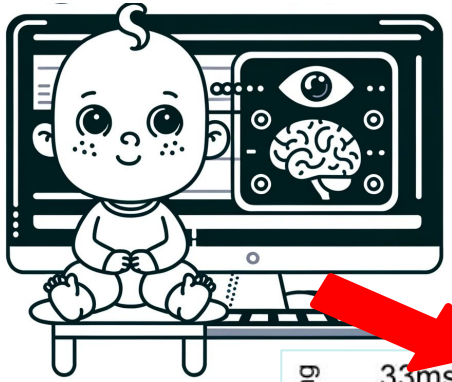
Investigating the Convergence of Child Language Assessment Measures

with 14-month-old Korean Infants

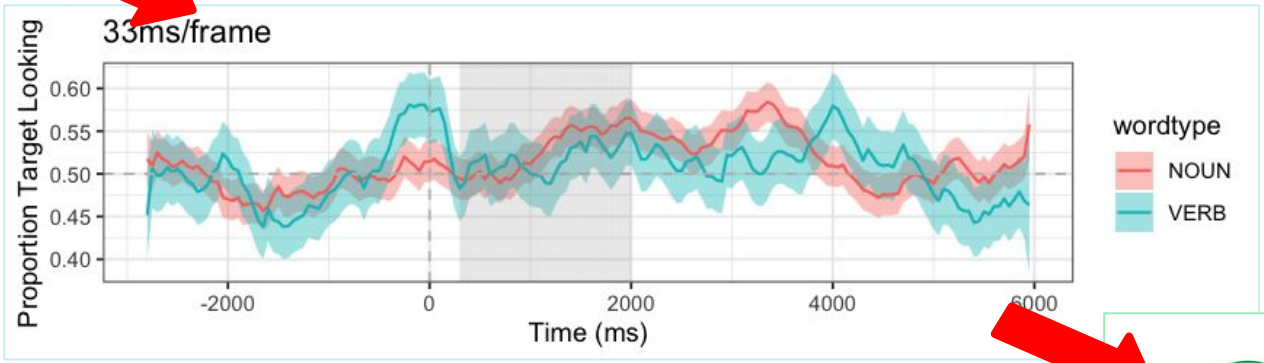


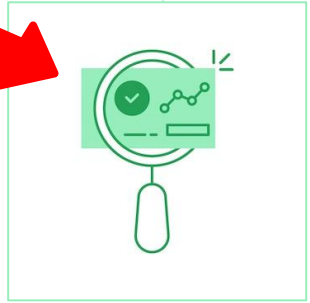
Jun Ho Chai[1], Margarethe McDonald[2], Eon-Suk Ko[1]

[1]Chosun University, [2]University of Kansas

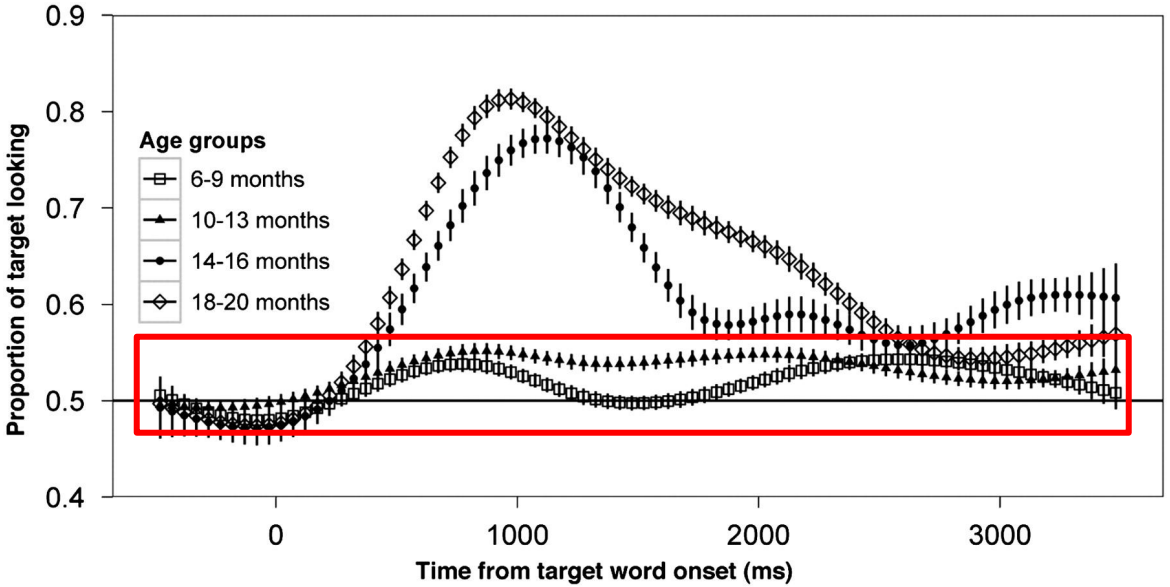


Why assess children language?
Why 14-month-old?
Why eye-tracking?





Early word learning



Bergelson & Swingley (2020)

- Infants begin understanding words around 6 months old

Early word learning paved the way for more learning

- Early words form the foundation for phonology, lexicon, and grammar.[1]
- Statistical patterns over acquired word forms help infants discover their language's structure.[1]

[1] Swingley (2009)

Early language development predicts later development

Table 6

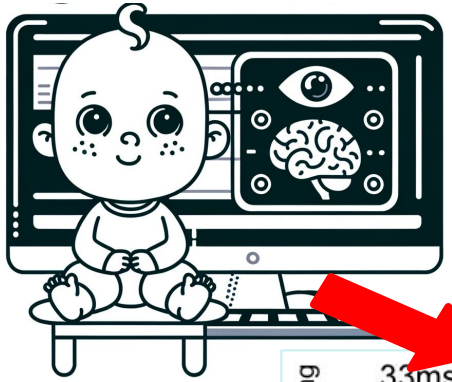
Correlations Between Accuracy at 25 Months and Offline Vocabulary and Grammar Measures at 12, 15, 18, and 21 Months

Age	Words understood[a]	Words produced[b]	Grammatical complexity[c]	M3L[d]
12 months	.29*	.32*	—	—
15 months	.28*	.31	—	—
18 months	—	.39*	.18	.32*
21 months	—	.42*	.36*	.41*

*$p < .05$.

Fernald et al., 2006

- Lexical and grammatical development from 12-21 months predict 25-month-olds' speed and accuracy in spoken word recognition.



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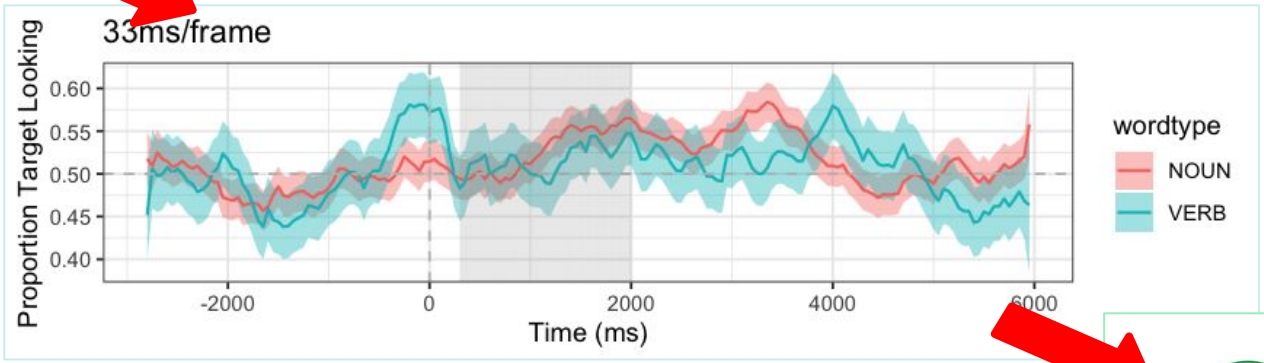
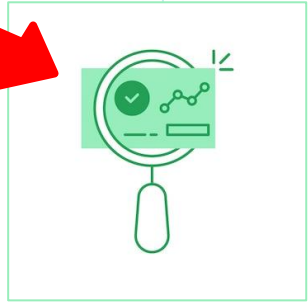




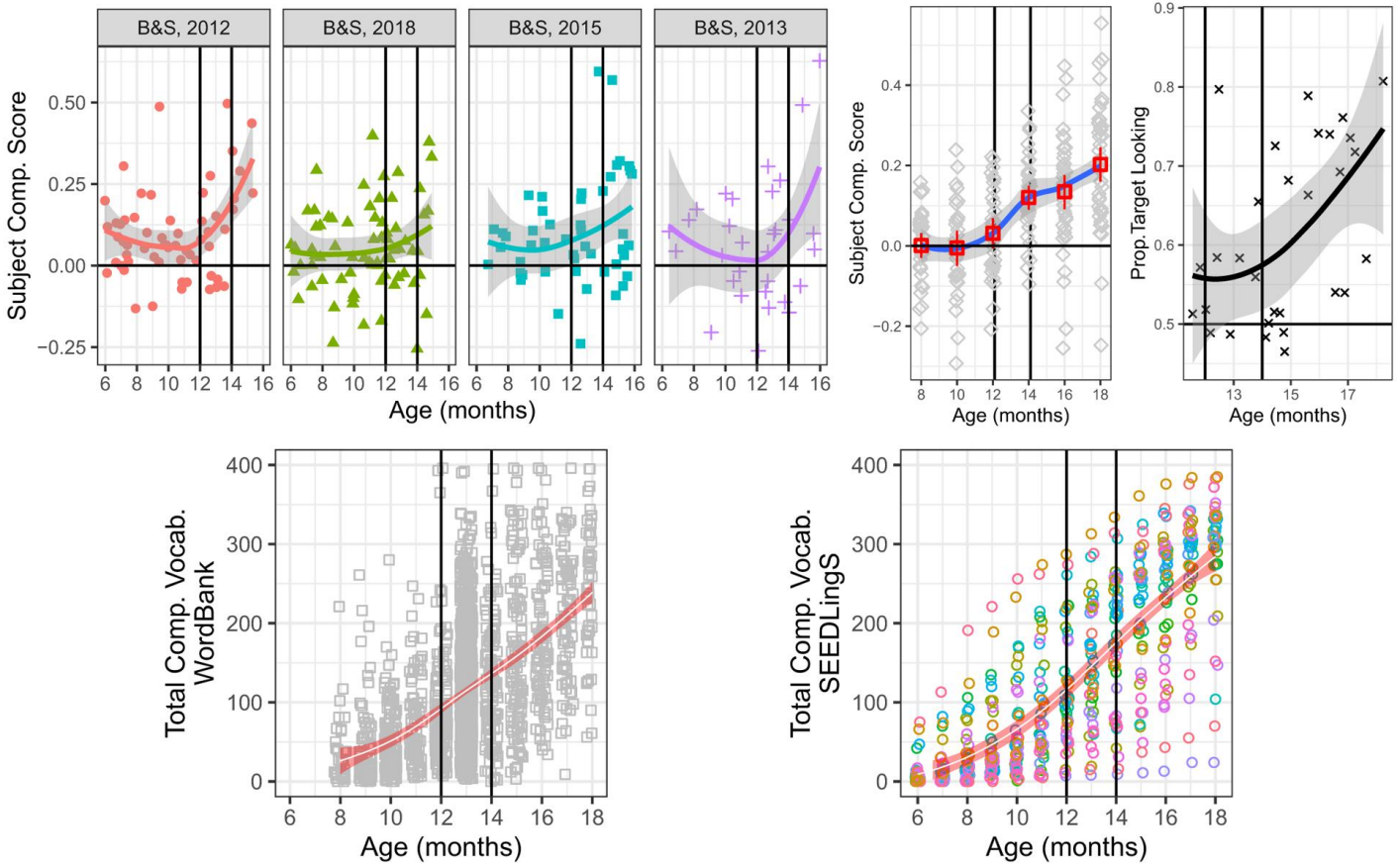
Early assessments and interventions

Table 5. Classification of the children < 36 months old and ≥ 36 months old in the three RCI categories.

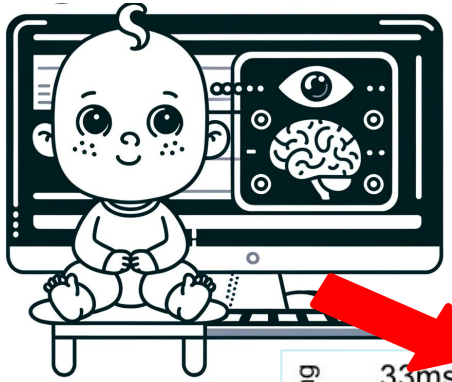
	Children < 36 months (*n*=45)			Children ≥ 36 months (*n*=138)		
	Deteriorated *n* (%)	Unchanged *n* (%)	Improved *n* (%)	Deteriorated *n* (%)	Unchanged *n* (%)	Improved *n* (%)
Receptive syntax	0 (0%)	34 (76%)	11 (24%)	1 (1%)	124 (90%)	13 (9%)
Receptive vocabulary	0 (0%)	28 (62%)	17 (38%)	5 (3%)	106 (77%)	27 (20%)
Expressive syntax	0 (0%)	38 (84%)	7 (16%)	0 (0%)	134 (97%)	4 (3%)
Expressive vocabulary	0 (0%)	7 (16%)	38 (84%)	3 (2%)	56 (41%)	79 (57%)

Vermeij et al. (2023)

Compiled by Bergelson (2020)



Top (spoken word comprehension): [1] Bergelson and Swingley (years); [2] Bergelson et al. (2017); [3] Garrison et al. (2020); Bottom: [4] Frank et al. (2020) (cross-sectional); [5] Bergelson (2016) (longitudinal)



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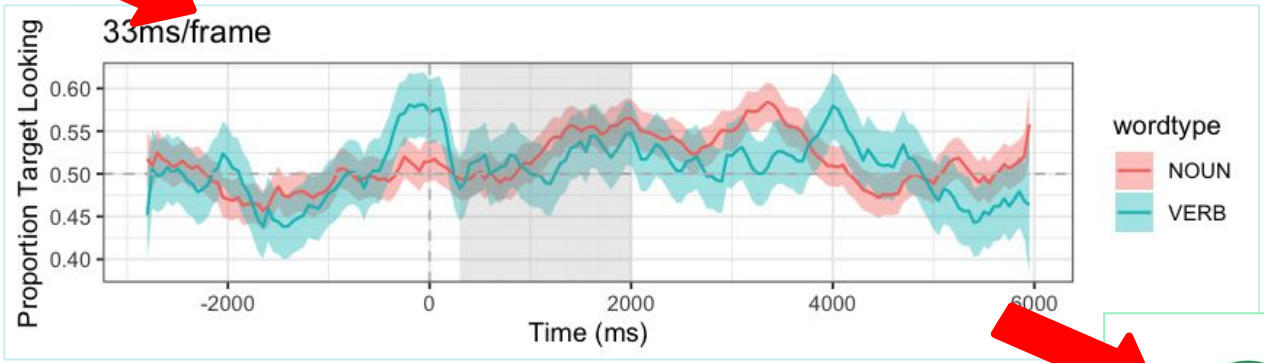
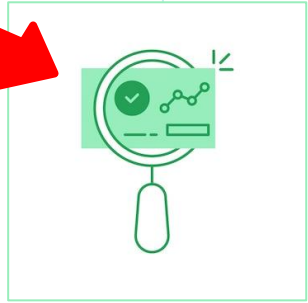




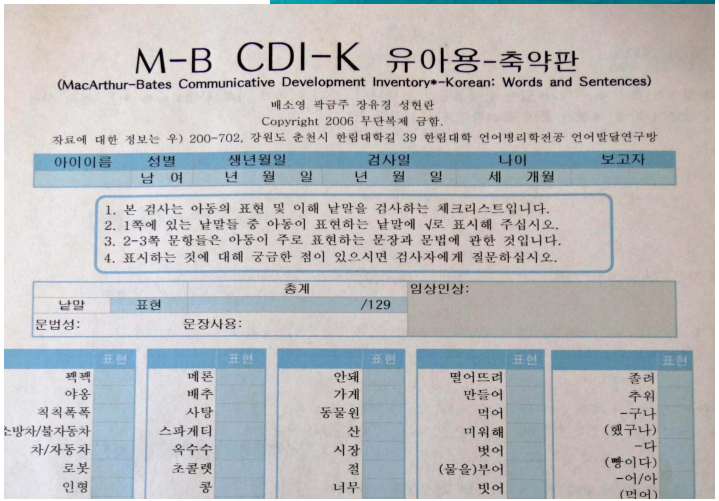
Assessing comprehension in preverbal infants

- Identifying early markers of language delay and impairment enables earlier diagnosis and intervention.[1]
- But it's challenging –
  - limited speech production and motor skills complicate verbal/behavioral responses
  - Observational methods are time-consuming and labor-intensive

[1] Rinaldi et al., 2021

Common assessments

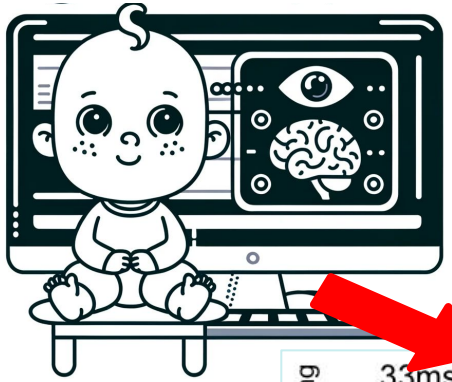
- Parental reports like MB-CDI have limitations:
  - Rely on parental inference of comprehension, which may be inaccurate
  - May over- or under-estimate vocabulary, especially for early-acquired words



or other developmental forms

Need for converging measures

- Eye-tracking provides real-time measure not reliant on verbal/motor response,
  - Suitable for preverbal infants
  - Allows item-level analysis of word recognition
  - Can be used to validate and complement parental reports
  - Can be easy and quick to implement (e.g., online and/or webcam-based)



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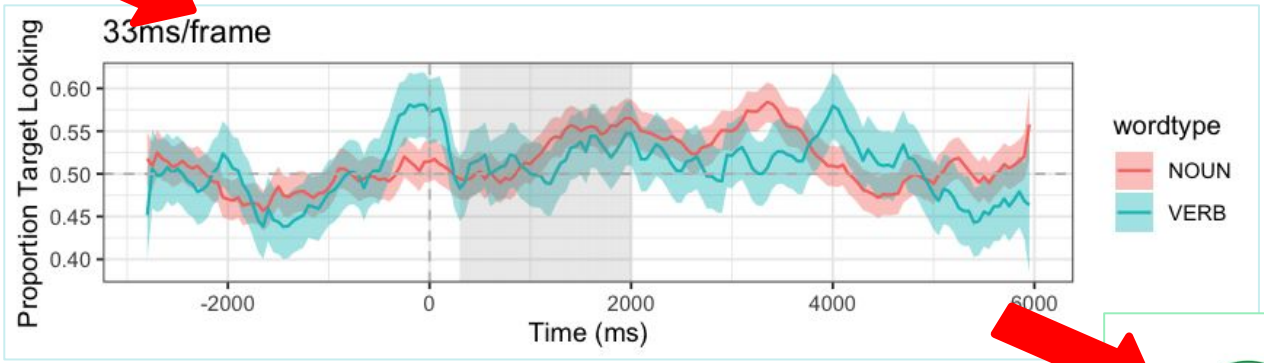
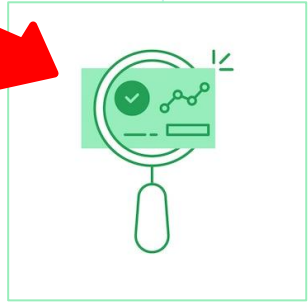




Study Aims

- Examine convergent validity between parental reports and direct measures of word comprehension in 13-14 month old Korean infants

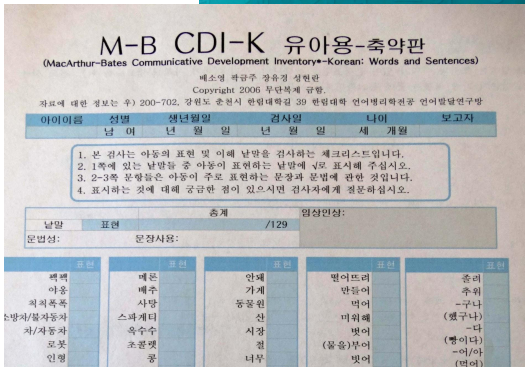
  ➔ Compare full MB-CDI, short MB-CDI with target words only, and eye-tracking measures

Methods - Participants

- 28 typically-developing Korean infants (mean age 13.2 months)
- Completed eye-tracking word recognition task and parents completed MB-CDIs

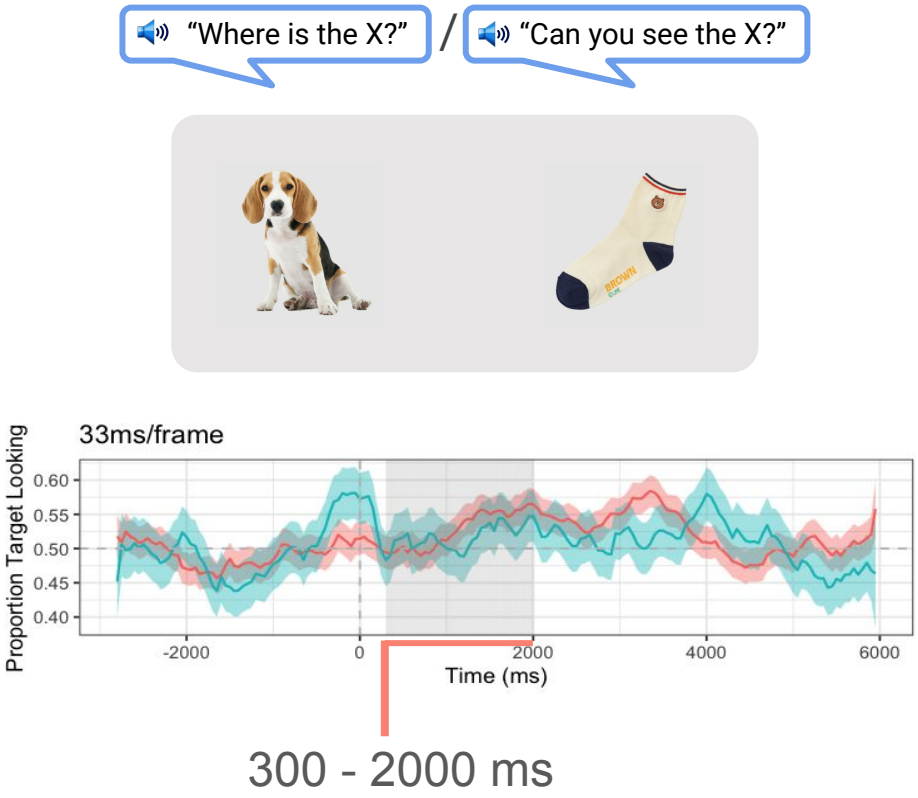
Methods - Parental Reports

- Full Korean M-B CDI
- Short K M-B CDI with only 40 target words rated on 4-point scale

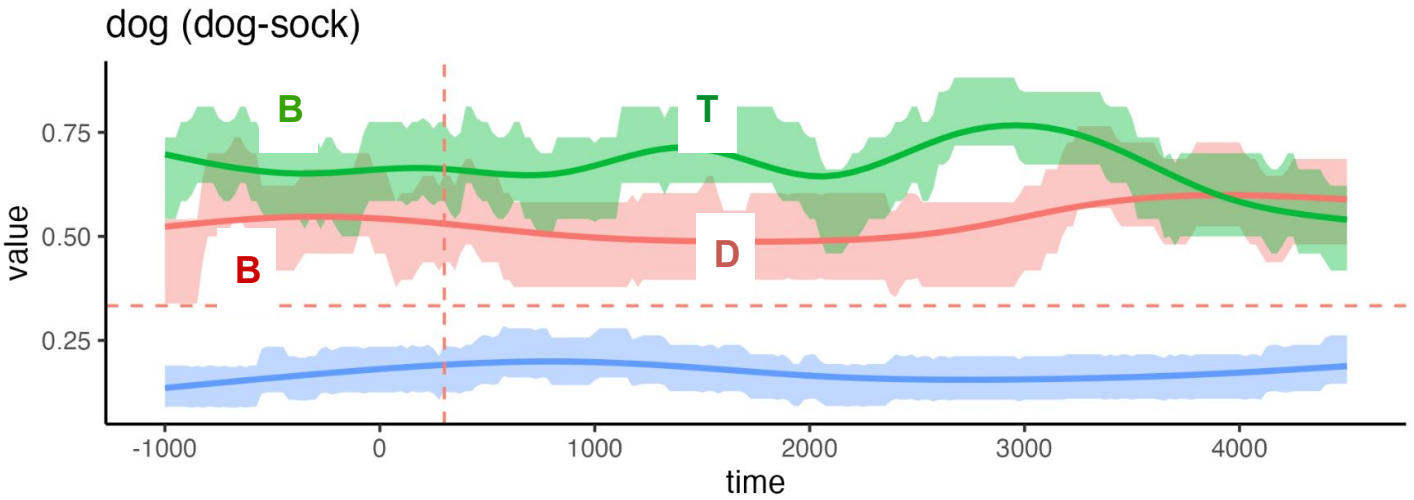


Methods - Eye-tracking Task

- Intermodal preferential looking paradigm / Looking-while-listening
- 40 target words (30 nouns, 10 verbs) from Korean MB-CDI in 20 yoked pairs



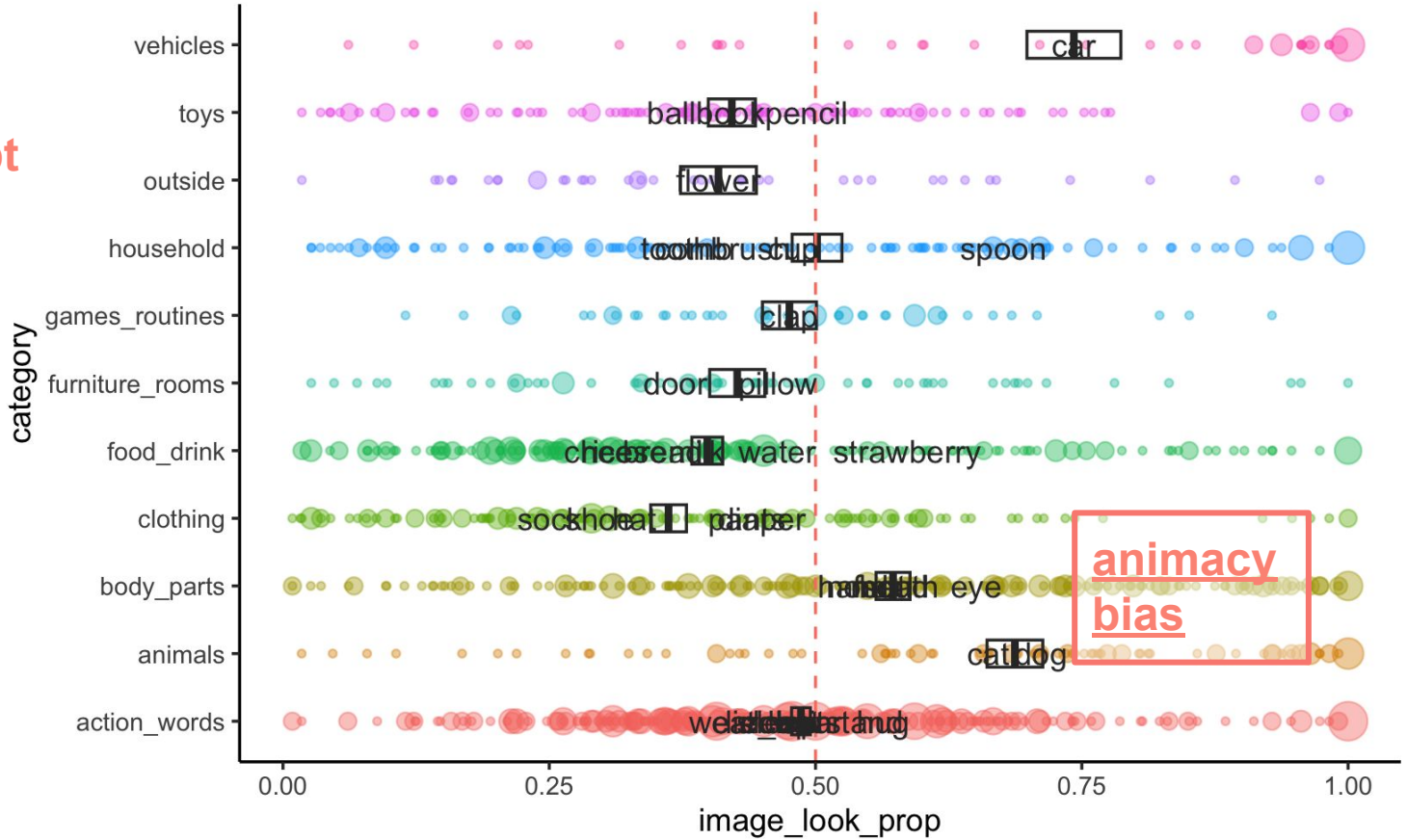
Methods - Eye-tracking Task



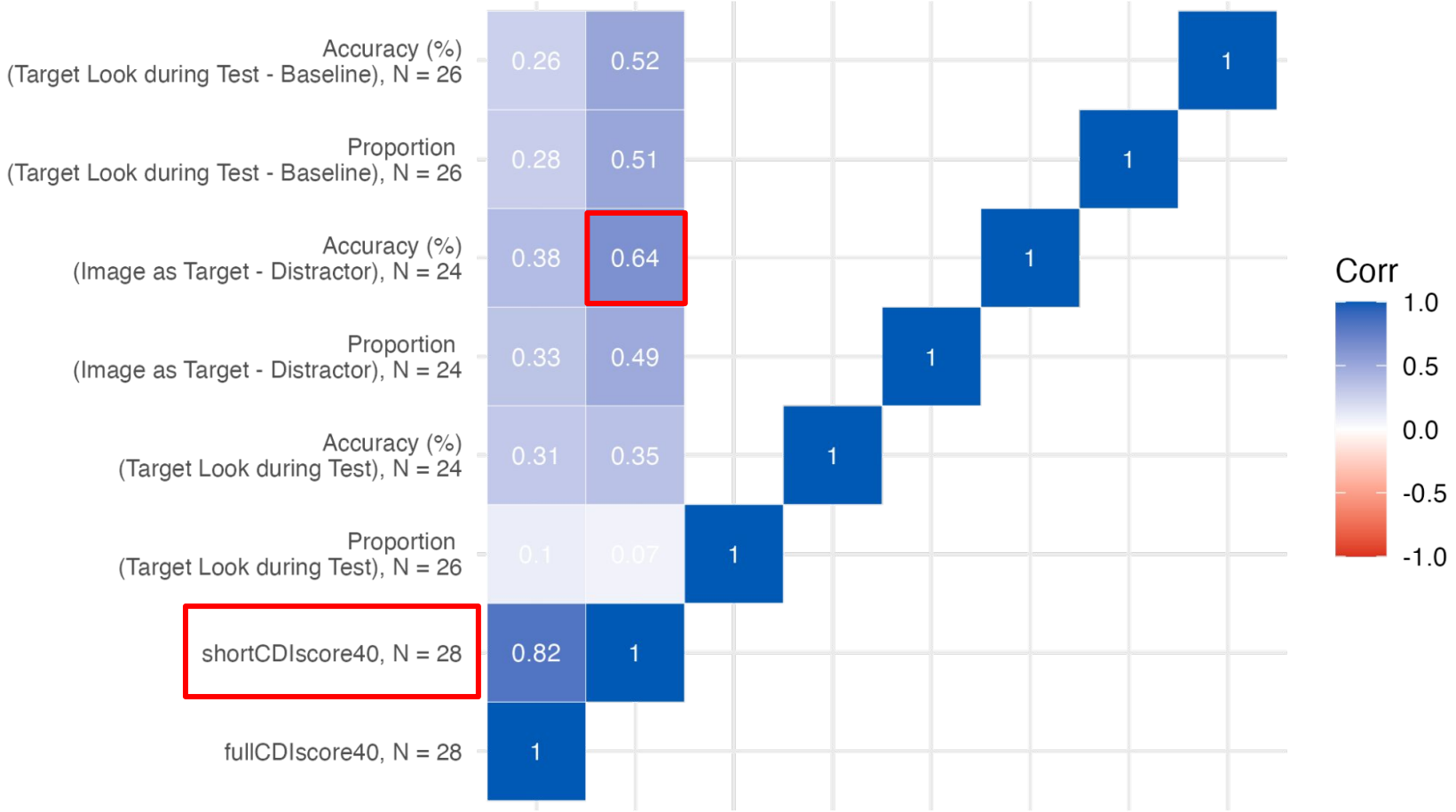
- Target look during **Test**: **T**
- Target look during **Test** - during **Baseline**: **T - B**
- Image as **Target** - Image as **Distractor**: **T - D** (requires at least a yoked pair)

Results - Perceptual biases at baseline

before audio prompt

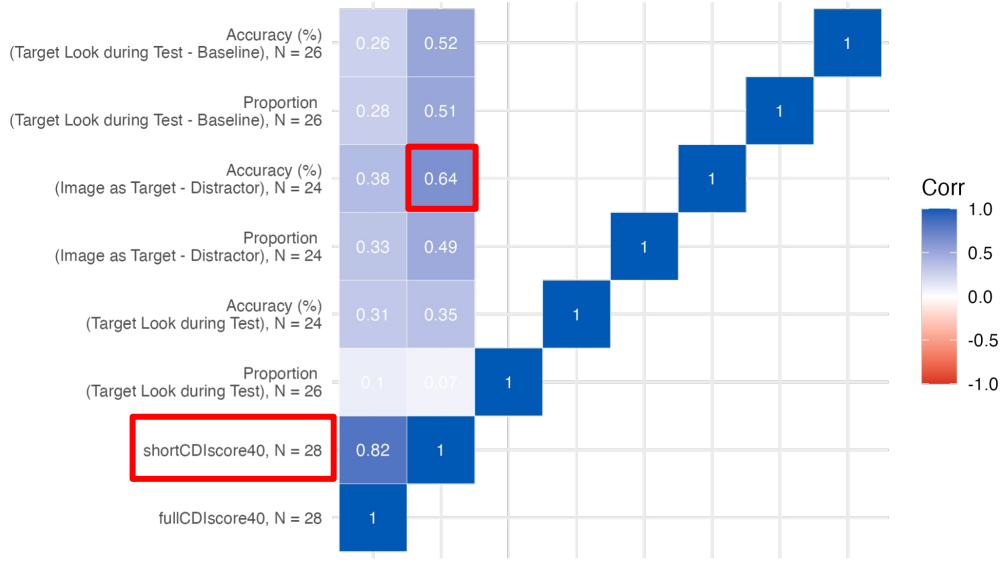


Results - Convergence (correlations)



Results - Convergence (correlations)

- Short MB-CDI converged better with eye-tracking than full MB-CDI
- Pathway towards item-level assessments



Results - Animacy vs Others (eye-tracking task)

after audio prompt

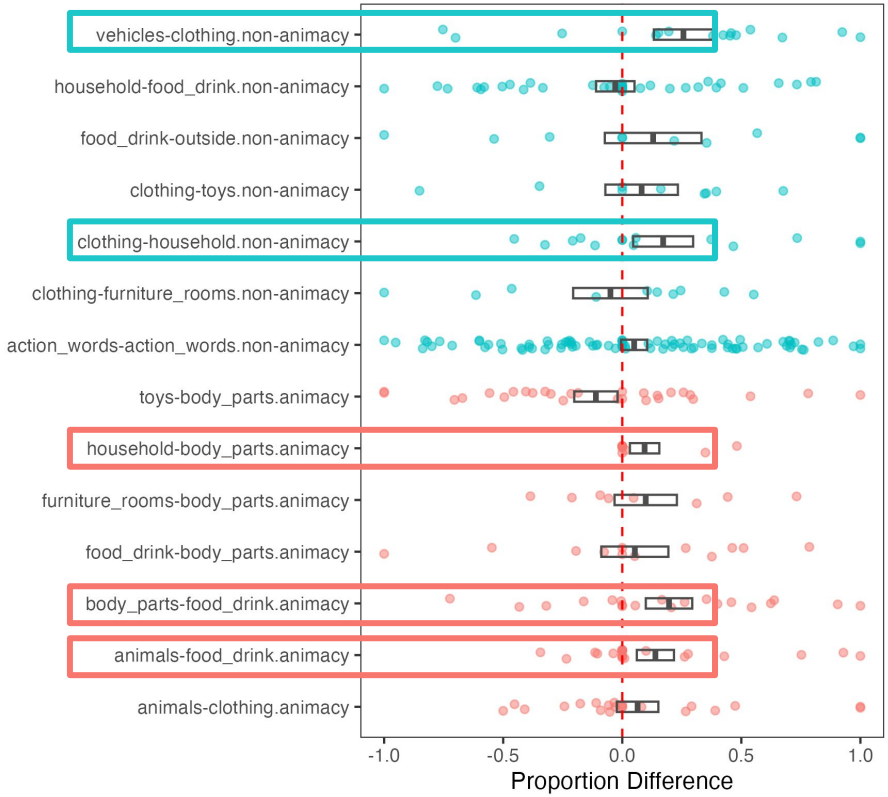


Image as **Target** - Image as **Distractor**

animacy
animacy
non-animacy

Results - Nouns vs Verbs (eye-tracking task)

after audio prompt

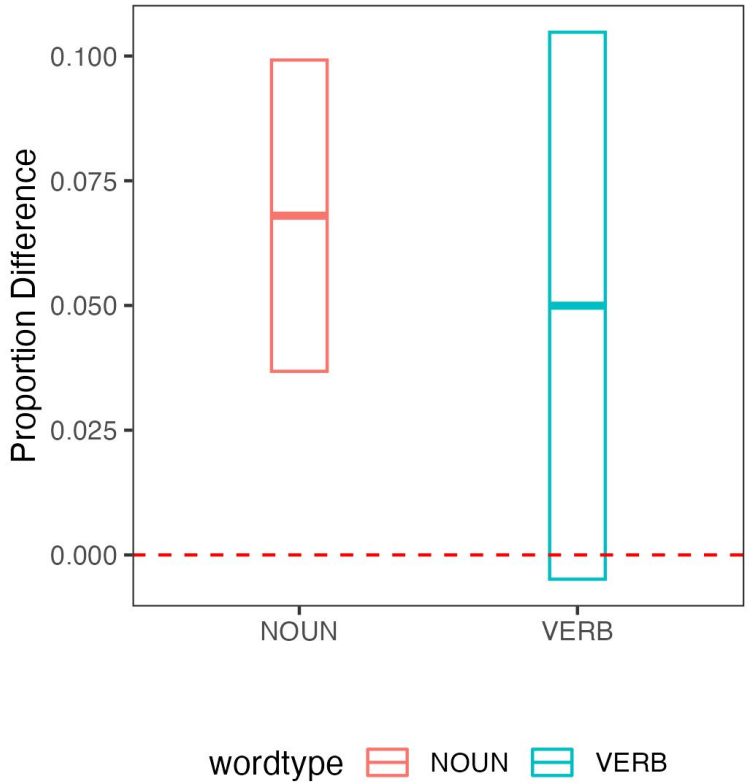


Image as **Target** - Image as **Distractor**

Results - Item-Level Alignment

- Parents over-reported comprehension (shortCDI) compared to infants' recognition performance (accuracy)

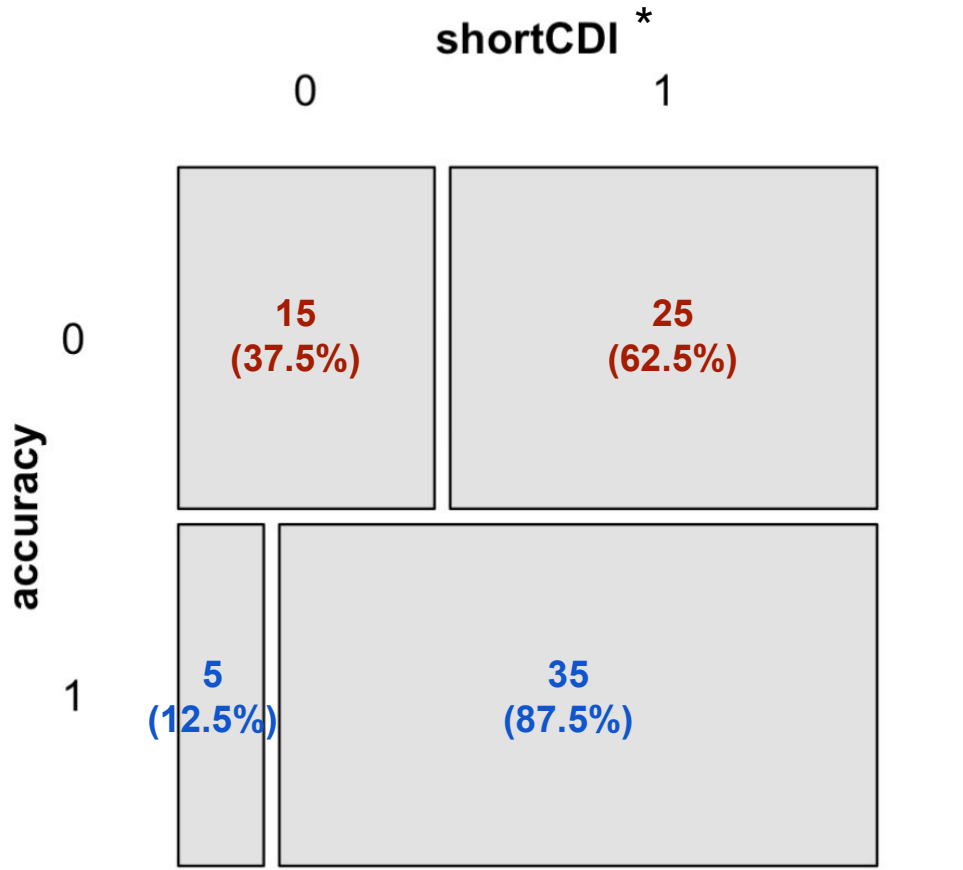
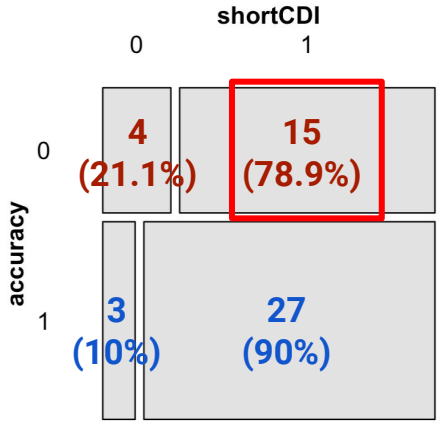


Image as **Target** - Image as **Distractor**

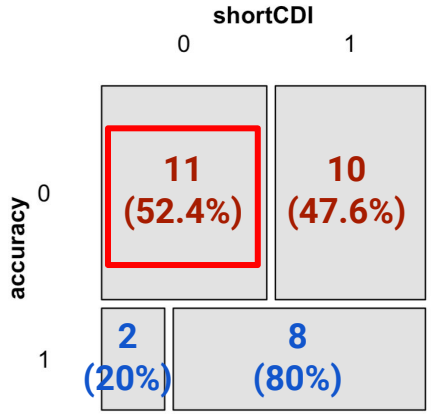
*either item responded “yes”

Results - Item-Level Alignment

- Parents tend to over-report earlier-acquired words
- For unrecognized words (accuracy = 0), parent-infant alignment higher in later acquired words



early AoA*(<= 13)



later AoA*(> 13)

Image as **Target** - Image as **Distractor**

*lowest among the pairs

Discussion - Limits of Parental Reports

- Full MB-CDI may be less reliable than short form focused on target words
- Relying solely on parental report has constraints for assessing infants' word knowledge

Discussion - Values of Converging Measures

- Eye-tracking provides direct, real-time measure not reliant on parent inference
- Short, targeted eye-tracking can complement parental reports (current findings suggest pairing with short-CDI consisting only target items)

Discussion - Values of Converging Measures

- Multiple converging measures give more complete picture of early comprehension:
- **Image as Target - Image as Distractor:** signalling infant's ability to increase attention to the same image when it is target vs distractor
- **Target look during Test - during Baseline:** signalling infant's ability to increase attention to target image compensating sustained attention during baseline

Future Directions

- Explore eye-tracking measures further, e.g. control for
  - item difficulty: use AoA[1] to pair easy, moderate, difficult items
  - animacy: pair animate with animate, inanimate with inanimate
  - semantic relatedness: pair each item with related & unrelated items[2]
  - test length: Use IRT[3] to select most informative items pairs, minimizing trials

[1] Frank et. al. (2017); [2] Lo et al. 2021; [3] Chai et al. (2020)

Future Directions

- Explore other means of quantifying gaze pattern
- Develop a convenient and easy to implement eye-tracking tool that is efficient for assessments, without the need for external system analysis

Conclusions

- Parental reports valuable but have constraints in measuring early comprehension
- Eye-tracking and targeted parental reports provide convergent validity
- Multiple measures needed for reliable language assessment during early infancy

Thank you.

Questions can be addressed to eonsuk@gmail.com.

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