

LSci 51/Psych 56L:
Acquisition of Language

Lecture 14
Lexical development III

Announcements

Be working on HW4 (due 11/16/20)

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

Be working on the lexical development review questions

No class this Wednesday (Happy Veterans Day!) — if you can, take the time you would normally devote to this class that day and do something that makes you happy

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**).

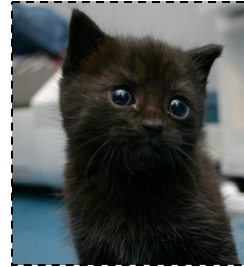
- Braginsky, Yurovsky, Marchman, & Frank 2015: large-scale analysis over tens of thousands of children in English, Spanish, Norwegian, & Danish confirming an “**over-representation of nouns**” in early vocabularies.

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*).



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.

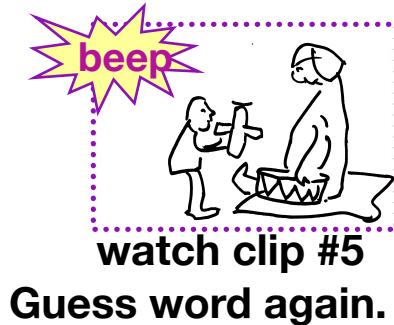
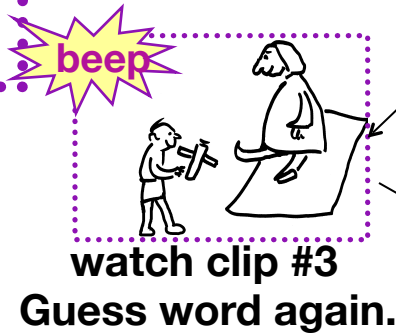
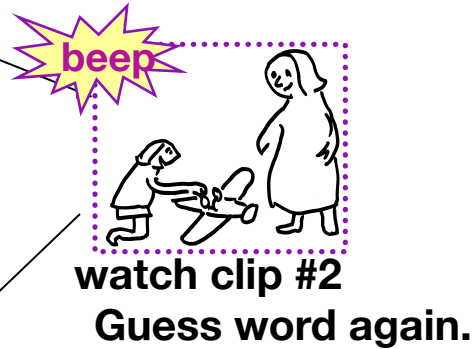


Experiment with English speakers (Snedeker, Gleitman, and Brent 1999)

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.



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>

What's the Word HD

By RedSpell

Open iTunes to buy and download apps.



View In iTunes

Free

Descript

Surprisingly :

We'll show yc

What's the W

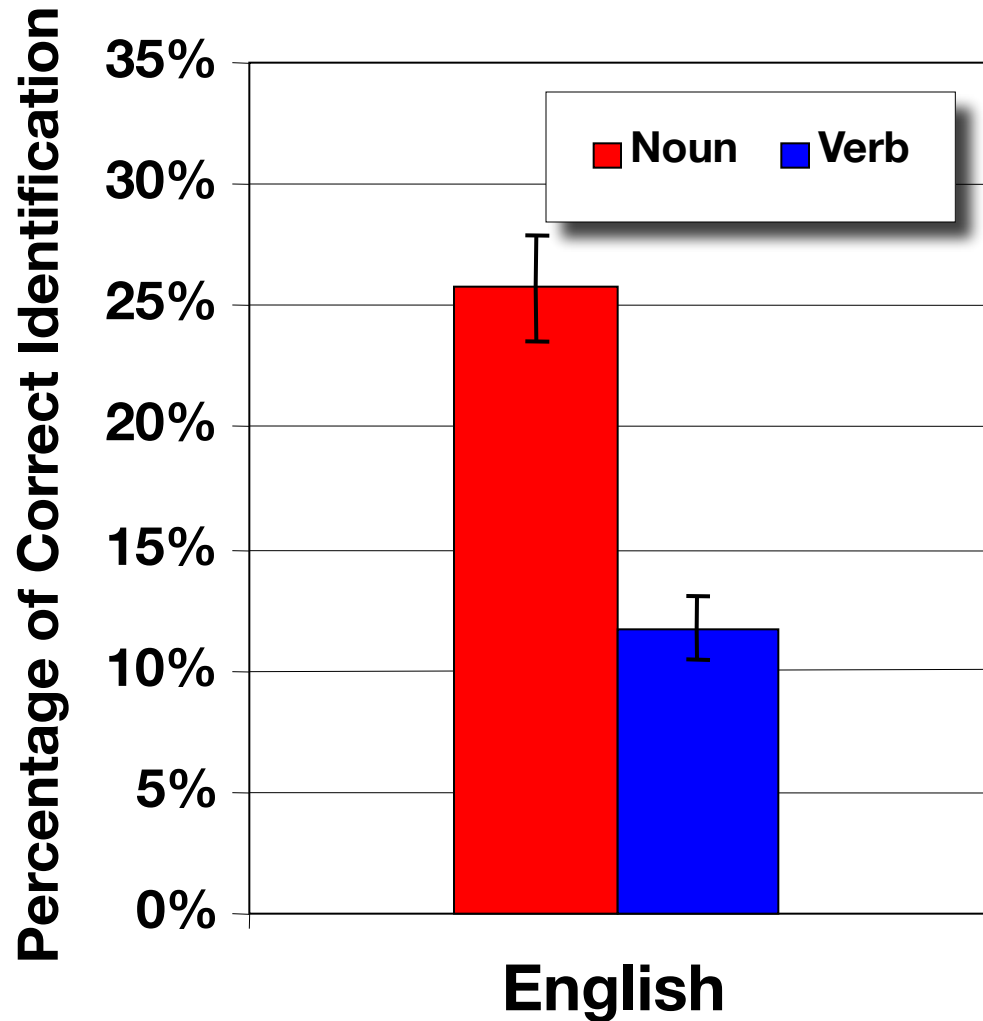
What's N

* minor chan



Percent correct identification in English

Snedeker, Gleitman, and Brent (1999)



Nouns seem to be easier... why might that be?

Verb meaning: Linguistic variation

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

Example of linguistic variation in verb meaning:

English:

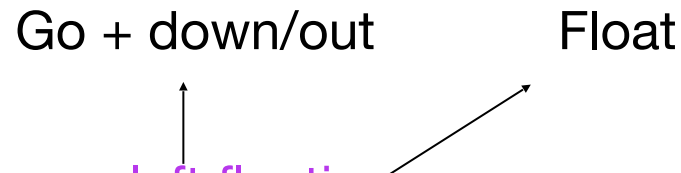
The goblin fell into the river and then floated down it.



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

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

Go + down/out Float

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

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

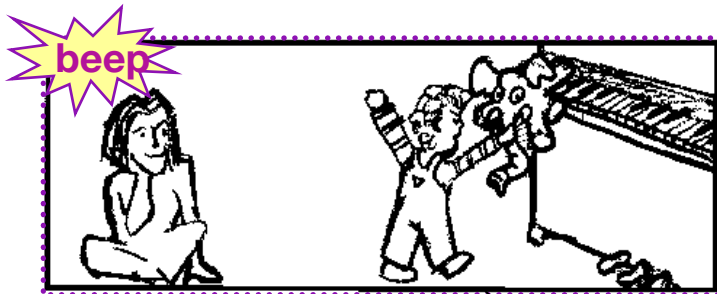
Can po SIRN while lo nirp nu?

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 SIRD the bussit?

Guess word.

2. Noggle SIRD?

Guess word again.

3. Can po SIRD while lo nirp nu?

Guess word again.

4. Lo are gonna SIRD nu?

Guess word again.

5. SIRD the neps.

Guess word again.

6. Lo SIRD tuggy wilm.

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.

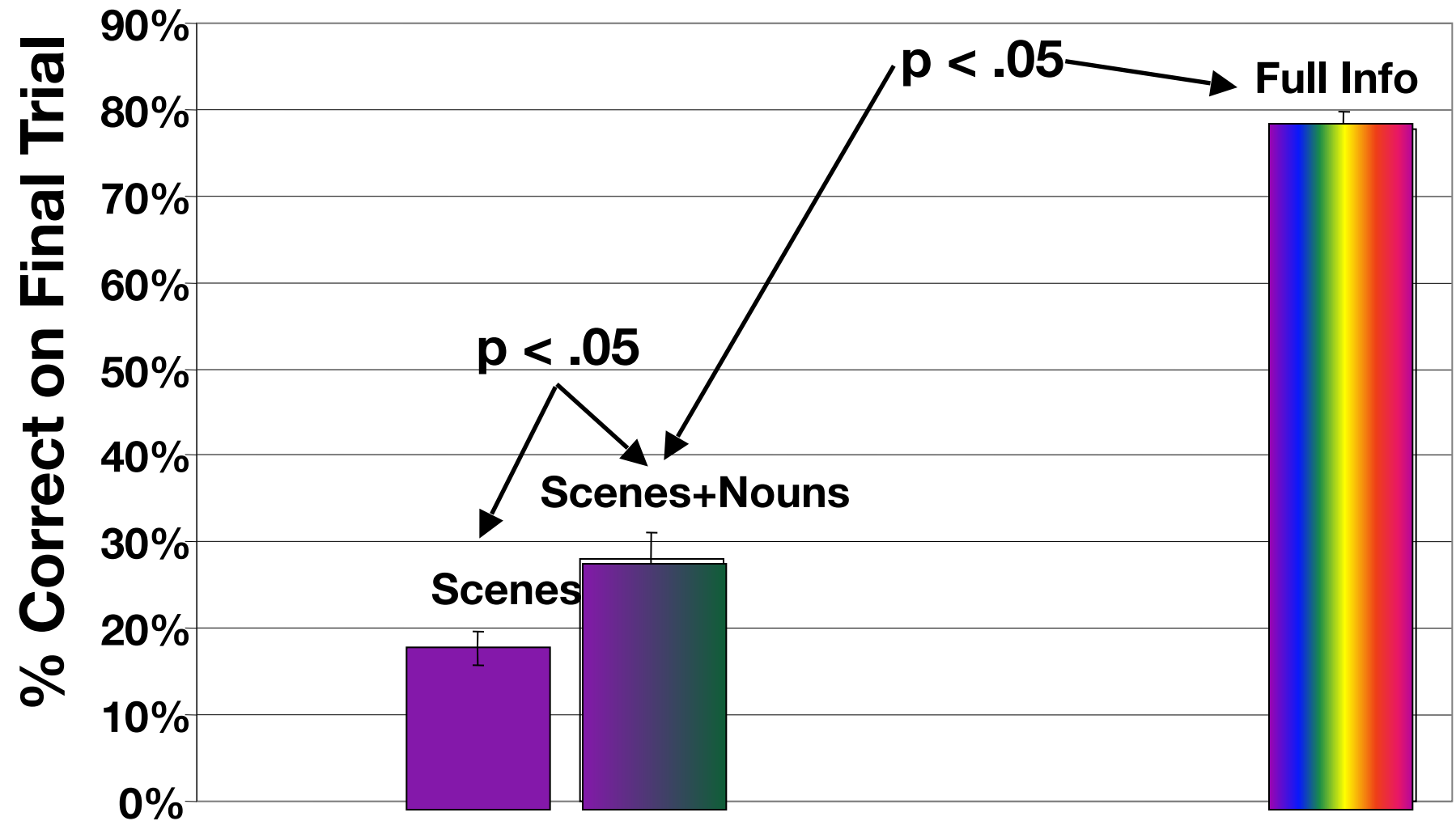
Final guess

On to next mystery verb

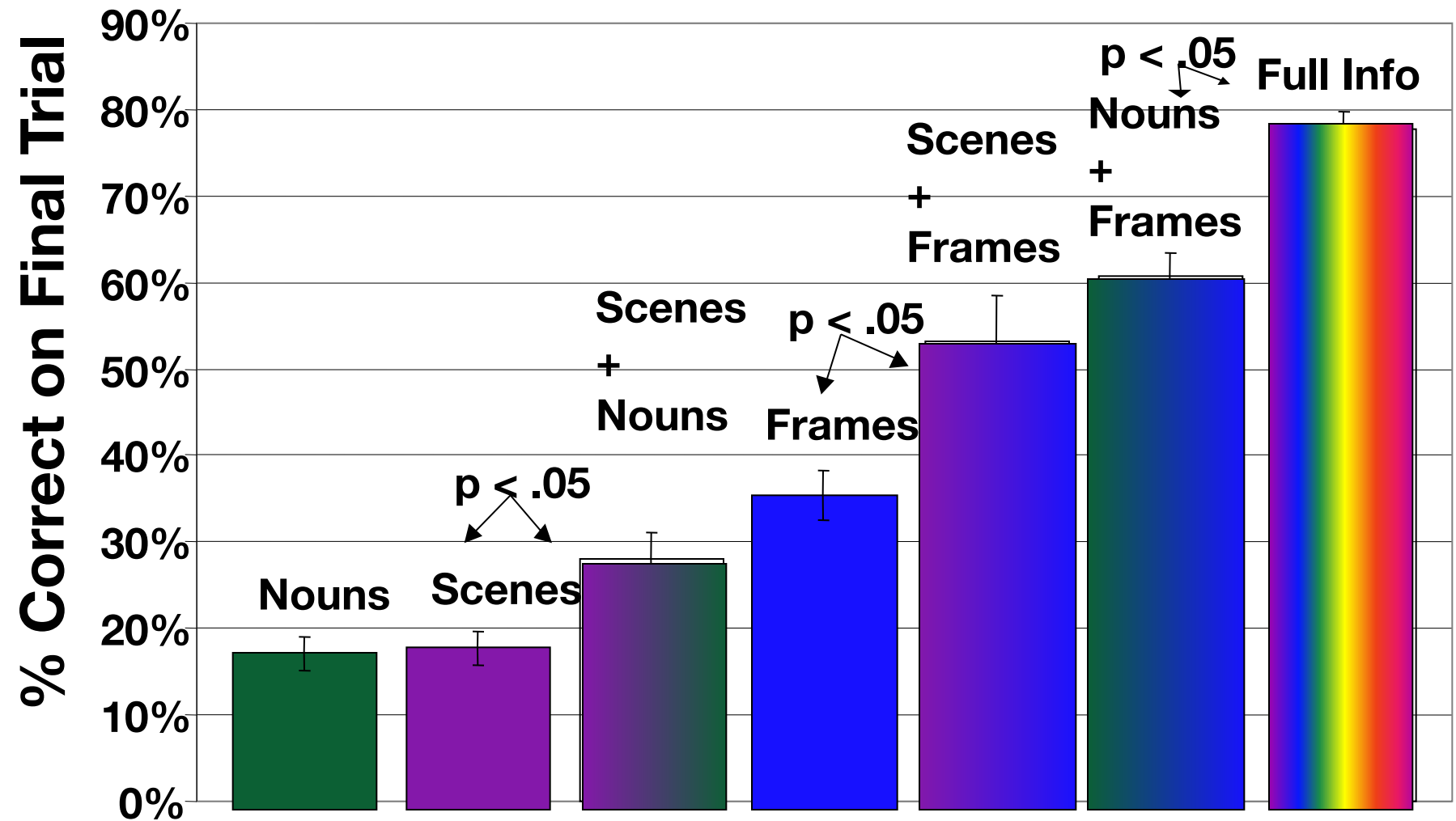
Correct identification varies with information condition



Correct identification varies with information condition

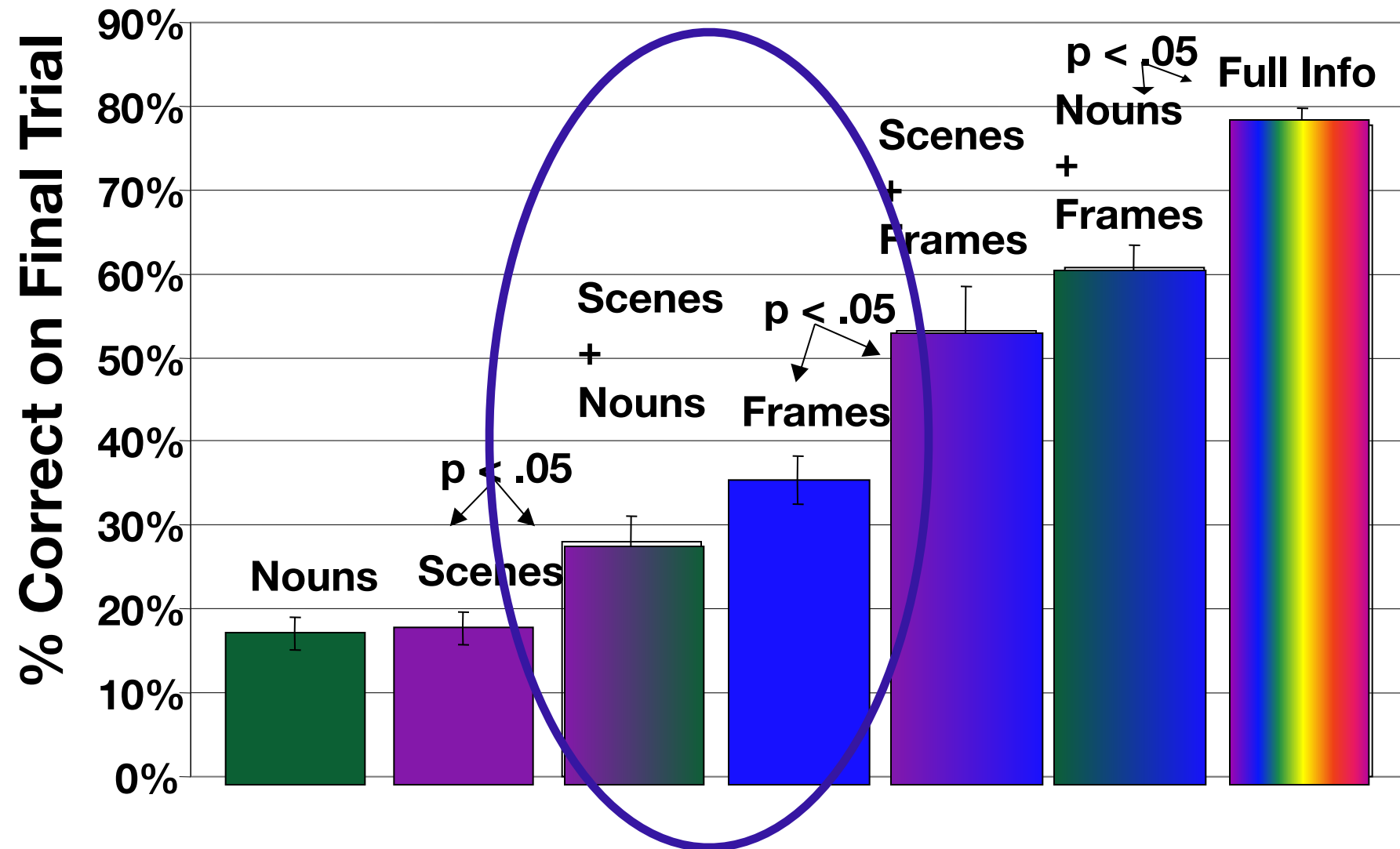


Correct identification varies with information condition



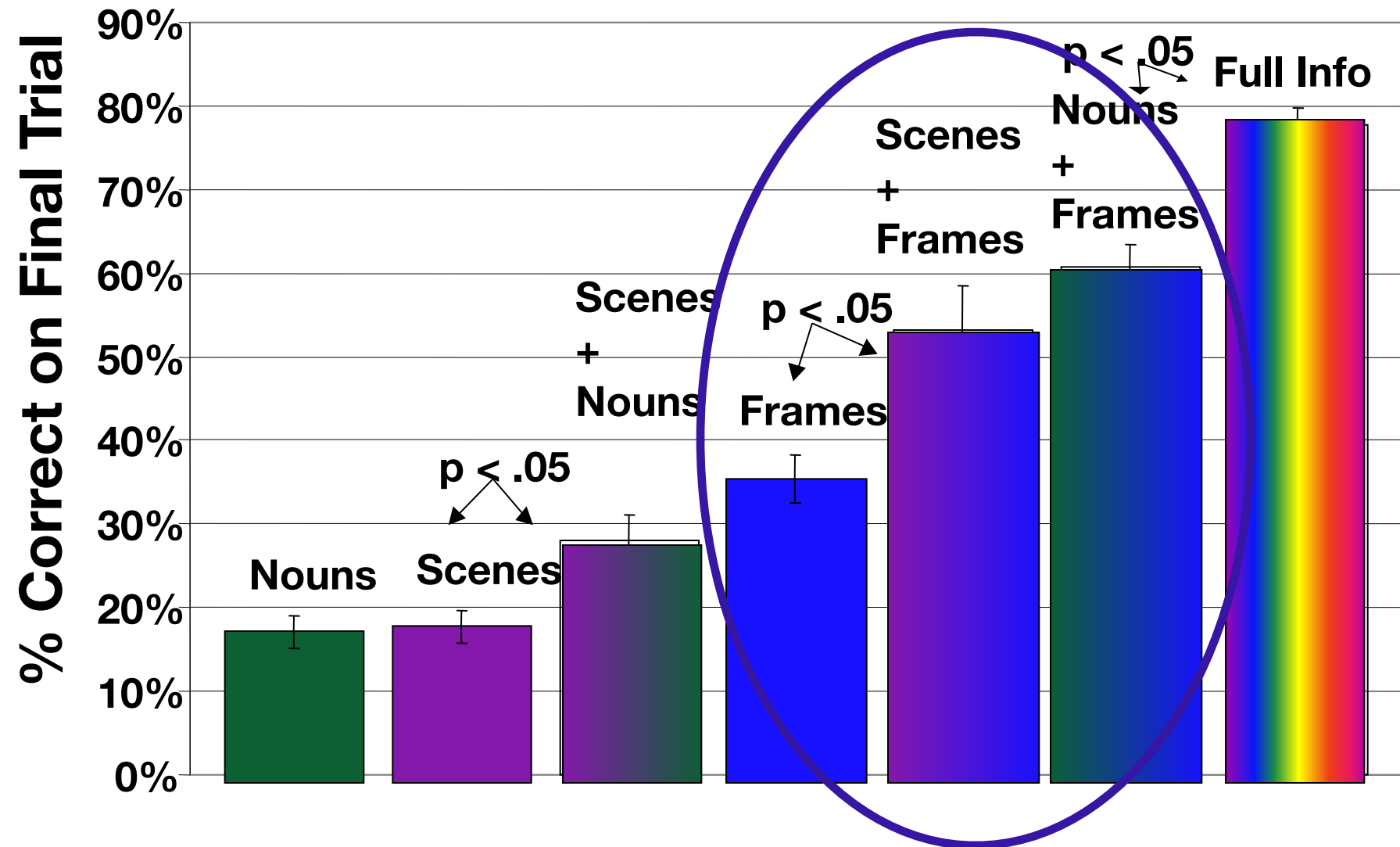
Utility of syntactic frame knowledge:

Scenes + Nouns equivalent to Syntactic Frames only

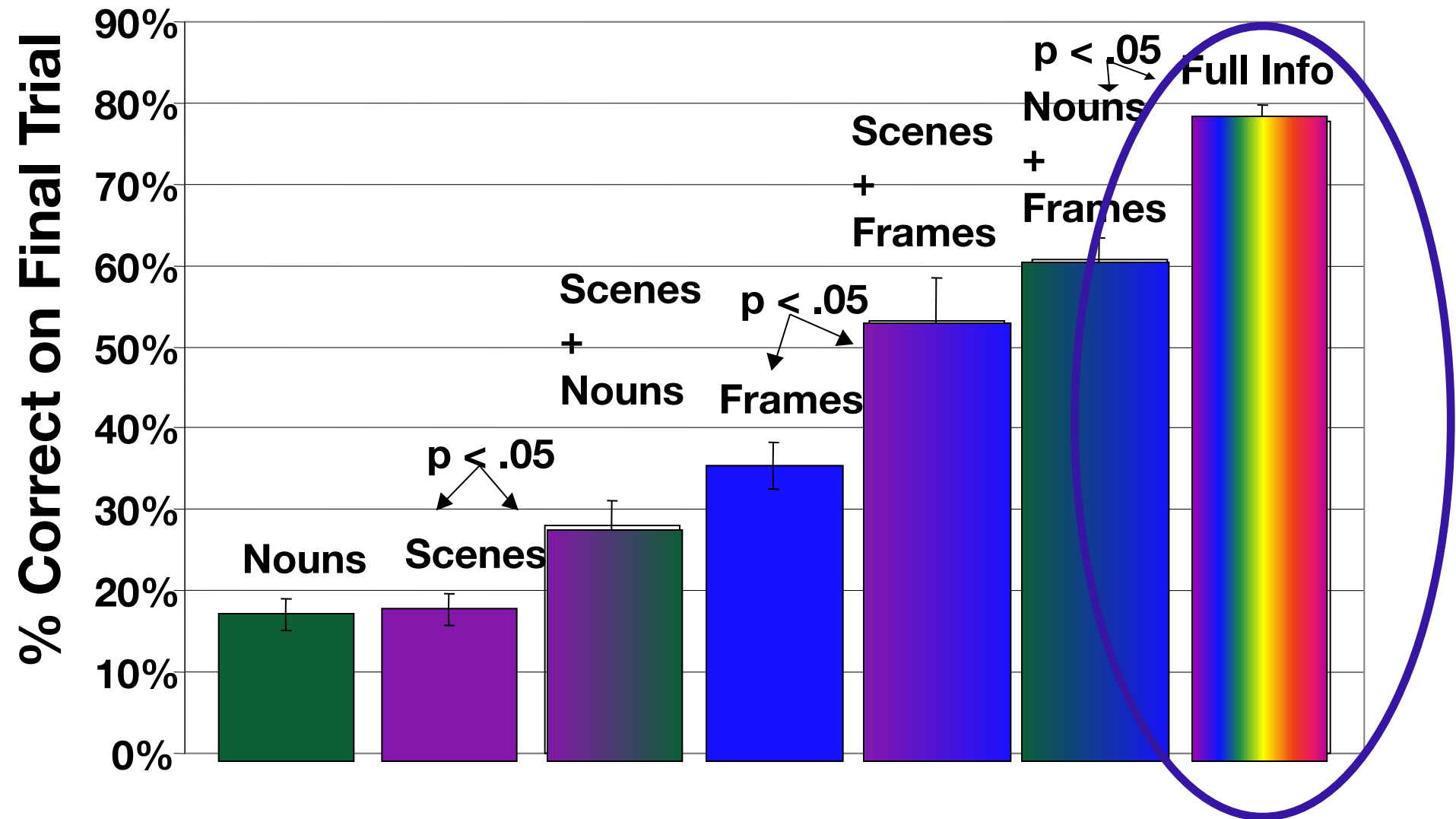


Utility of additional knowledge with Frames:

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

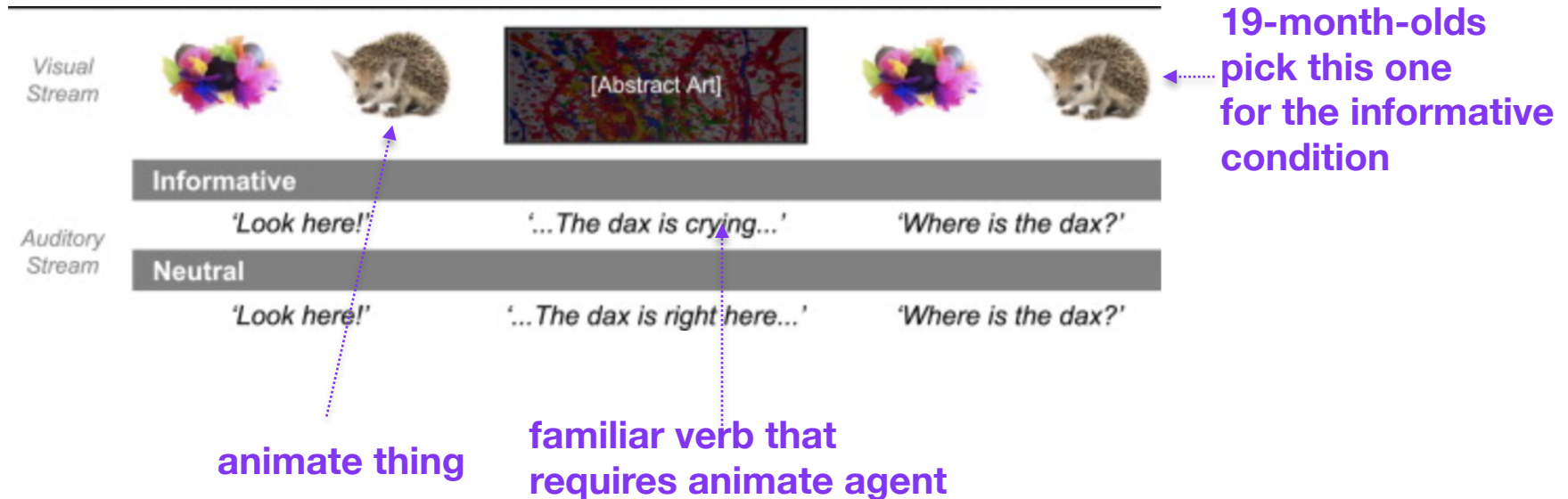
Knowing what to guess

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



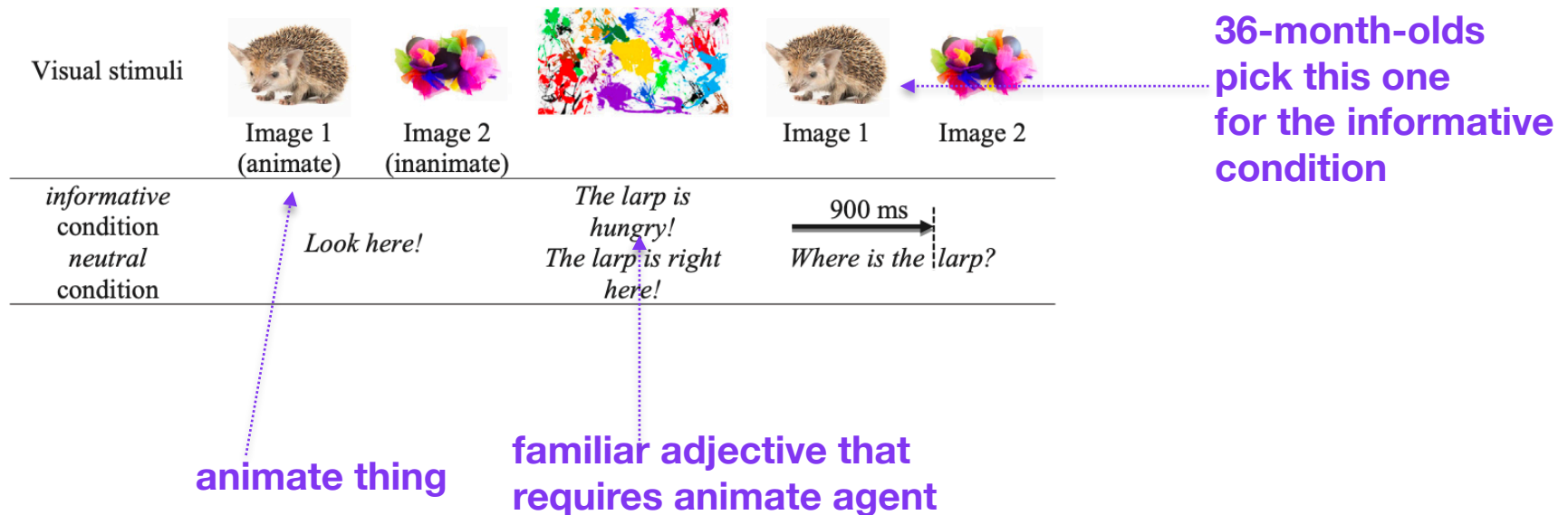
Knowing what to guess

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

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

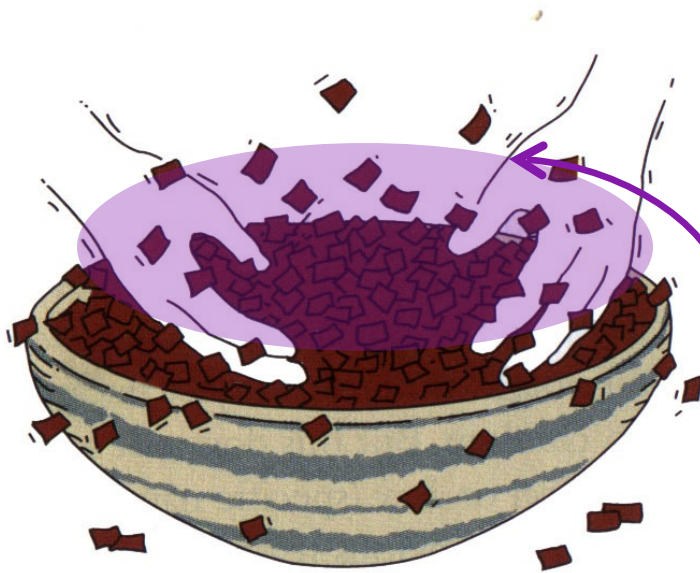
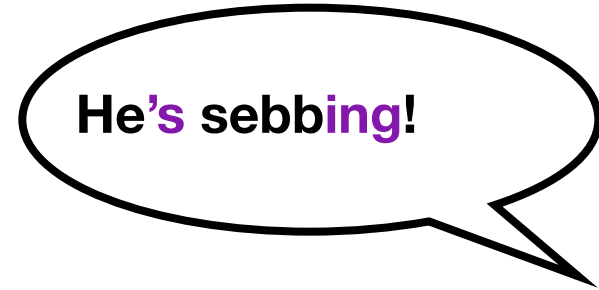
<https://www.youtube.com/watch?v=Ci-5dVVvf0U>

5:07 - 6:19



Knowing what to guess

Clues from the syntactic structure



seb = verb

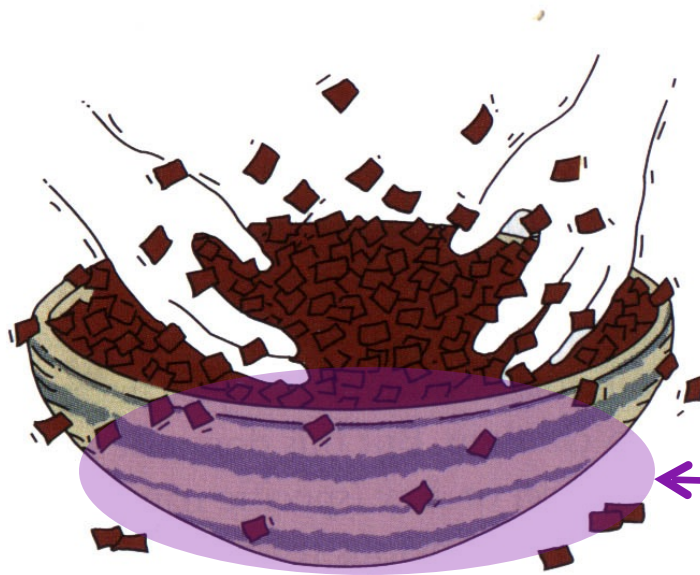
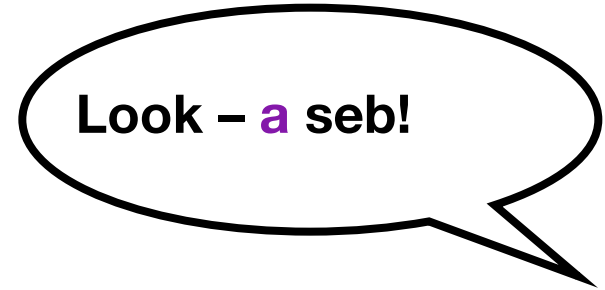
verb = action

seb

Brown, 1957

Knowing what to guess

Clues from the syntactic structure



Brown, 1957

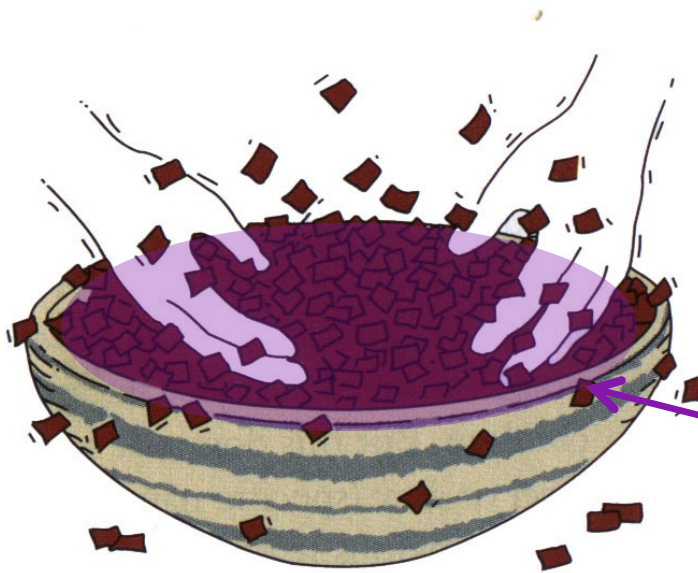
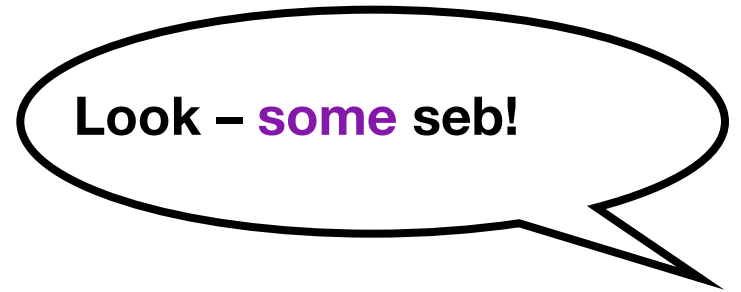
seb = noun with "a"

noun = countable object
like "bowl"

seb

Knowing what to guess

Clues from the syntactic structure



seb = noun with "some"

**noun = mass substance
like "stuff"**

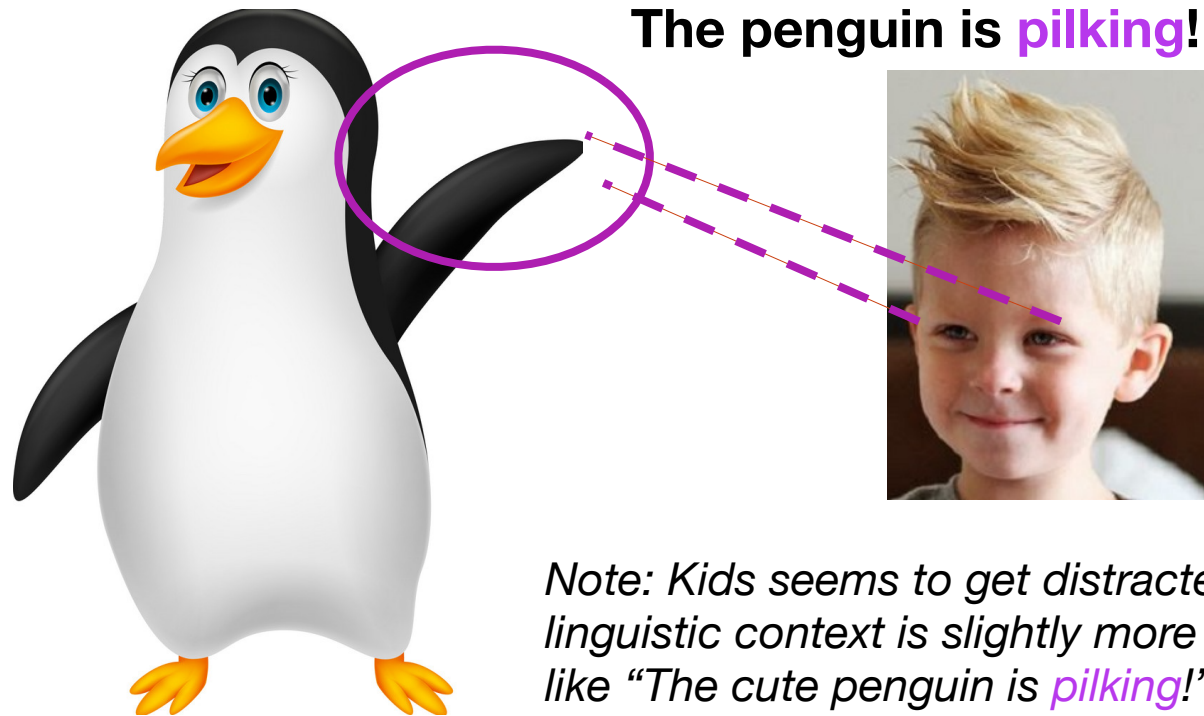
seb

Brown, 1957

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).



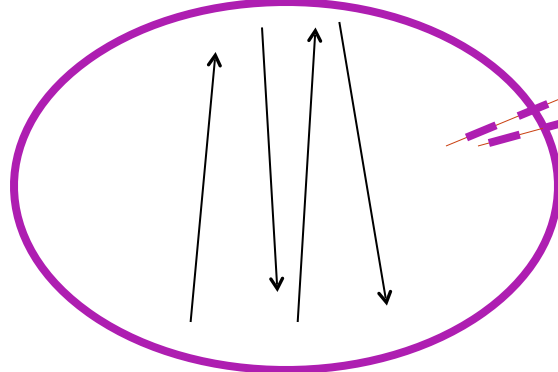
Knowing what to guess

Clues from the syntactic structure

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



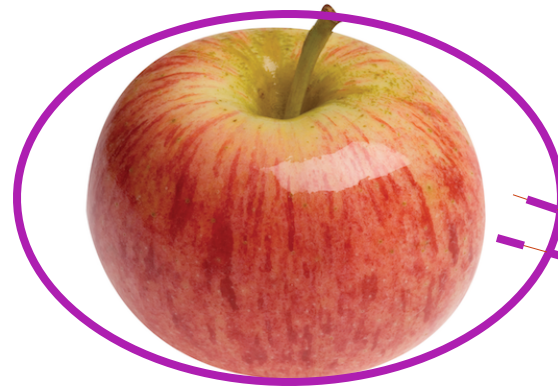
Look – it **dases!**



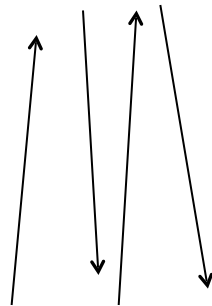
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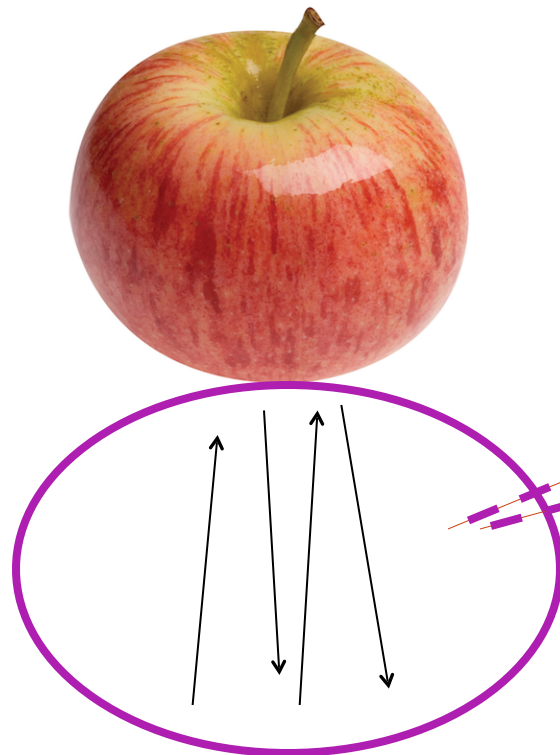
Look – a **dase!**



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

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



It's **pratching**

pratch = spin



Knowing what to guess

Clues from the syntactic structure

Kedar, Casasola, Lust, & Parnet 2017: 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?

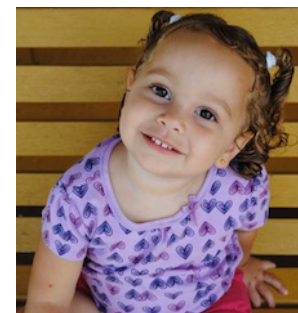


Knowing what to guess

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		<i>"THESE ARE nice blicketS. Can you find the blicketS?"</i>	
2		<i>"Where IS the blicket_? Can you see A blicket_?"</i>	







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

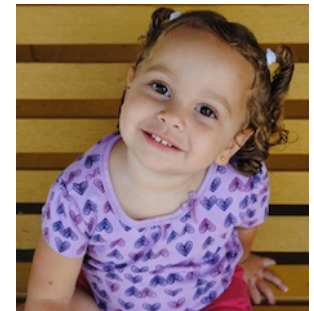


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Training 1		<i>"THESE ARE nice blicketS. Can you find the blicketS?"</i>	
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Two-year-olds prioritize the grammatical cues and figure out the right referent.

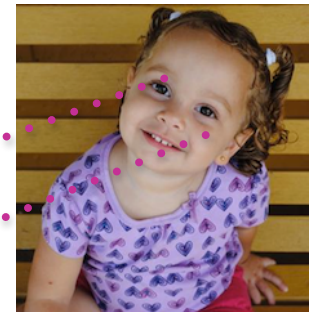








Knowing what to guess

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.



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

[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)

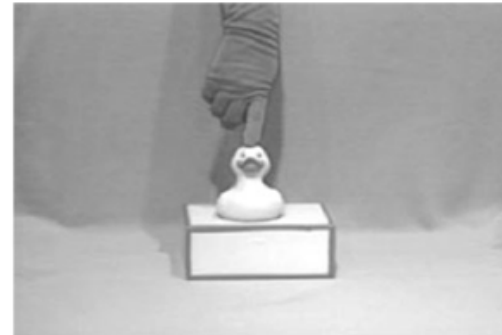
Knowing what to guess

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)!

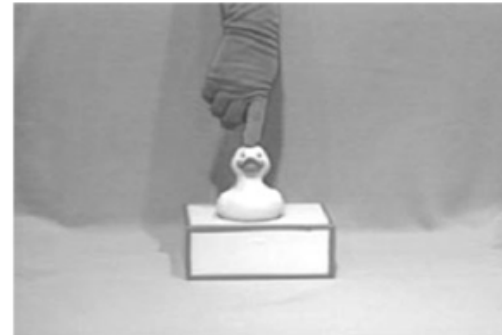
Knowing what to guess

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)

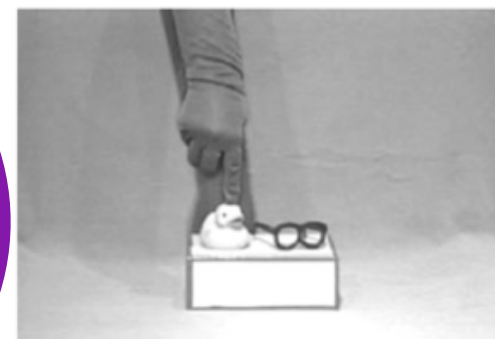


Training: This is acorp (my box)!

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

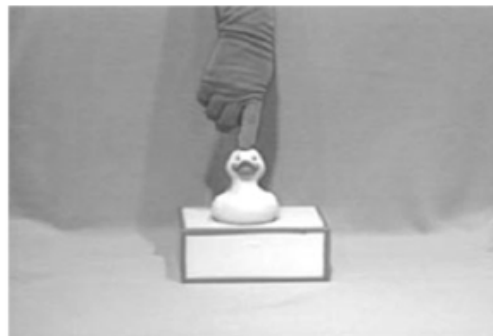
Test: This is acorp (my box)! What else is acorp (my box?)

Knowing what to guess

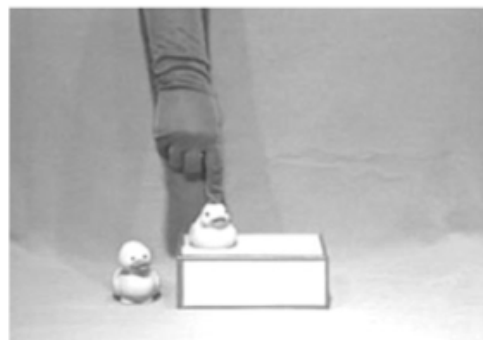
Syntactic Bootstrapping Hypothesis: primarily using the syntactic structure to get to meaning

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?”



Training: This is acorp (my box):



Object match screen



Location match screen

Test: This is acorp (my box)! 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

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).

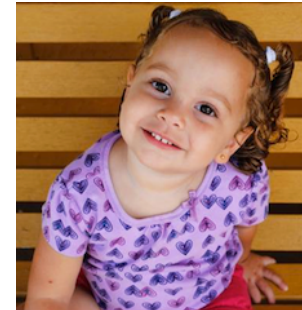
Still remaining: jalouse, siccar?

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

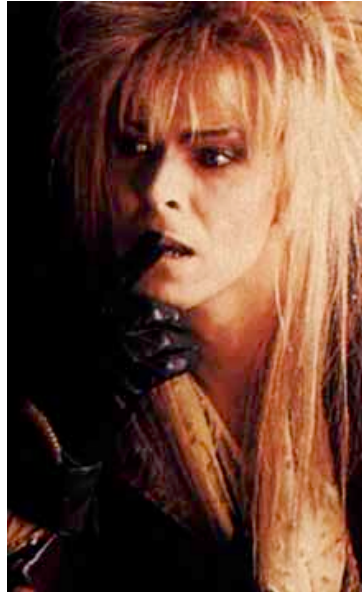
Lexical development recap

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 28 on the review questions for lexical development.

Extra Material

Carey & Bartlett 1978 [Extra]

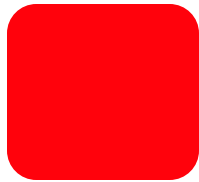
Children can use input to figure out which aspect of their experience is being lexicalized



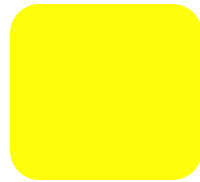
“What colors are these?”

Carey & Bartlett 1978 [Extra]

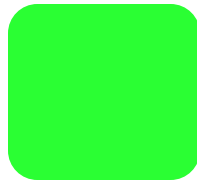
Children can use input to figure out which aspect of their experience is being lexicalized



“red”



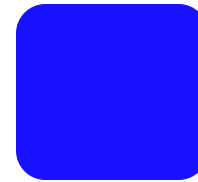
“yellow”



“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]

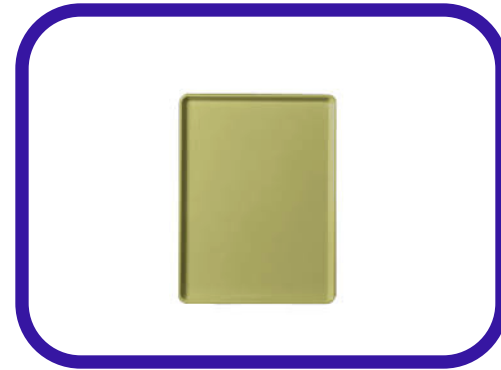
Children can use input to figure out which aspect of their experience is being lexicalized



“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...

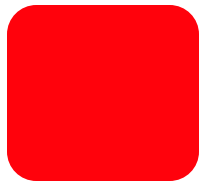


“What colors are these?”

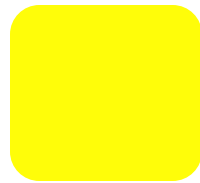
Carey & Bartlett 1978 [Extra]

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

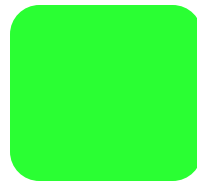
5 weeks later...



“red”



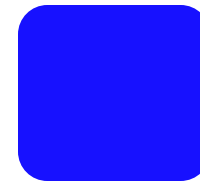
“yellow”



“green”



“????”



“blue”

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

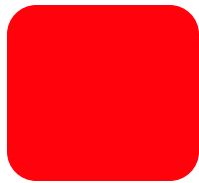
“I don’t know”

[other previously unused color term like “gray”]

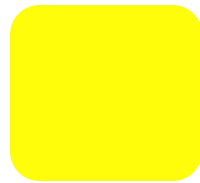
Carey & Bartlett 1978 [Extra]

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

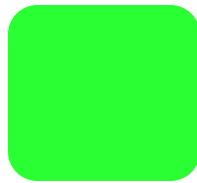
5 weeks later...



“red”



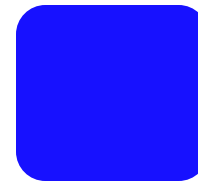
“yellow”



“green”



????



“blue”

...and also that the dark greenish color had a different name from “green”

“I don’t know”

[other previously unused color term like “gray”]