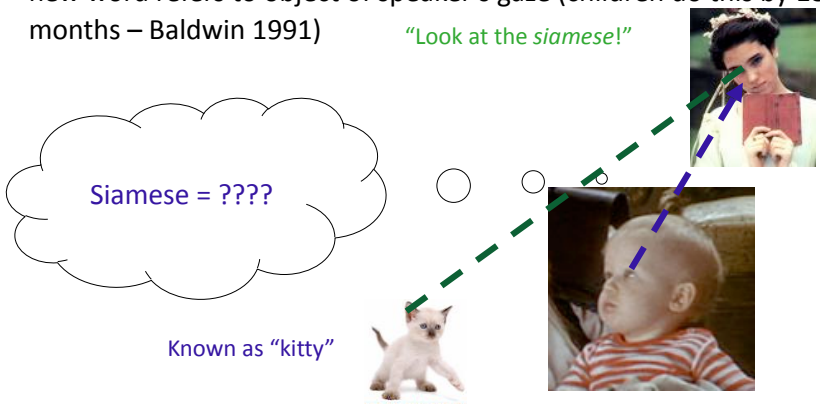

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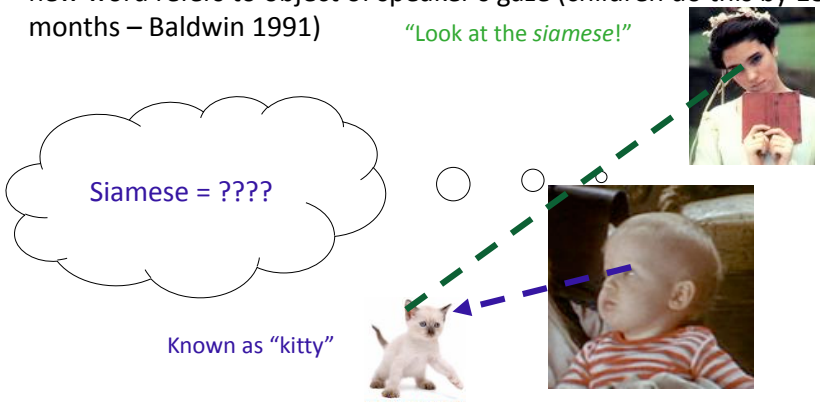

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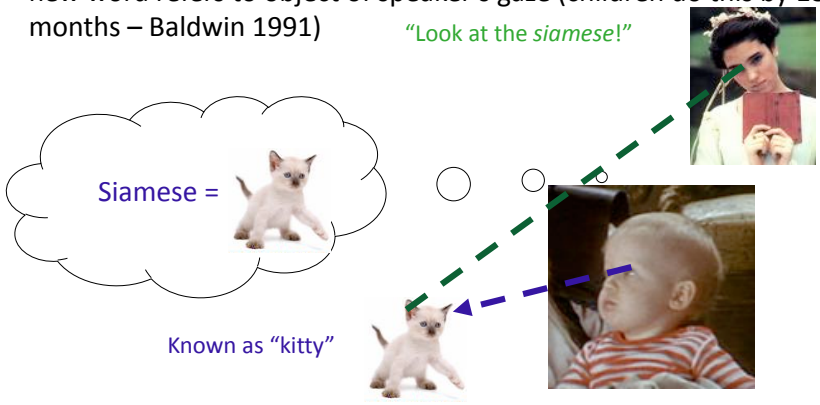
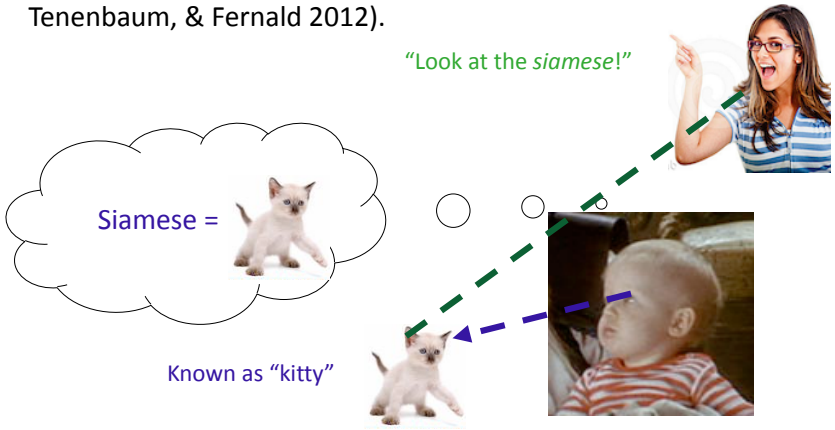


Knowing what to guess

Social Cues

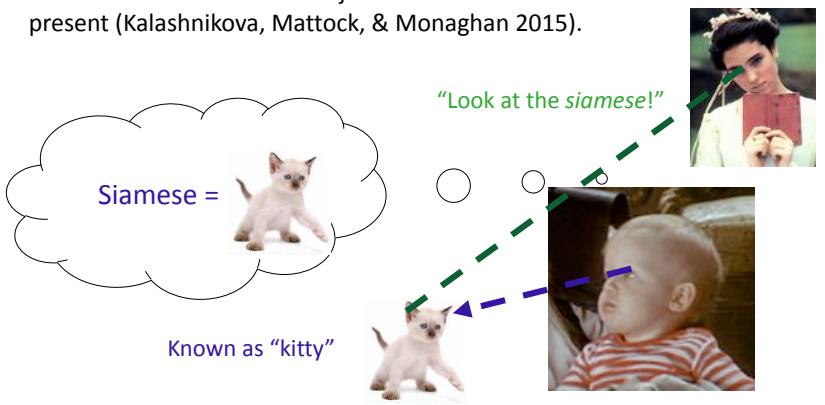
Pointing is an even better cue about the intended referent (Frank, Tenenbaum, & Fernald 2012).



Knowing what to guess

Social Cues

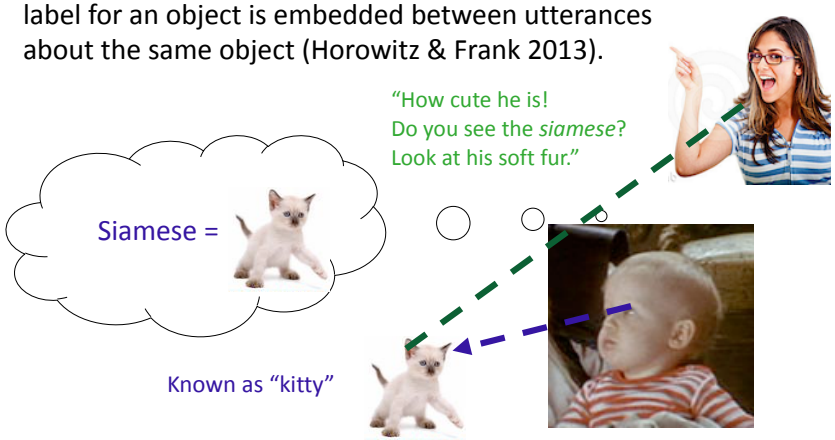
Speaker social cues are important: 4 and 5-year-olds will override mutual exclusivity when a speaker is pointing and having their gaze alternate between the child and the object - but not if those social cues *aren't* present (Kalashnikova, Mattock, & Monaghan 2015).



Knowing what to guess

Discourse Cues

Young children prefer discourse continuity, where a label for an object is embedded between utterances about the same object (Horowitz & Frank 2013).



Knowing what to guess

Clues from the input

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.")

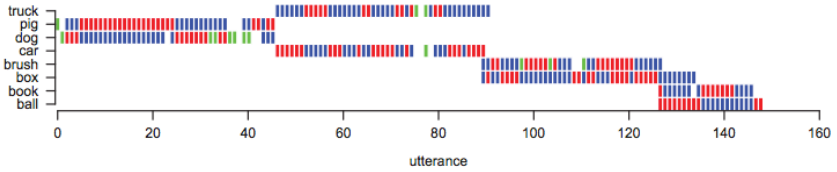
Knowing what to guess

Clues from the input

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



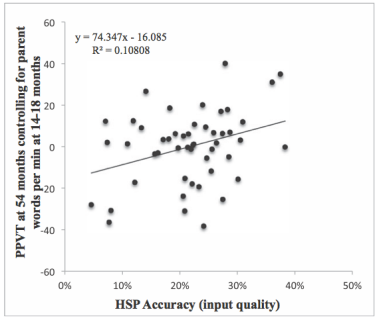
Blue = object present but not mentioned
Green = object mentioned but not present
Red = object present and mentioned

Knowing what to guess

Referential certainty

Cartmill, Armstrong, Gleitman, Goldin-Meadow, Medina, & Trueswell 2013 (the utility of talking about the here and now): How easy it is to infer the referent from the surrounding environment (using visual or social cues) predicts vocabulary size up to three years later.

Effect of quality of early input at 14–18 months on child comprehension vocabulary at 54 months. Each point represents a single family (n = 50).



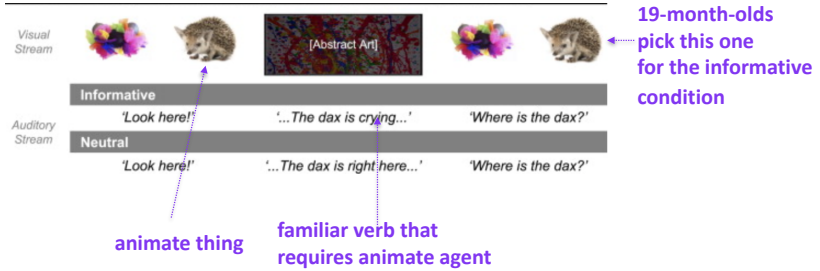
Knowing what to guess

Clues from the input

19-month-olds can use known words (like "crying") to figure out unknown words.

Ferguson, Graf, & Waxman 2014

Sample test scenario, where only animate things can cry



Knowing what to guess

Clues from the input

Speakers also sometimes provide explicit correction for meaning, and provide additional information about the word's meaning.

"Can I see the bugs again?"

"Those are goblins, honey, not bugs. Goblins live in the Labyrinth and occasionally take naughty children away."

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

"What colors are these?"

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

"red" "yellow" "green" "green" "blue"

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

"a blue tray"

"a *chromium* tray"

Note: none of the children knew either the word "olive" as a color or the word "chromium" as a property

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

"Bring me the chromium tray; not the blue one, the chromium one."

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

Children learned to give the olive tray.

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

5 weeks later…

"What colors are these?"

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

5 weeks later…

"red" "yellow" "green" ???? "blue"

Via input (contrast with blue), children figured out that "chromium" referred to a color the same way that blue does…

"I don't know"

[other previously unused color term like "gray"]

Carey & Bartlett 1978

Children can use input to figure out which aspect of their experience is being lexicalized

5 weeks later…

"red" "yellow" "green" ???? "blue"

…and also that the dark green-ish color had a different name from "green"

"I don't know"

[other previously unused color term like "gray"]

Knowing what to guess

Clues from the syntactic structure

Different grammatical categories (nouns, verb, etc.) tend to have different meanings. Once children have identified some grammatical categories (after ~14 months), they can use the syntactic structure (how words appear together) as a clue to meaning.

"Those are goblins."

goblins = noun

nouns = objects

goblins =

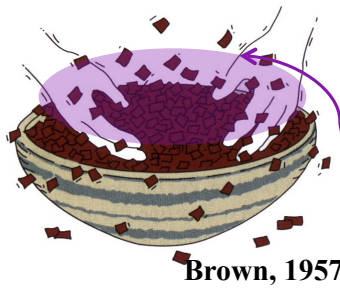
Using syntactic structure

http://www.thelingspace.com/episode-35
https://www.youtube.com/watch?v=Ci-5dVVvf0U
5:07 - 6:19

Knowing what to guess

Clues from the syntactic structure

He's sebbing!



seb = verb

verb = action

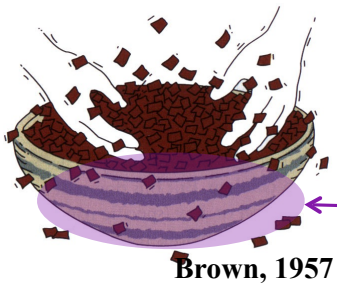
seb

Brown, 1957

Knowing what to guess

Clues from the syntactic structure

Look – a seb!



seb = noun with "a"

noun = countable object like "bowl"

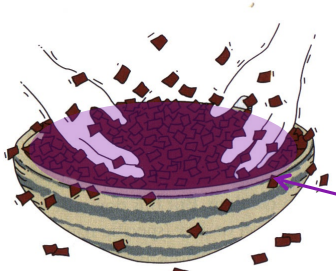
seb

Brown, 1957

Knowing what to guess

Clues from the syntactic structure

Look – some seb!



seb = noun with "some"

noun = mass substance like "stuff"

seb

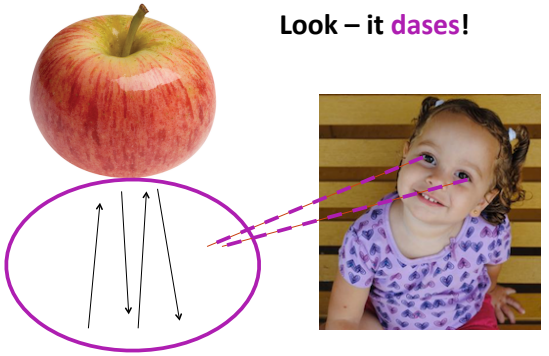
Brown, 1957

Knowing what to guess

Clues from the syntactic structure

Bernard et al. 2007: 23-month-olds are able to do the same thing.

Look – it dases!



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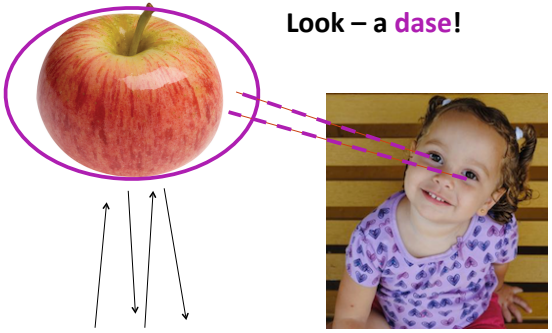
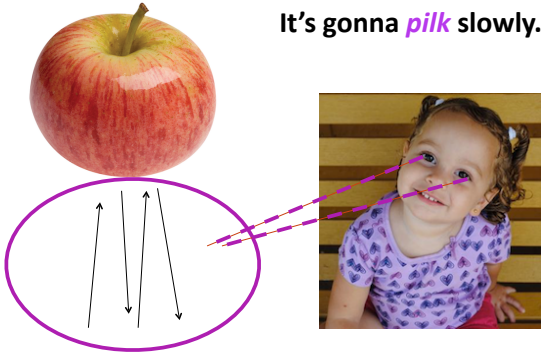


Knowing what to guess

Clues from the syntactic structure

Syrett, Arunachalam, & Waxman 2014: 27-month-olds can use adverbs like "slowly" to focus on the parts of the observed event that matter for verb meaning.

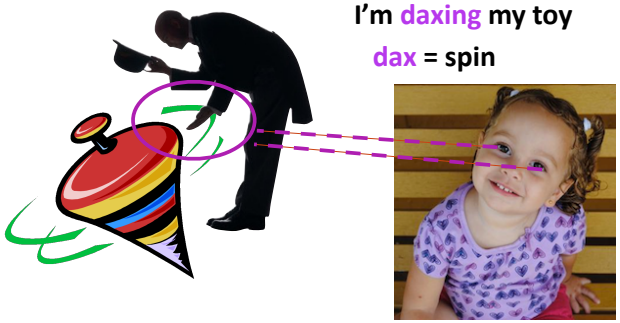
It's gonna *pilk* slowly.



Knowing what to guess

Clues from the syntactic structure

Klein & Snedeker 2015: 2-year-olds can use the words surrounding a verb to determine what kind of action it encodes



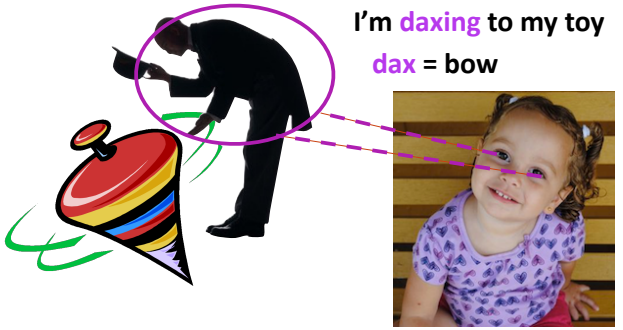
I'm daxing my toy

dax = spin

Knowing what to guess

Clues from the syntactic structure

Klein & Snedeker 2015: 2-year-olds can use the words surrounding a verb to determine what kind of action it encodes



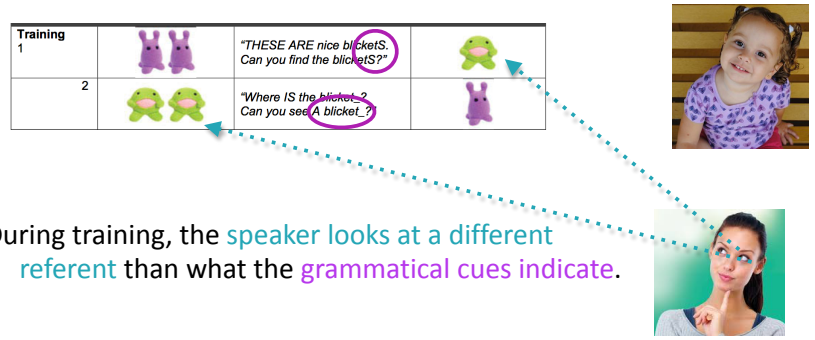
I'm daxing to my toy

dax = bow

Knowing what to guess

Clues from the syntactic structure

Paquette-Smith & Johnson 2016: 2-year-olds already rely on some grammatical cues more than eye gaze in cases of ambiguity.

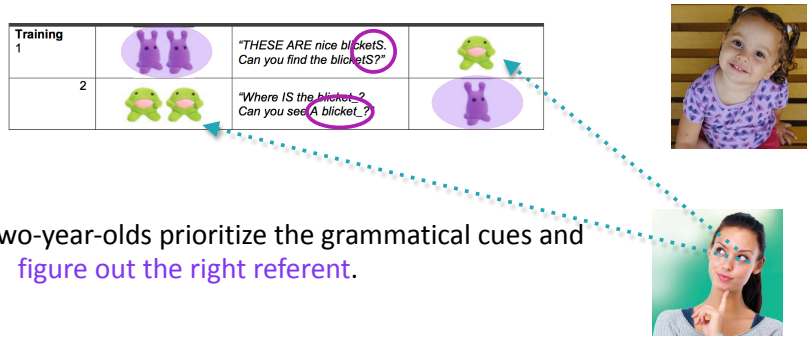


During training, the speaker looks at a different referent than what the grammatical cues indicate.

Knowing what to guess

Clues from the syntactic structure

Paquette-Smith & Johnson 2016: 2-year-olds already rely on some grammatical cues more than eye gaze in cases of ambiguity.



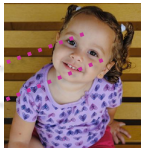
Two-year-olds prioritize the grammatical cues and figure out the right referent.

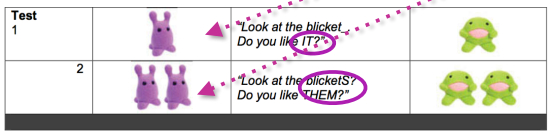
Knowing what to guess

Clues from the syntactic structure

Paquette-Smith & Johnson 2016: 2-year-olds already rely on some grammatical cues more than eye gaze in cases of ambiguity.

We can see this because they look to the correct referent when we test them afterwards (and the grammatical cues are again present).





Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Naigles (1990): 2-year-olds can use syntactic structure to guess aspects of word meaning, including the difference between transitive and intransitive verbs

Transitive: The rabbit is gorping the duck.
(expectation: rabbit is doing something to the duck)

Intransitive: The rabbit and the duck are gorping.
(expectation: rabbit and duck doing actions separately)

Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Yuan & Fisher (2009), Scott & Fisher (2009), Messenger, Yuan, & Fisher (2015) : 2-year-olds can keep track of the syntactic structures in which a verb appears and use that to infer a verb's meaning.

Transitive dialogue — Example verb: kiss
A: Guess what? Jane blicked the baby!
B: Hmm. She blicked the baby?
A: And Bill was blicking the duck.
B: Yeah, he was blicking the duck.

Intransitive dialogue — Example verb: sneeze
A: Guess what? Jane blicked!
B: Hmm. She blicked?
A: And Bill was blicking .
B: Yeah, he was blicking.

Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Yuan & Fisher (2009), Scott & Fisher (2009), Messenger, Yuan, & Fisher (2015) : 2-year-olds can keep track of the syntactic structures in which a verb appears and use that to infer a verb's meaning.

Causal dialogue — Example verb: melt
A: Matt dacked the pillow.
B: Really? He dacked the pillow?
A: Yeah. The pillow dacked.
B: Right. It dacked.

Unspecified-object dialogue — Example verb: eat
A: Matt dacked the pillow.
B: Really? He dacked the pillow?
A: Yeah. He dacked.
B: Right. He dacked.

Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Gertner, Fisher, & Eisengart (2006): even before children are 2 years old, they know the subject of an English sentence should be the one doing the action (the agent)

Wugs hug blicks.

(expectation: the ones doing the hugging are wugs)

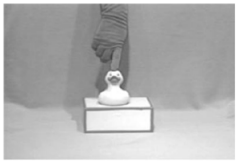
Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Fisher, Klingler, & Song (2006)

Noun context:

This is acorp.



Training: This is acorp (my box)!

Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Fisher, Klingler, & Song (2006)

Preposition context:

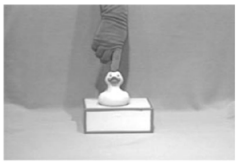
This is acorp my box.

Training: This is acorp (my box)!

Knowing what to guess

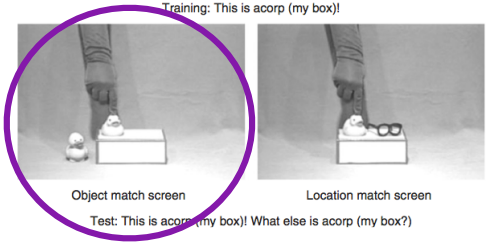
Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Fisher, Klingler, & Song (2006)



Training: This is acorp (my box)!

At test, those trained with the noun-context (this is acorp) looked at the object match (inferred it was an object) when asked "What else is acorp?"



Object match screen

Location match screen

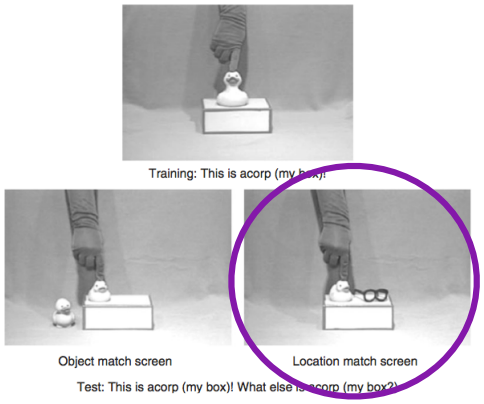
Test: This is acorp (my box)! What else is acorp (my box?)

Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Fisher, Klingler, & Song (2006)

At test, those trained with the preposition-context (this is acorp my box) looked at the location match (inferred it was a relationship between objects) when asked "What else is acorp my box?"



Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Cauvet et al. 2014: 18-month-old children recognize that determiners (like *the*) precede nouns (like *ball*) and pronouns (like *I*) precede verbs (like *eat*).

Knowing what to guess

[Extra]

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Gordon (2003): 10-month-old children are sensitive to the fact that events (which we indicate with verbs) have key participants (which correspond to subjects and objects in adult language). This is the precursor to realizing the mapping from sentence form to meaning.

Knowing what to guess

[Extra]

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Goldin-Meadow & Mylander (1998): Children seem to naturally translate their prelinguistic understanding of events into linguistic structures. Studies of deaf children who are forced to create their own home-sign systems show that they systematically use syntactic position to signal semantic roles like agent.

Knowing what to guess

Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Alishahi & Pyykkönen (2011): The ability to track and combine multiple contexts of a word and infer its meaning seems to work much better for verbs than for nouns, given realistic child-directed speech (the Brown corpus from the CHILDES database). A&P speculate that this may be because nouns are not as dependent on syntactic context in order to learn their meaning (for example, nouns may be observable objects).

Getting a sense of how a child might feel

From *But n Ben A-Go-Go*, Matthew Fitt (2000), p.85

But his hert cawed him on. He nou had the information he had been tryin tae jalouse on his ain aw these years. Or pairt o it onywey. A whusper. A hauf truth. An the time had come tae mak siccar. He would meet with Broon an tak fae him whit wis needed.

Some contextual clues available (syntactic bootstrapping + known words).

Getting a sense of how a child might feel

From *But n Ben A-Go-Go*, Matthew Fitt (2000), p.85

But his heart called him on. He now had the information he had been trying to jalouse on his ain all these years. Or part of it anyway. A whisper. A half truth. And the time had come to make siccar. He would meet with Broon and take fae him what was needed.

Add in knowledge of "near-words" that sound close to recognizable words.

Remaining: jalouse, ain, siccar, fae?

Getting a sense of how a child might feel

From *But n Ben A-Go-Go*, Matthew Fitt (2000), p.85

But his heart called him on. He now had the information he had been trying to jalouse on his own all these years. Or part of it anyway. A whisper. A half truth. And the time had come to make siccar. He would meet with Broon and take from him what was needed.

Guess common words by their position in the sentence (syntactic bootstrapping).

Still remaining: jalouse, siccar?

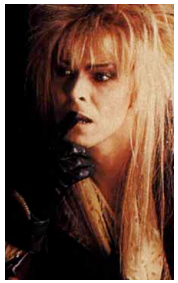
What are your guesses as to what these words mean? Why?

Lexical development recap

Children have to figure out what concept a word refers to. They may have different learning strategies they use when hearing a word for a first time, such as the whole-object assumption and mutual-exclusivity assumption. While these are helpful, they may lead to errors sometimes.

Children may benefit from a number of different sources of information, including social knowledge, discourse knowledge, and knowledge of syntactic structure.

Questions?



You should be able to do all the questions on HW4 and all the review questions for lexical development.