

# Naturalistic Language Input to Blind, Deaf/Hard-of Hearing, and Typically-Developing Infants:

a Quantitative and Qualitative Analysis

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# Language & Perception

- Children learn language from the world around them
- Blind children & Deaf/Hard-of-Hearing (DHH) children have different sensory experiences from sighted/hearing children
- Does language input and and early production differ for blind, DHH, and typically-developing children?
  - Big differences = language is changed by sensory experiences
  - Minimal differences = language unchanged by sensory experiences

# Sensory Impairment

## Deaf / Hard-of-Hearing (DHH)

- >40 dB hearing loss
- ~10/10,000
- persistent spoken language delays
- *spoken language* can be inaccessible

## Blindness

- No more than light perception
- ~3/10,000
- perhaps initial language delays, but quickly catch up
- *visual world* inaccessible

(Moeller et al., 2007; Landau & Gleitman, 1985; Perez- Pereira & Conti-Ramsden, 1999; Gilbert 2003; CDC, n.d.)

# Language Input & Sensory Impairment

## Deaf / Hard-of-Hearing (DHH)

- Similar speech quantity vs. hearing children
- Utterance type differences – more directives vs. hearing children

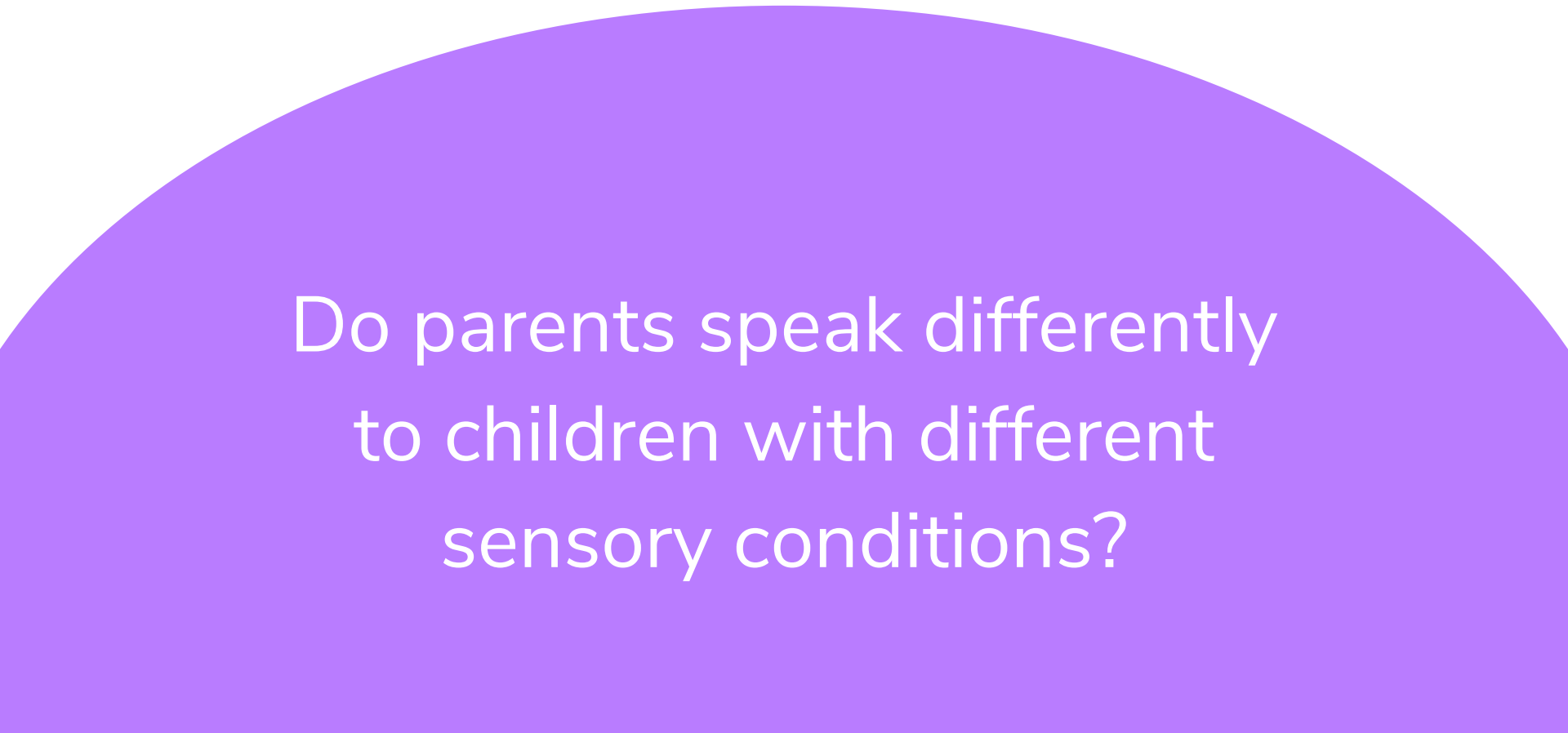
## Blindness

- Unknown speech quantity
- Utterance type differences – more directives vs. sighted children

- **No existing cross-group comparisons** of blind, DHH, and typically developing children

# Why compare DHH, Blind, and typically-developing kids?

- Blind children: **full** access to spoken language; **no** visual access
- DHH children: **limited** access to spoken language; **full** visual access
- Typically-developing kids: **full access** to spoken language & **full** visual access
- Comparing all 3 let's us probe how **perceptual and linguistic experiences** link up



Do parents speak differently  
to children with different  
sensory conditions?

# Methods

LENA



Do parents provide the same amount of input?

Play Session



Do parents tailor description to children's sensory abilities?

30-min video



Daylong audio





LENA

Do parents provide the  
same amount of input?





# LENA

## Methods

- Daylong audio recordings in the home (~25,000 min)

Thanks to Derek Houston!

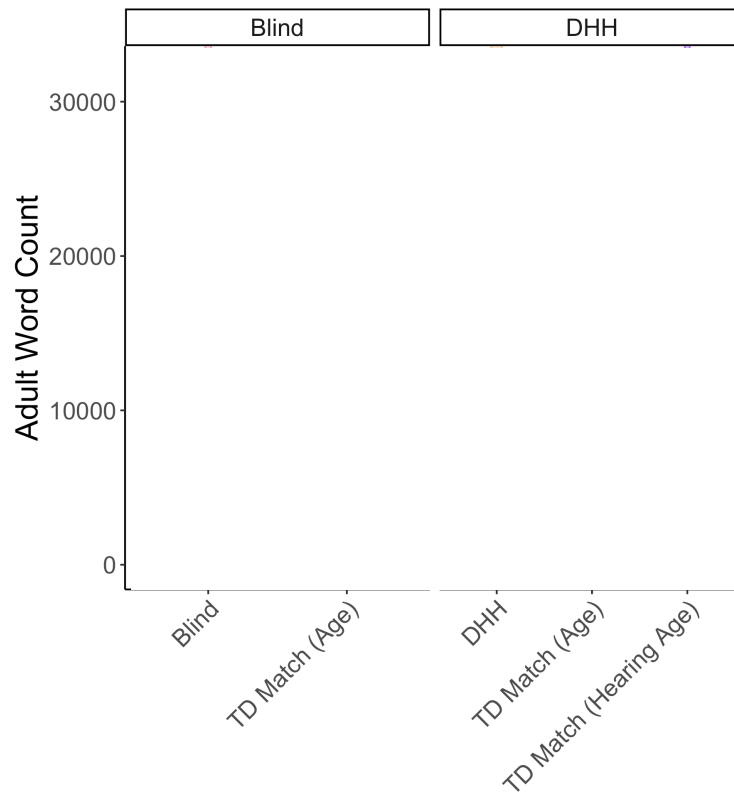
Group	Blind	TD- Age controls	DHH (cochlear implant)	TD- Age controls	TD- Hearing Age controls
n	6	6	11	11	11
Age range (mean)	6.7 – 22.2 (12.5)	7.1 – 22.2 (13.1)	14.1 – 31.5 (20.6)	14.0 – 31.5 (20.5)	6.0 – 8.8 (6.9)

- Extracted adult word count (LENA algorithm) for each recording

# LENA

## Do parents provide the same amount of input?

- Yes! No evidence for differences
- But: **large variability** across all groups





# Play Session

## Do parents tailor description to children's sensory abilities?

### Adjective Analysis

#### Why Adjectives?

- Encode sensory information
- One way for parents to provide *linguistic* description of *perceptually-inaccessible* information about the environment

# Play Session

## Methods

- 30 minute video recordings in the lab

Thanks to Ambrose-Moeller corpus!

Group	Blind	DHH (hearing aid or cochlear implant)	Typically- Developing age controls
n	1 (2 recordings)	18	18
Age range (mean)	10 & 14.4 (12.2)	12.9 – 14.8 (13.7)	13.2 – 13.8 (13.5)

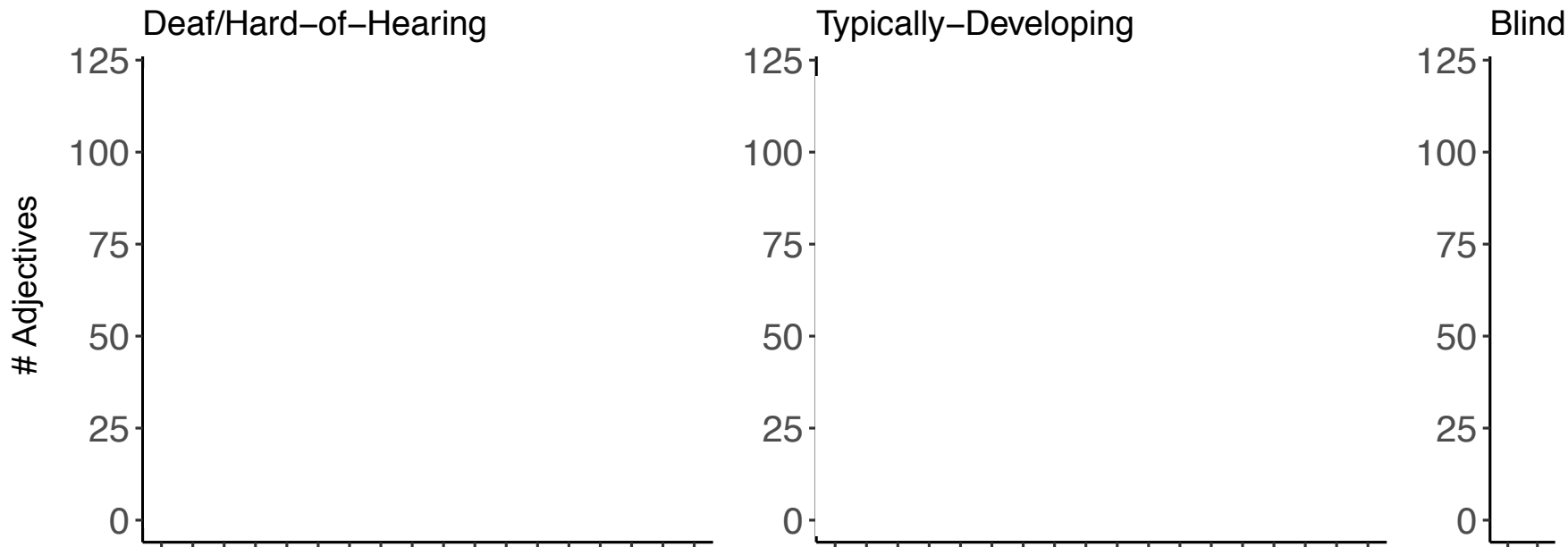
- Extracted adjective tokens and coded for sensory modality
  - Smell, touch, taste, sound, sight, amodal

# Play Session

Do parents provide the same *amount* of adjectives, overall?

Yes, DHH = TD

Blind may be higher—need more data!



# Play Session

## Adjective Coding

Category	n tokens / types	Examples
<b>Amodal</b> (79%)	1214 / 128	<i>good, big, nice</i>
<b>Vision</b> (11%)	191 / 21	<i>blue, shiny</i>
<b>Touch</b> (6%)	96 / 18	<i>soft, scratchy</i>
<b>Taste</b> (2%)	19 / 4	<i>yummy, delicious</i>
<b>Smell</b> (.8%)	11 / 4	<i>stinky</i>
<b>Sound</b> (.7%)	10 / 4	<i>quiet, squeaky</i>

# Play Session

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# Play Session

## Do parents tailor description to children's sensory abilities?

for each sense,  
for each video:

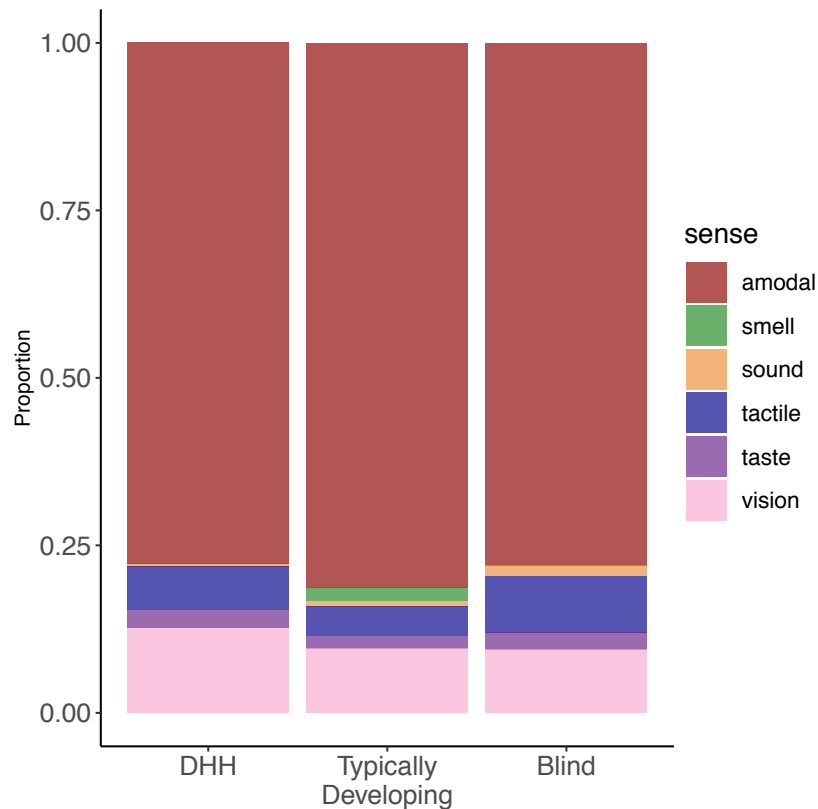
$$\frac{\text{\# sound adjectives}}{\text{total number adjectives}} = \text{proportion sound adjectives}$$



# Play Session

## Do parents tailor description to children's sensory abilities, overall?

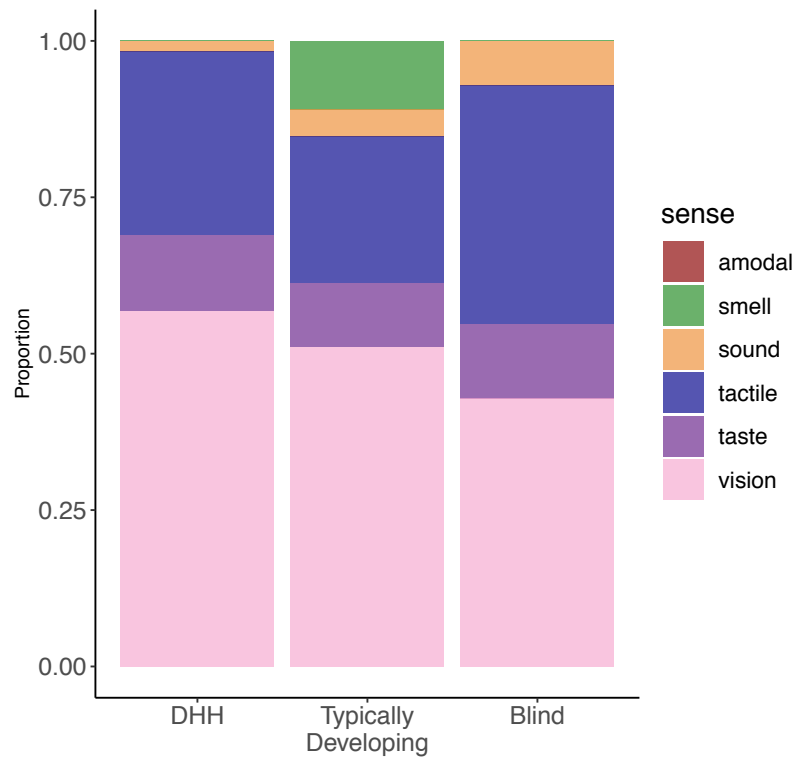
- No! Distribution of adjective types does not differ  
(DHH vs. TD; blind not analyzed due to n=1)
- Bulk of **all** group's adjectives are amodal

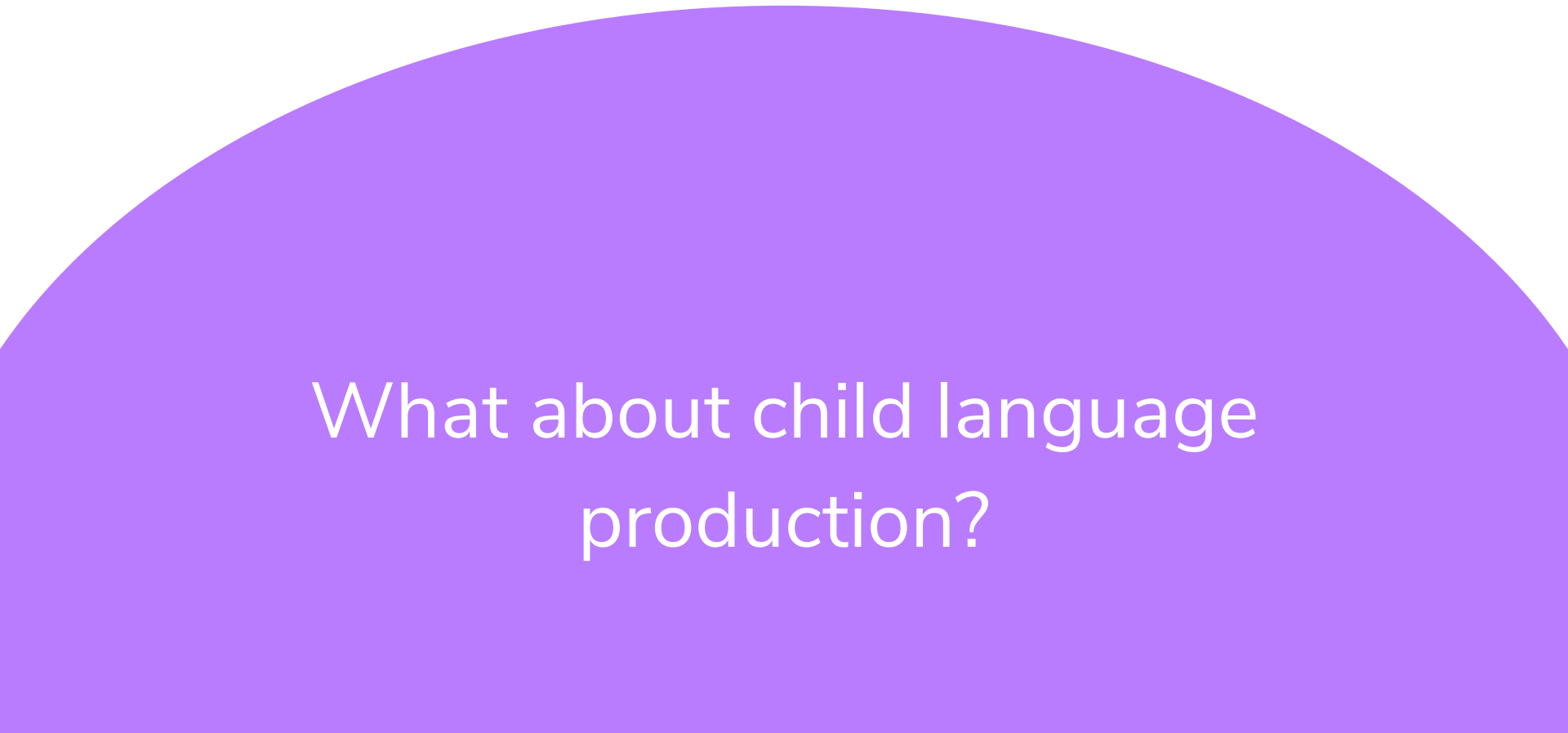


# Play Session

## Do parents tailor description to children's sensory abilities, for sensory adjectives?

- Descriptive analysis only because <350 sensory adjectives total across 37 children
- Very similar distributions
- Blind child: not an outlier





What about child language  
production?



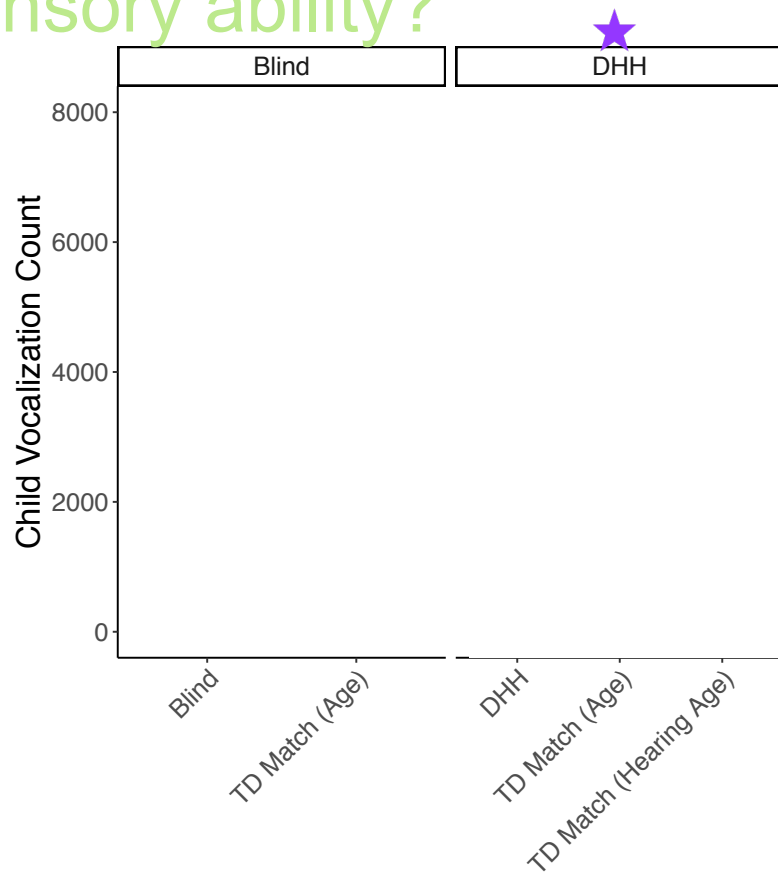
LENA

Does children's spontaneous  
language differ by sensory  
ability?

LENA

Does children's spontaneous language differ by sensory ability?

- No!
- Spontaneous language is the same in age-matched groups



# Result Summary

## Do parents provide the same amount of speech input?

- Yes! Amidst large variability

## Do parents tailor their adjective input?

- Similar number of adjectives DHH / typically-developing groups
  - Few sensory adjectives overall (<20% of input)
- Similar (low) *proportion* of sound adjectives for DHH compared to hearing group
- More VI data needed – and coming!

## What about child outcomes?

- Both blind and DHH groups had similar # of vocalizations to age-matched peers

# Discussion & Conclusions

- No big differences in spoken language input & early productions across blind, DHH, and typically-developing children
  - more data needed, but suggests early input unchanged by children's sensory experiences
- Input may function differently for different children
  - For DHH kids, words in environment  $\neq$  words heard
  - Words that are “visual” for sighted children may have “tactile” or other connotation for blind children
- Robustness of language richness across sensory circumstances
  - Converges with evidence that DHH and blind individuals have rich representations of sight and sound

# Thank You



Bergelson Lab



NSF GRFP to EC



NSF Career to EB

## Data Donors

Play session videos  
from DHH / TD children:  
**Ambrose-Moeller**  
corpus

LENA recordings from  
DHH / TD children:  
**Derek Houston**  
(**& OSU BabyTalk Lab**)



