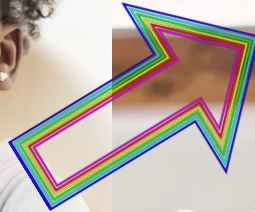
A stylized eye icon with a black pupil and white iris, surrounded by green and yellow segments. The background features a blue vertical bar on the left with white dots and geometric shapes (green triangles, yellow diamonds) on a light blue background.

Emerging Phonological and Semantic Specificity in Infant's Lexical Processing

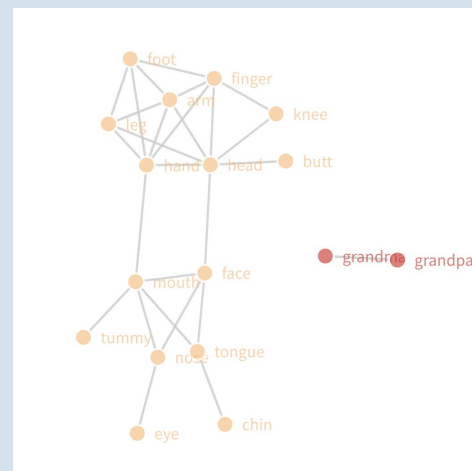
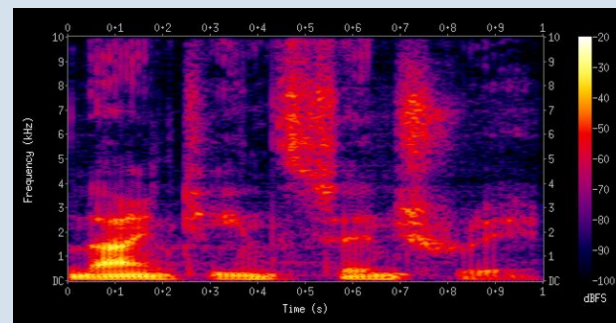
Erin Campbell, Lillianna Richter, Erika Bergelson



What do infants know about words?

Word knowledge could constitute:

- What words sound like
 - Allowing for variability due to speakers, coarticulation conditions, etc.
- What words mean
 - How do words relate to other words
 - Which words co-occur together
 - Semantic features



Phonological specificity

Infants must accept some wordform variability (speaker, token level)
BUT infants must also be able to discriminate minimal pairs (pen, pan)

How do infants' phonological representations develop over time?



Phonological specificity

Infants must accept some wordform variability (speaker, token level)
BUT infants must also be able to discriminate minimal pairs (pen, pan)

How do infants' phonological representations develop over time?



Phonological specificity

Infants must accept some wordform variability (speaker, token)
BUT infants must also be able to discriminate minimal pairs (pen, pan)

How do infants' phonological representations develop over time?

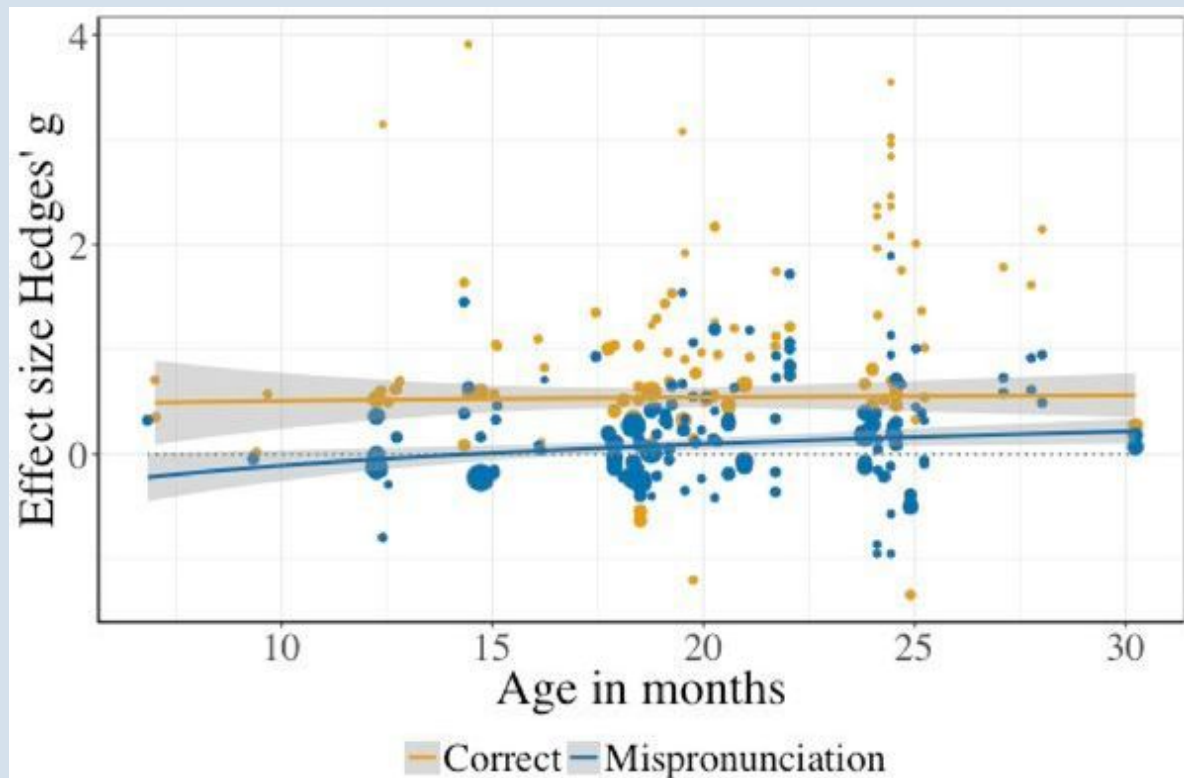
- **Under 12 months:** limited evidence for mispronunciation sensitivity (overly broad wordform representations)
- **Over 12 months:** consistent evidence for mispronunciation sensitivity (precise wordform representations)

Prediction: Phonological representations get increasingly specific.

→ bigger effect of mispronunciations on looking behavior

(Altvater-Mackensen & Mani, 2013; Mani & Plunkett, 2007; van der Feest & Fikkert, 2015; Mani & Plunkett, 2011; Swingley & Aslin, 2000, 2002; Bailey & Plunkett, 2002; Zesiger et al. 2012; Van Holzen & Berggman, 2018... and lotsa other refs)

But!!



Semantic specificity

Infants must also determine the scope and specificity of word meanings

"Dog" applies to both great danes and chihuahuas

but not cats or bears

Semantic specificity

Infants must also determine the scope and specificity of word meanings

"Dog" applies to both great danes and chihuahuas

but not cats or bears



Semantic specificity

Infants must also determine the scope and specificity of word meanings

“Dog” applies to both great danes and chihuahuas

but not cats or bears

How do infants' semantic representations develop over time?

- Mixed evidence for properly scoped meanings
 - some meanings seem properly scoped from 6 months old → onwards (Campbell & Hall, 2022)
 - some meanings seem overly broad (Bergelson & Aslin 2017 LLD, 2017 PNAS)
- Clear evidence for semantic competition (whether perceptual or conceptual), in toddlers and adults (Arias-Trejo & Plunkett, 2010, inter alia)

Prediction: Semantic representations get increasingly specific.

→ smaller effect of semantic similarity on looking behavior

Our Questions

1. Do infants' phonological representations grow more specific as they get older?
2. Do infants' semantic representations grow more specific as they get older?
3. Are infants' phonological specificity and semantic specificity related to one another?

Participants

N = 106/160 infants

9 months - 24 months (M = 17.7)

>75% English exposure



Methods:

- Infants participate in two experiments within one week
 - 1. Phonological sensitivity:**
 - Correctly pronounced vs. mispronounced words
 - 2. Semantic sensitivity:**
 - Semantically similar vs. semantically dissimilar pairs
- Experiments use the same set of stimuli and have the same set of “control” trials



Stimuli

- Words commonly understood/produced by participants in our age range
- **Phonological Experiment:**
 - Words are mispronounced → vowel shifted by two features
 - Cat → Keet
 - Ball → Bool
 - Milk → Malk
- **Semantic Experiment:**
 - Target words are paired with a word from the same semantic category or a different semantic category:
 - Cat–Banana → Cat–Dog
 - Ball–Apple → Ball–Car
 - Milk–Diaper → Milk–Juice

Stimuli

Control trials	Mispronunciation Trials	Semantically-Similar Trials
Cat – Banana Apple – Ball Blanket – Juice Milk – Diaper Cookie – Dog Bottle – Car Foot – Cracker Nose – Spoon	[kit] or [bə.'nu.nə] ['i.pl] or [bul] ['blʌŋ.kɪt] or [jis] [mɒtk] or ['dʊʊ.pə] ['kæ.ki] or [dug] ['bɪ.rɪ] or [kʊʊ] [fɛt] or ['kiu.kə] [neɪz] or [spɛn]	Cat – Dog Apple – Banana Ball – Car Blanket – Diaper Milk – Juice Cookie – Cracker Bottle – Spoon Foot – Nose

Correctly pronounced
Semantically **dissimilar**

Phon. Exp.

Sem. Exp.



Predictions

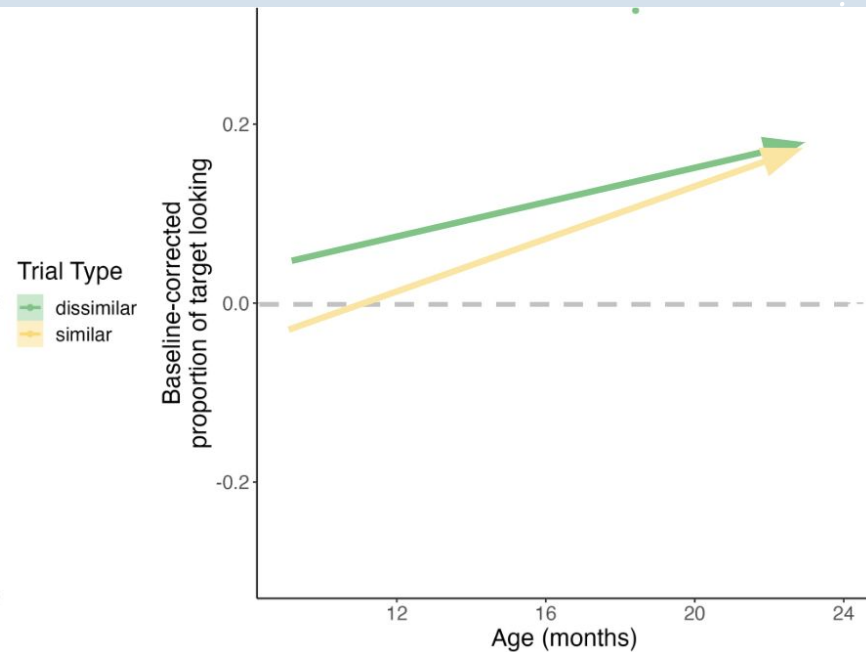
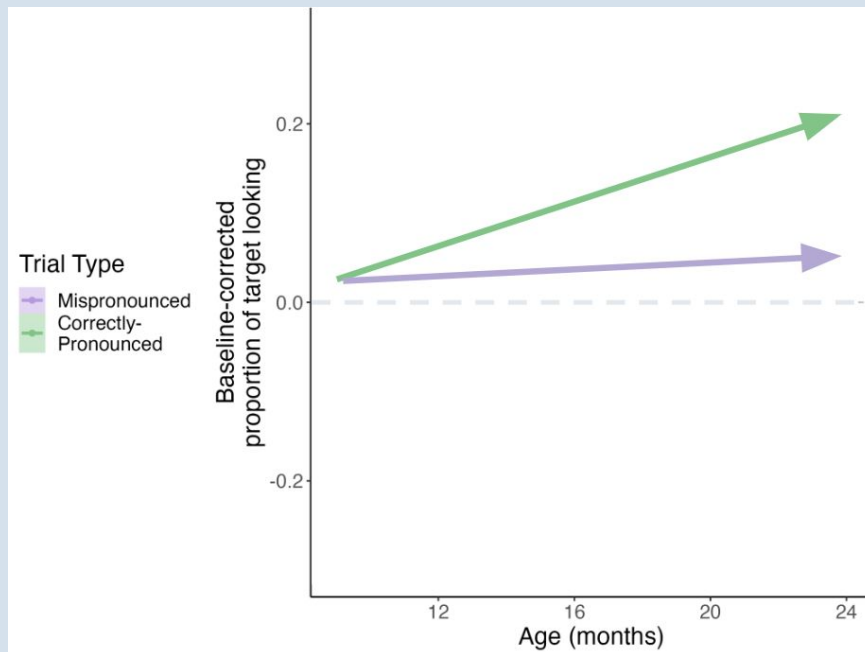
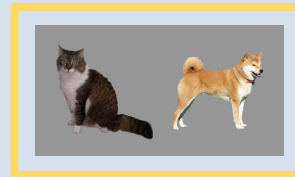
CAT



KEET



CAT

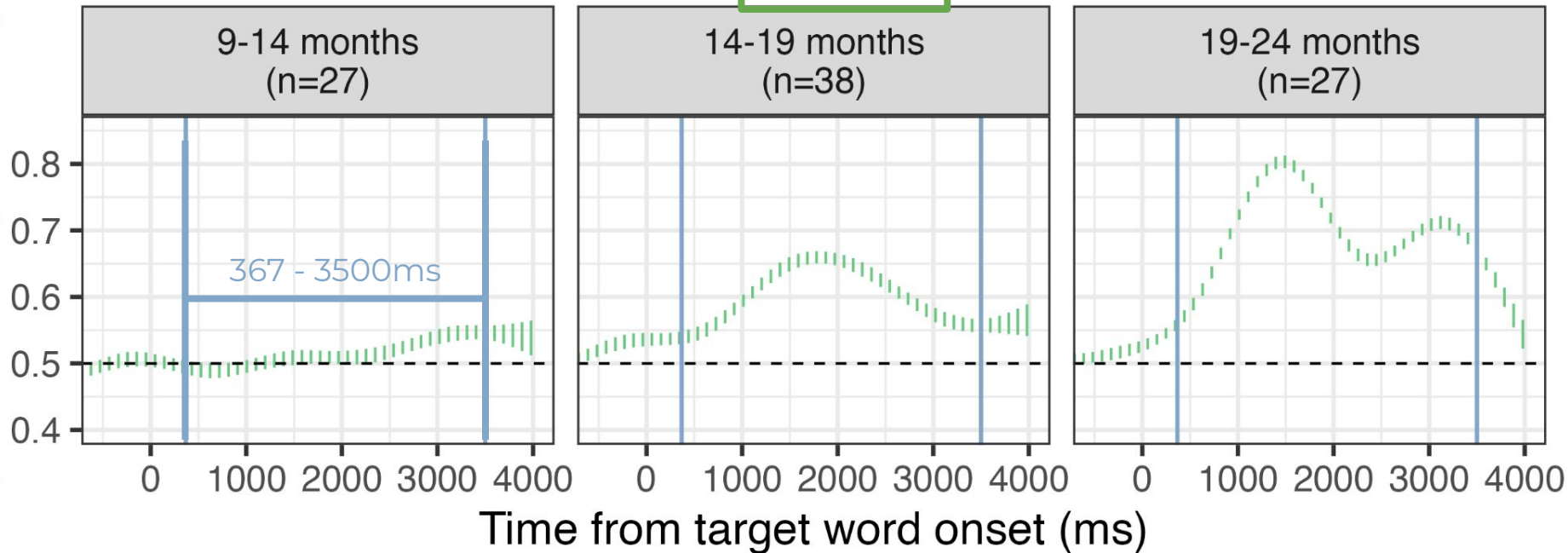


Phonological Experiment: Mispronunciations

Trial Type **CAT**



Proportion of target looking



Phonological Experiment: Mispronunciations

Trial Type

CAT

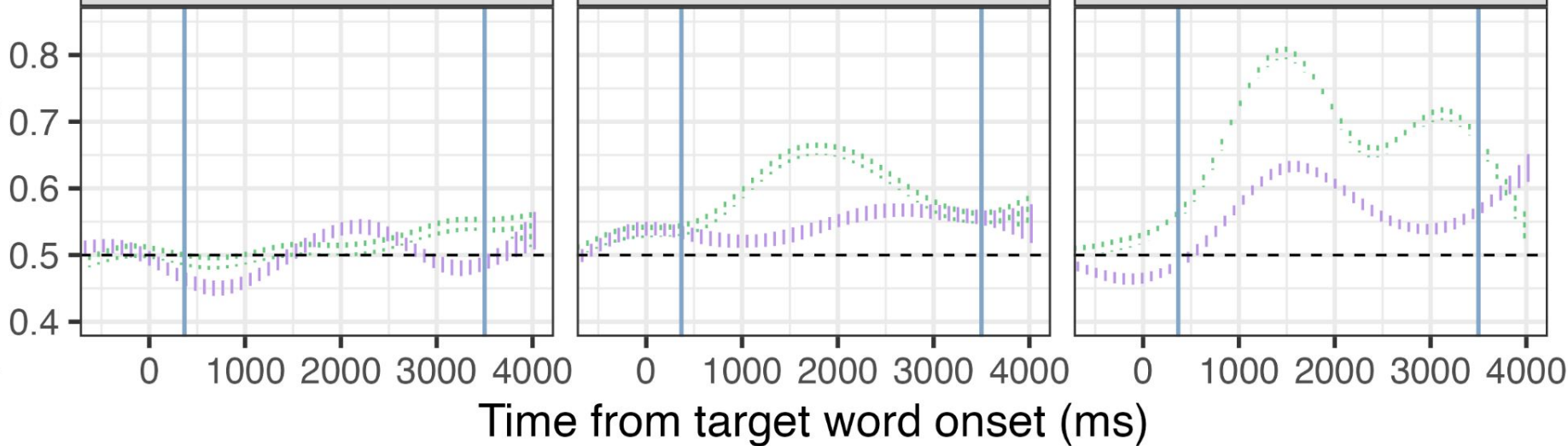
KEET



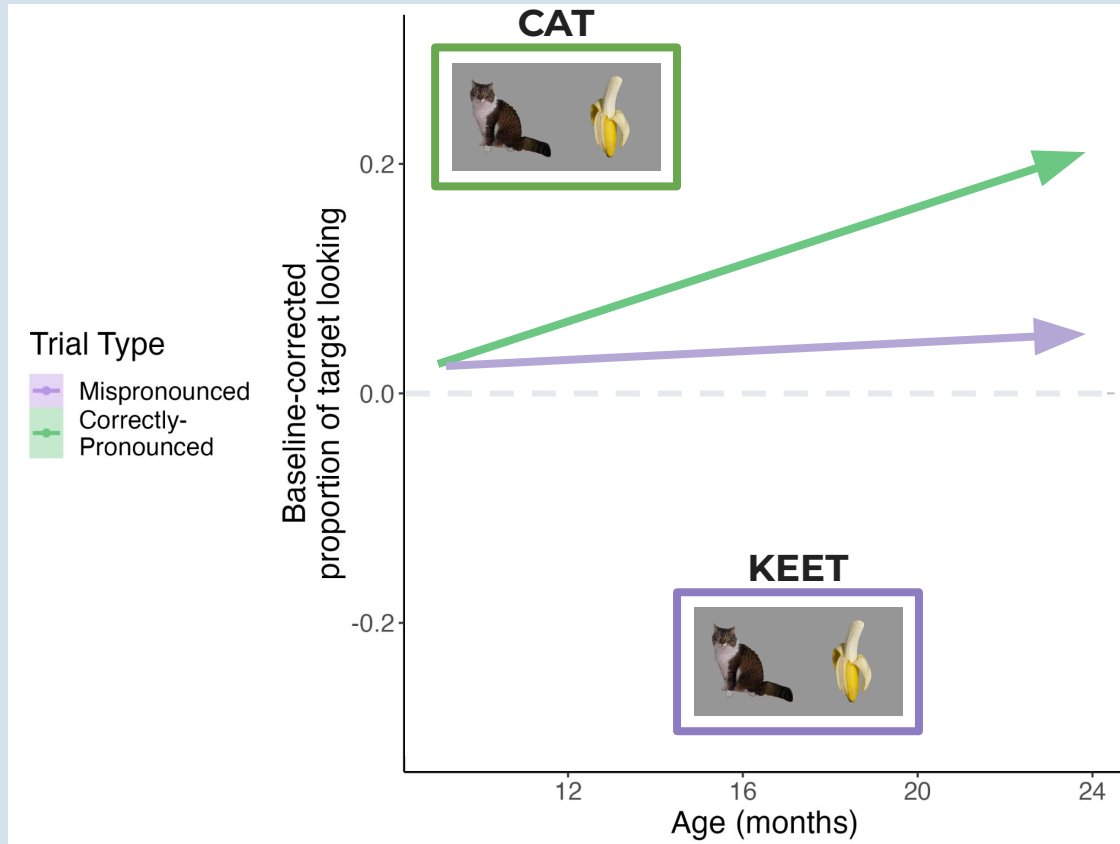
9-14 months
(n=27)

14-19 months
(n=38)

19-24 months
(n=27)



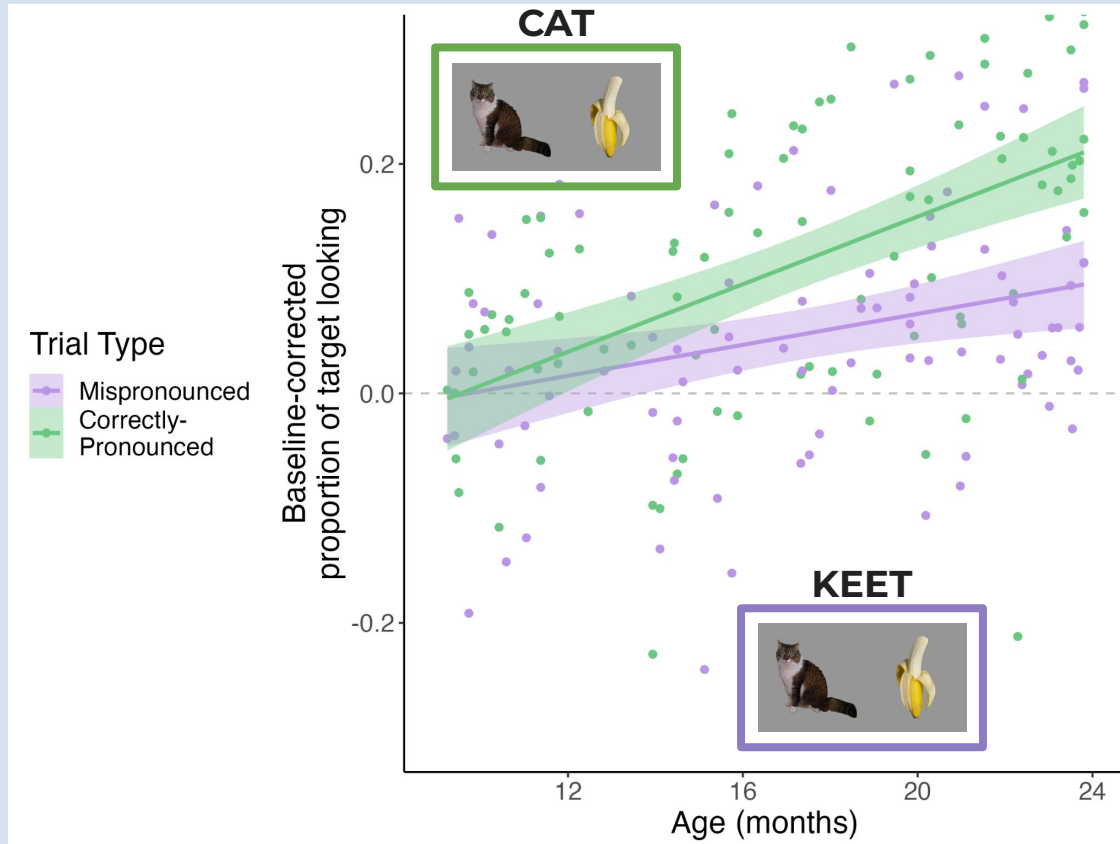
If infants get more specific...



- Older infants are:
- Better at word recognition
 - Increasingly sensitive to mispronunciations

I know what this word should sound like and that ain't it!

Actual Results



Older infants are:

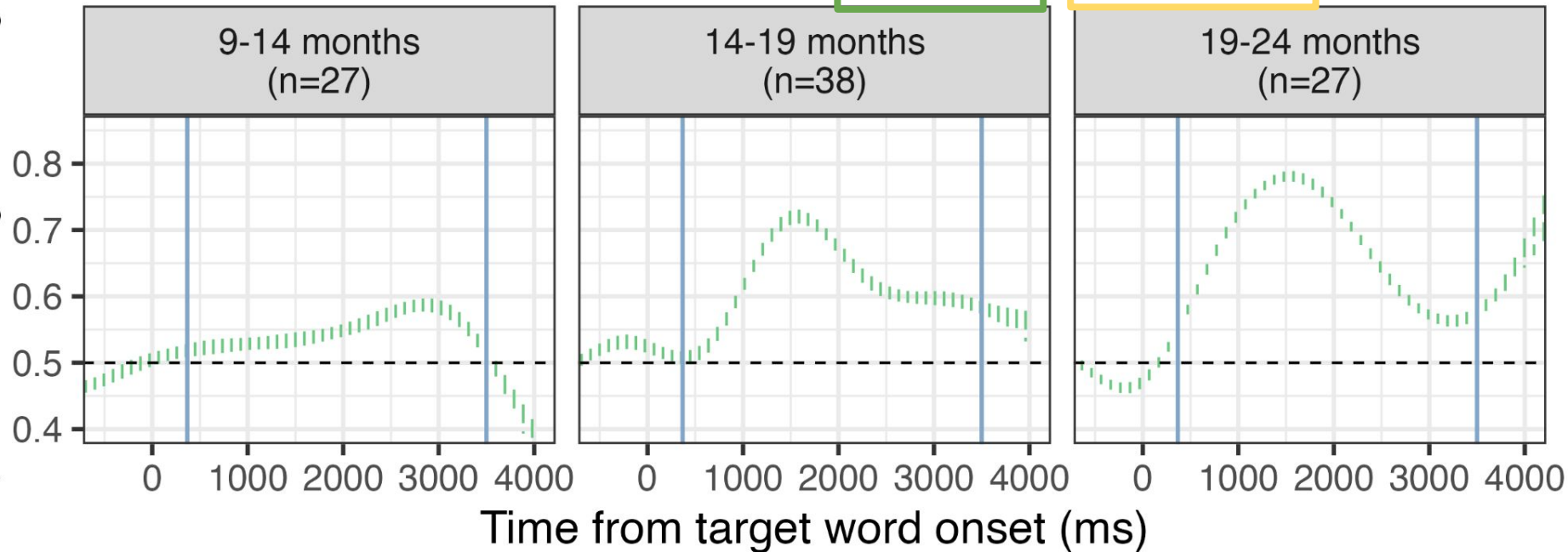
- Better at word recognition ✓
- Increasingly sensitive to mispronunciations ✓

I know what this word should sound like and that ain't it!

Semantic Experiment: Relatedness



Proportion of target looking



Semantic Experiment: Relatedness

Trial Type

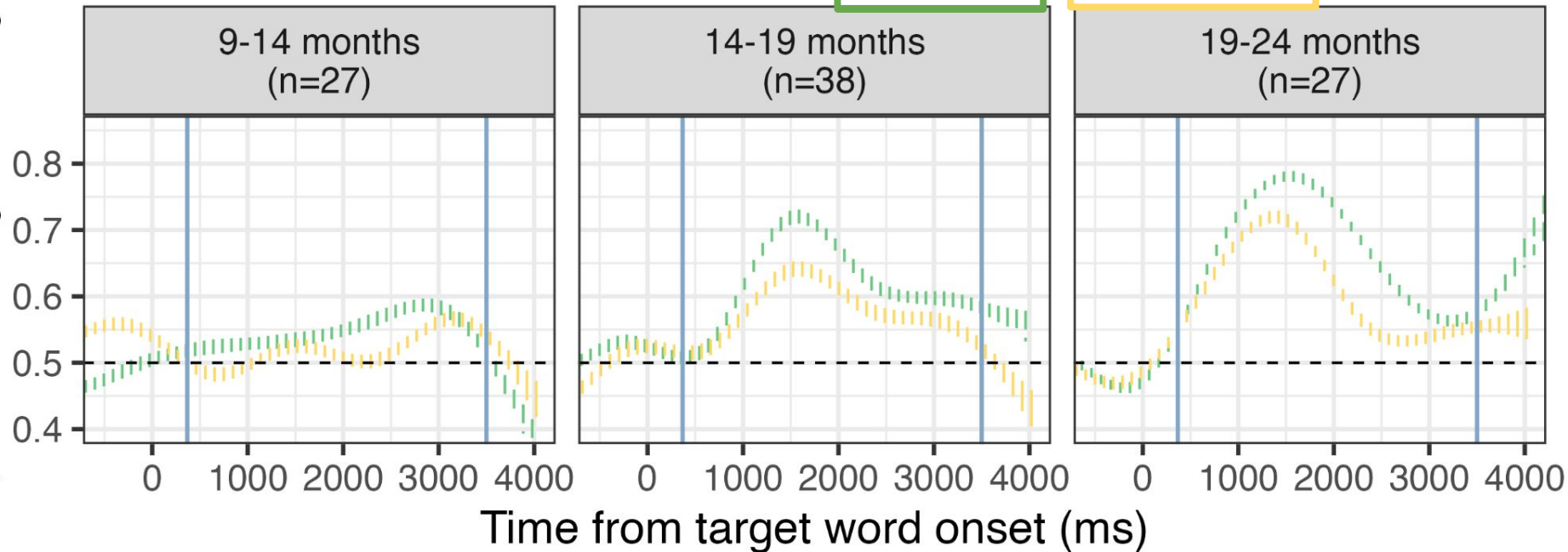
CAT



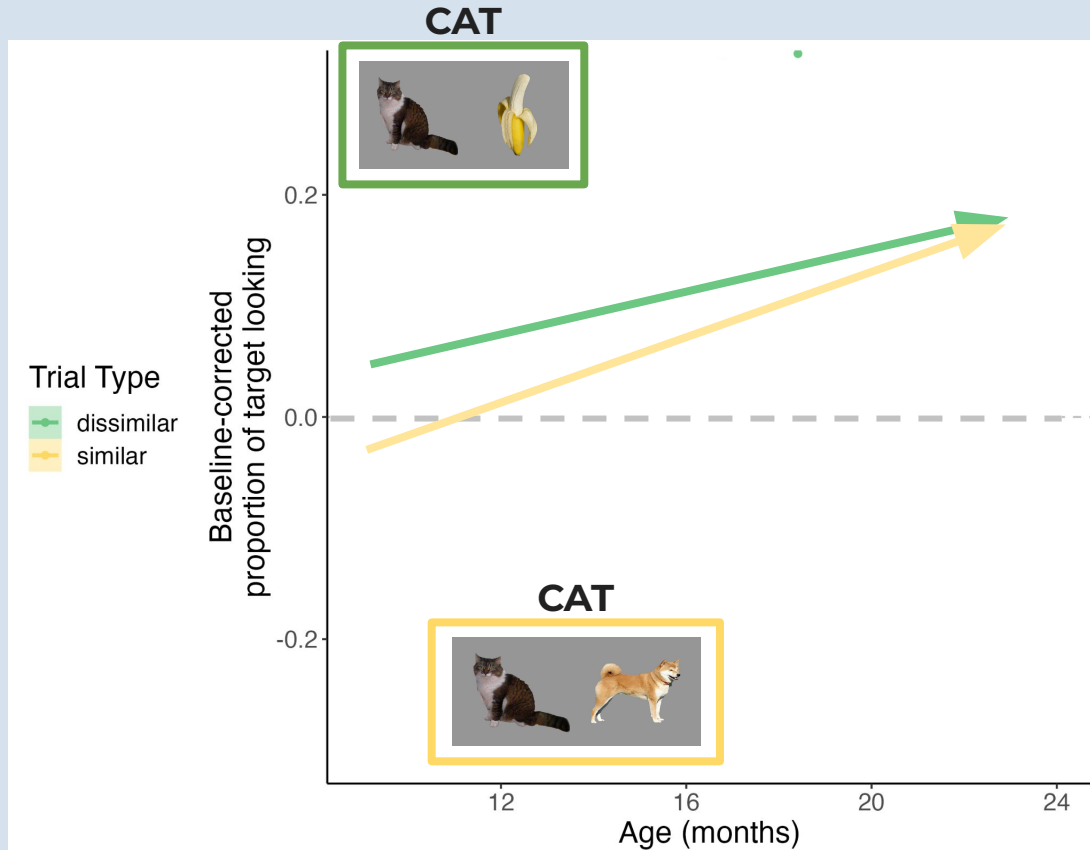
CAT



Proportion of target looking



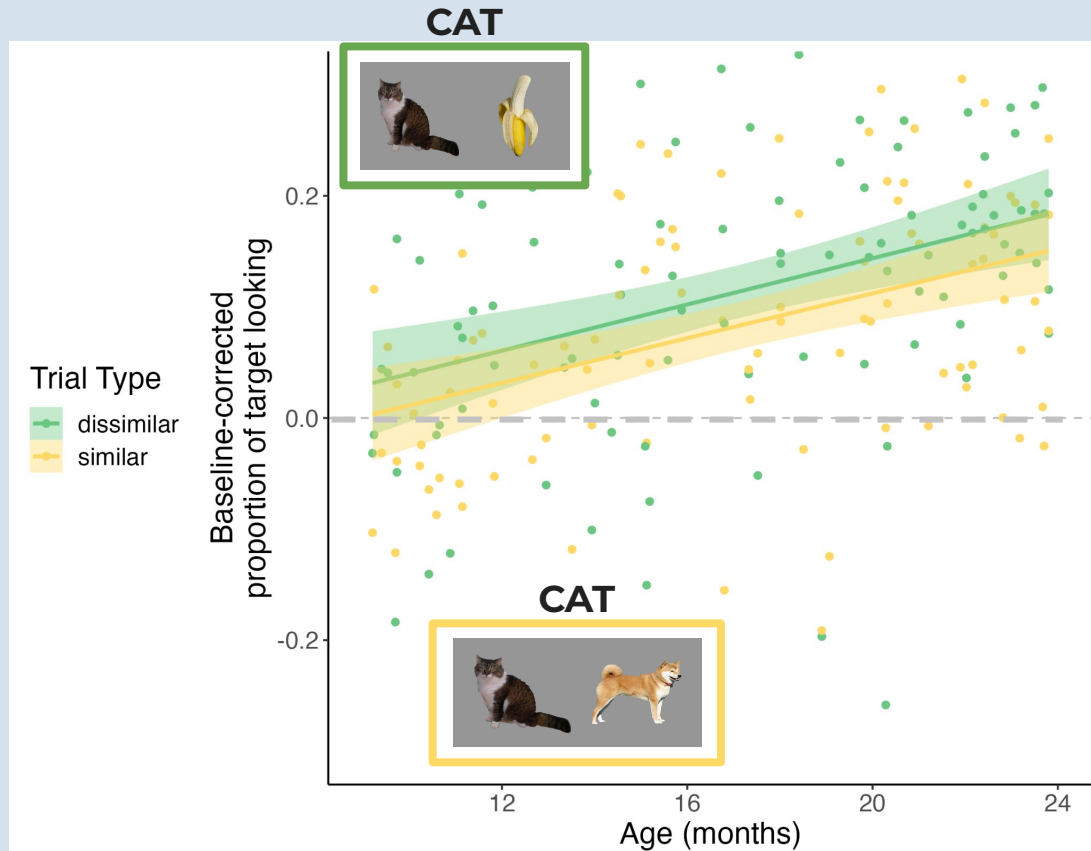
If infants get more specific...




Older infants are:

- Better at word recognition
- Increasingly able to recognize words even when faced with a semantically-similar possibility

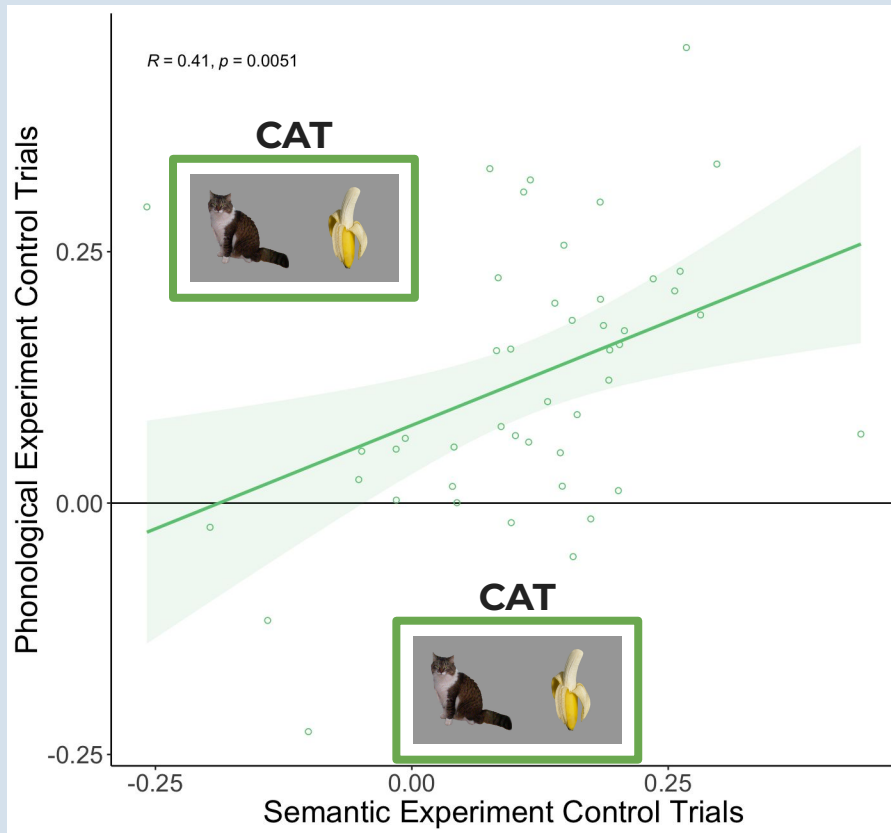
Actual Results



Older infants are:

- Better at word recognition 
- Increasingly able to recognize words even **MAYBE** faced with a semantically-similar possibility
- Semantically similar words seem equally challenging across development

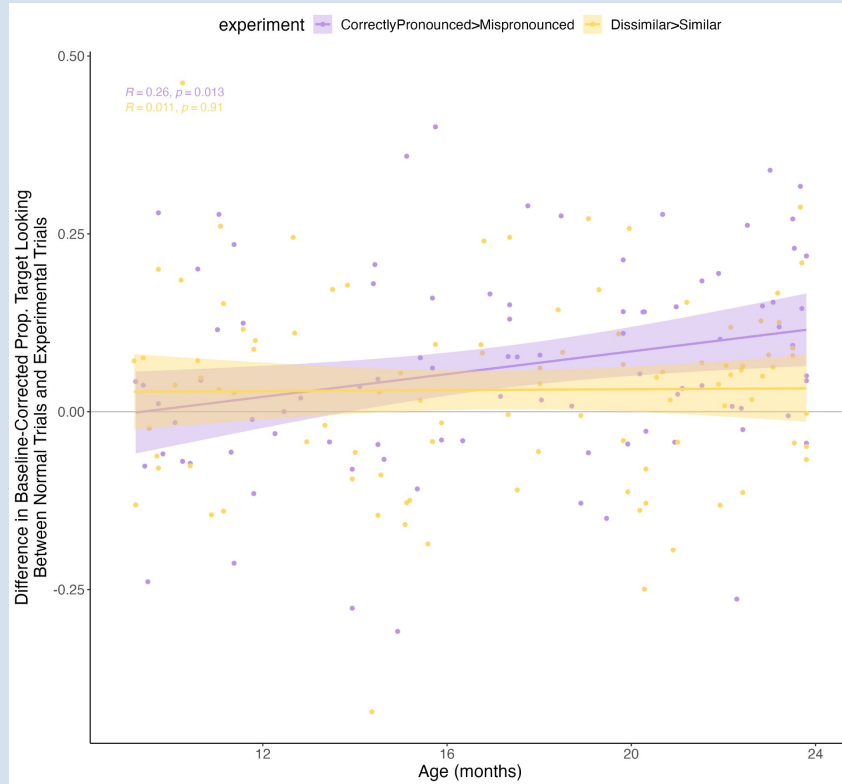
Test-Retest Reliability?



- Most children look to target well above chance on control trials
- Performance on control trials (identical stimuli) correlates across experiments



To Summarize



- Larger effect of mispronunciation across age
 - More phonological specificity?
- Stable effect of semantic relatedness across age

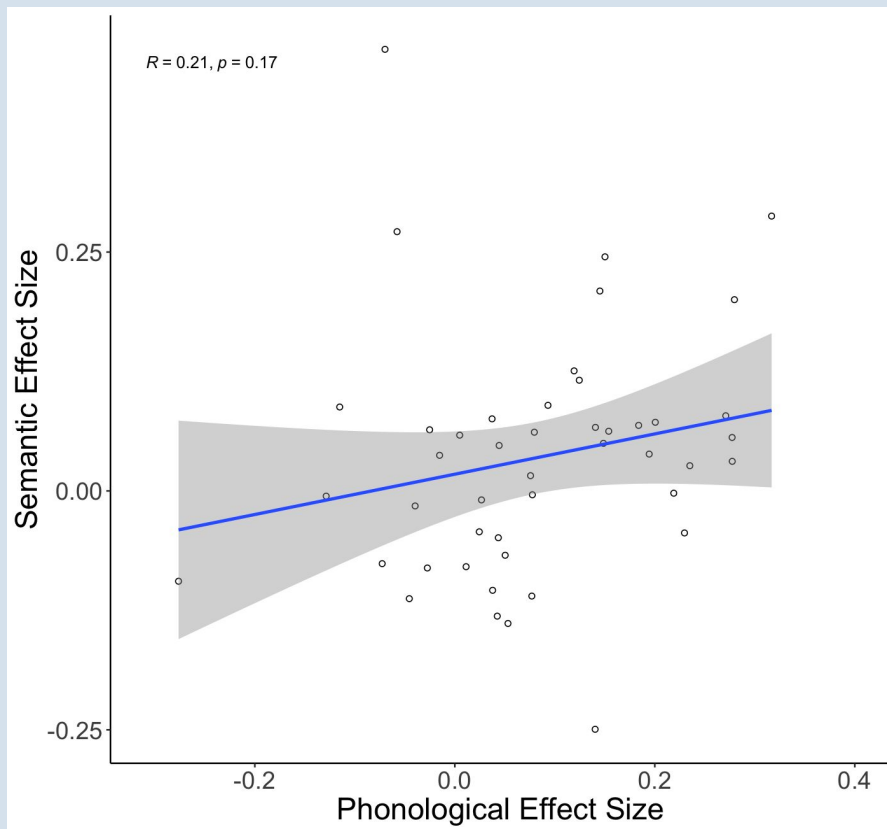
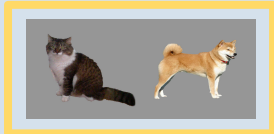
Correlation in effect sizes between experiments?

CAT

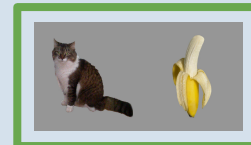


MINUS

CAT



CAT



MINUS

KEET



Our Questions

1. Do infants' phonological representations grow more specific as they get older?
2. Do infants' semantic representations grow more specific as they get older?
3. Are infants' phonological specificity and semantic specificity related to one another?

Our Questions

1. Do infants' phonological representations grow more specific as they get older?

Yes, as infants get older, they become increasingly sensitive to mispronunciations.

2. Do infants' semantic representations grow more specific as they get older?

3. Are infants' phonological specificity and semantic specificity related to one another?

Our Questions

1. Do infants' phonological representations grow more specific as they get older?

Yes, as infants get older, they become increasingly sensitive to mispronunciations.

2. Do infants' semantic representations grow more specific as they get older?

No, it seems like it's ~equally hard for younger vs. older infants to recognize words when paired with a semantically similar possibility

3. Are infants' phonological specificity and semantic specificity related to one another?

Our Questions

1. Do infants' phonological representations grow more specific as they get older?


Yes, as infants get older, they become increasingly sensitive to mispronunciations.

2. Do infants' semantic representations grow more specific as they get older?

No, it seems like it's ~equally hard for younger vs. older infants to recognize words when paired with a semantically similar possibility

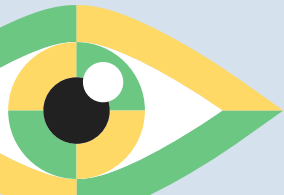
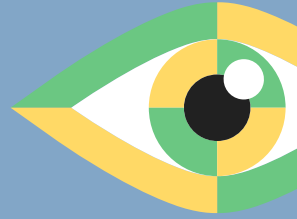
3. Are infants' phonological specificity and semantic specificity related to one another?

Currently: no.



What would it mean for phonological and semantic specificity to develop independently?

- Separate developmental pathways?
- Potential for word-level differences:
 - If phonological and semantic properties are related (as is the case for strongly iconic words), would phonological and semantic knowledge show a tighter link?
- Potential for infant-level differences:
 - More mature knowledge in one domain than another (e.g., good at distinguishing sounds but slower to differentiate meanings)
 - Might certain populations show patterns like this?





Conclusions

- Over 9-24 months, as word comprehension improves:
 - infants' phonological representations for words they know grow more precise
 - the effect of semantically-similar referents (cat/dog vs. cat/banana) is stable
- The same items elicit the same behavior within kids (pewhew!)
- but measures of phonological and semantic specificity seem separate (at least with these kids, in this paradigm, etc.)

THANKS!

- All of our squirmy, word-knowing participants
- Bergelson Lab
- Lex Lab and LAVA Labs for feedback on this presentation and our eyetracking analysis support group
- NSF GRFP to EC

CREDITS: This presentation template was created by **Slidesgo**, including icons by **Flaticon** and infographics & images by **Freepik**

