

# LSci 51/Psych 56L: Acquisition of Language

## Lecture 15 Lexical development IV

# Announcements

Be working on review questions for lexical development

HW4 due 11/5/21

Post/like questions for in-class review on 11/5/21

Timed Assessment 4 available 11/5/21 and due by 11/8/21

# The difference after 50 words



Up to 50 words: about 8-11 words added every month, adding words is a slow process

After 50 words: about 22-37 words added every month, words often added after a single exposure

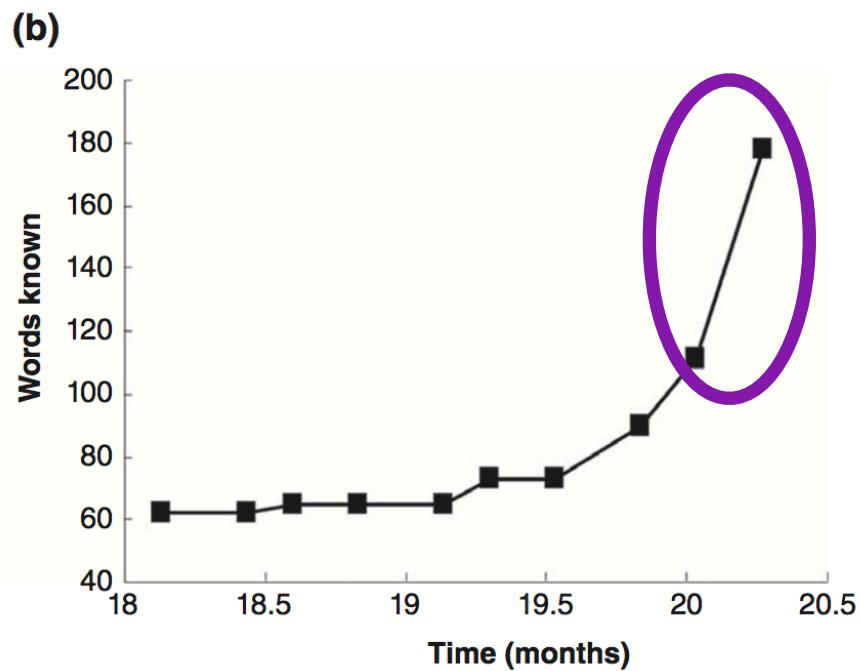
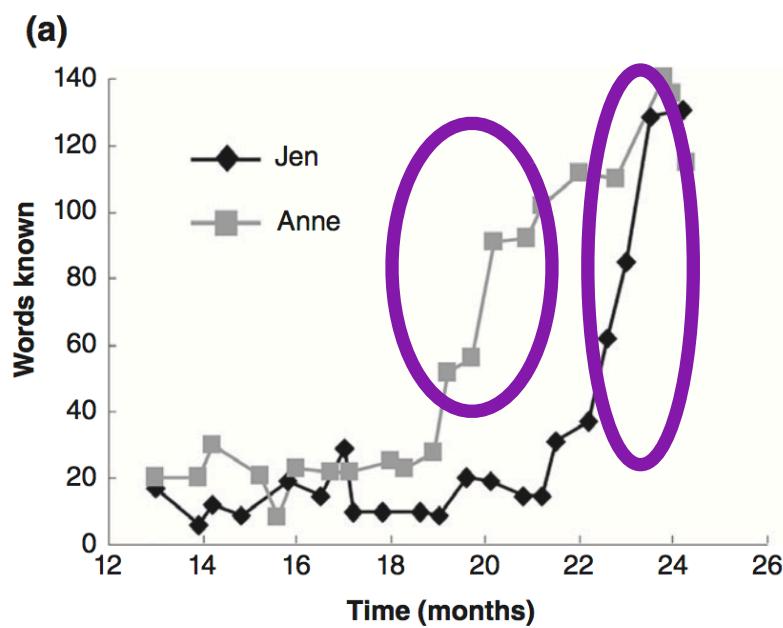
Called the “word spurt”, “word explosion”, “naming explosion”.

Occurs for most (but not all) children around 18 months.

# A word spurt

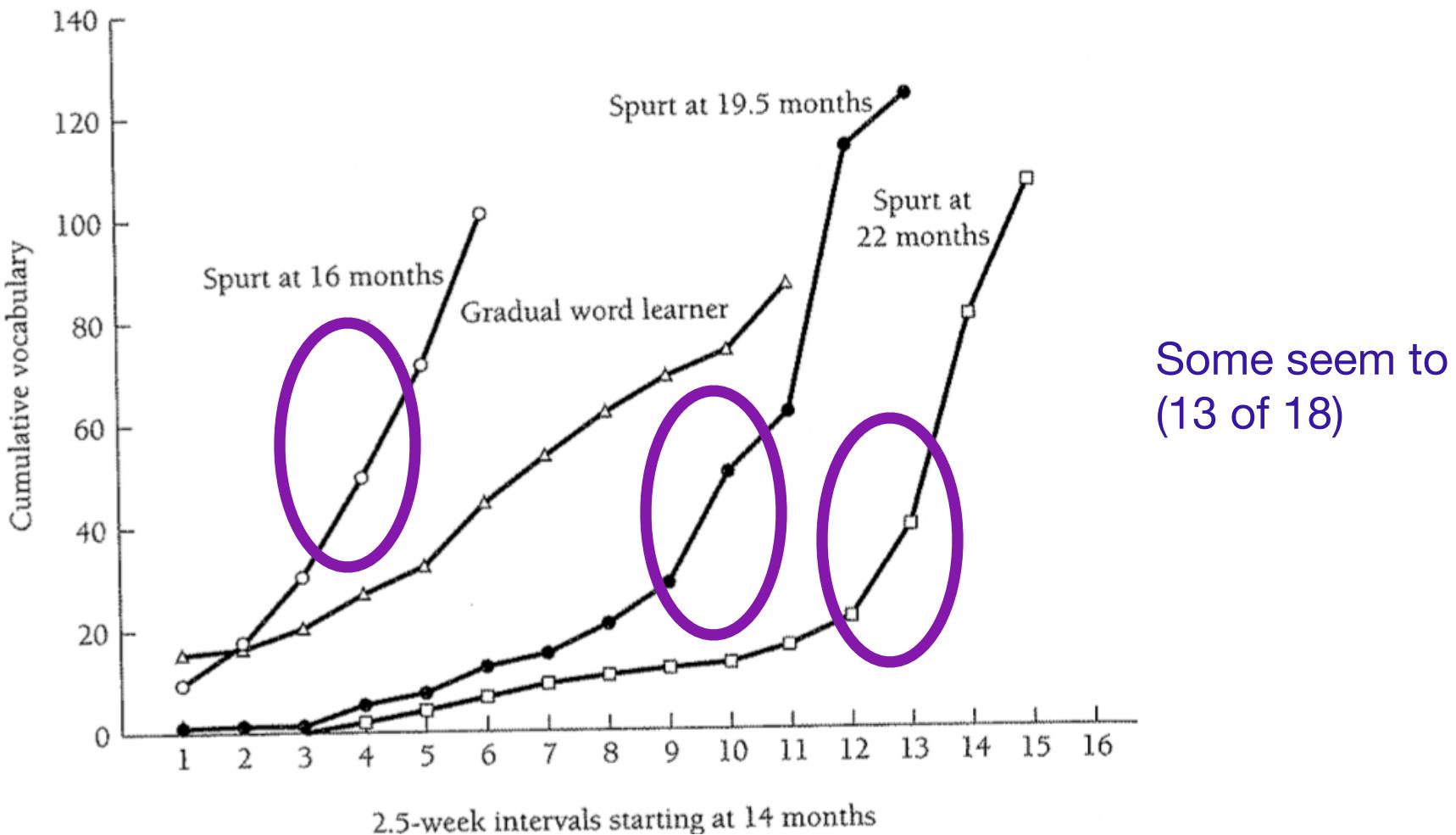
From Samuelson & McMurray 2017

“...a rapid acceleration of the pace at which toddlers add new words to their productive vocabulary...a **nonlinear shift** in vocabulary development.” —> **big slope** of line.



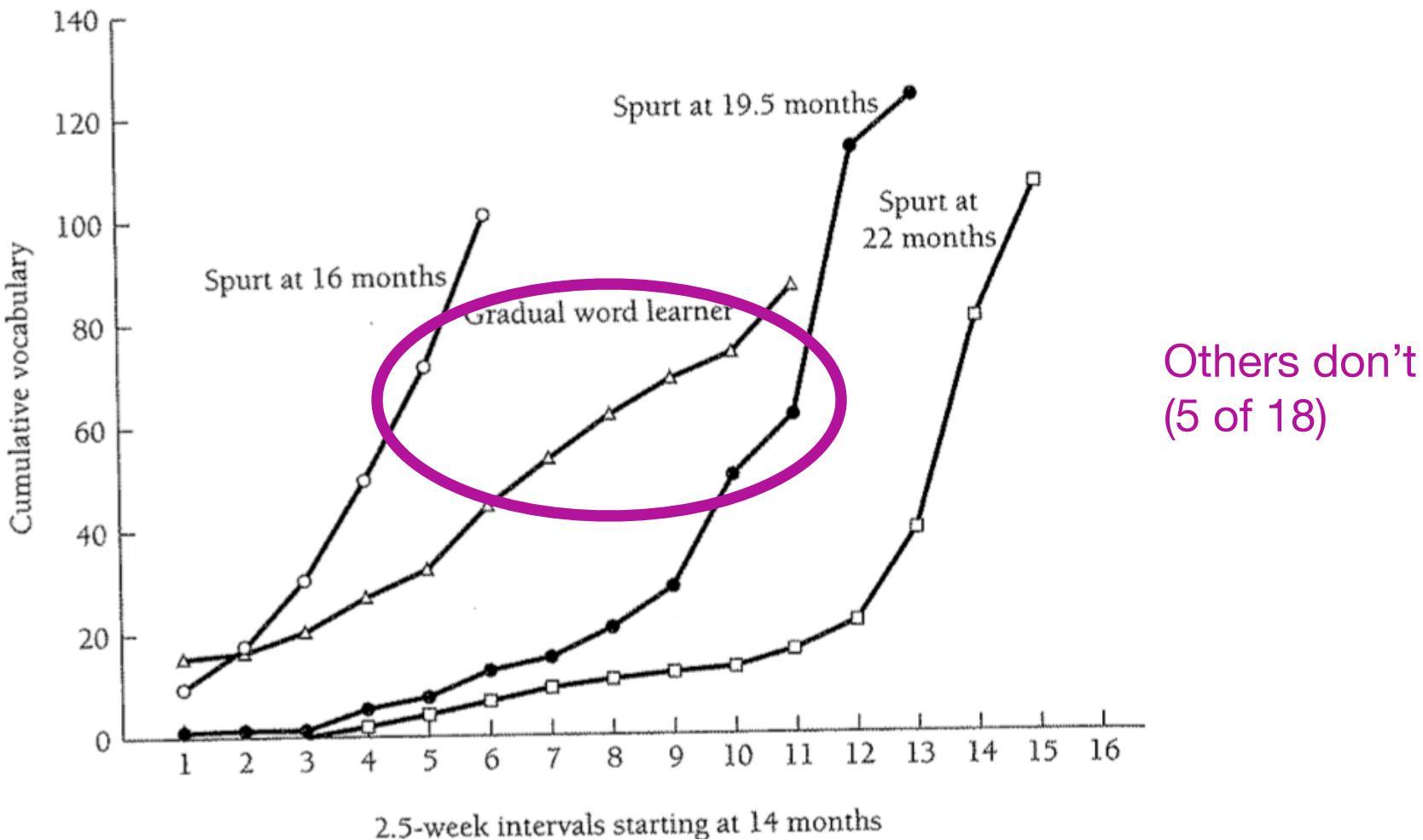
from Plunkett 1993

# Does every child have a word spurt?



Goldfield & Reznick 1990

# Does every child have a word spurt?



Goldfield & Reznick (1990)

# Leveraging known words

On Borovsky, Ellis, Evans, & Elman 2015:

“Children leverage their early world knowledge to help them unlock their language skills. Knowing a few related words helps children recognize links between new word meanings, and this could be a very useful strategy for helping children learn vocabulary early in life. This might be part of the explanation for why children begin to start 'talking up a storm' between the ages of 18-24 months.” — Arielle Borovosky



<https://www.sciencedaily.com/releases/2015/10/151012132455.htm>

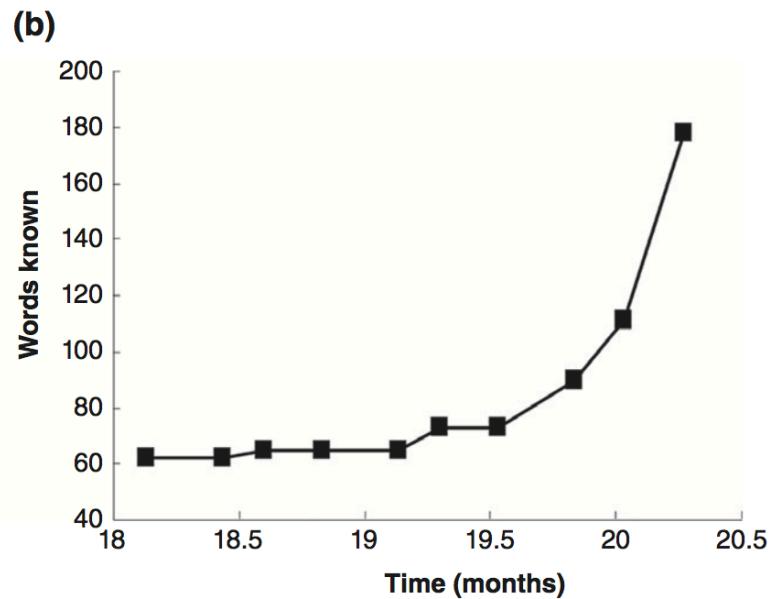
# Causes of the vocabulary spurt

Samuelson & McMurray 2017:

“actually the necessary consequence of two basic facts about word learning:

- (1) children learn multiple words at once, and
- (2) those words vary in difficulty (with most words being moderately difficult).”

“the combination of these two things always produces an accelerating learning curve”

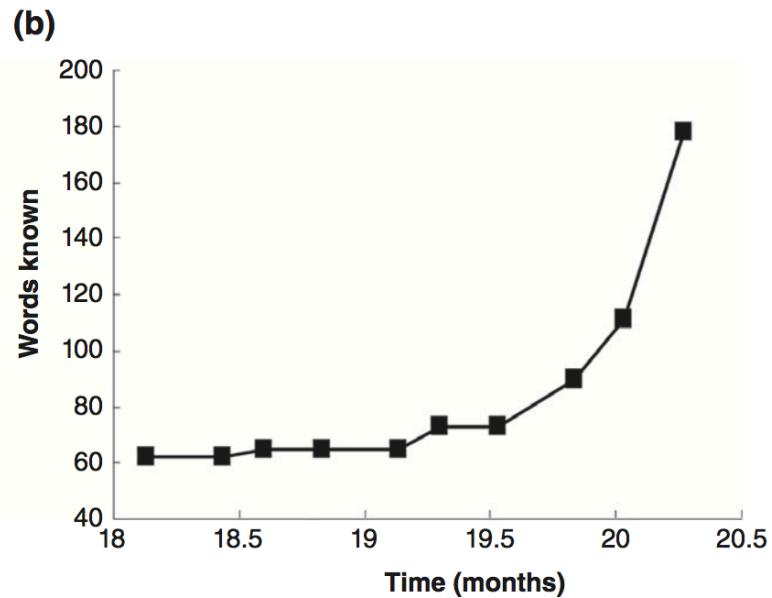


# Causes of the vocabulary spurt

Abend, Kwiatkowski, Smith, Goldwater, & Steedman 2017:

One reason children can learn multiple words at once is syntactic bootstrapping (linguistic structure helps kids zero in on word meaning and generalize across utterances).

One reason these words vary in difficulty is that the syntactic structures associated with their linguistic context (which makes syntactic bootstrapping possible) are learned at different ages.



# Causes of the vocabulary spurt

Frank, Lewis, & MacDonald 2016:

The impact of developing **processing** abilities

“**difficulties using knowledge or representations** that they nevertheless possess”

“any cognitive operation requires multiple steps, each of which require some time to complete and have some probability of failure...”



“...even the simplest word learning input for object referents involves **following some kind of attentional cue** (e.g., gaze or pointing) to a distal target and then **processing some kind of link between a word and the target referent...**”

# Causes of the vocabulary spurt

Frank, Lewis, & MacDonald 2016:

The impact of developing **processing** abilities

“**difficulties *using* knowledge or representations** that they nevertheless possess”

These abilities “**develop dramatically over the first two years and beyond**”, which leads to better ability to learn and use vocabulary.



# Some known variation in lexical development



## Wordbank

An open database of children's vocabulary development



<https://wordbank.stanford.edu>

Frank, Braginsky, Yurovsky & Marchman 2017

“Across languages and forms, it appears to be the norm that toddlers vary.”

Variation by gender: “...considerable and strikingly consistent cross-linguistic **female advantage in early language production** (replicating and extending Eriksson et al. 2012). A much smaller but still relatively consistent female advantage was reported in comprehension.”



# Some known variation in lexical development



## Wordbank

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Frank, Braginsky, Yurovsky & Marchman 2017

“Across languages and forms, it appears to be the norm that toddlers vary.”

Variation by birth order: “...earlier-born children show larger vocabularies in production (though not in comprehension for the most part). This general finding is consistent with previous literature [like Laing & Bergelson 2017] reporting a first-born advantage for individual languages.”



# Some known variation in lexical development



## Wordbank

An open database of children's vocabulary development



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Frank, Braginsky, Yurovsky & Marchman 2017

“Across languages and forms, it appears to be the norm that toddlers vary.”

From Laing & Bergelson: “...across three different measures of input quality/quantity, disadvantages were found for infants with more siblings. Having a larger number of **siblings diminished the quality of the input** and led to slower overall lexical development.”



# Links between quality of motherese and word learning

[Extra]

<http://www.sciencedaily.com/releases/2014/09/140917141431.htm>

**Brady & Goodman 2014:** Investigating 18- to 36-month-olds

- children learn better when a variety of cues are available (like the scenes+nouns+frames condition in Snedeker & Gleitman 2002)



# Links between cognitive development and word learning

[Extra]

<http://www.sciencedaily.com/releases/2014/09/140917141431.htm>

**Brady & Goodman 2014:** Investigating 18- to 36-month-olds

- children's ability to figure out a word using linguistic context (like the frames condition in Snedecker & Gleitman 2002) improved with age
- children's memories are still limited — the first 3 words they learn the previous day stick with them better
- by 36 months, children relied less on social cues like eye gaze

# Word comprehension

The word spurt refers to words children actually produce.

However, another way to test children's developing lexicons is via their comprehension of words.

Production usually lags behind comprehension.

Ex: At 16 months, children typically produce less than 50 words, but parents report they comprehend between 92 and 321 words.



Production vocabularies are different from comprehension vocabularies. (This may be because communication works just fine with a minimal verb vocabulary. Ex: *go* is very versatile. Go + night-night, go + car, go + park, etc.)

# How learning works: Links between phonology and word learning

phonological memory = ability to remember a sequence of unfamiliar sounds

Children's phonological memory has been linked to their vocabulary size from 22 months up to 9 years old. (This makes sense since the ability to remember the forms of newly encountered words would be vital if a child wants to learn the mapping between sound and meaning.)



# How learning works: Links between labeling and word learning [Extra]

Ferguson, Havy, & Waxman (2015) found that 12-month-olds who recognize that different labels indicate different categories have a larger vocabulary at 18 months.



What this means: Recognizing that words (labels) denote specific concepts.

<https://www.sciencedaily.com/releases/2015/08/150831135841.htm>

# How learning works: Links between motherese and word learning

Ma, Golinkoff, Houston, & Hirsh-Pasek (2011)

found that 21-month-olds learn better from child-directed speech (as compared to regular adult-directed speech).

What this means: Remember that **motherese has exaggerated prosody**, and when learning novel words early on in lexical development, children rely more on prosodic cues. Also, the exaggerated prosody may get children's attention more.



# How learning works: Links between motherese and word learning

Ferjan Ramírez, Roseberry Lytle, Fish, & Kuhl

(2018) found that when parents were coached to **use more motherese with their infants between 6 and 10 months old**, those infants had **better language development at 14 months**.

What this means: “...it sounds happy and **conveys total engagement with the child**. Spoken directly to the child -- and used across many languages -- [motherese] resonates with infants...and **helps babies tune in socially to their parents, and motivates them to talk back**, even if that just means babbling”



# How learning works: Links between motherese and word learning

Ota, Davies-Jenkins, & Skarabela (2018)

found that 9-month-olds who heard more **diminutives** (like “**bunny**” and “**kitty**”) and words with **reduplication** (like “**choo choo**” and “**night night**”) were faster at picking up words between 9 and 21 months old.

What this means: These types of words are **much more frequent in motherese**, and their prosodic forms may get children’s attention more.



<https://www.sciencedaily.com/releases/2018/08/180801102605.htm>

# How learning works: Links between motherese and word learning

Taumoepeau (2016) found that mothers who expanded more of the utterances directed at children between the ages of 24 and 33 months really gave those children a boost when learning words.

What this means: Remember that motherese tends to have more expansions and repetitions, and this seems to be helpful (most likely for remembering word forms and determining their referents).



# How learning works: Links between motherese and word learning

On Newman, Rowe, & Bernstein Ratner (2015):

“Parents who **repeat words more often** to their infants have children with better language skills a year and a half later...A lot of recent focus has been on simply talking more to your child -- but **how you talk to your child matters**. It isn't just about the number of words.”

- Rochelle Newman



<https://www.sciencedaily.com/releases/2015/09/150921103539.htm>

# How learning works: Links between motherese and word learning

Rowe (2012):

The **quantity** of speech is the strongest predictor of **vocabulary growth in the second year of life**.

**Diversity of vocabulary** used by parents predicts **vocabulary growth in the third year of life**, and the **complexities** associated with narratives and **decontextualized speech** predict **vocabulary growth in the fourth year of life**.



Decontextualized speech: Things that aren't about the “here” and “now” of the current context.

# How learning works: Links between quantity of motherese and word learning

<http://www.economist.com/news/science-and-technology/21596923-how-babbling-babies-can-boost-their-brains-beginning-was-word#>

(video: up through about 1:14)

## Issues of developmentally-meaningful input differences

“It is also now clear from Dr Fernald’s work that words spoken directly to a child, rather than those simply heard in the home, are what builds vocabulary...Telling parents is the first step: many who volunteered themselves and their children for study did not know they could help their babies do well simply by speaking to them.”

# How learning works: Links between quantity of motherese and word learning

Schwab & Lew-Williams 2016:

Differences by socio-economic status (SES)

“On average, children from lower-SES families show slower vocabulary growth relative to their higher-SES peers, and these differences persist into the school years. From where do these differences arise? Research suggests that variation in parents’ speech to children—as a function of SES—relates to children’s language development.”

Note: SES is often measured by maternal education level, and not by factors like race. Maternal race has *not* been shown to impact input quality (Vernon-Feagans, Bratsch-Hines, Reynolds, & Willoughby 2019)

<https://www.sciencedaily.com/releases/2019/07/190718164854.htm>

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From Wordbank: “...did observe some kind of college advantage for [early language] production in nearly every dataset that we examined.”

# How learning works: Links between quantity of motherese and word learning

Schwab & Lew-Williams 2016:

Differences by socio-economic status (SES)

“For example, Hart and Risley revealed dramatic differences in the amount that parents talk to their young children as a function of SES. Their estimations suggest that by age 4, children from professional families hear a total of 45 million words on average [*from their mother*], while children living in poverty hear 13 million words on average [*from their mother*]. This finding is often described as the ‘30 million word gap.’ Importantly, quantitative differences in parents’ language input have been shown to uniquely predict aspects of children’s language development, such as vocabulary growth and speed in processing familiar words.”

# How learning works: Links between quality of motherese and word learning

Schwab & Lew-Williams 2016:  
Differences by socio-economic status (SES)

“Rowe found that SES was related to both quantity and **quality measures**, with more highly educated parents using more **word tokens** and **word types**, as well as more **rare words** and more of some types of **decontextualized utterances**...”



# How learning works: Links between quality of motherese and word learning

Schwab & Lew-Williams 2016:  
Differences by socio-economic status (SES)

“By 18 months, group-level differences in vocabulary knowledge and language processing efficiency (i.e., comprehension of language in real time) between lower-SES and higher-SES toddlers are already apparent.”



# How learning works: Links between quality of motherese and language learning

Schwab & Lew-Williams 2016:  
Differences by socio-economic status (SES)

“By 24 months, there is a 6-month gap between SES groups in language processing efficiency, which has been shown to forecast later language learning. Thus, infants hearing **more rich language from their caregivers early in life develop stronger language processing skills**, which can affect their ability to learn new words more quickly, and this in turn seems to influence their ability to process future sentences containing those words.”



# How learning works: Links between quantity & quality of motherese and language learning

Schwab & Lew-Williams 2016:  
Differences by socio-economic status (SES)

“Specifically, children at the lower end of the SES spectrum tend to receive significantly less high-quantity and high-quality language experience, which affects their development of vocabulary, grammar, and language processing.”



# How learning works: Links between quantity & quality of motherese and language learning

Bates & Pearl 2019, 2021

But sometimes *not* differences in input quality across SES for more sophisticated knowledge, like the building blocks of *wh*-questions



Who did Lily think the pretty kitty was for?



*Who did Lily think the kitty for was pretty?*

“We find that the [building blocks] in low-SES children’s complex syntactic input are quantitatively and qualitatively similar to those of high-SES children...Our results suggest that the linguistic evidence for more complex syntactic knowledge...may not differ by SES.”

# How learning works: Links between quantity & quality of motherese and word learning

Mandy J. Maguire, Schneider, Middleton, Ralph, Lopez, Ackerman, & Abel 2018:

Differences by socio-economic status (SES)  
in **syntactic bootstrapping** for grade-school age children (ages 8-15)

“...children of lower socioeconomic status are not as effective at **using known vocabulary to build a robust picture or concept of the incoming language and use that to identify the meaning of an unknown word.**”



<https://www.sciencedaily.com/releases/2017/11/171130122802.htm>

# How learning works: Links between quality of motherese and language learning

Schwab & Lew-Williams 2016:

Differences *within* socio-economic status (SES)

“...within this low-SES sample, measures of the quality of mother–child communication more strongly predicted children’s expressive language abilities one year later than did the total number of words spoken by mothers...”

“...children from low-SES families whose mothers spoke to them using more complex language at 18 months were significantly faster in a real-time comprehension task at 24 months.”

# How learning works: Links between quality of motherese and word learning

Rowe, Leech, & Cabrera 2017:  
Differences *within* socio-economic status (SES)

Speech samples from “low-income,  
African-American fathers and their 24-  
month-old children”



“the overall quantity of father talk did not relate to children’s vocabulary or reasoning skills...**fathers’ use of wh-questions** (but not other questions) related to both...a challenging type of input, which elicits a verbal response from the child that likely helps build vocabulary and foster verbal reasoning abilities.”

# How learning works: Links between quality of motherese and word learning

Romeo, Leonard, Robinson, West, Mackey, Rowe, & Gabrieli 2018:  
The importance of interactive input

“...conversation between an adult and a child appears to change the child's brain, and that this back-and-forth conversation is actually more critical to language development than the word gap. In...children between the ages of 4 and 6....differences in the number of "conversational turns" accounted for a large portion of the differences in brain physiology and language skills that they found among the children. This finding applied to children regardless of parental income or education.”



<https://www.sciencedaily.com/releases/2018/02/180214145833.htm>

# How learning works: Links between quality of motherese and word learning

Romeo, Segaran, Leonard, Robinson, West, Mackey, Yendiki, Rowe, & Gabrieli 2018:

The importance of interactive input

“In their neuroimaging study of 40 four- to six-year-old children and their parents of diverse socioeconomic backgrounds...found that greater conversational turn-taking (measured over a weekend with an in-home audio recording device) was related to stronger connections between Wernicke's area and Broca's area -- brain regions critical for the comprehension and production of speech...”



<https://www.sciencedaily.com/releases/2018/08/180813133422.htm>

# How learning works: Links between quality of motherese and word learning

Perry, Prince, Valtierra, Rivero-Fernandez, Ullery, Katz, Laursen, & Messinger 2018:

The importance of interactive input for 2- and 3-year-olds

“...how important it was to see those conversational turns with teachers, that back-and-forth conversation with the child is very beneficial.”



<https://www.sciencedaily.com/releases/2018/07/180723142948.htm>

# How learning works: Links between quality of motherese and word learning

Kartushina et al. 2021: The impact of Covid-19 lockdowns

The importance of interactive input for 8- to 36-month-olds, looking at 1742 children across 13 countries and 12 languages

“Children who had **less passive screen exposure and whose caregivers read more to them** showed larger gains in vocabulary development during lockdown, after controlling for SES and other caregiver-child activities.”



# How learning works: [Extra] Interactive input

Myers, LeWitt, Gallo, & Maselli 2016: 17-month-olds can learn words from video chats, but only interactive chats where the on-screen partner responded to them in real-time, as opposed to prerecorded ones without that interaction.



# How learning works: [Extra]

## Links between social cues and word learning

Brooks & Meltzoff 2008: 10- and 11-month-old infants who follow the **gaze** of their caretakers and **pointed themselves** when learning new words had faster vocabulary growth.



Bergelson & Swingley 2013: 10-month-old ability to **follow pointing** of caretaker correlates with current non-noun (verb, adjective, etc.) vocabulary.

# How learning works: [Extra] Links between social cues and word learning

Wu & Gros-Luis 2015: 16-month-olds learned the labels for new objects the best when the labels were provided contingently after the child's own pointing gesture.



What this means: Very early word learning may be greatly facilitated by these kind of social cues in a communicative context.

# How learning works: [Extra] Links between social cues and word learning

Scott, Sakkalou, Ellis-Davies, Hilbrink, Hahn, & Gattis 2013: 14-month-old tendency to look at objects after being encouraged to do so (called [infant follow-in](#)) is strongly related to productive vocabulary size and growth.



What this means: Very early word learning may be greatly facilitated by these kind of social cues in a communicative context.

# How learning works: [Extra] Links between social cues and word learning

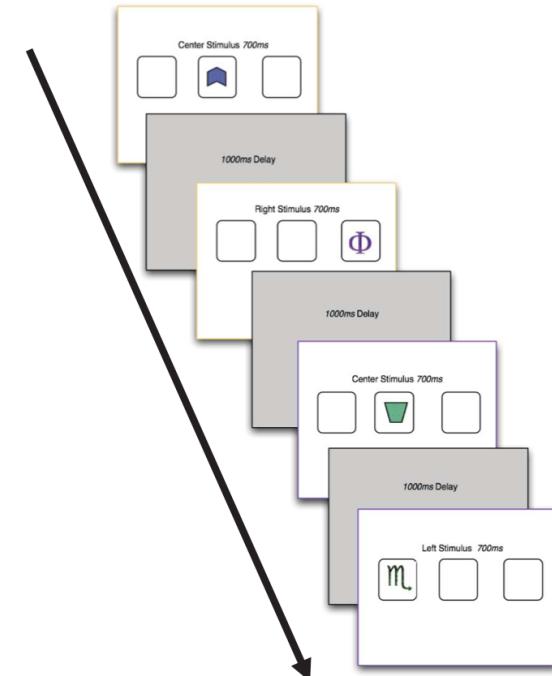
<http://sites.sinauer.com/languageinmind/wa05.03.html>

Joint attention “in the wild”



# How learning works: Links between sequential pattern sensitivity and word learning

Ellis, Robledo Gonzales, & Deák 2013:  
6-month-old capacity to respond to **novel**  
**but predictable events** robustly predicted  
both receptive and productive  
vocabulary at 22 months.



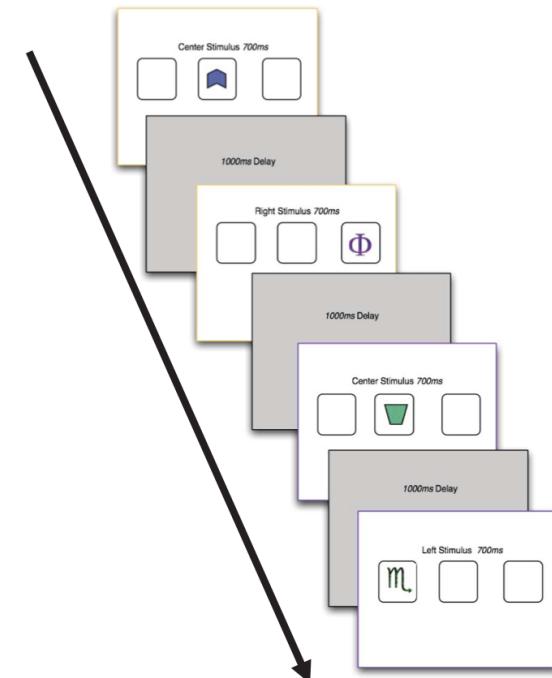
What this means: This **domain-general ability** to track probabilities  
(sometimes called **statistical learning**) matters for early word learning.

# How learning works: Links between sequential pattern sensitivity and word learning & SES

Eghbalzad, Deocampo, & Conway 2016, 2021:

**SL = statistical learning**

“For children with high SL ability, SES had a weaker effect on language compared to children with low SL ability, suggesting that having good SL abilities could help ameliorate the disadvantages associated with being raised in a family with lower SES when it comes to language learning.



# [Extra] How learning works: Links between quality of motherese and word learning

Hoff, Quinn, & Giguere 2017:  
Bilingual acquisition

“Children may hear very rich language use in Spanish and less rich use in English...if their parents are more proficient in Spanish than in English.” - Erika Hoff



<https://www.sciencedaily.com/releases/2017/04/170420093711.htm>

# [Extra] How learning works: Links between quality of motherese and word learning

Hoff, Quinn, & Giguere 2017:  
Bilingual acquisition

"There is something about differences among the children and **the quality of English they hear** that make some children acquire vocabulary and grammar more rapidly in English and other children develop more slowly," said Hoff. "I think the key takeaway from our study is that it's not the quantity of what the children are hearing; **it's the quality of their language exposure that matters.** They need to experience a rich environment."



<https://www.sciencedaily.com/releases/2017/04/170420093711.htm>

# Recap: Children's lexical development

Children typically acquire their first 50 words over a series of months, and then increase their rate of lexical acquisition suddenly (word spurt)

The quantity and quality of language experiences (especially as transmitted by motherese) impacts lexical development.

There are significant differences in motherese both across SES classes and within SES classes.

Social cues (like interactive input) and statistical learning abilities impact children's vocabulary development.

# Questions?



You should be able to do all of HW4, and all of the lexical development review questions.