LSci 51/Psych 56L: Acquisition of Language

Lecture 14

Lexical development III

Announcements

Be working on HW4 (due 11/5/21)

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

Be working on the lexical development review questions

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

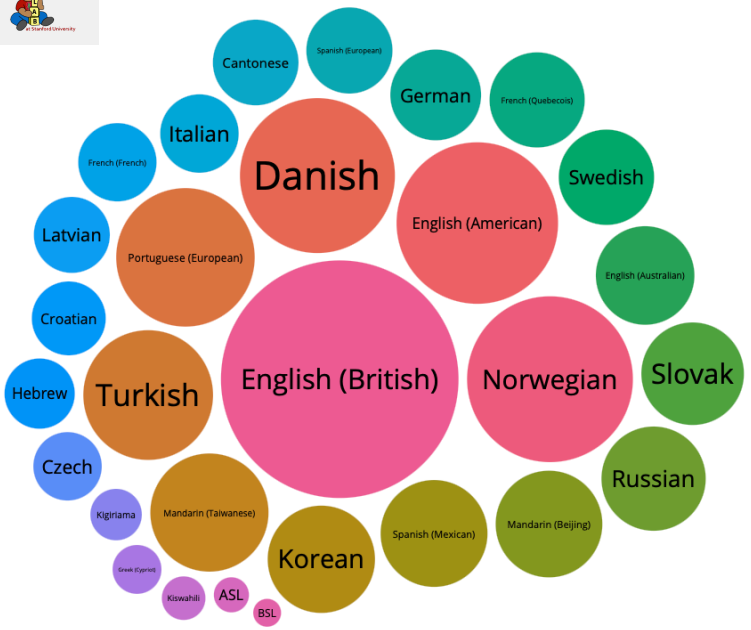
Similar words appear in the first 10 words across languages, consisting primarily of important family members (*mommy*, *daddy*, *grandma*), social routines (*hi*, *bye*, *peekaboo*), and sounds (*yum yum*, *vroom*, *woof woof*).

From 0 to 50 words

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.



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).

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*).

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?

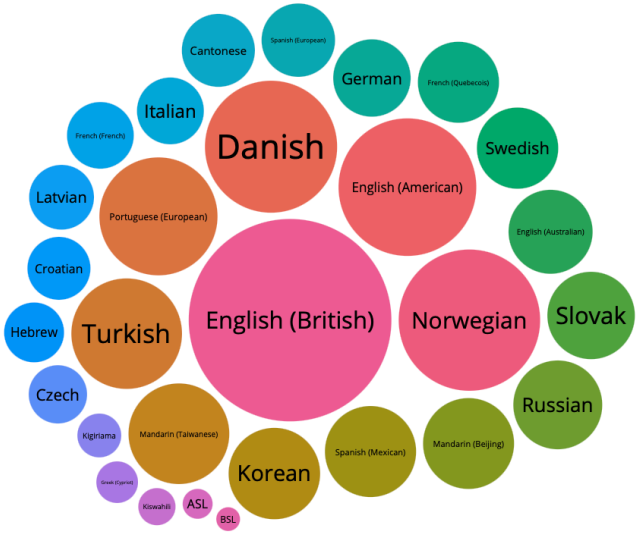
The preponderance of nouns

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.”

Wordbank

An open database of children's vocabulary development

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 = ?

The preponderance of nouns

How do we test if it's true that the meaning of nouns is easier to learn from observation than the meaning of 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

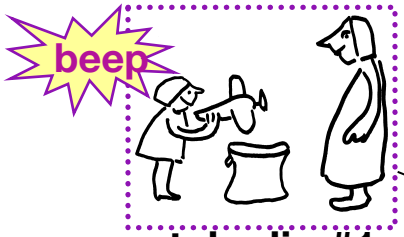
1. Videotape English speaking mothers playing with their 18- to 24-month-old children

2. Transcribe video tape for mothers' 24 most frequent nouns and 24 most frequent verbs.

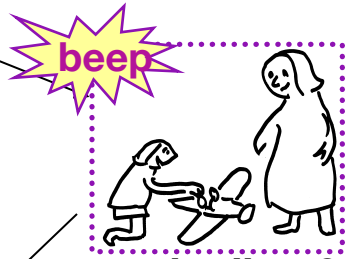
3. For each of the most frequent words, randomly select 6 uses of the word.

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

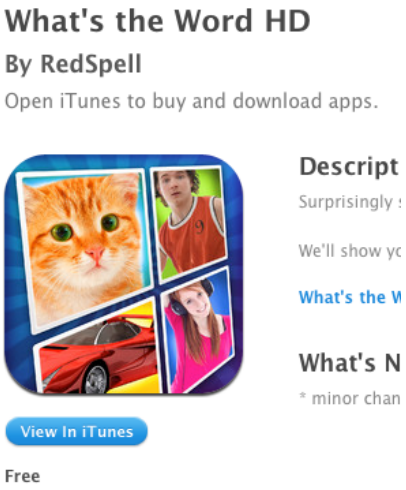
Human Simulation Paradigm ("Guess the mystery word")

http://sites.sinauer.com/languageinmind/wa05.01.html
Videos 3-10

Getting a sense of noun information in scenes

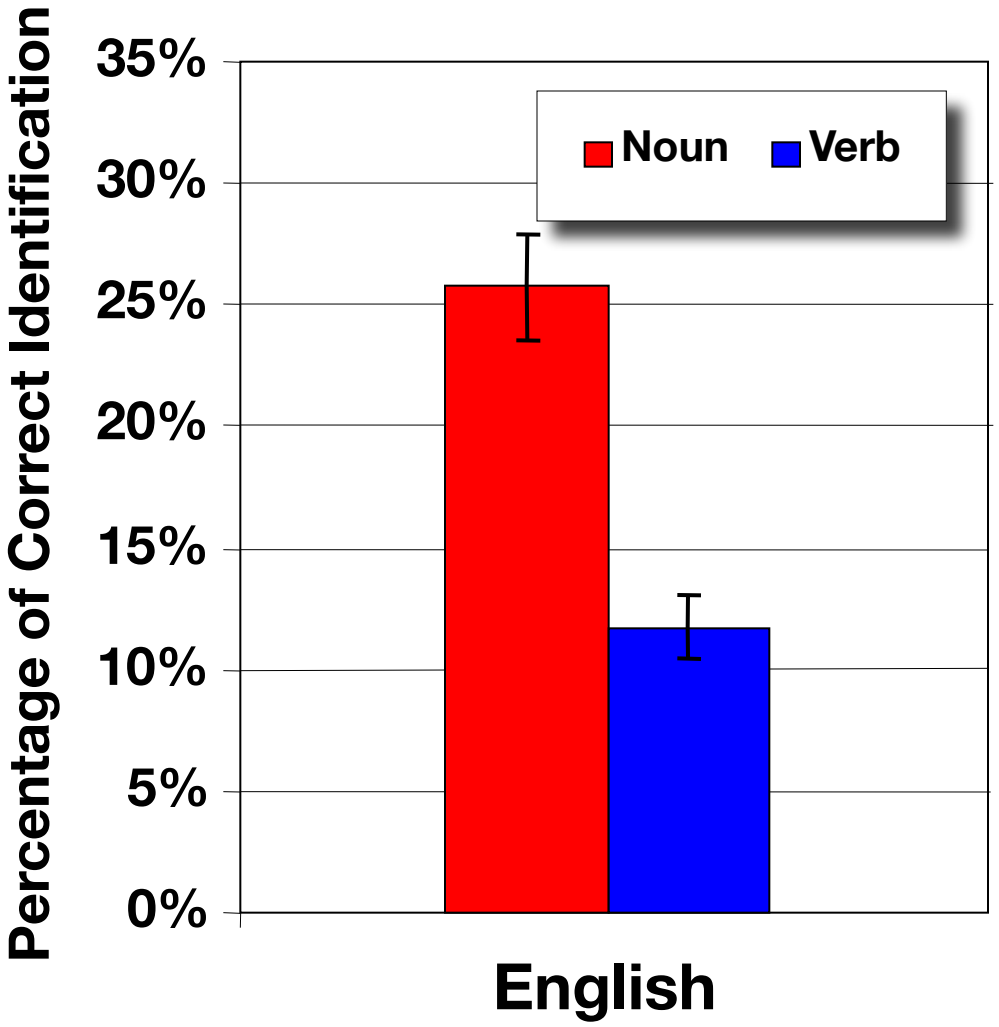
[Extra]

https://itunes.apple.com/us/app/whats-the-word-hd/id594488190?mt=8



Percent correct identification in English

Snedeker, Gleitman, and Brent (1999)



Nouns seem to be easier… why might that be?

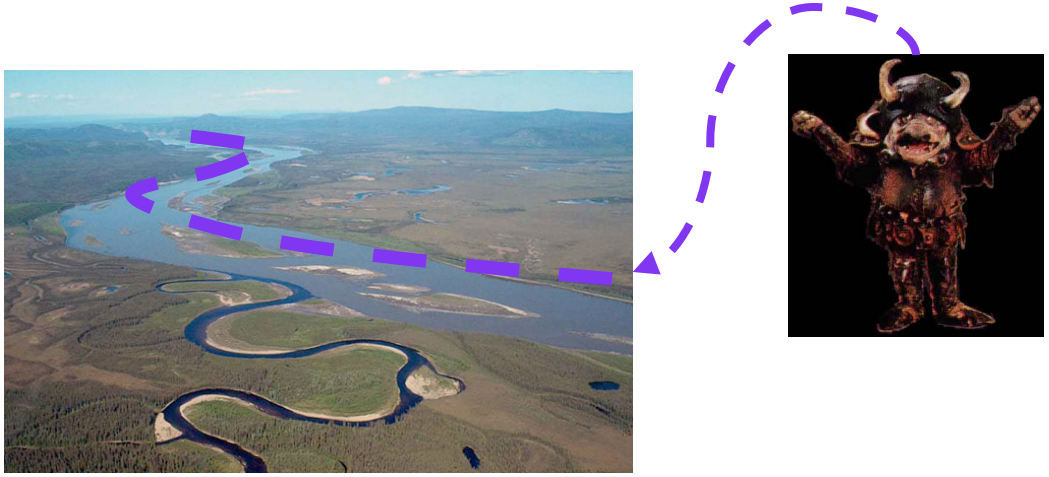
Verb meaning: Linguistic variation

[Extra]

Example of linguistic variation in verb meaning:

English:

The goblin fell into the river and then floated down it.



Spanish equivalent:

The goblin fell into the river and then left floating.

El duende cayó en el río y después salió flotando

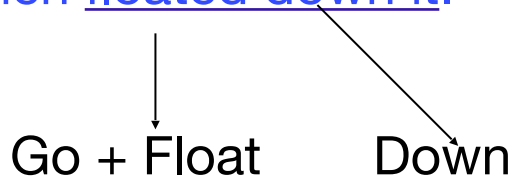
Verb meaning: Linguistic variation

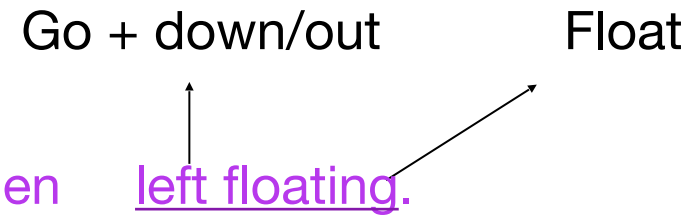
[Extra]

Example of linguistic variation in verb meaning:

English:

The goblin fell into the river and then floated down it.





Spanish equivalent:

The goblin fell into the river and then left floating.

El duende cayó en el río y después salió flotando

Verb meaning: Linguistic variation

[Extra]

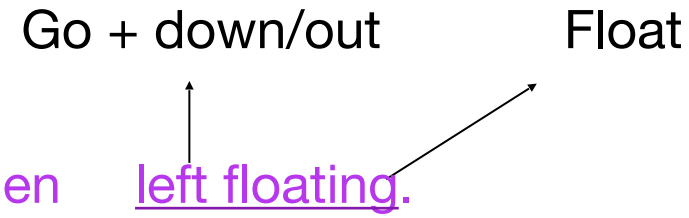
Example of linguistic variation in verb meaning:

English:

The goblin fell into the river and then floated down it.

Manner of Motion encoded in verb

Direction of Motion encoded in verb



Spanish equivalent:

The goblin fell into the river and then left floating.

El duende cayó en el río y después salió flotando

Becoming aware of language-specific preferences for verb meaning

[Extra]

Maguire et al. 2010

English and Spanish 2-year-olds seem to show a default preference for encoding direction of motion in a verb (perhaps because path information is more salient).

English and Spanish 5-year-olds seem to show a preference for encoding manner of motion in a verb.

By adulthood, English speakers maintain their preference for encoding the manner of motion in a verb while Spanish speakers recover their initial preference for encoding direction of motion.

Also…

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

Korean (Kim, McGregor, & Thompson 2000), Japanese, and Mandarin children show less of a noun bias (though there still is something of a noun bias). These languages have several ways of making verb information more salient to learners: verbs appearing sentence-final (very prominent for children), nouns optionally omitted

How might verbs be learned?

Proposal for vocabulary development (Snedeker & Gleitman 2002):

1. Learn from Scenes
   - Child relies on situational context alone
   - Can learn only very concrete words: object labels

How might verbs be learned?

Proposal for vocabulary development (Snedeker & Gleitman 2002):

1. Learn from Scenes
2. Learn from Nouns
   - Object labels provide richer representation of linguistic context
   - Utterance = set of known nouns
   - Child can learn concrete relational words like spatial prepositions (ex: “near”) and many verbs

I, it, you

How might verbs be learned?

Proposal for vocabulary development (Snedeker & Gleitman 2002):

1. Learn from Scenes
2. Learn from Nouns
3. Learn from Syntactic Frames
   - Learning relational words allows the child to learn the basic grammar of her language
   - Utterance is represented as a syntactic structure + known words
   - This representation allows the child to learn more abstract words

Can po SIRN while lo nirp nu?

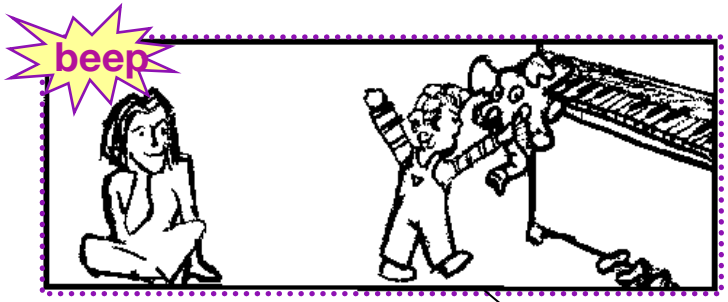
Snedeker & Gleitman (2002)

- Targets
  - Videotaped interactions of 4 mother-child pairs
  - 24 most common **verbs** chosen as targets
  - for each target, 6 instances randomly selected

- Subjects participated in one of 7 Information Conditions
  - Scenes
  - Nouns
  - Frames
  - Scenes + Nouns
  - Scenes + Frames
  - Nouns + Frames
  - Scenes + Nouns + Frames

Scenes condition

Example “mystery verb”: “play”



Guess word.

Guess word again.

Etc….

Final guess

On to next mystery verb

Task: Subjects guess mystery verb from watching 6 instances of word use in video clips. The video clips are silent except beeps replace the moments the mystery word were uttered.

Nouns condition

Example “mystery verb”: “play”

1. elephant, piano

Guess word.

2. mommy

Guess word again.

3. I, it, you

Guess word again.

4. it, you

Guess word again.

5. drums

Guess word again.

6. music, you

Task: Subjects shown the nouns co-occurring with the mystery verb in 6 sentences, the same sentences as those in the video clips with the beeps.

Final guess

On to next mystery verb

Frames condition

Example “mystery verb”: “play”

1. Can kax SIRN the bussit?

Guess word.

2. Noggle SIRN?

Guess word again.

3. Can po SIRN while lo nirp nu?

Guess word again.

4. Lo are gonna SIRN nu?

Guess word again.

5. SIRN the neps.

Guess word again.

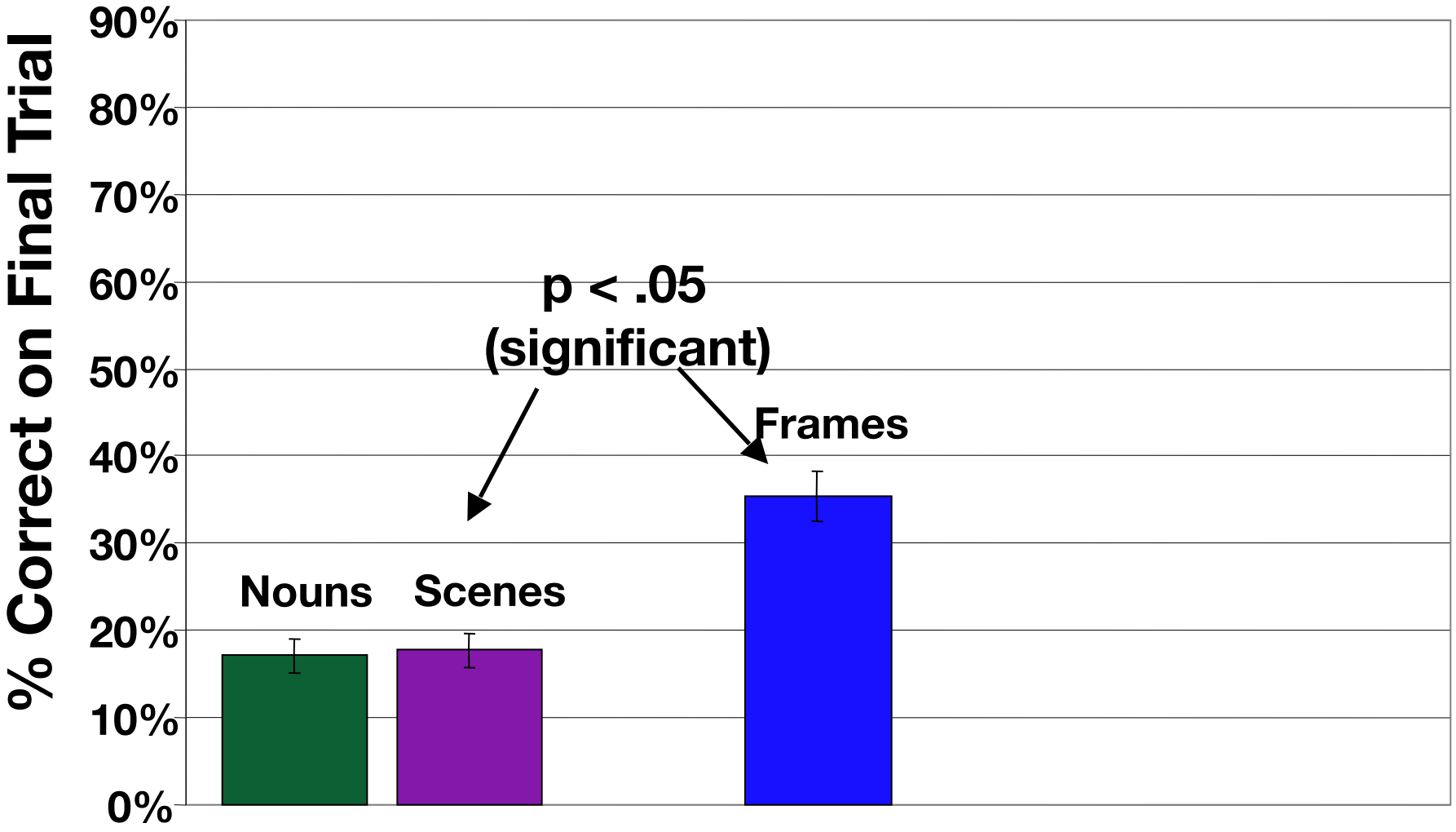
6. Lo SIRN tuggy wilm.

Final guess

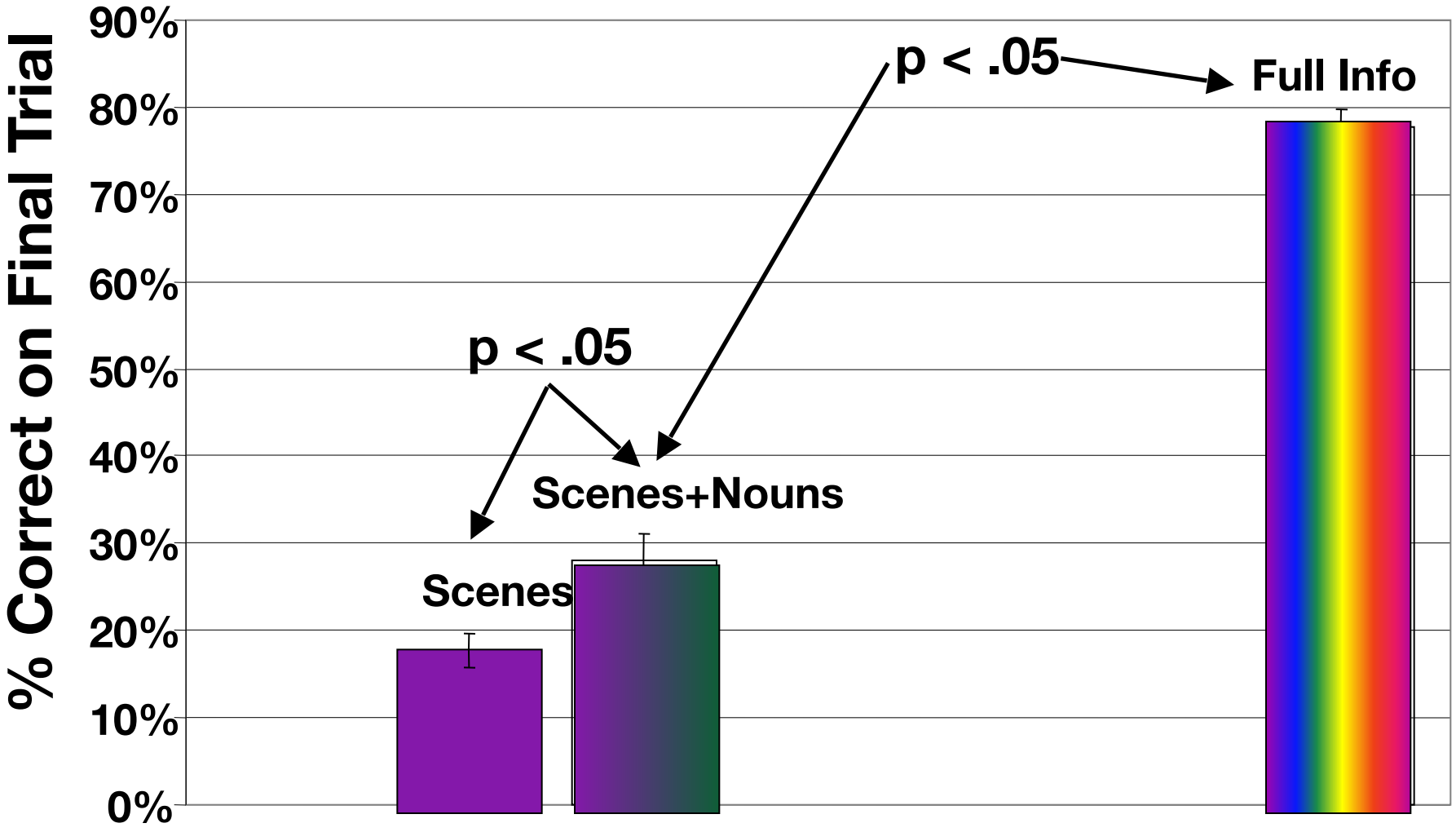
Task: Subjects guess the mystery verb from the 6 sentence frames. The sentence frames are constructed by replacing words in the 6 utterances with nonsense words.

On to next mystery verb

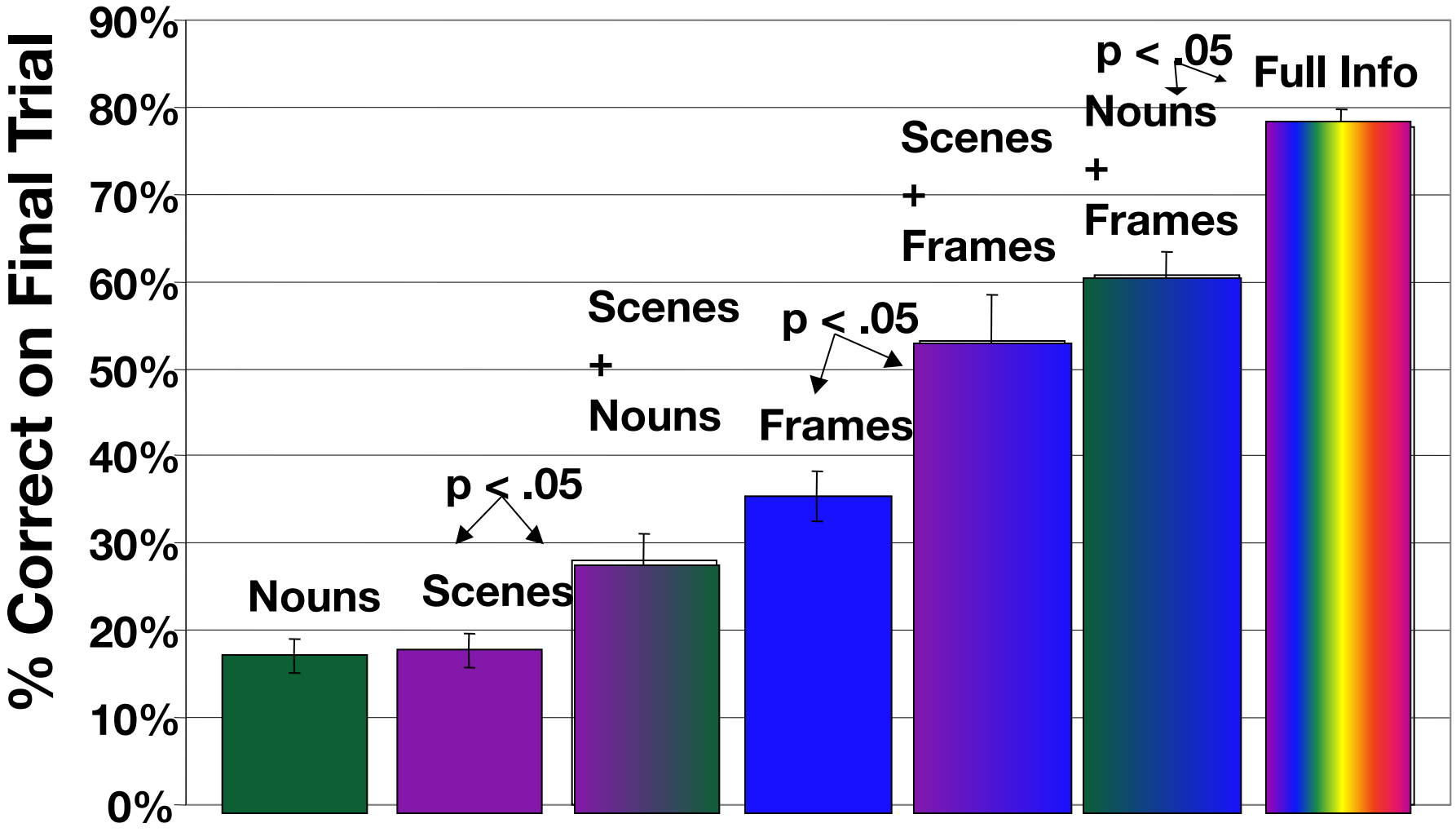
Correct identification varies with information condition



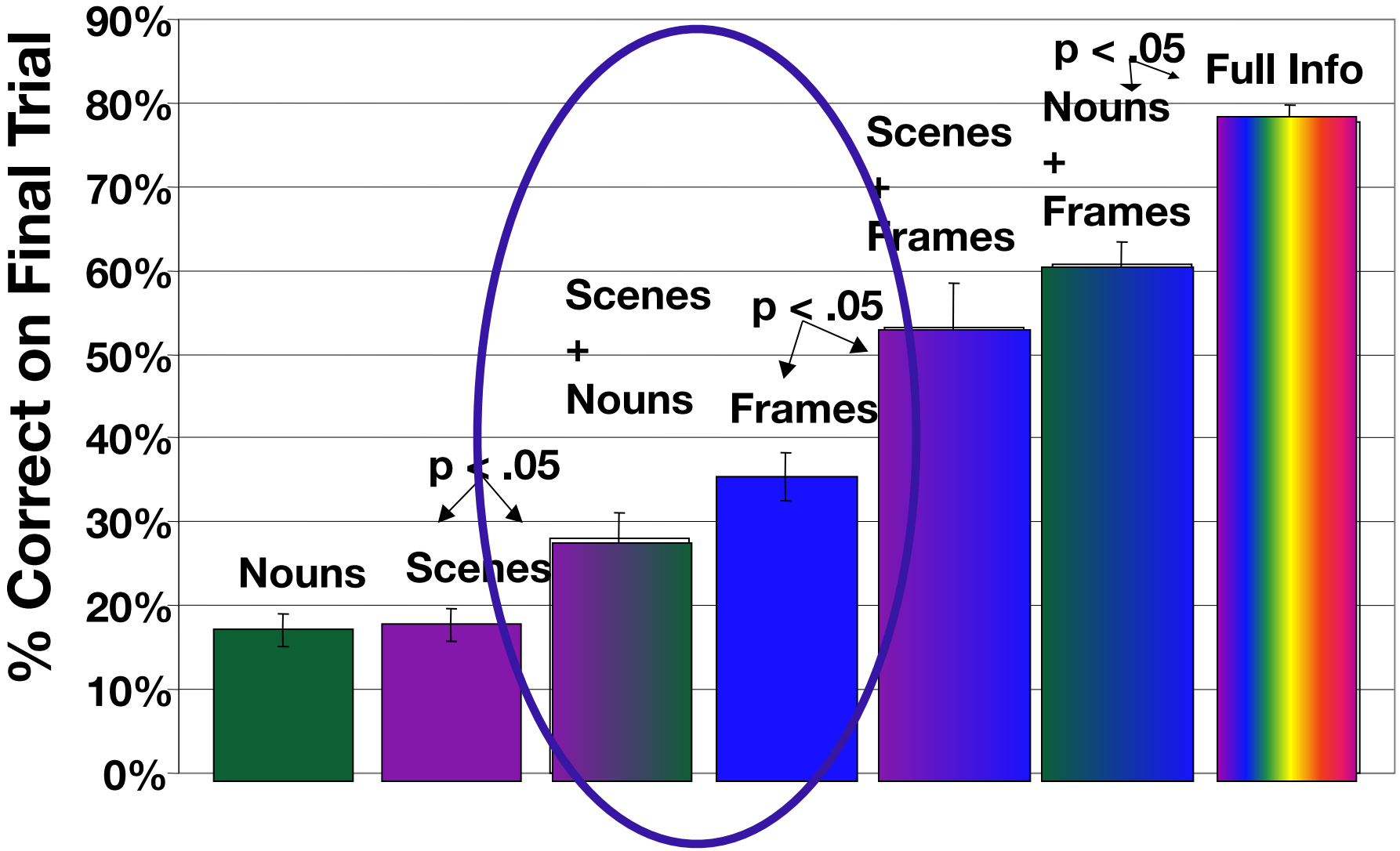
Correct identification varies with information condition



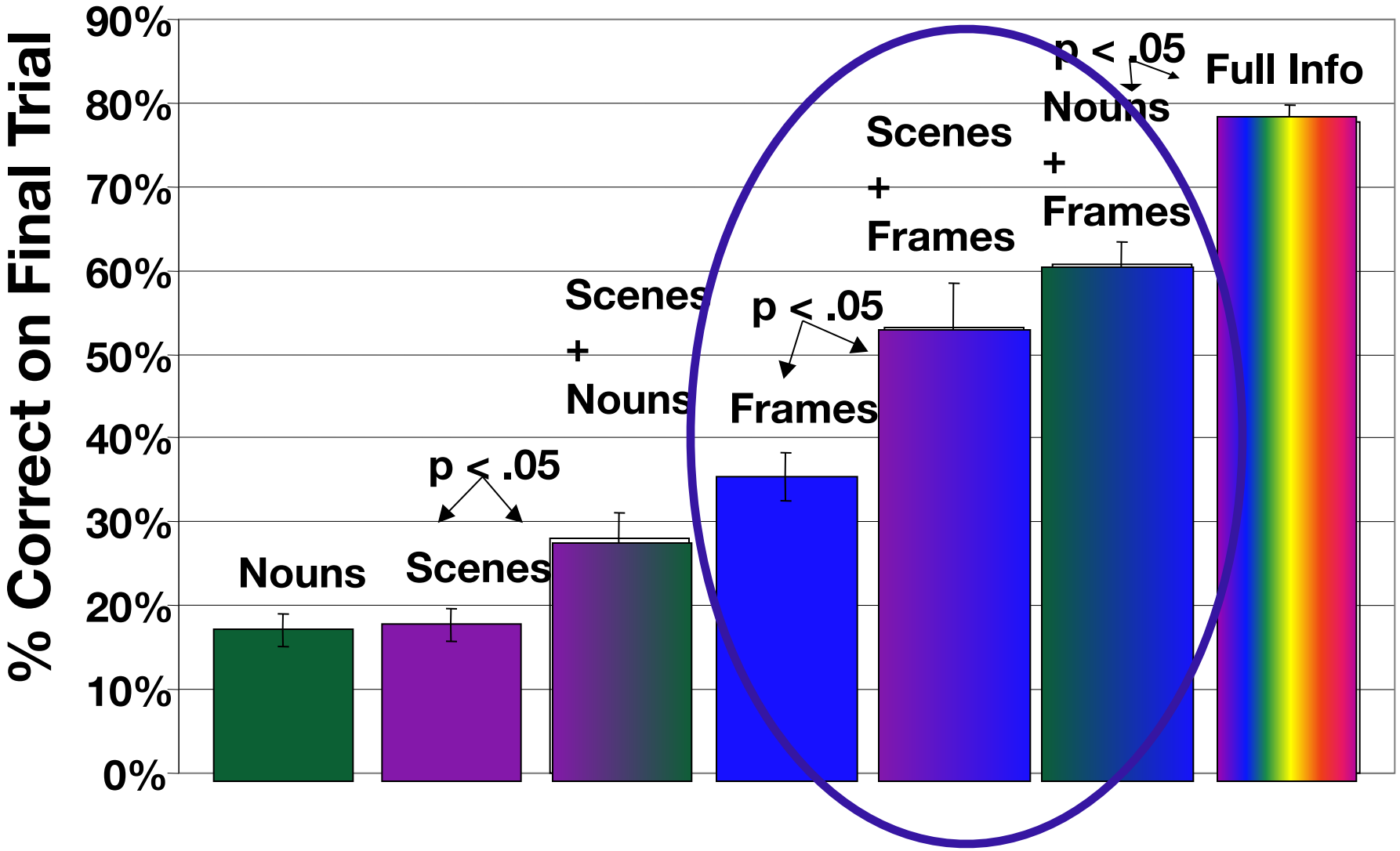
Correct identification varies with information condition



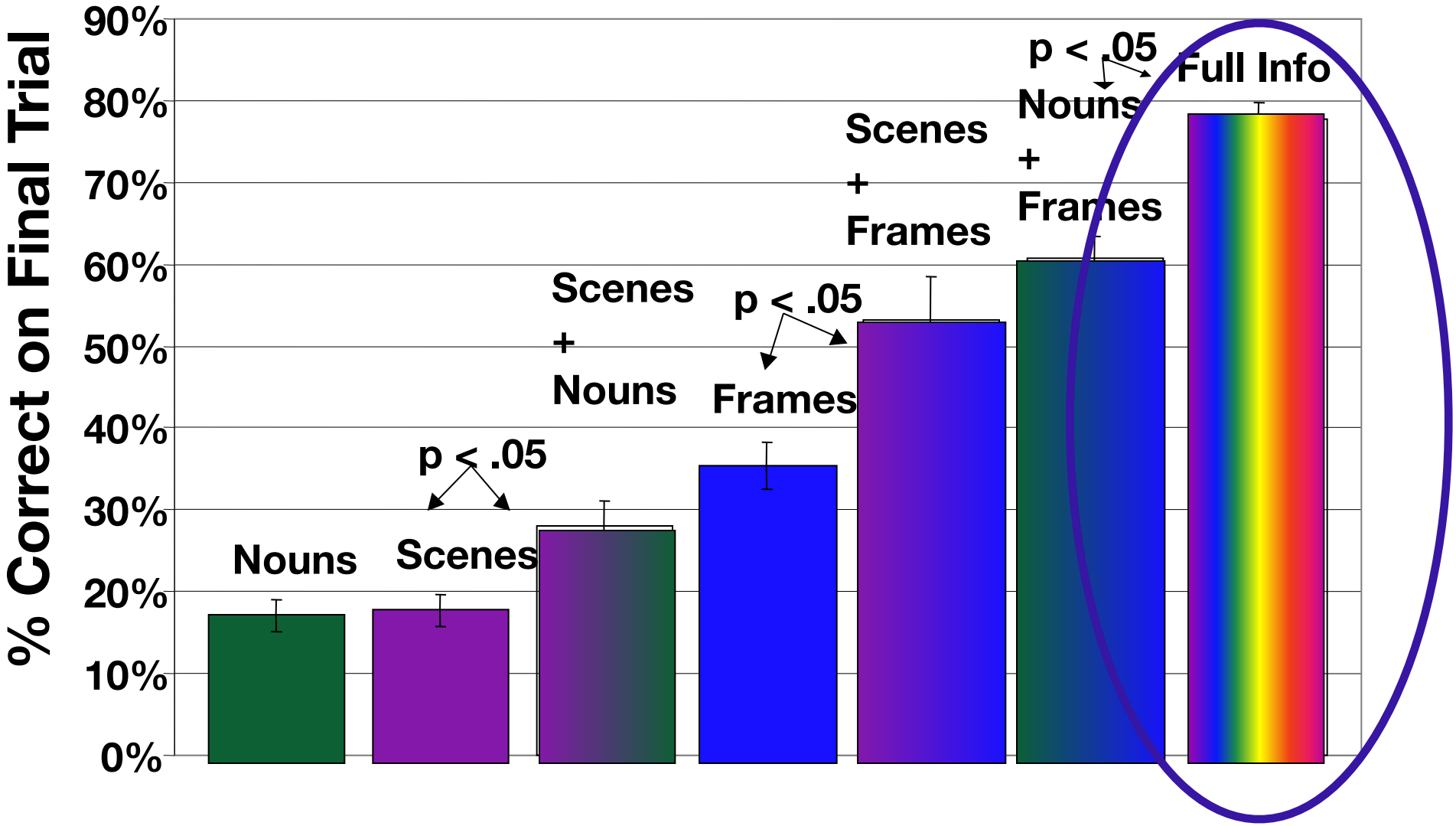
Utility of syntactic frame knowledge:
Scenes + Nouns equivalent to Syntactic Frames only



Utility of additional knowledge with Frames: Scenes + Frames equivalent to Nouns + Frames which is better than Frames alone



Superiority of using all the available information: Scenes + Nouns + Frames is better than all other information type combinations



So Snedeker & Gleitman (2002) have shown that maybe learning verbs isn't so bad once you have some linguistic background (like knowing some nouns and some syntactic frames) and informative situational context (scenes)

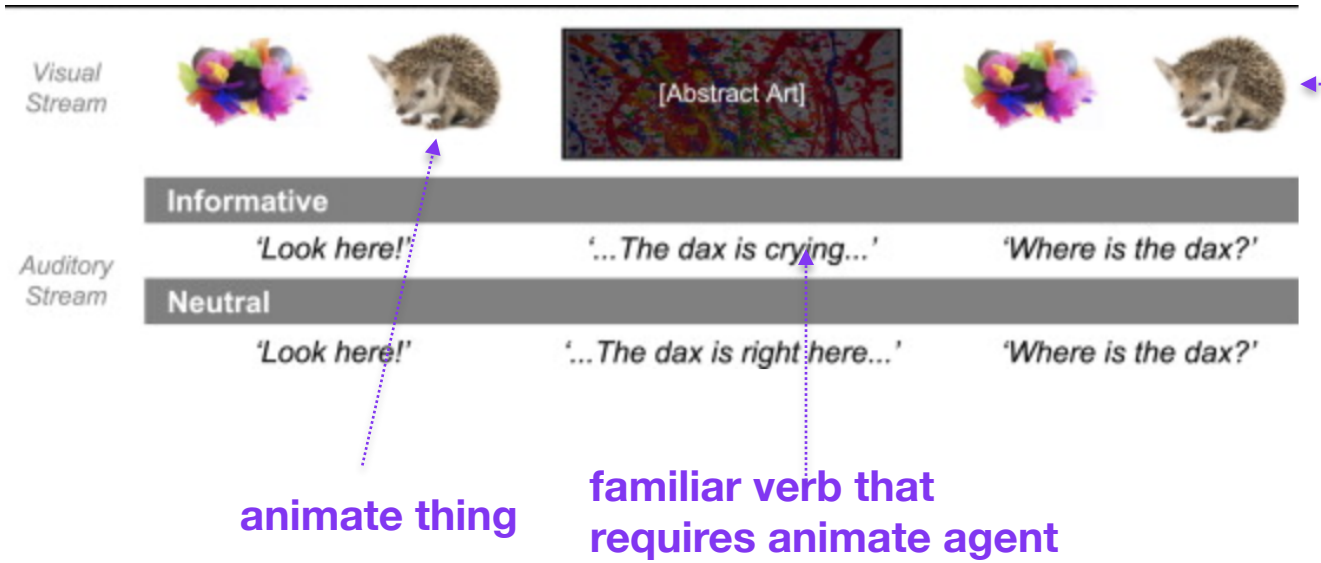
Let's look more at clues from the input

Knowing what to guess

Clues from the input

19-month-olds can use known words (like the verb “crying”) to figure out unknown words.

Ferguson, Graf, & Waxman 2014, 2018
Sample test scenario, where only animate things can cry

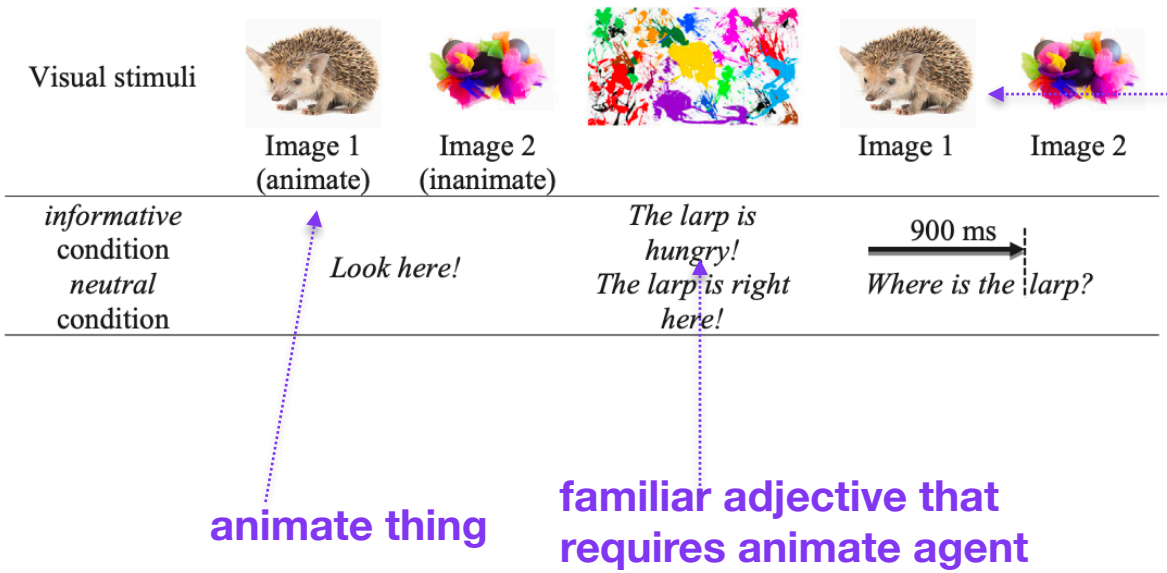


Knowing what to guess

Clues from the input

…but it's not till 36 months, that children can use known adjectives (like "hungry") to figure out unknown words.

Syrett, LaTourrette, Ferguson, & Waxman 2019
Sample test scenario, where only animate things can be hungry



Knowing what to guess

Clues from the input: what you know helps you learn new things

Ferguson, Graf, & Waxman 2018: At both 19 and 24 months, the number of verbs infants know predicts their ability to use known verbs to learn novel nouns.

Knowing what to guess
[Extra]

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."

Knowing what to guess

Clues from the syntactic structure

Different syntactic categories (noun, verb, etc.) tend to have different meanings. Once children have identified some syntactic 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

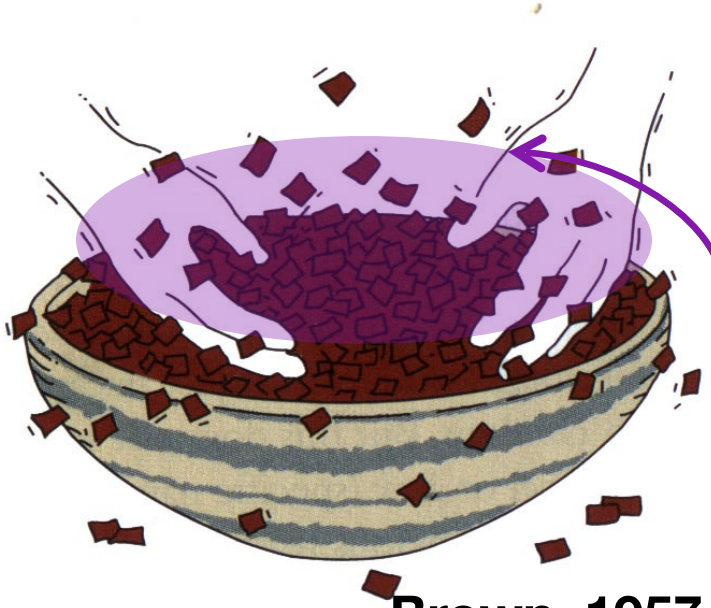
[Extra]

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

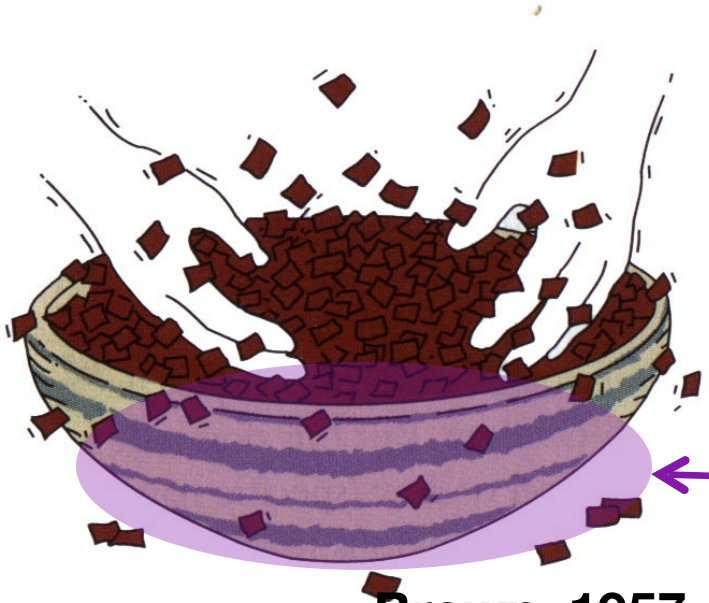
seb

Brown, 1957

Knowing what to guess

Clues from the syntactic structure

Look – a seb!



Brown, 1957

seb = noun with “a”

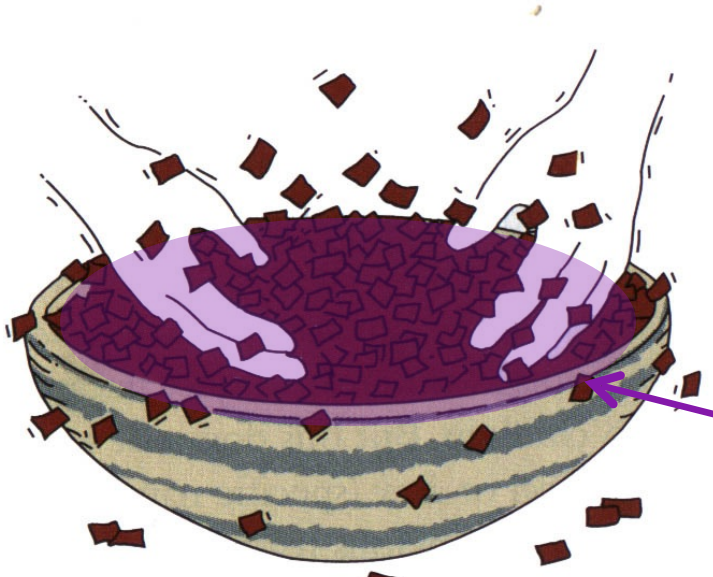
noun = countable object like “bowl”

seb

Knowing what to guess

Clues from the syntactic structure

Look – some seb!



Brown, 1957

seb = noun with “some”

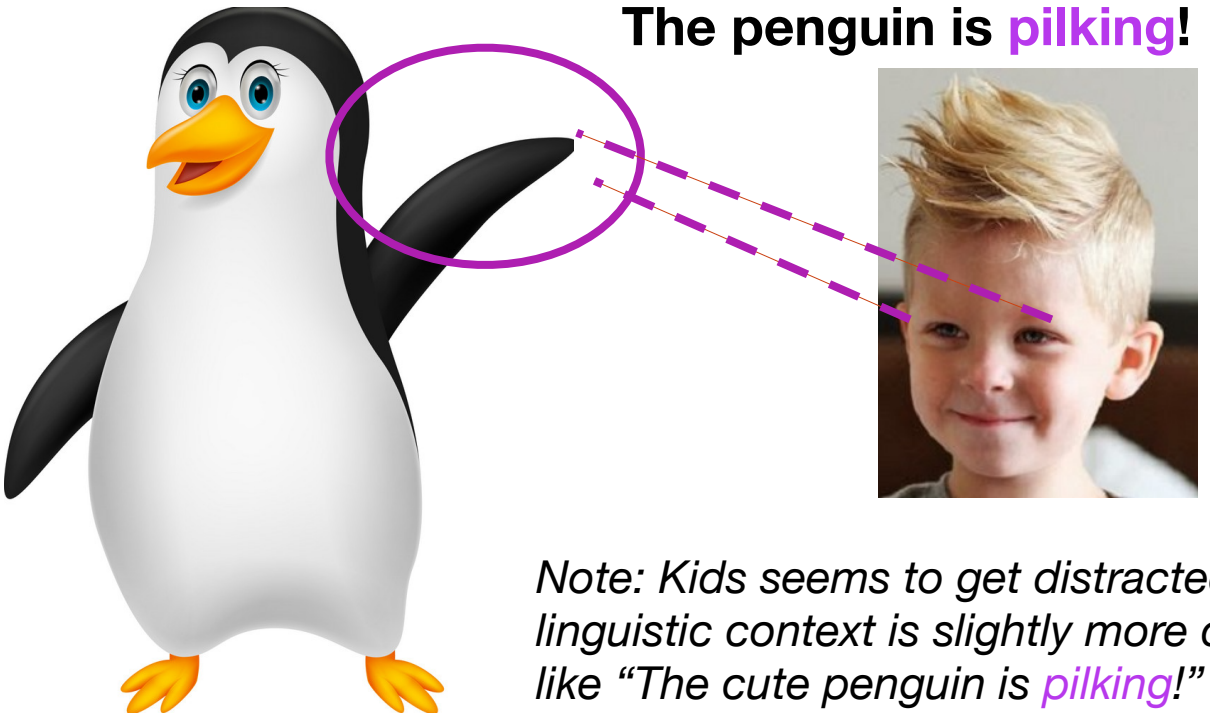
noun = mass substance like “stuff”

seb

Knowing what to guess

Clues from the syntactic structure

He, Kon, & Arunchalam 2019: three- and four-year-olds are able to do the same thing (though only if the linguistic context is simple).

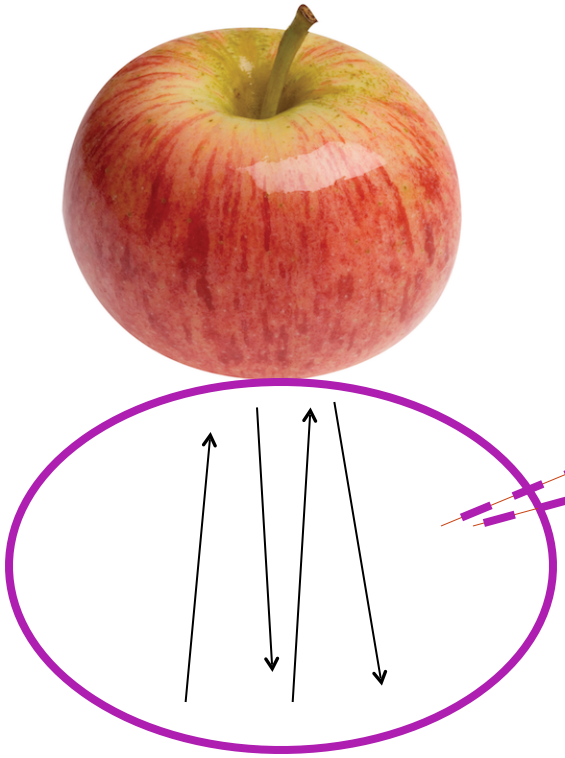


Note: Kids seems to get distracted if the linguistic context is slightly more complex, like "The cute penguin is pilking!"

Knowing what to guess

Clues from the syntactic structure

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

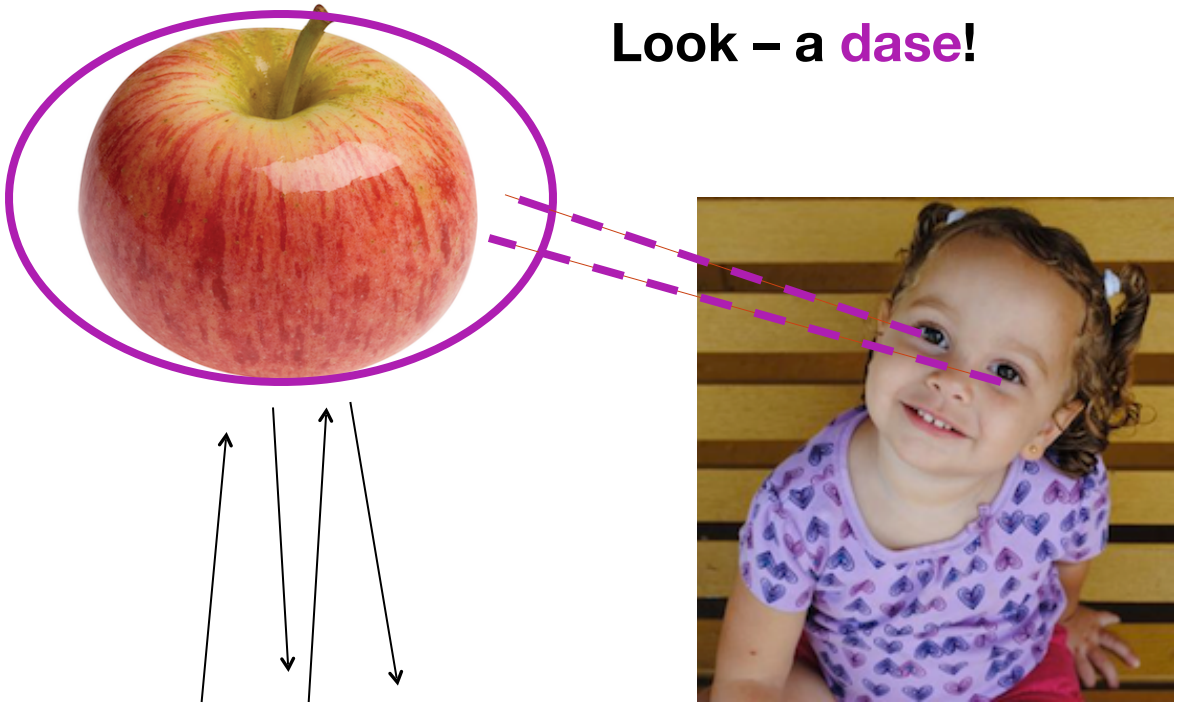


Look – it dases!

Knowing what to guess

Clues from the syntactic structure

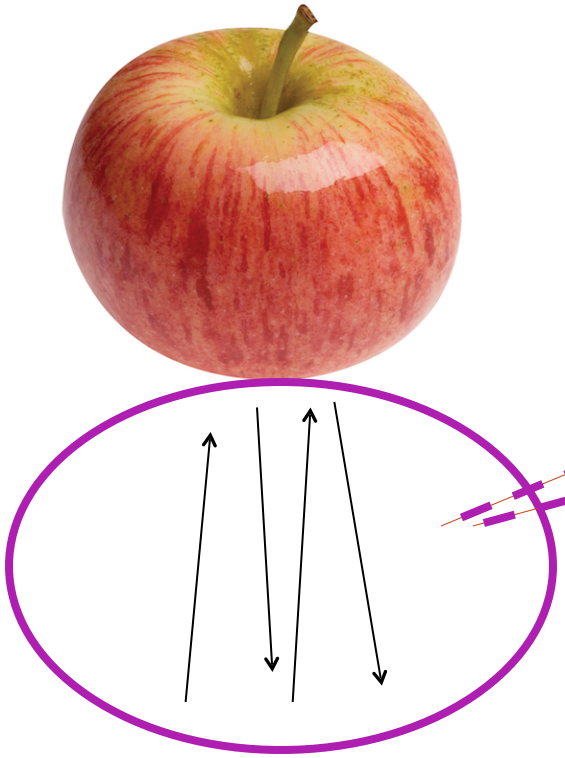
Bernard et al. 2007: 23-month-olds are able to do the same thing.



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.

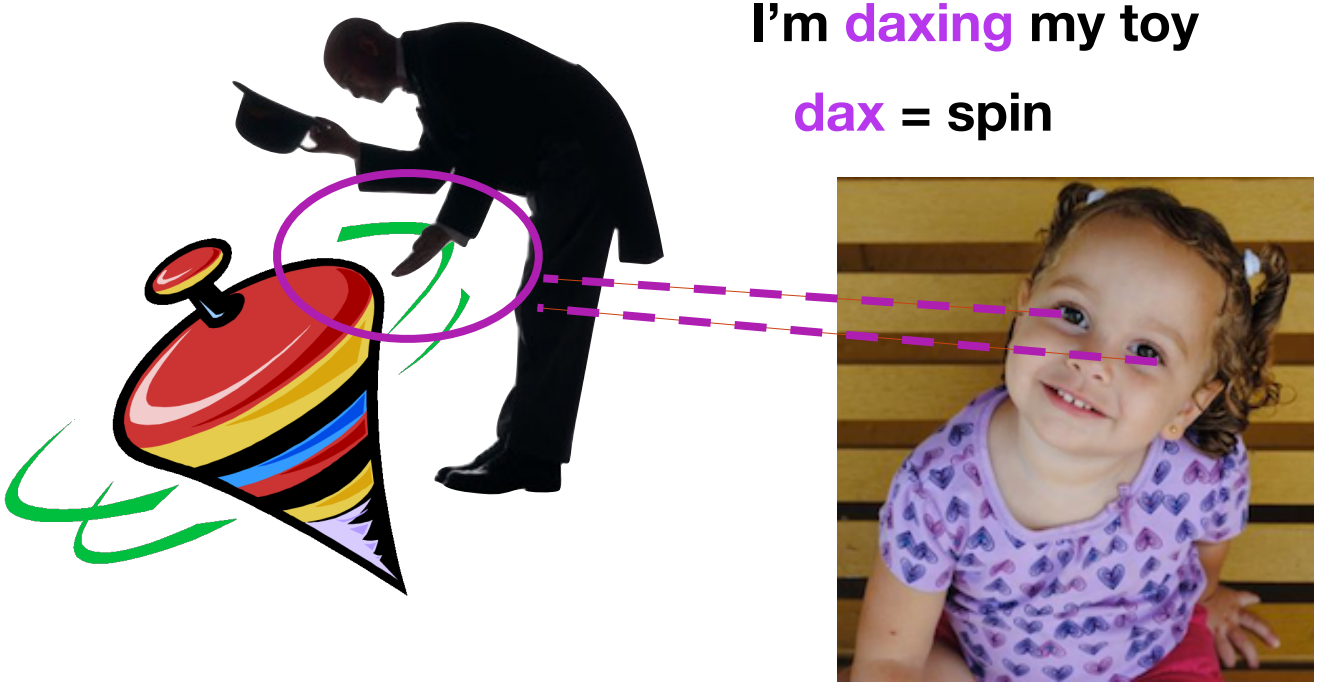


It's gonna *pilk* slowly.

Knowing what to guess

Clues from the syntactic structure

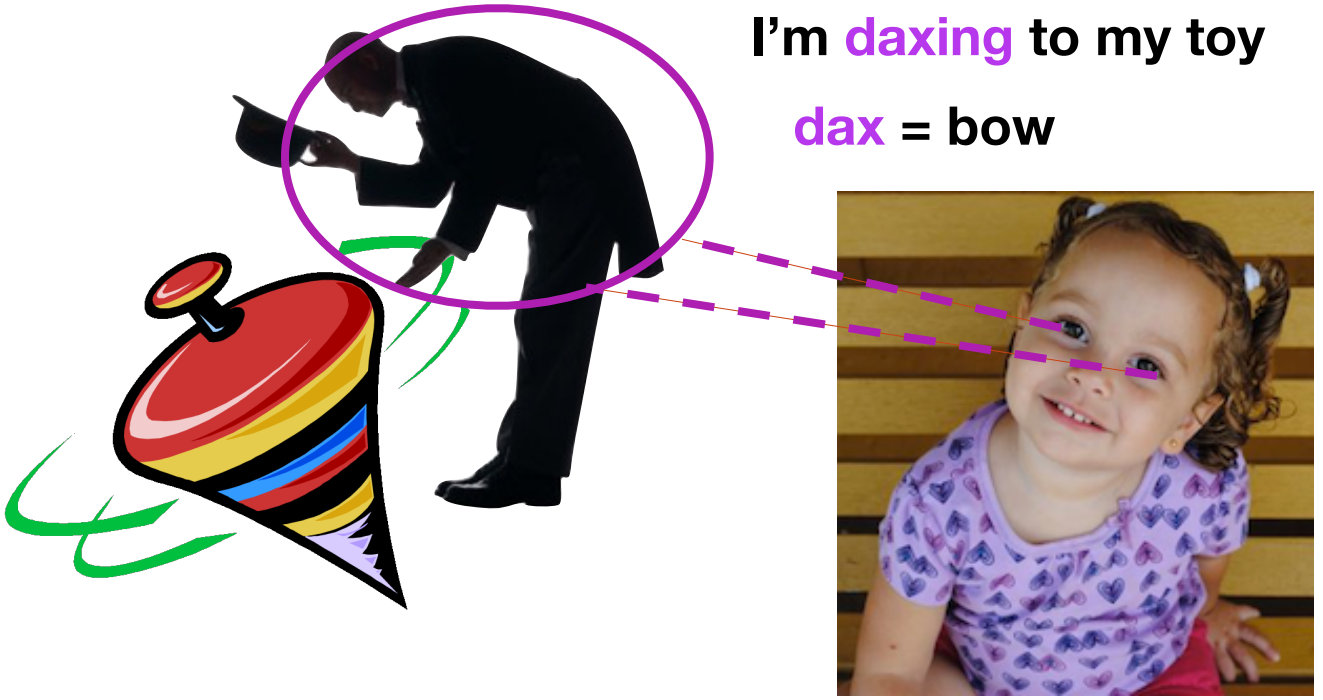
Klein & Snedeker 2015: 2-year-olds can use the words surrounding a verb to determine what kind of action it encodes



Knowing what to guess

Clues from the syntactic structure

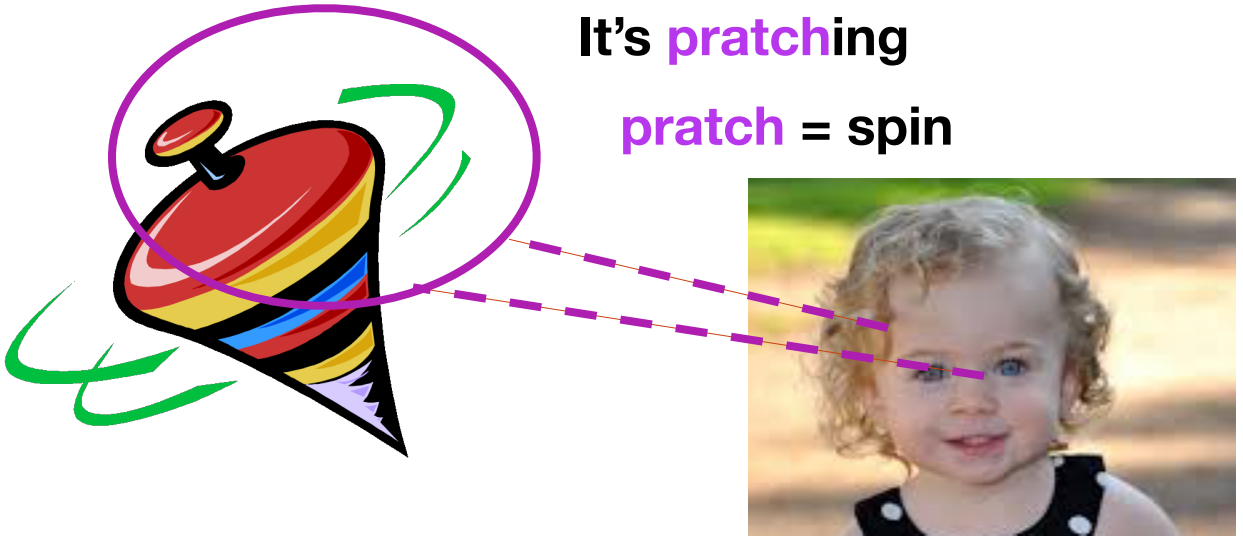
Klein & Snedeker 2015: 2-year-olds can use the words surrounding a verb to determine what kind of action it encodes



Knowing what to guess

Clues from the syntactic structure

He & Lidz 2017: 18-month-olds can use the word and word parts surrounding a verb to determine what kind of action it encodes



Knowing what to guess

Clues from the syntactic structure

Kedar, Casasola, Lust, & Parmet 2017, de Carvalho, He, Lidz, & Christophe 2019: 18-month-olds can use determiners like *the* to figure out the next word should have a referent (and so be a noun). Some of this sensitivity is already present at 12 months old.

Can you see the ball?

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.

Training 1		*"THESE ARE nice blicketS. Can you find the blicketS?"*	
2		*"Where IS the blicket_? Can you see A blicket_?"*	

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.

Training 1		*"THESE ARE nice blicketS. Can you find the blicketS?"*	
2		*"Where IS the blicket_? Can you see A blicket_?"*	

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).

Test 1		*"Look at the blicket. Do you like IT?"*	
2		*"Look at the blicketS? Do you like THEM?"*	

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.

One thought on why this might be from Lidz (2019):

Children "expect words with similar meanings to have similar distributions, and so learning depends on a memory for syntactic environments. The [non-linguistic] context in which a word is used is less constrained and hence contributes less to the memories that drive word learning."

grammatical cues = syntactic environment

eye gaze = non-linguistic context

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.

Example verb: kiss

Transitive dialogue
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.

Example verb: sneeze

Intransitive dialogue
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

Harrigan, Hacquard, & Lidz (2019): Four-year-olds can use the syntactic context to tell the (subtle) differences between mental state verbs reflecting attitudes, like *think*, *want*, and *hope*.

	think	*want*	*hope*
Jack ___s that Lily is home.	✓		
Jack ___s to be home.		✓	✓
Jack ___s Lily to be home.		✓	
Jack ___s for Lily to be home.			✓

Knowing what to guess

[Extra]

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)

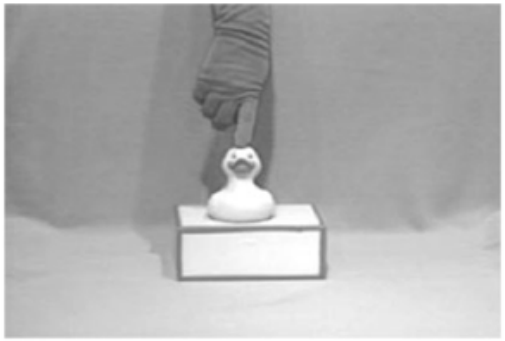
Knowing what to guess
[Extra]

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)!

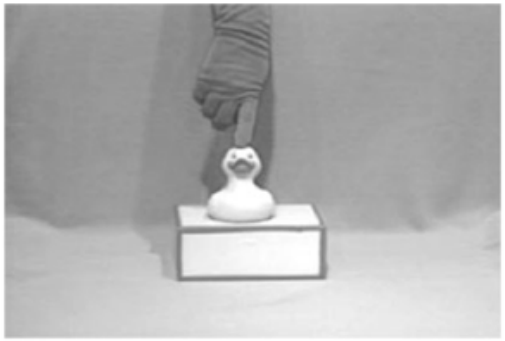
Knowing what to guess
[Extra]

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

Fisher, Klingler, & Song (2006)

Preposition context:

This is acorp my box.

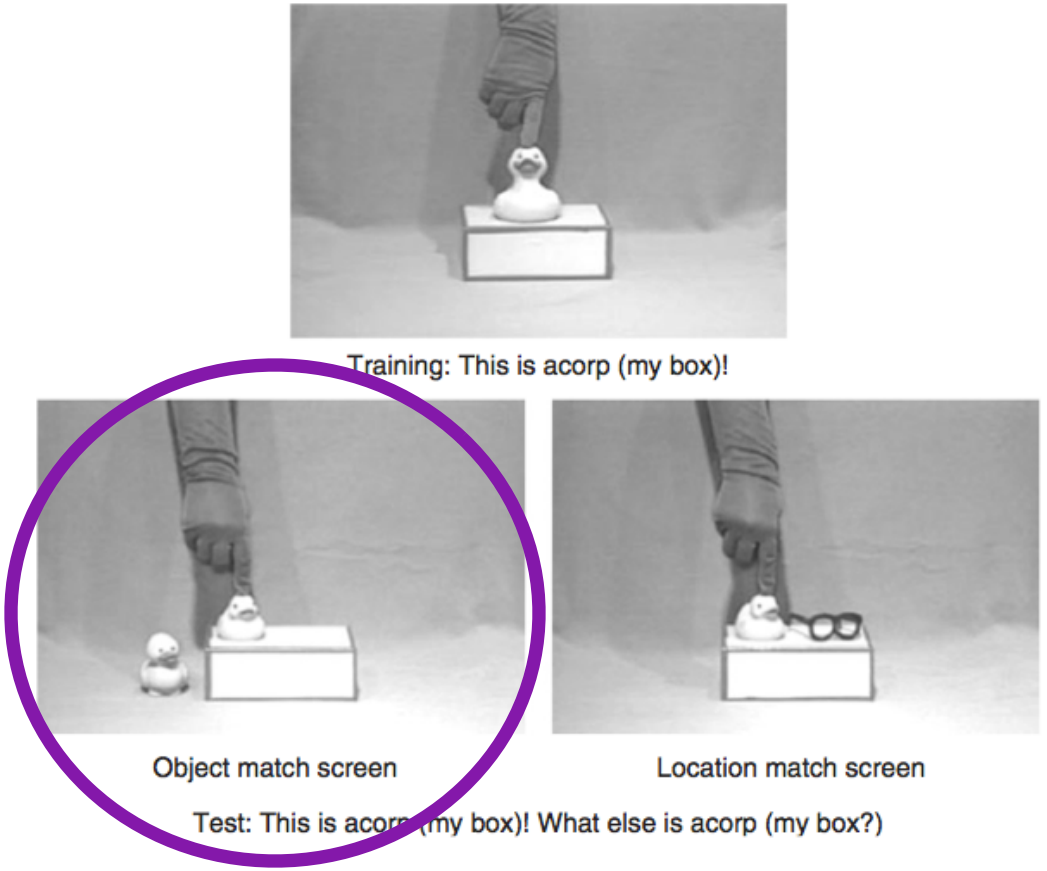


Training: This is acorp (my box)!

Knowing what to guess
[Extra]

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

Fisher, Klingler, & Song (2006)

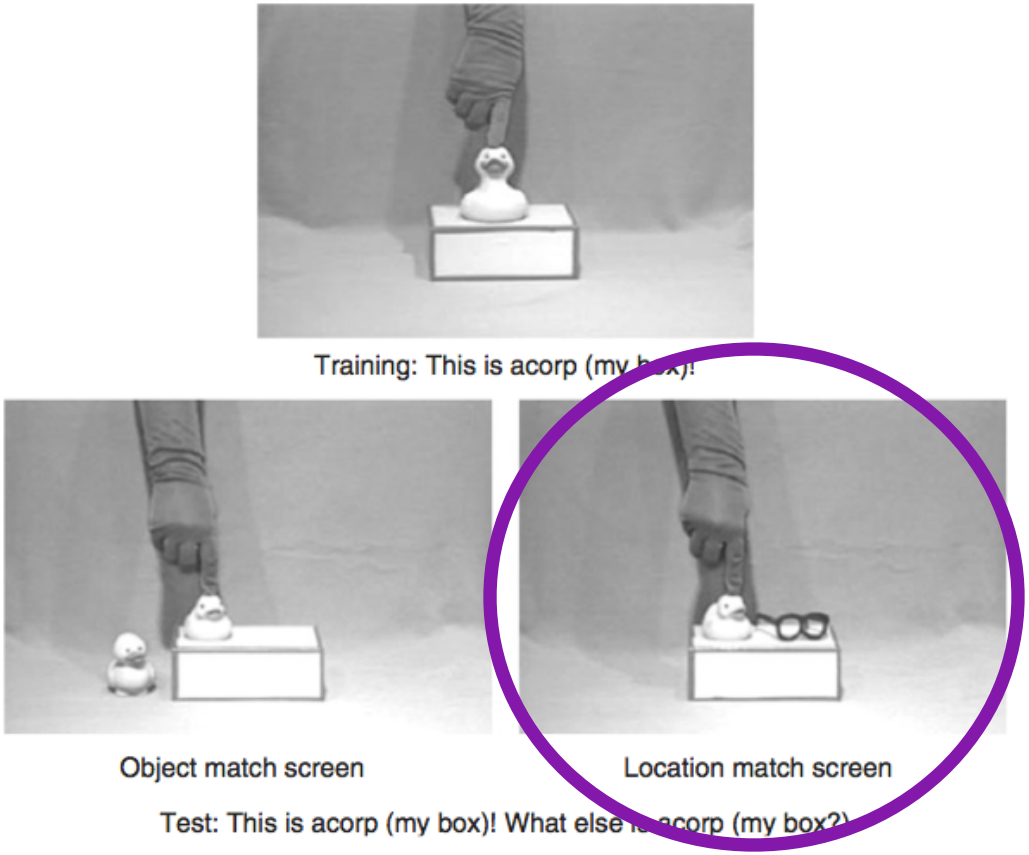


At test, those trained with the noun-context (this is acorp) looked at the object match (inferred it was an object) when asked "What else is acorp?"

Knowing what to guess
[Extra]

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

[Extra]

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 homesign systems show that they systematically use syntactic position to signal semantic roles like agent.

Knowing what to guess
[Extra]

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).

Knowing what to guess

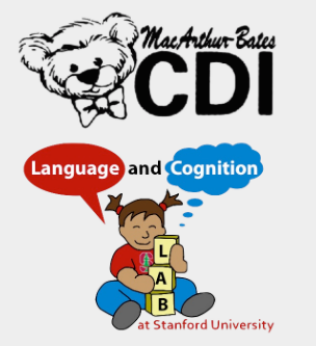
Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

Braginsky, Yurovsky, Marchman, & Frank 2016: While concreteness tends to predict the age of acquisition for nouns, knowledge of linguistic structure is a good predictor for function words like *how, why*, and *his*. This is true across seven different languages (English, Italian, Norwegian, Russian, Spanish, Swedish, Turkish) from the Wordbank database.

http://wordbank.stanford.edu

Wordbank

An open database of children's vocabulary development



Knowing what to guess

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

Abend, Kwiatkowski, Smith, Goldwater, & Steedman 2017: Syntactic bootstrapping may also play a part in children's early noun bias. The relevant linguistic context for nouns is actually learned earlier than the relevant linguistic context for verbs. This means nouns, in addition to being easier to pick up from the referential context (like scene information), are easier to pick up from the linguistic context.

Getting a sense of how a child might feel

Jabberwocky, by Lewis Caroll

Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe

https://www.ted.com/talks/lewis_carroll_jabberwocky_one_of_literature_s_best_bits_of_nonsense?utm_campaign=tedspread&utm_medium=referral&utm_source=tedcomshare

Getting a sense of how a child might feel

Jabberwocky, by Lewis Caroll

Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe

adjectives
properties

nouns
things
stuff

verbs
actions

https://www.ted.com/talks/lewis_carroll_jabberwocky_one_of_literature_s_best_bits_of_nonsense?utm_campaign=tedspread&utm_medium=referral&utm_source=tedcomshare

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. This may be easier for nouns than for verbs, possibly because the meaning of nouns (especially concrete nouns) is easy to observe.

Linguistic structure may be one of the more useful cues for learning the meaning of verbs. The syntactic bootstrapping hypothesis formalizes this idea.

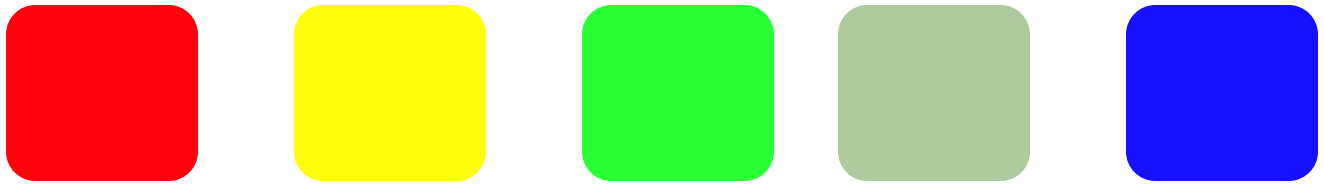
Questions?

You should be able to do up through 14 on HW4 and up through 30 on the review questions for lexical development.

Extra Material

Carey & Bartlett 1978 [Extra]

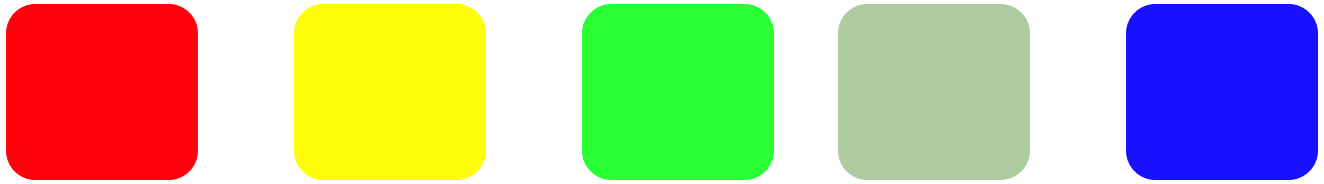
Children can use input to figure out which aspect of their experience is being lexicalized



“What colors are these?”

Carey & Bartlett 1978 [Extra]

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



“red” “yellow” “green” “green” “blue”

Carey & Bartlett 1978 [Extra]

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 [Extra]

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 [Extra]

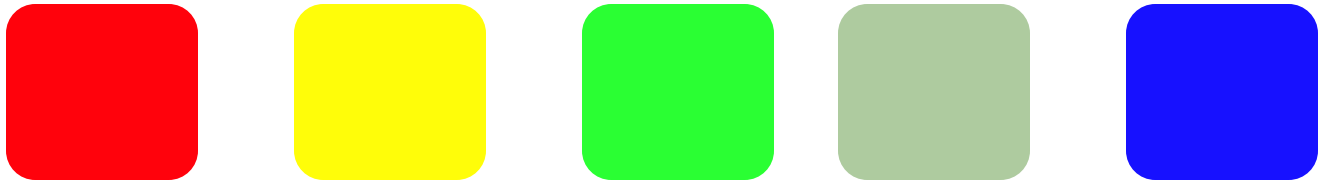
Children can use input to figure out which aspect of their experience is being lexicalized

Children learned to give the olive tray.

Carey & Bartlett 1978 [Extra]

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

5 weeks later…

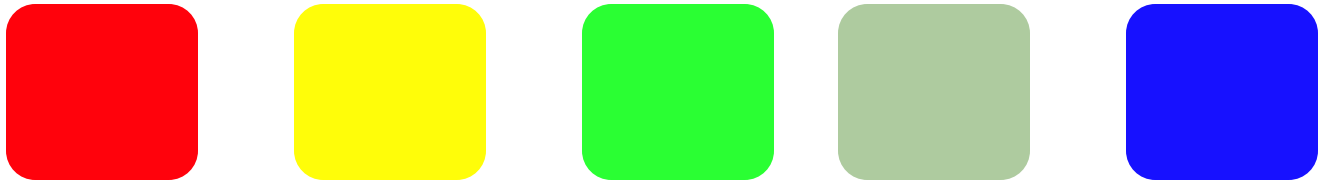


“What colors are these?”

Carey & Bartlett 1978 [Extra]

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…

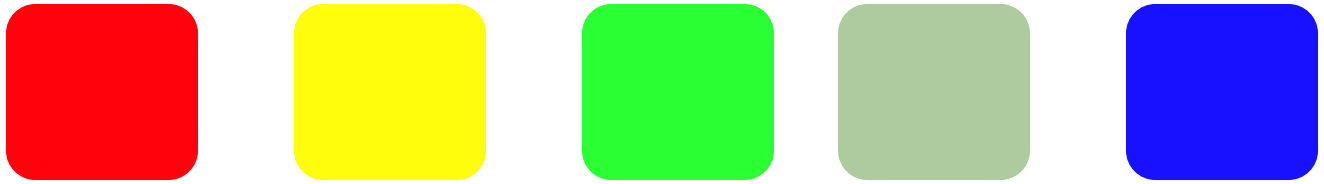
"I don't know"

[other previously unused color term like "gray"]

Carey & Bartlett 1978 [Extra]

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"]