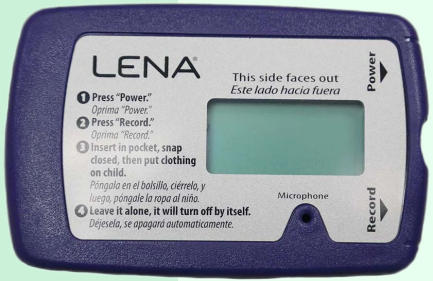
Comparing language input in the homes of blind and sighted children: Insights from daylong recordings

Erin Campbell, Lillianna Righter, Eugenia Lukin, Elika Bergelson



Why study language in blind children?

To what extent are vision-based skills necessary for acquiring language?

(e.g., Brooks & Meltzoff, 2008; Carpenter et al., 1998; Lucca & Wilbourn, 2018)

How necessary is vision for acquiring language?

- Blind infants show vocabulary delays (Campbell, Casillas, & Bergelson, *under review*)
  - Roughly 7.5 month delay on average
  - Only ~20% of blind children score above the 50th percentile for vocab.
- But ultimately blind adults are fluent language users (Röder et al., 2003)
  - *Showing that children can learn language without vision*

So how do blind infants catch up?

Language input as a source of meaning

If parents modify the input:

- Parents are sensitive to the perceptual abilities of the child
- Possibly compensatory

If parents *don't* modify the input:

- Language input is sufficient for acquiring language in the absence of vision

Previous studies of blind children's language input

Blind children get:

- Fewer descriptions, more directives (Kekelis & Andersen, 1984; Landau & Gleitman, 1985)
- Less interaction (Rowland, 1984; Moore, 1994; Preisler, 1991; Andersen et al., 1993; Grumi, 2021)
- Less decontextualized language (Andersen et al., 1993; Campbell, 2003; Kekelis & Andersen, 1984)

Present study: build on this literature with larger sample size and more naturalistic language sample

Methods

15 blind participants:

- English monolingual (>75% English input)
- No more than minimal light perception
- No hearing or cognitive/developmental diagnoses
- 6.4 – 30.3 mo. old; Mean = 15.7 mo.
- 7 male, 8 female
- 0-2 older siblings
- Mid-to-high SES, majority of moms completed some post-secondary ed.

15 sighted participants, matched on:

- Age (within one month)
- Gender
- Maternal Education ±1
- # of older siblings ±1

Daylong audio recordings with LENA

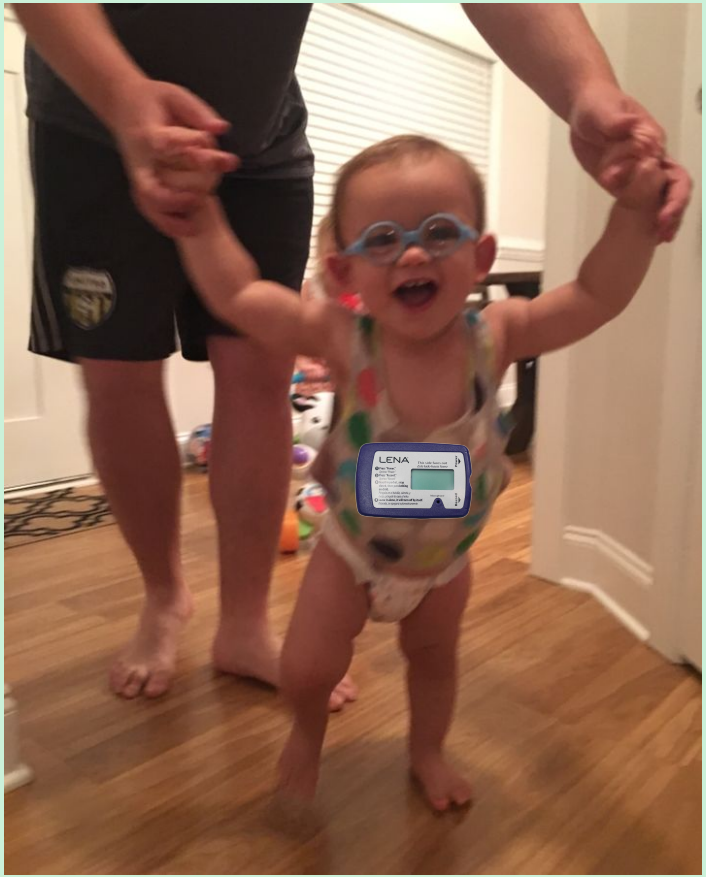


Image courtesy of parent

Methods

Daylong audio recordings with LENA

- 15 two-minute random samples
- 5 two-minute high-talk-density samples
- 40 min per kid = 1200 annotated minutes

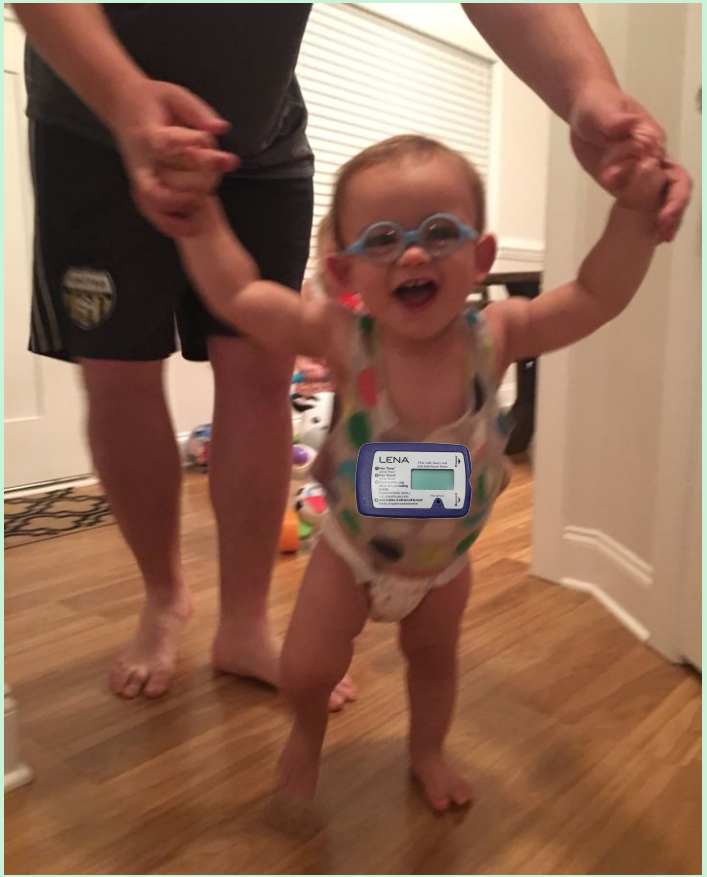


Image courtesy of parent

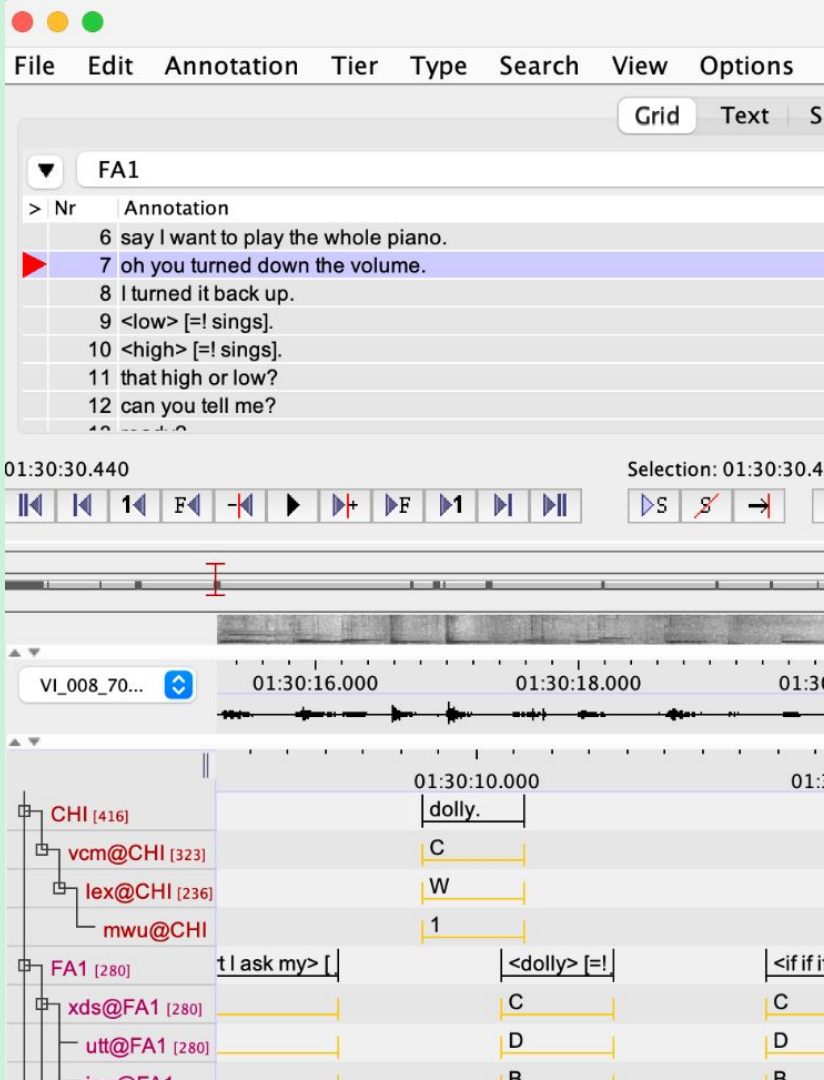
Methods

Daylong audio recordings with LENA

- 15 two-minute random samples
- 5 two-minute high-talk-density samples
- 40 min per kid = 1200 annotated minutes

ACLEW Annotation:

- Utterance
- Speaker
- Addressee



FA1 10904824 10905346 522 can you say-. FA1 10906081 10907502 1421 can you say glug glug glug? xds@FA1 FA1 12914268 12916198 1930 C FA1 10909748 10911383 1635 can you say glug glug glug? FA1 11842451 11844694 2243 are okay should we stop bang banging? FA1 I guess I should agree with you that from a communication standpoint there-. xds@FA1 FA1 12914268 12916198 1930 C FA1 11919756 11920884 1128 there- whoops. FA1 12352191 12355377 3186 but w ks back and forth on my lap and so like- 5804 12358100 2296 w he um.FA1 12359472 12364 he sounds that are coming and w cause it's pretty repetitive 7824 12389603 1779 ama and we'll pop the weasel? M 18744 1408 I wanna see I wanna s . MA1 40319376 40320207 n MA1 40320612 40 MA1 40335492 MA1 40352148 hers> [=! sings] 2 volume

FA1 FA1 12914268 12916198 1930 oh look at all these toys. xds@FA1 FA1 12914268 12916198 1930 C FA1 FA1 12918638 12919592 954 its a where sign. FA1 FA1 12920518 12921745 1227 <ooh> [=! Imitates]. xds@FA1 FA1 12920518 12921745 1227 C FA1 FA1 12932875 12934528 1653 its a little steep for a puzzle. FA1 FA1 12937682 12938402 720 enough in there. xds@FA1 FA1 12914268 12916198 1930 C FA1 FA1 12949405 12949715 uh-huh. xds@FA1 FA 2906902 897 C FA1 FA1 12960 shake shake it down.xds@FA1 6902 897 C FA1 FA1 12 30 yay shake shake shake! 5 129660 xds@FA1 FA1 1653 C1633 uh-oh c FA1 FA1 13019532 13020 ? FA1 FA1 13333078 13 da> [=! Imitates]? xds@FA1 FA1 06902 897 CMA1 414671 56 what song is this buddy? 0144 828 it's a good jam. xds 19592 954 C

Characterizing the input

1. **Quantity** — *How much speech?*
2. **Interaction** — *How interactive is the input?*
3. **Linguistic Properties** — *How are words used and combined?*
4. **Conceptual Properties** — *Can the child perceive the referent?*

(Rowe & Snow, 2012)

Characterizing the input: quantity

Adult Word Count:

Automated LENA count of speech tagged as nearby adult

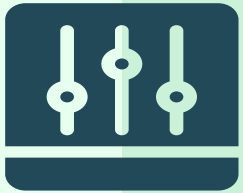
Manual Word Count:

Number of words in the manual transcriptions of the random samples

Quantity

Adult Word Count

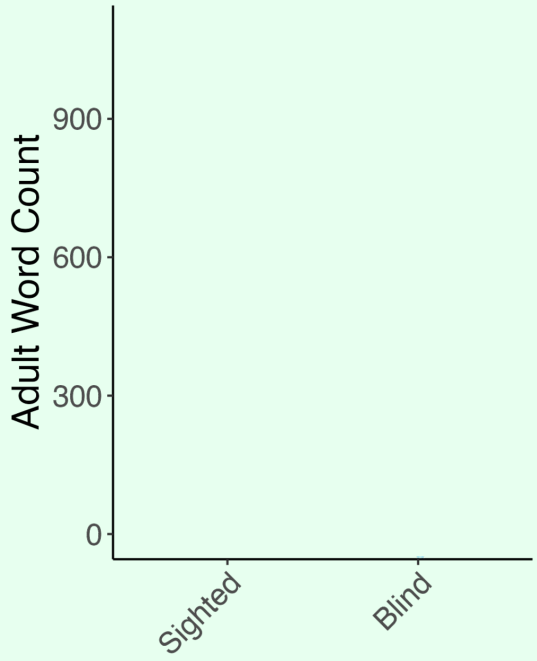
Automated LENA count of speech tagged as nearby adult

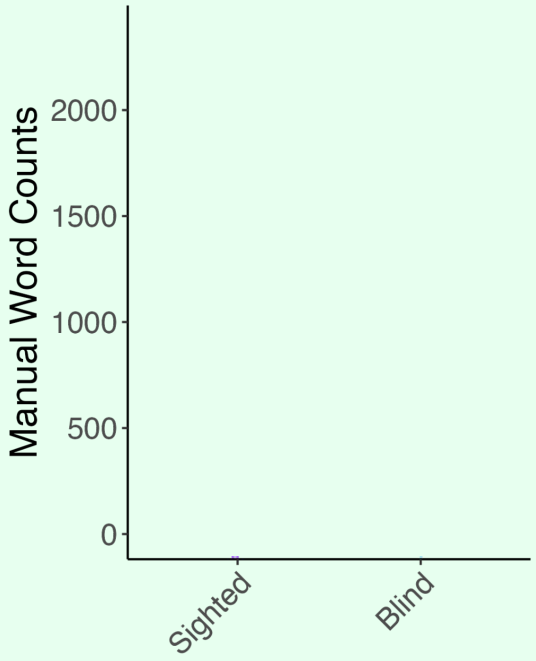


Manual Word Count

Number of words in the manual transcriptions of the random samples

No difference in input quantity

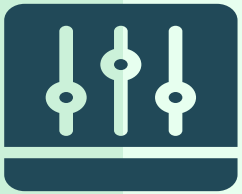




Interactiveness

Proportion of Child-Directed Speech

Proportion of utterances spoken **to** children
(as opposed to adults, pets, etc.)



Conversational Turn Count

Number of switches between child/adult speakers within 5 sec. of each other

Characterizing the input: interaction

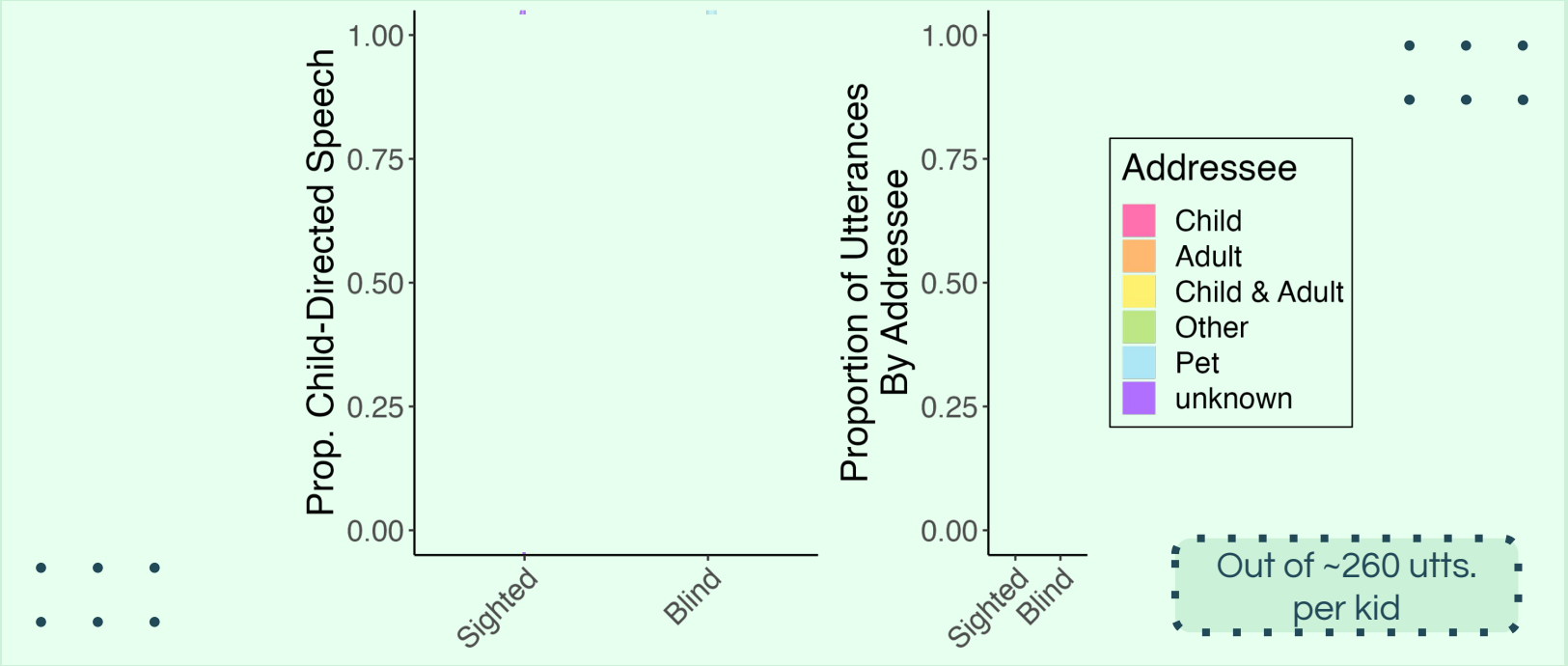
Conversational Turn Count:

Number of switches between child/adult speakers within 5 sec. of each other

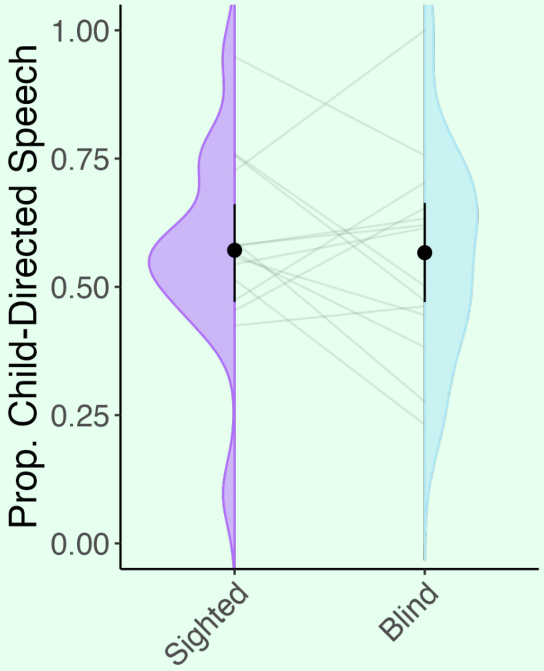
Proportion of Child-Directed Speech:

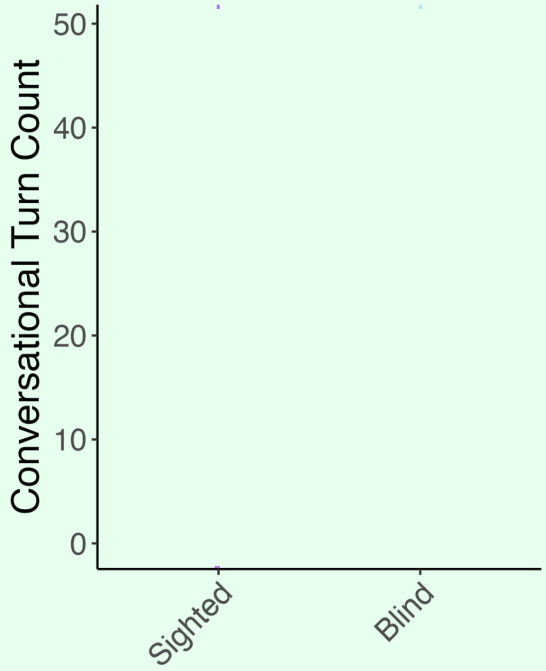
Proportion of utterances spoken to children (as opposed to adults, pets, etc.)

No difference in child-directed speech



No difference in interactiveness





Linguistic Properties

Type-Token Ratio

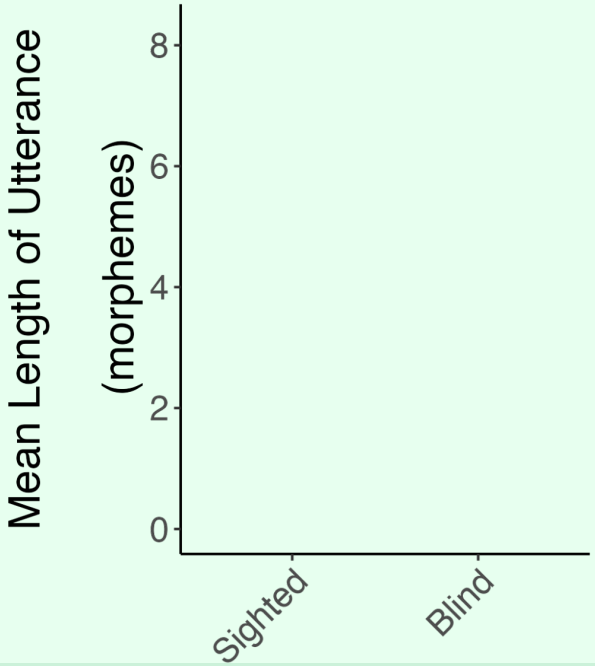
$$\frac{\text{Number of unique words}}{\text{Number of total words}}$$

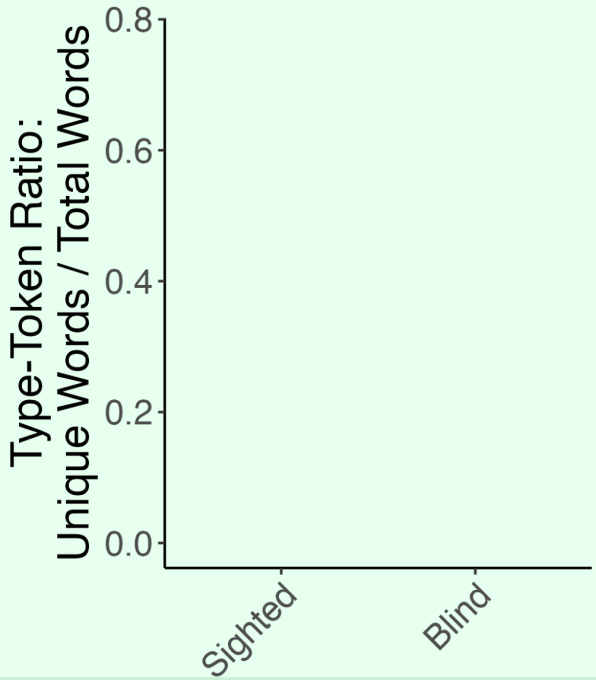
Mean Length of Utterance

Average length of utterances, measured in morphemes

Longer, more lexically-diverse utterances

11/15 kids





12/15 kids

Conceptual Properties

Proportion of visual words

Lancaster Sensorimotor Norms
(Lynott & Connell, 2020)
"How visual/auditory/tactile/etc. is the word ____?"
Assign perceptual modality to each content word in each child's input:
Auditory, Visual, Gustatory, Tactile, Olfactory, Interoceptive, Multimodal, Amodal

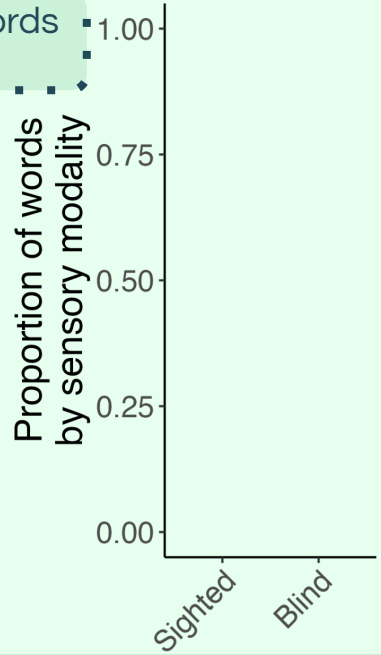
Proportion of temporally "displaced" verbs

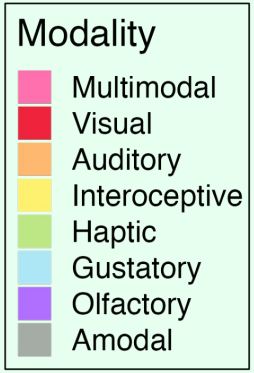
Categorize verbs as present or displaced:

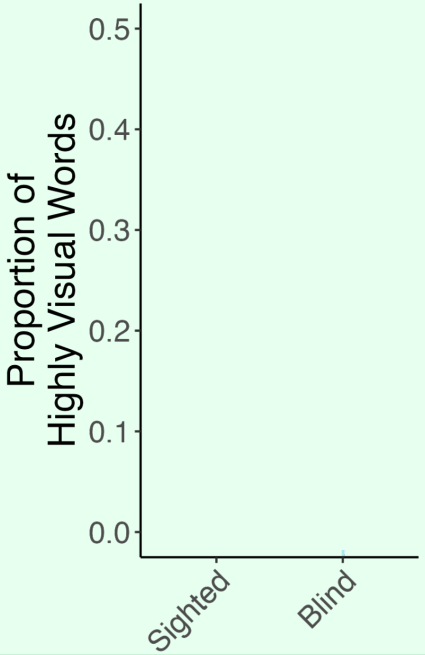
Present: current, ongoing events
I see a seagull!
Displaced: past, future, or hypothetical
We saw a seagull at the beach last week.

No difference in amount of visual words

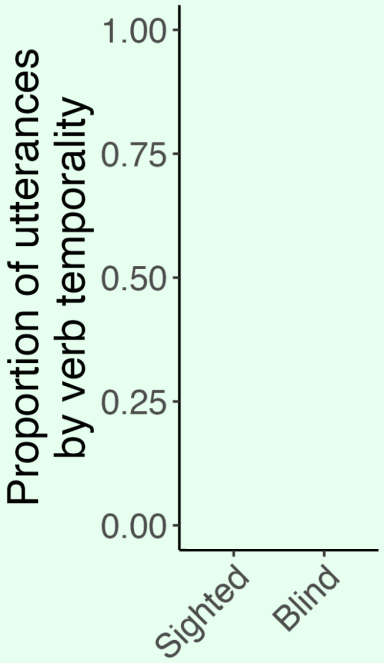
Out of ~398 words per kid

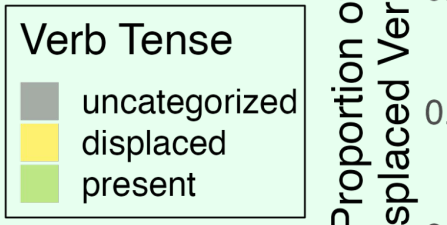




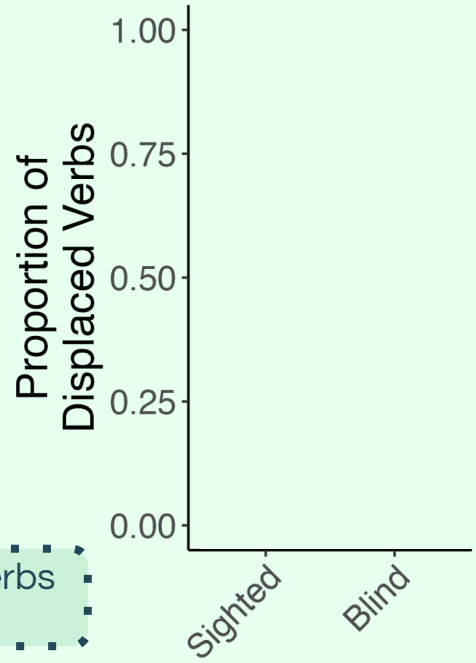


More temporally-displaced verbs





Out of ~310 verbs per kid



11/15 pairs

Characterizing the input

1. **Quantity**	*similar number of words in input*
2. **Interaction**	*similar number of conversational turns and proportion of child-directed speech*
3. **Linguistic Properties**	*higher lexical diversity and longer utterances*
4. **Conceptual Properties**	*more temporally-displaced verbs, and similar # of highly visual words*

Summary

In many ways, similar input across groups:

- Similar quantity and parent-child interaction
- All differences small in magnitude

Also, evidence of differences:

Blind (vs. sighted) children hear:

- More complex speech (higher MLU and type-token ratio)
- More decontextualized language

Blind children do not receive *"deficient"* language input

Discussion

What does it mean for blind children's language outcomes?

- In sighted children:
  - Longer utterances → larger vocab. (Anderson et al., 2021)
  - More lexical diversity → larger vocab. (Anderson et al., 2021)
  - More decontextualized speech → larger vocab. (Rowe, 2013)

- **Properties of language input may support word learning in the absence of visual input**
  - Perhaps blind children use strategies like syntactic bootstrapping to build vocab.

Future Directions

Connecting to language outcomes:

- What could additional complexity mean for language development?
  - Does this help blind children learn language without visual input?

Honing in on the “visual” words:

- Do blind individuals rate these words similarly?
- Are these used in similar ways, in similar contexts?

Poster session

Thursday 17:10

The Interdependence of Vocabulary & Morphosyntax Development in Blind and Sighted Children

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October 26th, 2023

Introduction

Background

- Blind children lag ~7 months behind sighted children in vocab size (Campbell et al. submitted)
- Sighted children: lexicon and syntax are deeply related, grow symbiotically (Bates & Goodman 1997)
- Lexicon and syntax *may* show a different degree of linkage in blind children:
  - To attain the same level of vocab, may be MORE attuned to syntax (Gleitman 1990) without visual cues to word meaning
  - OR vision may be equally supportive (e.g. observing the relationship between agent/patient & referents)

1. **Do morphosyntactic skills differ** for vocab-matched blind vs. sighted children?
2. What is the **relationship between vocabulary, age, and morphosyntax** for blind children?
3. How well **does vocabulary mediate the effect of age (i.e. visual experience) on morphosyntax for blind vs. sighted children?**

Instrument MCDI:Words and Sentences

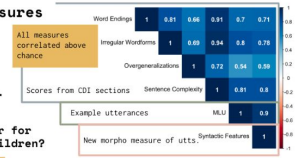
- Parent report: Total Vocab
- 6 Morphosyntax measures derived from:
  - Multiple Choice Questions:
    - Endings: -s,-ing,-ed,'s?
    - Irregulars: Children, drank?
    - Overgeneralization: Run vs. runned vs. ran
    - Sentence Complexity: "Turn on light" or "Turn on the light so I can see"
  - Free response: "3 longest utt's your child has said"
    - Converted to MLU & scored for syntax features

Current Study

Participants

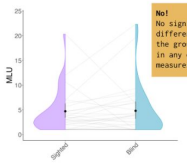
- 32 blind children, 14-57 mo. (M=31.4)
- 33 sighted children, matched to blind children by **productive vocabulary**, 13-36 mo. (M=24.5)

Measures



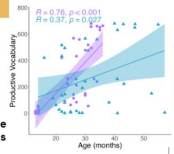
Results (MLU as sample measure)

1. Do morphosyntactic skills differ for vocab-matched blind vs. sighted children?



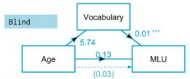
No! No significant differences at the group level, in any of the six measures.

2. Relationship between age, vocab, and morphosyntax skills

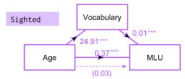


→ Sighted kids' vocabulary is correlated strongly with age (as expected). Blind kids' correlation is much weaker.

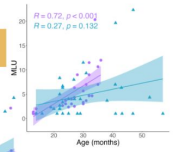
3. Vocabulary as a mediator of age & morphosyntax? Mediation analysis

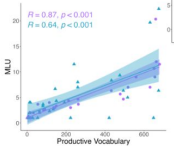


For both groups, vocabulary mediated the majority of the relationship between age and morphosyntax (Prop.Mediated$_{Blind}$ = 62%; Prop.Mediated$_{Sighted}$ = 92%).



→ Only sighted kids' MLU correlates with age.





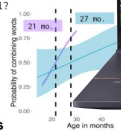
→ **Morphosyntax & vocabulary are significantly and similarly correlated in both groups.**

Outcomes

Discussion & Future Work

- Vocab delay + mediation → maybe vocab delay *causes* morphosyntax delay (rather than missing vision separately slowing morphosyntactic growth)
- Measuring production may obscure morphosyntactic knowledge. How can we measure **receptive** morphosyntactic skills in blind children?
- If age matched, how big is morphosyntax delay? Is it aligned with vocab delay, or is it additional?

→ 50% probability of combining words using data from Wordbank (Frank et al. 2021). **6 month delay!**



Conclusions

1. When matched on vocabulary, blind and sighted children's morphosyntax skills are on par: neither advanced nor deficient.
2. Vocab & morphosyntax are deeply related in blind children, but weaker/not correlated with age.
3. Vocab mediates the relationship between age and morphosyntax, perhaps more strongly in sighted kids
   a. Both facets of language ~half a year delay in blind vs. sighted kids

Thank you

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- NSF GRFP 2019274952
- Our participating families

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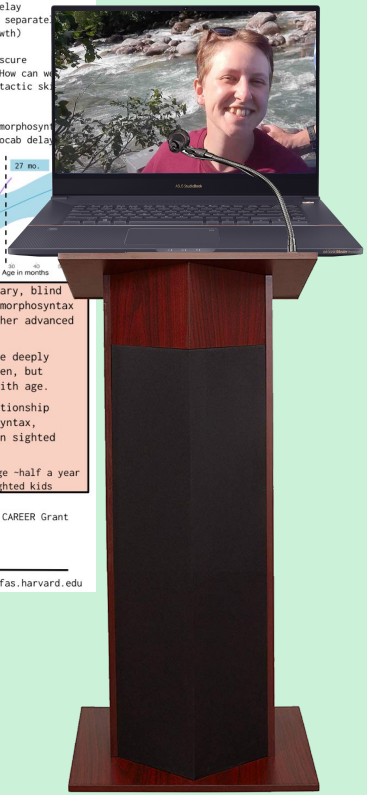

Learn more!

NSF Career Award (BCS-1844710)
NSF GRFP (2019274952)

Thank you