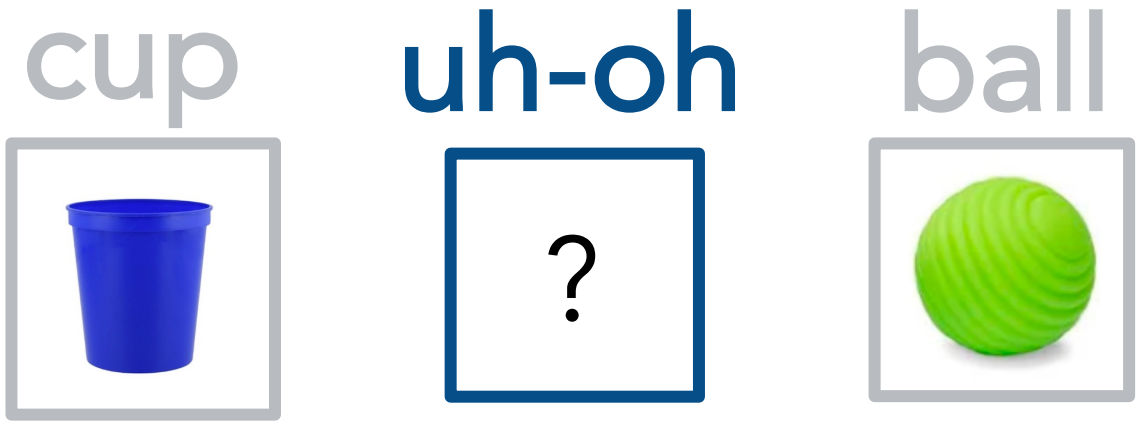
Moving beyond "nouns in the lab": Using naturalistic data to understand why infants' first words include uh-oh and hi

Kennedy Casey, Christine Potter, Mira Nencheva, Casey Lew-Williams, & Erica Wojcik

How does early word learning unfold in naturalistic contexts?



How do infants map labels onto objects?

Word learning: Theories

Key predictors of AoA:

- Concreteness
- Imageability
- Frequency

Goodman et al., 2008; McDonough et al., 2011; Swingley & Humphrey, 2018

Word learning: Theories

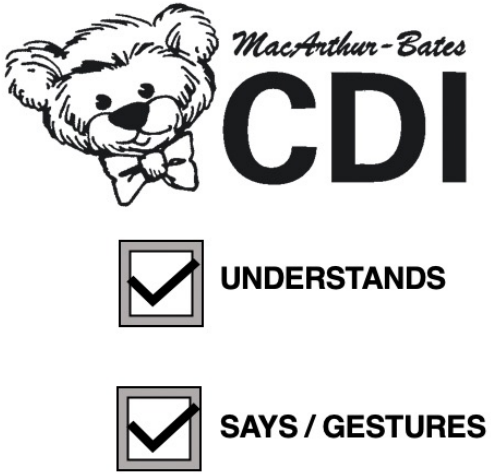
Theories of noun learning depend on **stable visual referents**

Cross-situational mechanism:

Akhtar & Montague, 1999; Smith & Yu, 2008; Vouloumanos & Werker, 2009

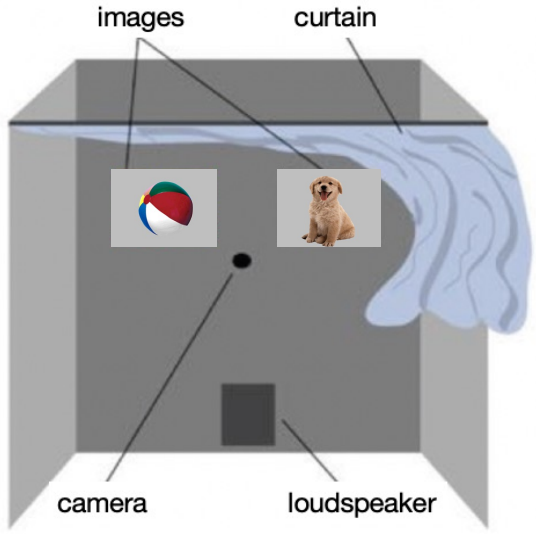
Word learning: Methods

parent-report surveys



Fenson et al., 1994

eye-tracking studies



Fernald et al., 2008

Bergelson & Swingley, 2012; Frank et al., 2016; Tincoff & Jusczyk, 1999; 2012

Evidence for a "noun bias"?

15 most commonly-produced English words at 16 months:

Frank et al., 2016

Earliest-produced words in 15 languages

Croatian
mommy
daddy
grandma
bye-bye
woof-woof
baby
no
yes
grandpa
aunt

Danish
hi
woof-woof
thank-you
mommy
no
bye-bye
daddy
vroom
yes
food

English (American)
mommy
daddy
ball
bye-bye
hi
no
dog
baby
woof-woof
banana

French (French)
daddy
mommy
baby
bye-bye
thank-you
bread
peekaboo
ball
sock
shoe

French (Quebecois)
mommy
daddy
no
bye-bye
baby
ball
vroom
sock
peekaboo
moo

Hebrew
mommy
yum
grandma
vroom
grandpa
daddy
banana
this
bye-bye
car

Italian
mommy
daddy
woof-woof
grandma
water
hi
grandpa
meow
no
shoe

Kiswahili
mommy
daddy
car
cat
meow
motorcycle
baby
bug
banana
baa-baa

Korean
mommy
daddy
peekaboo
woof-woof
cracker
water
baby
yes
ball
no

Norwegian
vroom
mommy
yum
hi
daddy
bye-bye
thank-you
woof-woof
yes
peekaboo

Russian
meow
daddy
woof-woof
grandpa
aunt
mommy
grandma
bye-bye
cereal
ball

Slovak
mommy
daddy
woof-woof
grandma
vroom
food
yum
bye-bye
cereal
ball

Spanish (Mexican)
mommy
daddy
water
yum
woof-woof
bread
no
bye-bye
baby
yes

Swedish
mommy
daddy
thank-you
woof-woof
hi
peekaboo
drawer
meow
moo
no

Turkish
mommy
yum
brother
woof-woof
baby
vroom
bye-bye
water
ball
doll

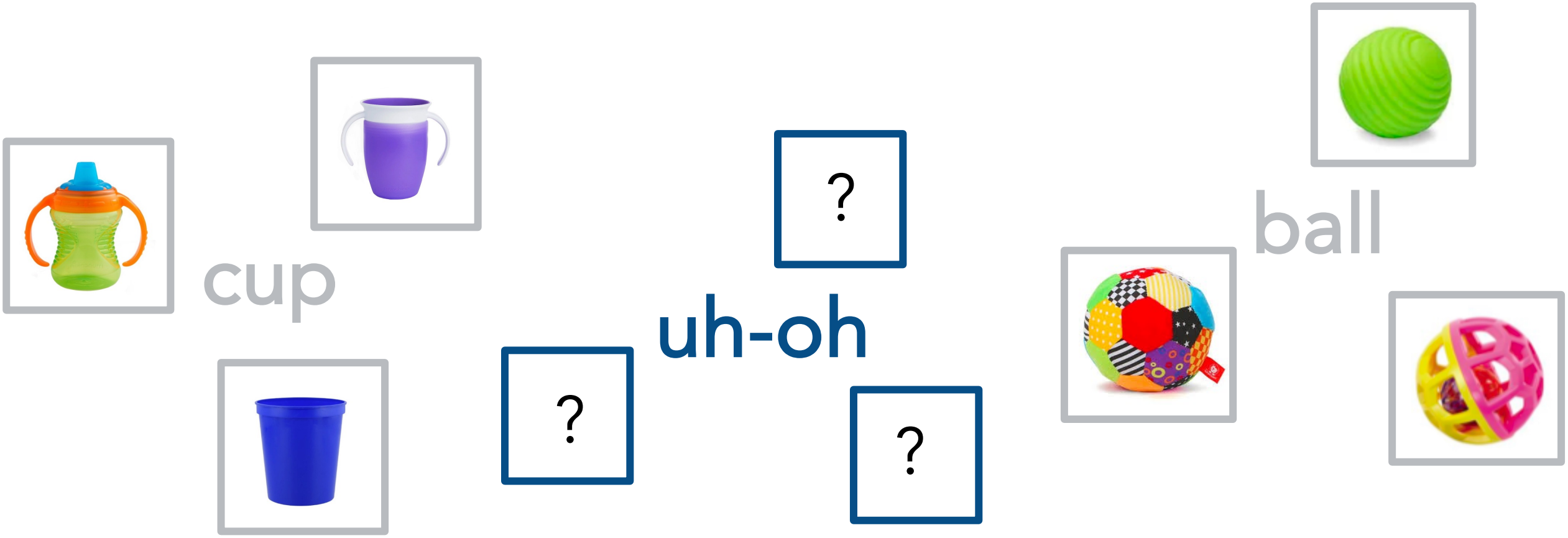
Adapted from Frank et al., 2021

Everyday words

- Do not fit into established lexical categories
- Highly frequent and early-learned
- Grounded in common routines / social interactions

See exceptions: Bergelson & Swingley, 2013; Syrnyk & Meints, 2017

Stable referents → early learning



*How do **everyday words** fit into learning theories?*

Current investigation

Study 1: Behavioral experiment

- *Evidence of comprehension?*

Study 2: Corpus-based observational research

- *Real-world input statistics?*

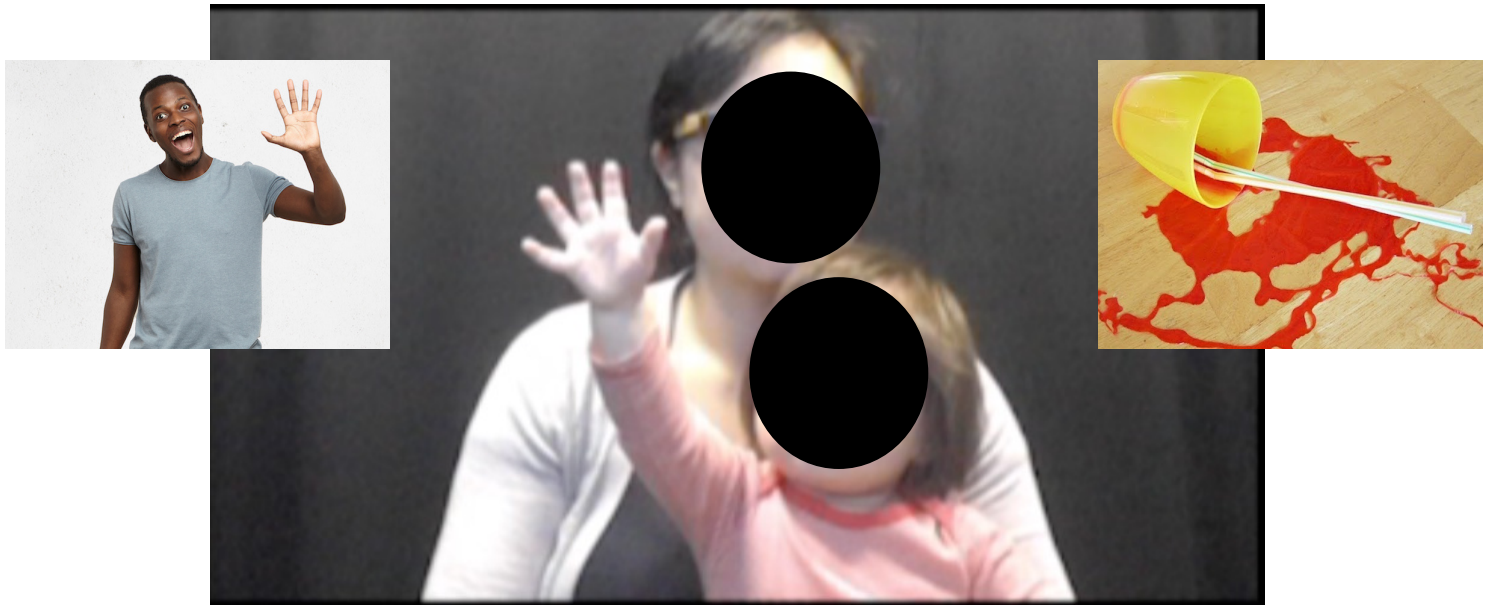
Study 1: Behavioral experiment

Evidence of comprehension via eye-tracking?

Standard LWL design

N = 33 infants

Age range = 10-16m



Study 1: Behavioral experiment

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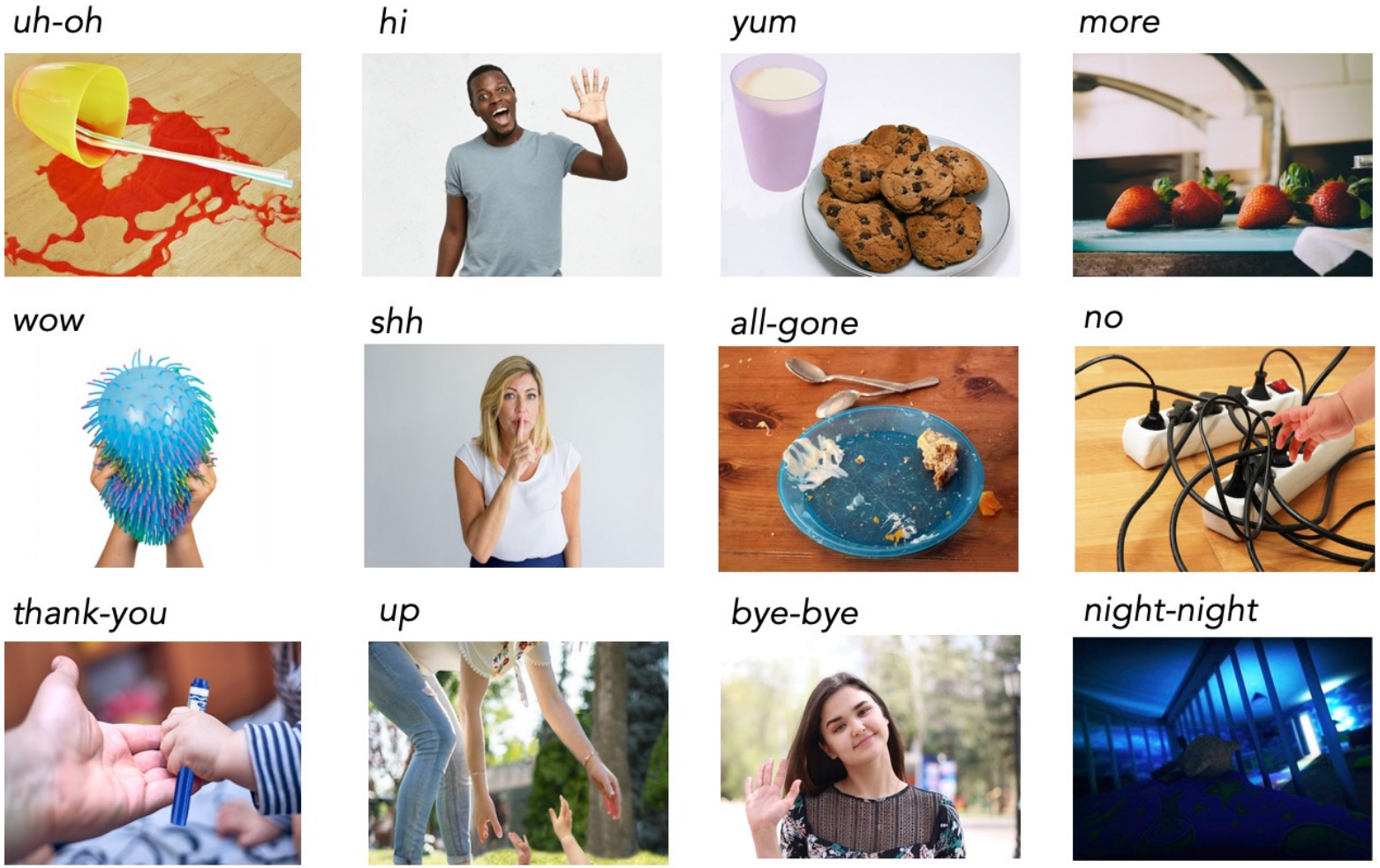


Study 1: Behavioral experiment

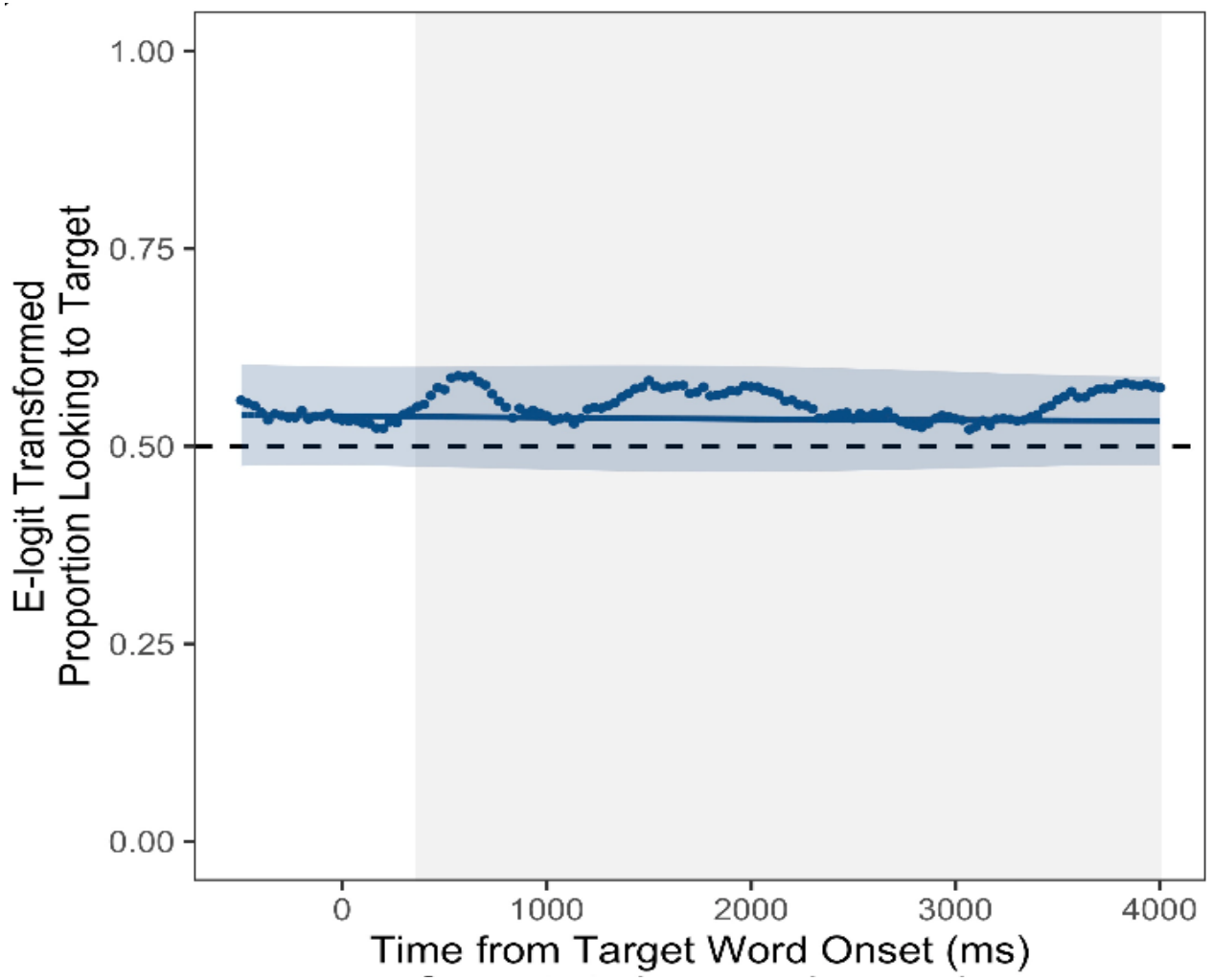
Evidence of comprehension via eye-tracking?

Standard LWL design

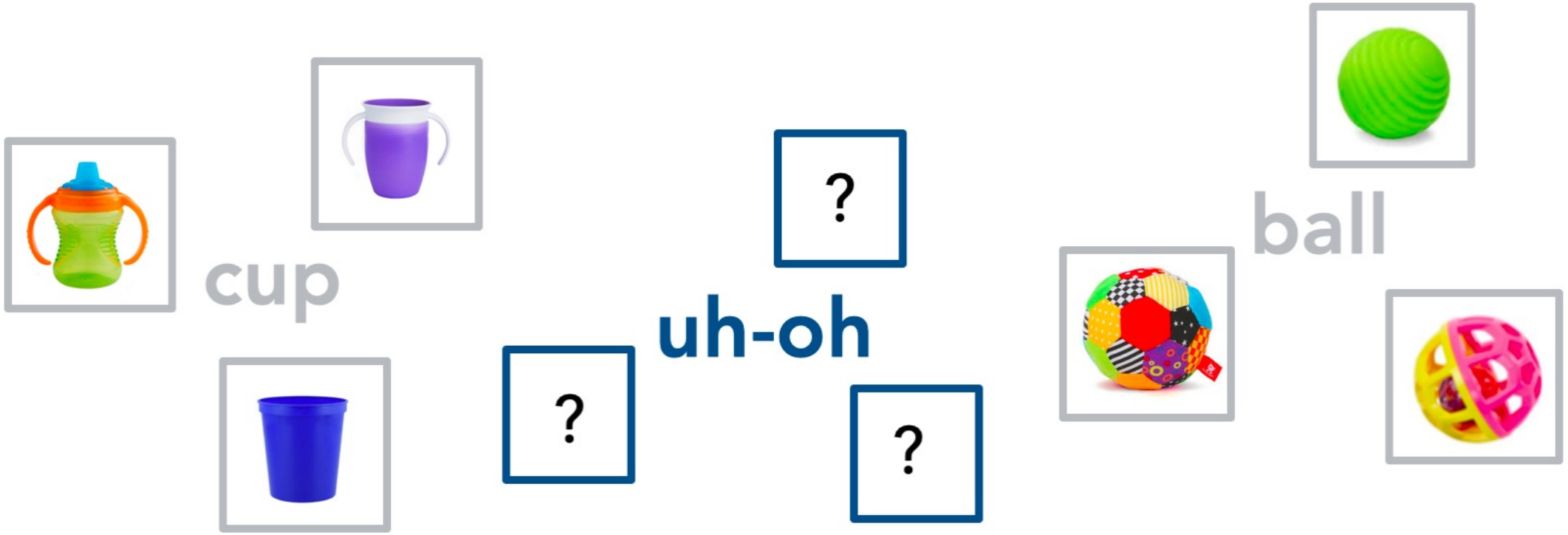
N = 33 infants

Age range = 10-16m

No evidence of reliable comprehension



What does uh-oh look like?



Current investigation

Study 1: Behavioral experiment

- *Evidence of comprehension? (No, based on looking time)*

Study 2: Corpus-based observational research

- *Real-world input statistics?*

Study 2: Video corpus analysis

Real-world input associated with everyday words?

Providence corpus

- 5 infants
- Age range = 11-24 months
- 114 at-home sessions (~1 hour each)
- 11,920 total tokens (*M* = 993, *SD* = 827)

Coding scheme

- Exact visual referent
- Situation surrounding production
- Match to experimental stimuli

Demuth et al., 2006

Study 2: Video corpus analysis

Top-down: Ecological validity of experimental stimuli?

Match vs. Non-Match

Bottom-up: Characteristics of infants' real-world input?

Visual vs. Situational

Assessing the ecological validity of experimental stimuli

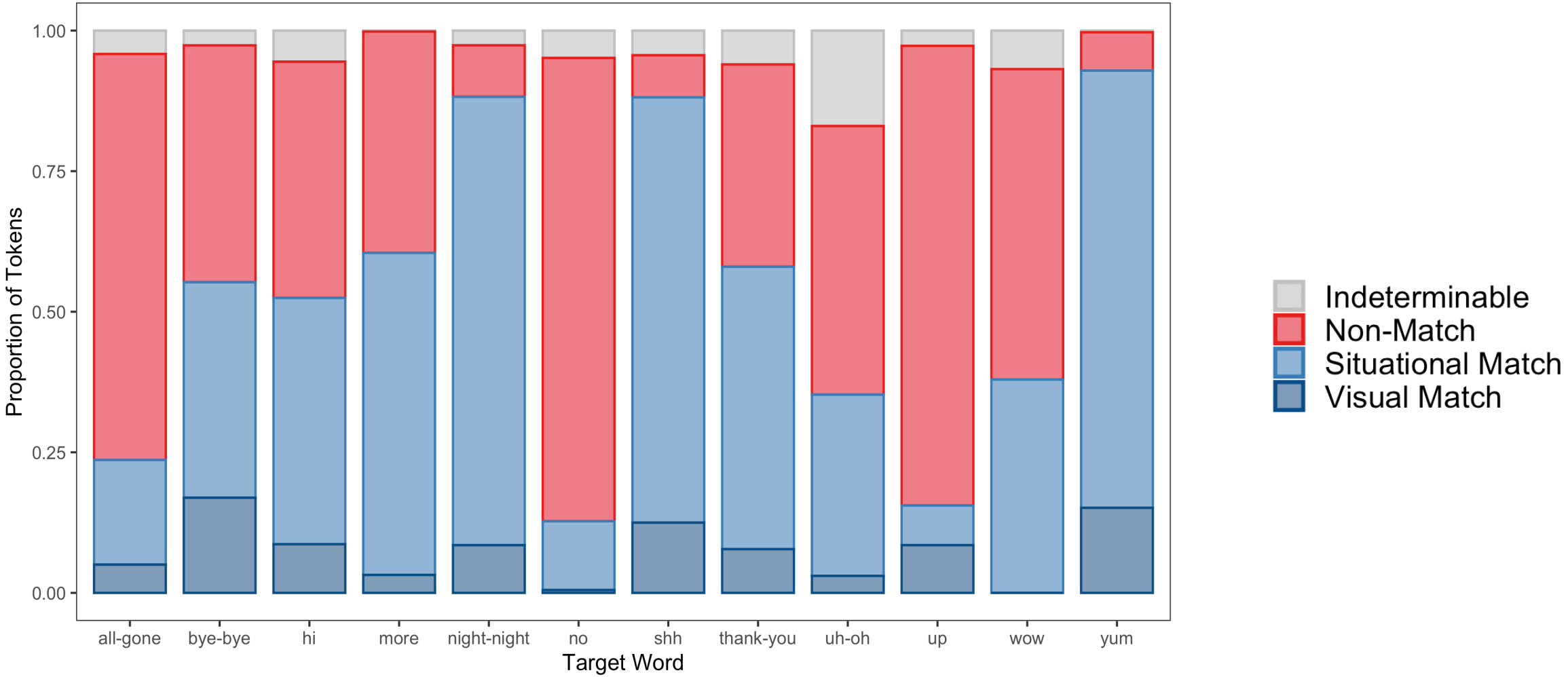
Study 1 target
(*uh-oh*)

Visual Match

Situational Match

Non-Match

Rare **visual** but common **situational** matches to stimuli



Study 2: Video corpus analysis

Top-down: Ecological validity of experimental stimuli?

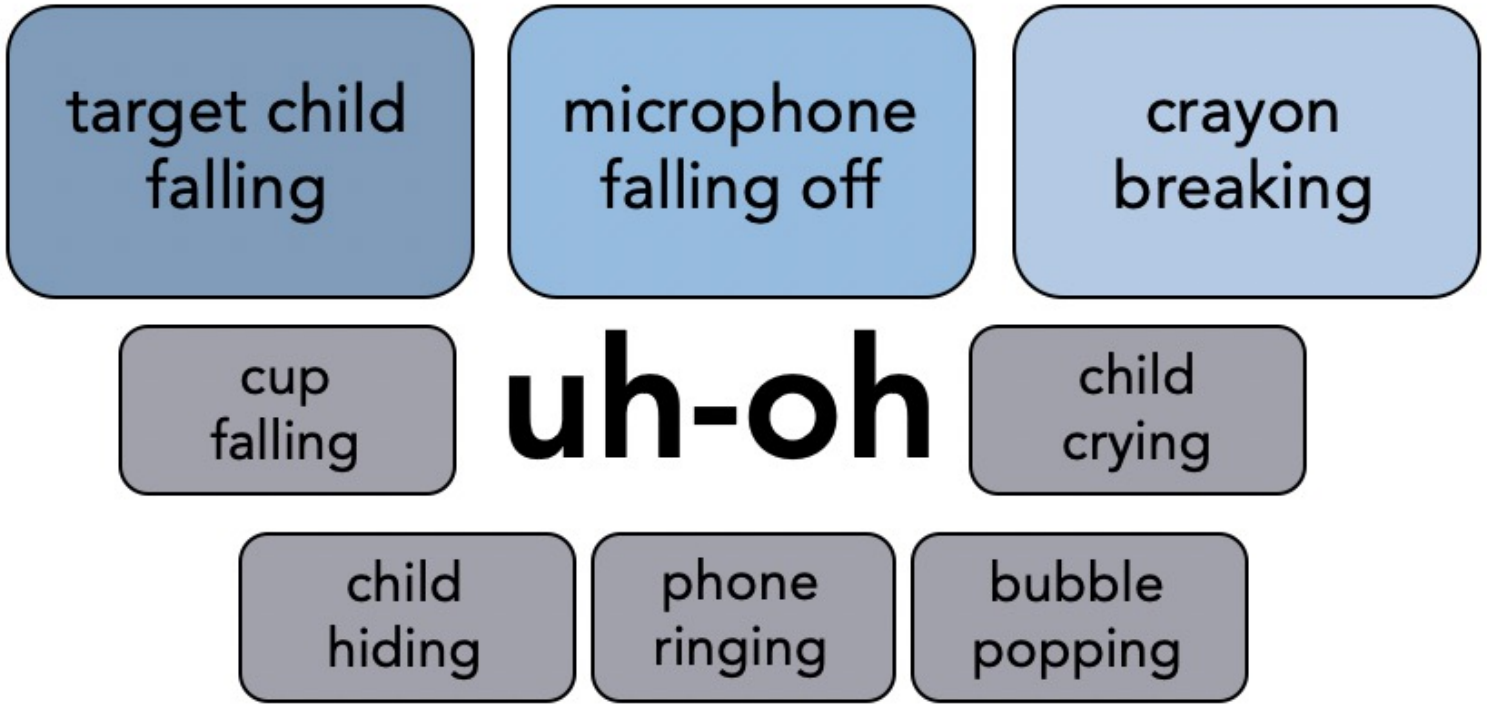
Match vs. **Non-Match**

Bottom-up: Characteristics of the real-world input?

Visual vs. **Situational**

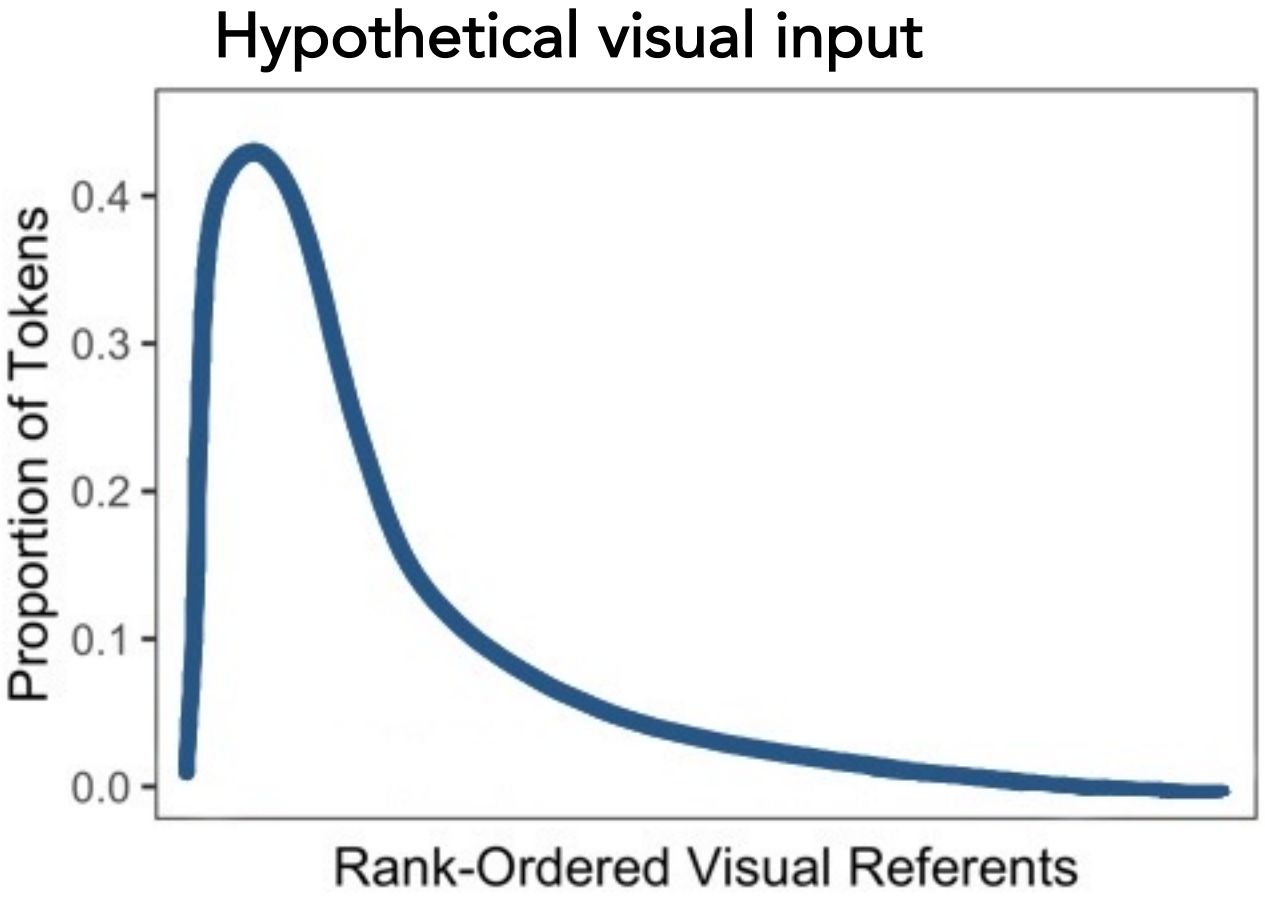
Visual stability?

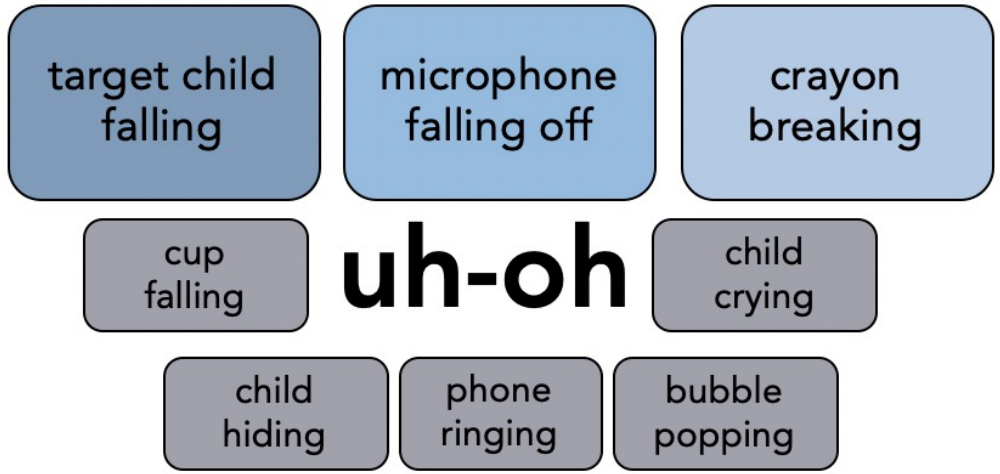
Co-occurrence with consistent visual referents?



Everyday words are variable at the **visual level**

Prototypical visual referent?





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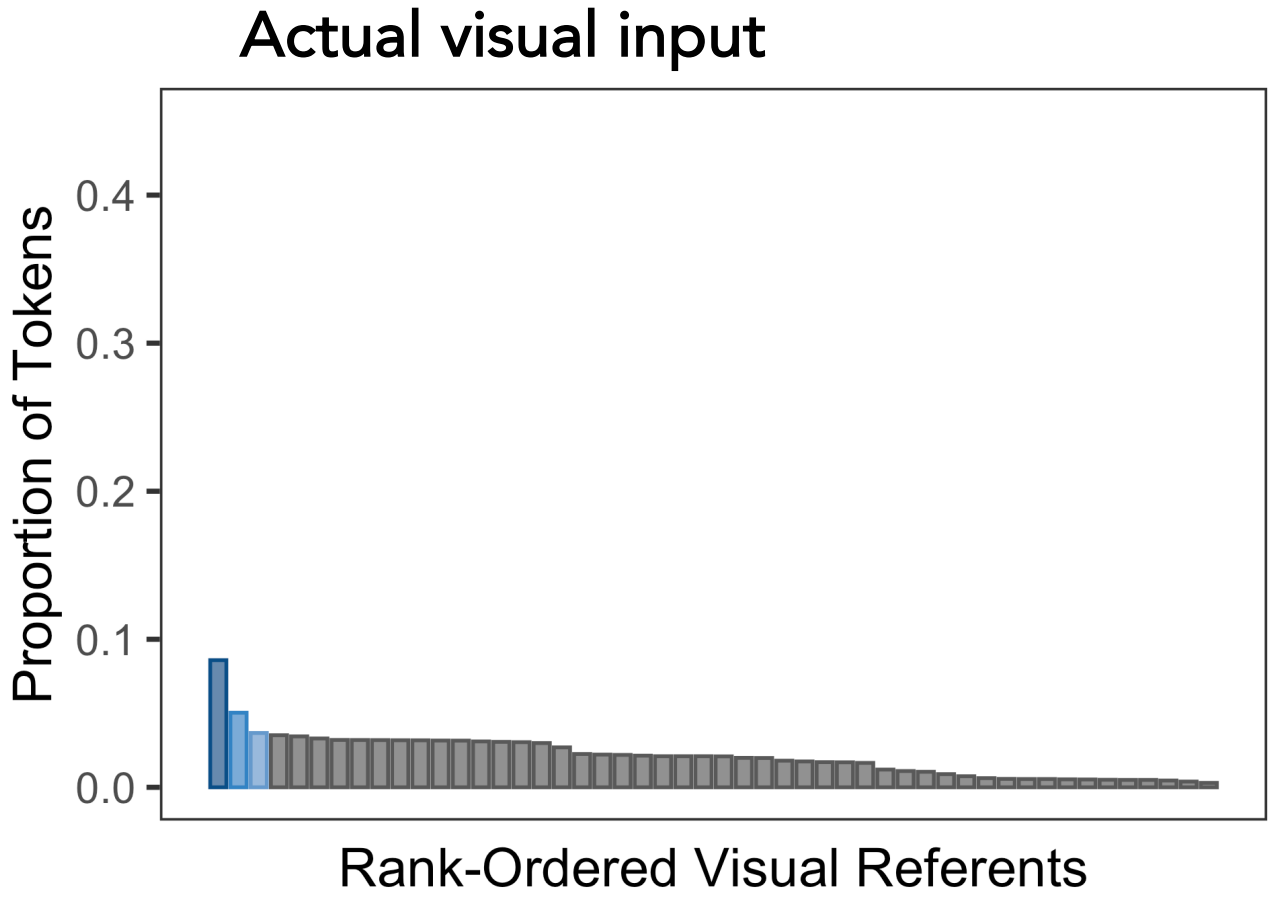
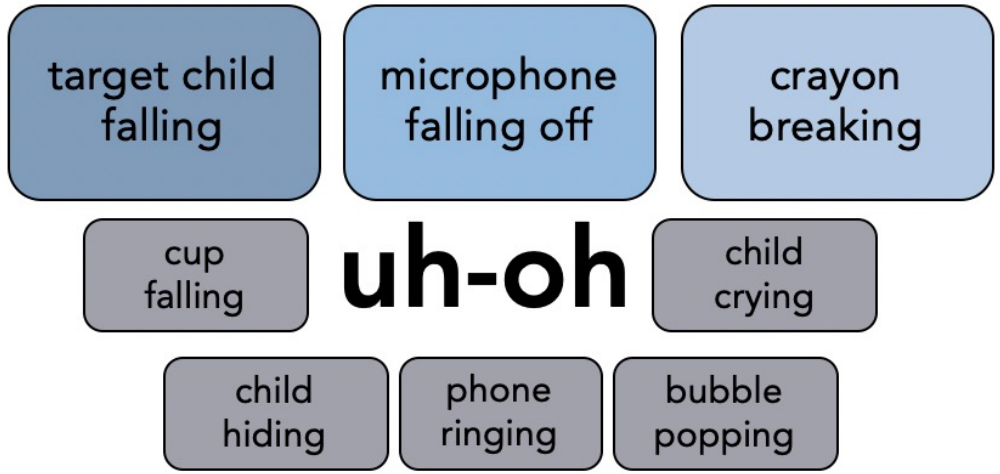




Everyday words are variable at the **visual level**

Prototypical visual referent?

- Co-occurred with **hundreds** of unique visual referents:

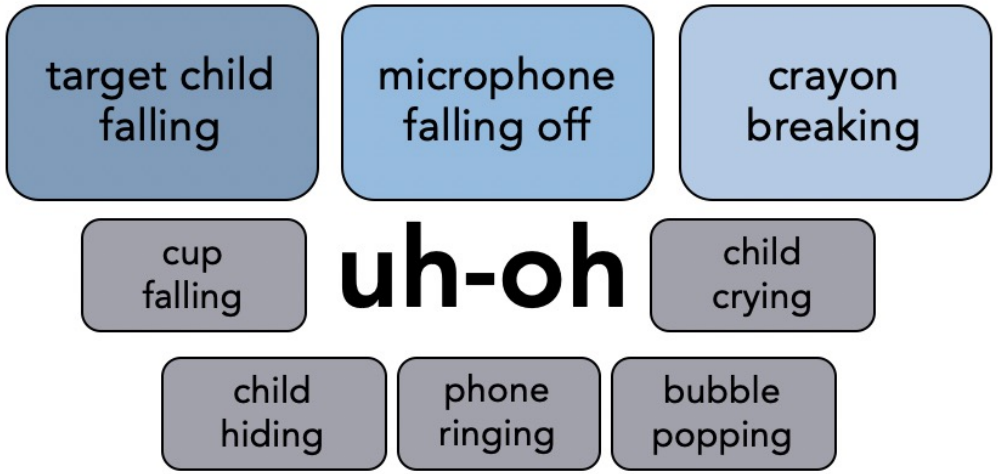
  M = 343 unique referents

  range = 34 - 1,414

- Appeared with unique visual referent for 1 in 3 tokens:

  M = 34.5% unique referents

  range = 19.0 - 45.6%



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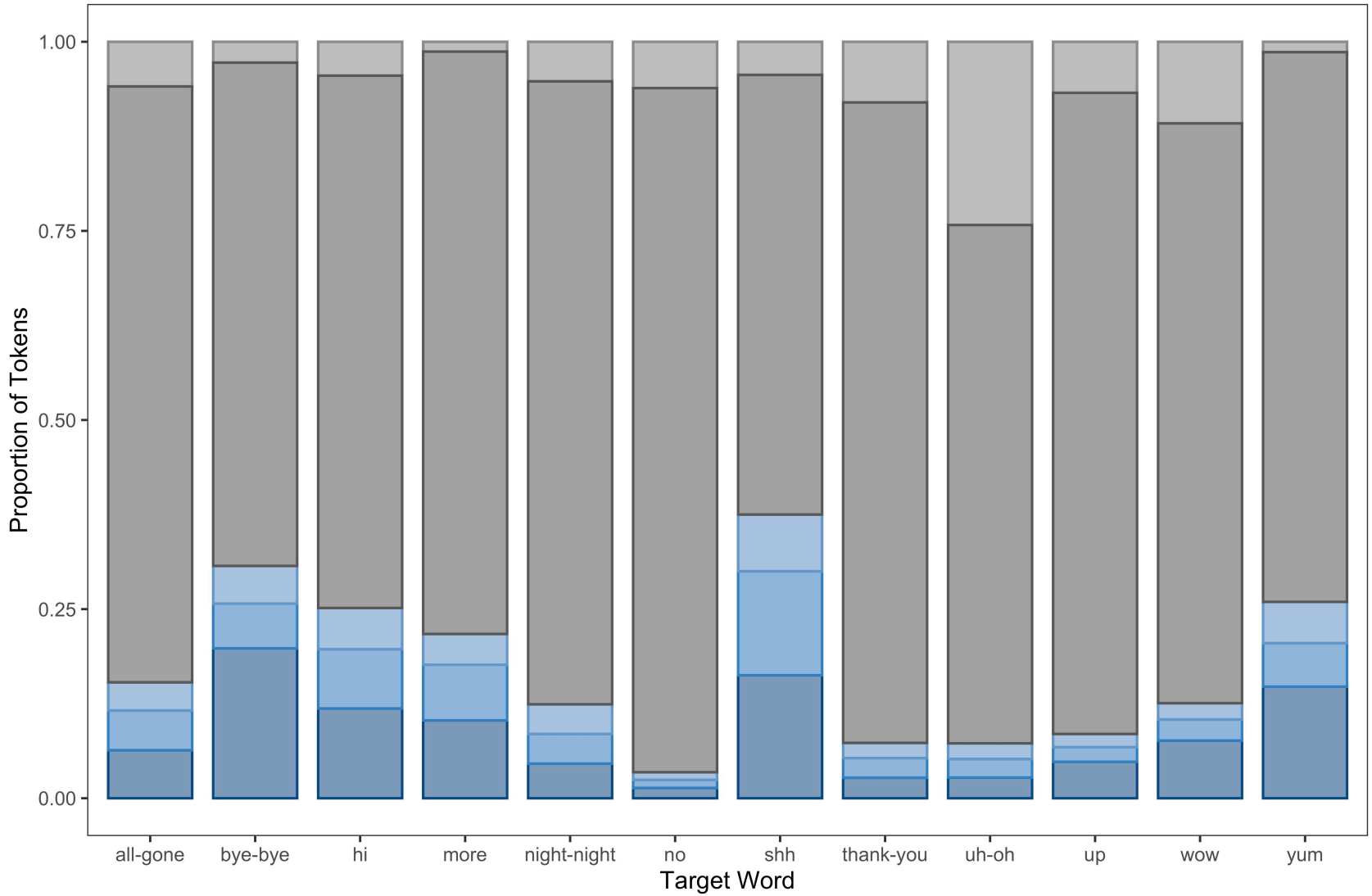


Top Visual Referents

most common referent

2nd most common referent

3rd most common referent

all other referents

indeterminable

target child falling

microphone falling off

crayon breaking

cup falling

uh-oh

child crying

child hiding

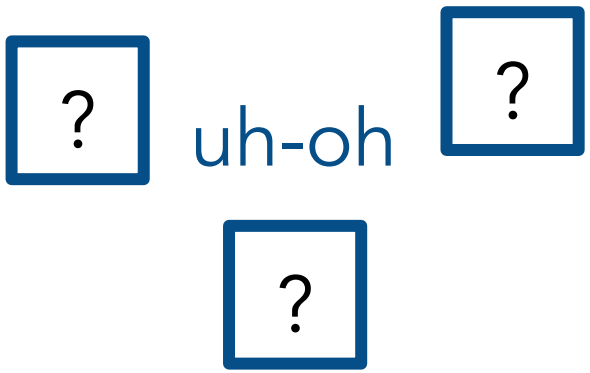
phone ringing

bubble popping

Everyday words are variable at the **visual level**

everyday words vs. concrete nouns

9%

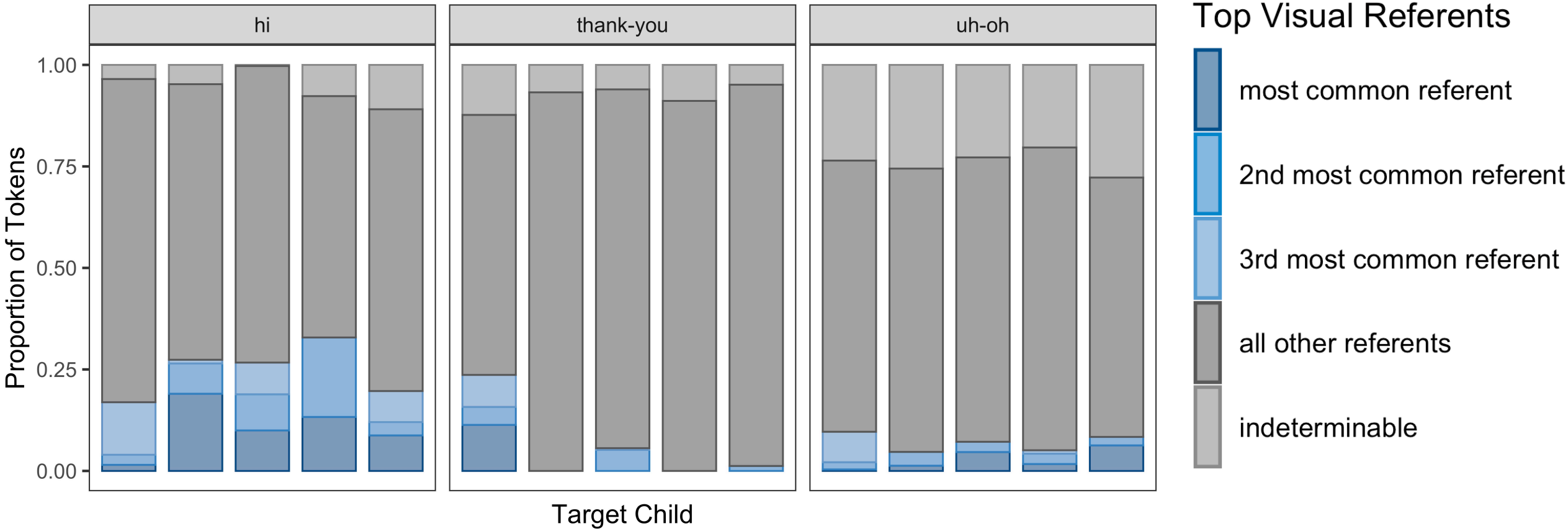


85-92%

Bergelson & Swingley, 2013; Custode & Tamis-LeMonda, 2020

Everyday words are variable at the **visual level**

*Referents vary **within** and **across** children*



Study 2: Video corpus analysis

Top-down: Ecological validity of experimental stimuli?

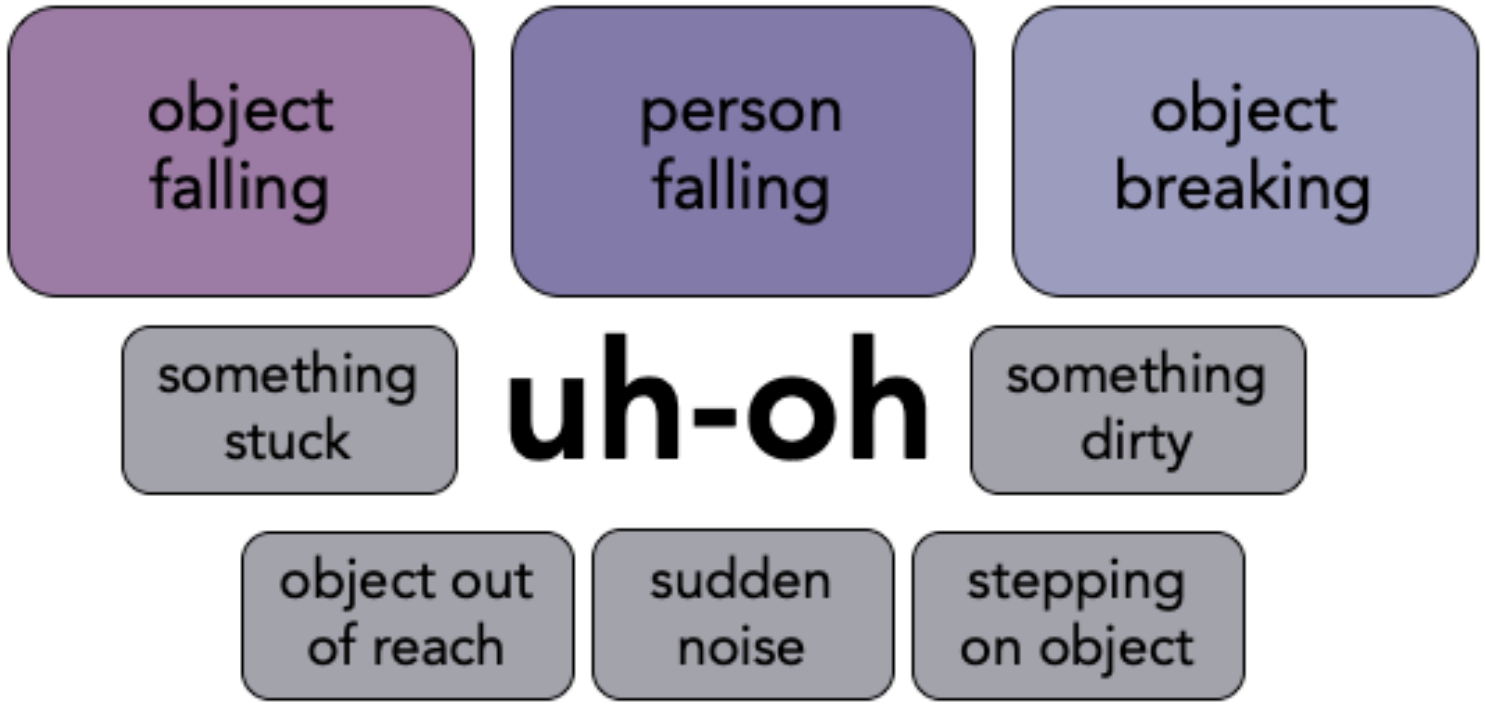
Match vs. **Non-Match**

Bottom-up: Characteristics of the real-world input?

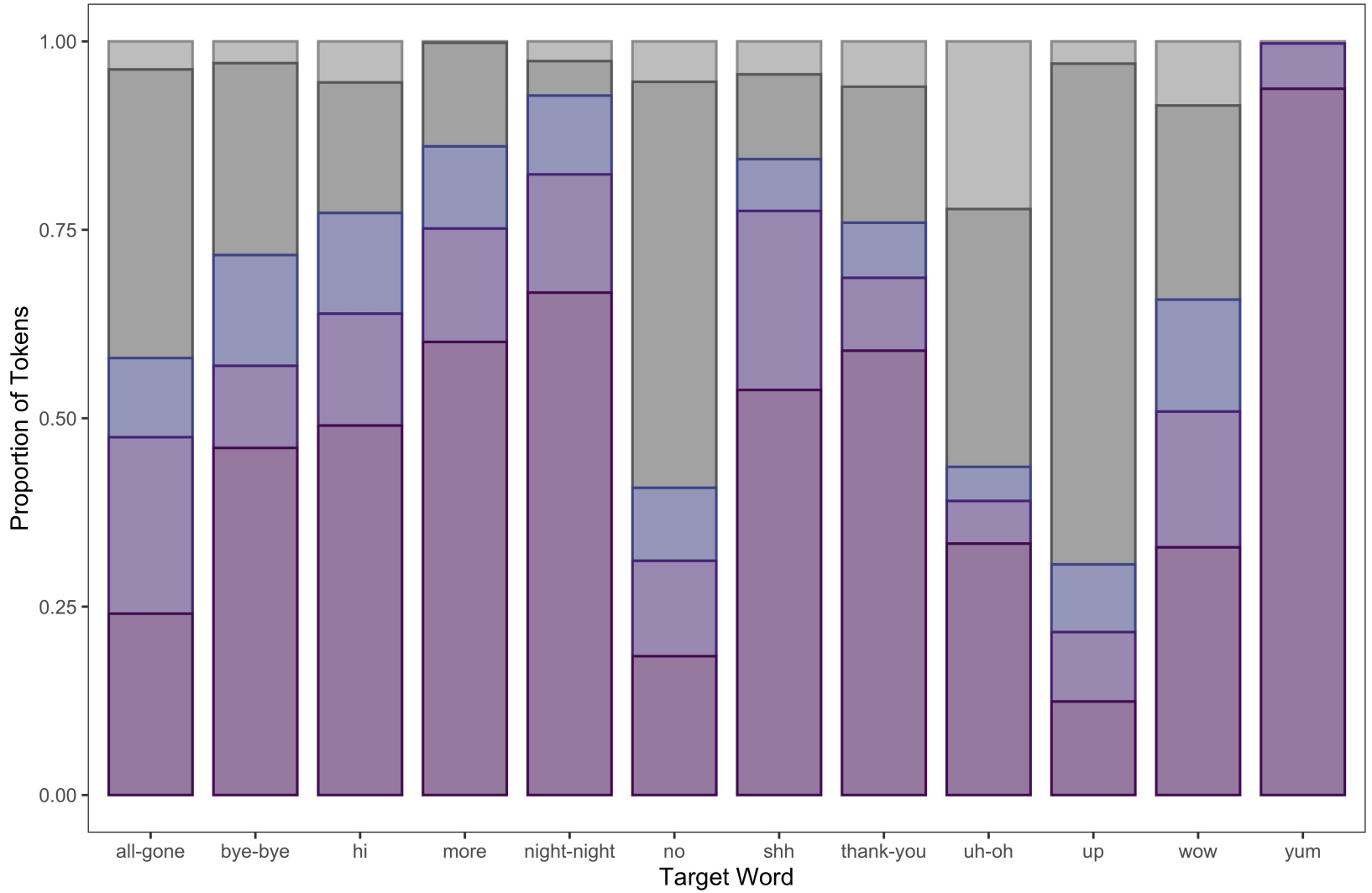
Visual vs. **Situational**

Situational stability?

Consistency in broader context surrounding production?



Everyday words are more stable at the **situational level**



Top Situational Contexts

- most common situation
- 2nd most common situation
- 3rd most common situation
- all other situations
- indeterminable

object falling | person falling | object breaking

something stuck | **uh-oh** | something dirty

object out of reach | sudden noise | stepping on object

Discussion

- **Study 1:** Standard lab-based measures failed to show evidence of everyday word comprehension
- **Study 2:** Naturalistic investigation found that everyday words do not co-occur with consistent visual referents but more reliably appear in stable situational contexts
- Current theories/methods over-prioritize visual information
- Visual cues matter, but what else?

Using naturalistic data to refine theories and methods

- **Past ecological work:**
  - Multimodal cues (e.g., Abu-Zhaya et al., 2017)
  - Contextual/spatial cues (e.g., Roy et al., 2015)

- **New questions:**
  - Frequency of occurrence in isolation? (e.g., Brent & Siskind, 2001; Lew-Williams et al., 2011)
  - Consistency of prosodic information? (e.g., Nencheva et al., 2021)
  - Frequency of occurrence at event boundaries? (e.g., Sonne et al., 2017)
  - Contingency on infant behavior? (e.g., Tamis-LeMonda et al., 2014)
  - Link to social reward? (e.g., Gros-Louis et al., 2014)

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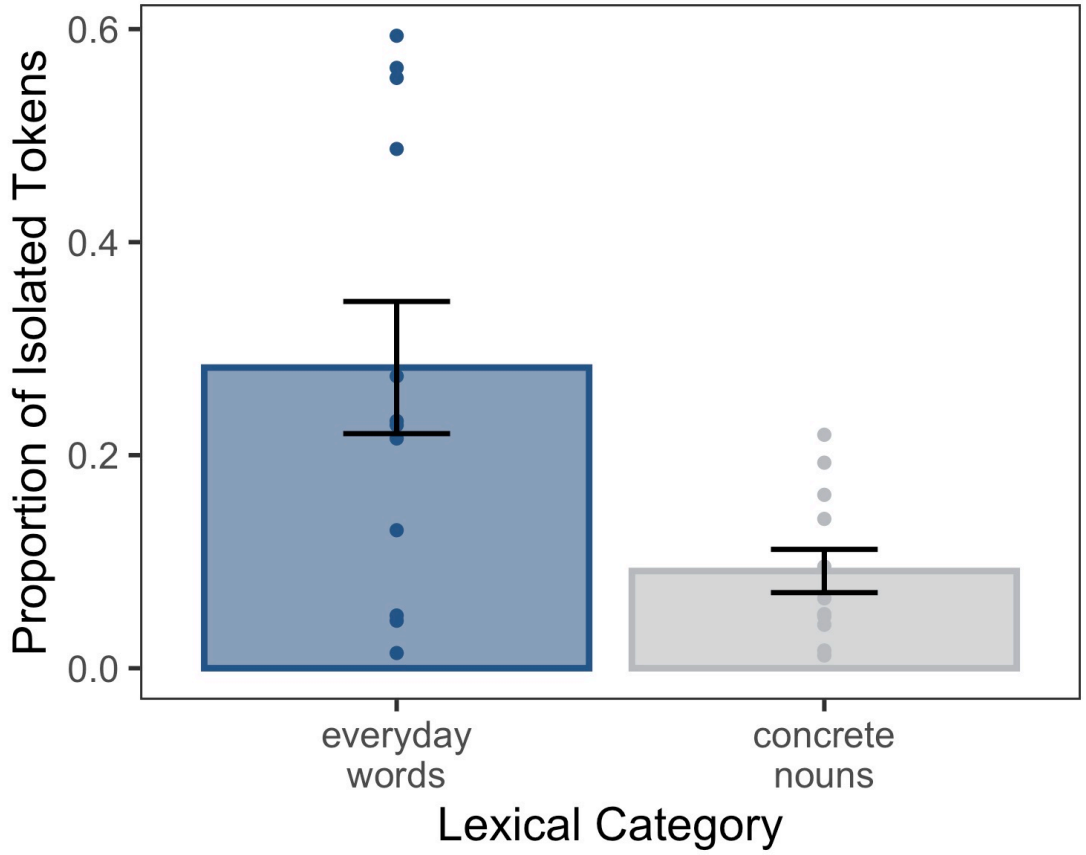
Everyday words occur frequently in isolation

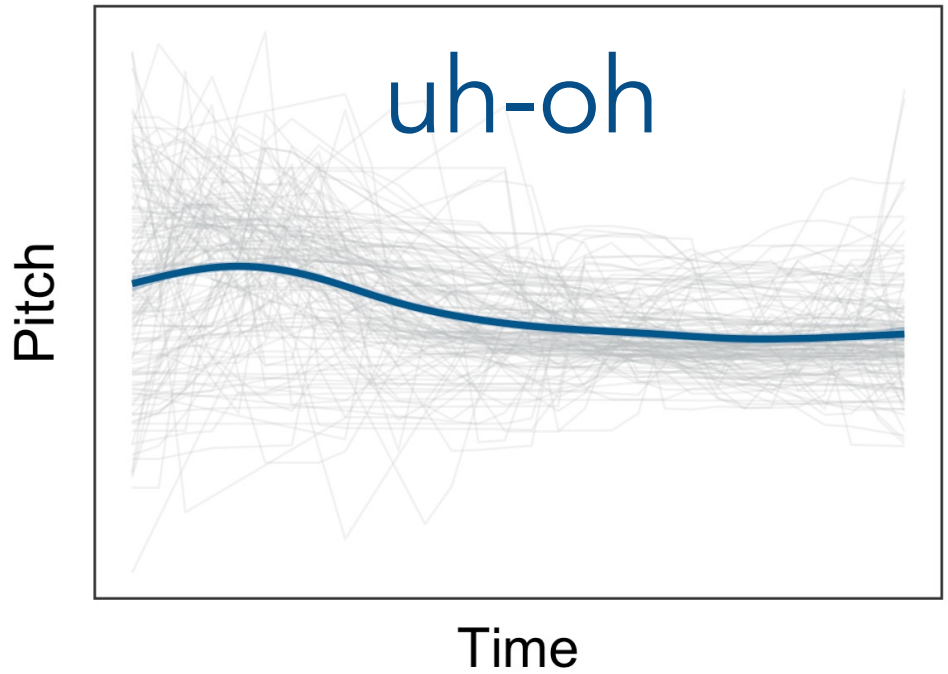
everyday words vs. **concrete nouns**

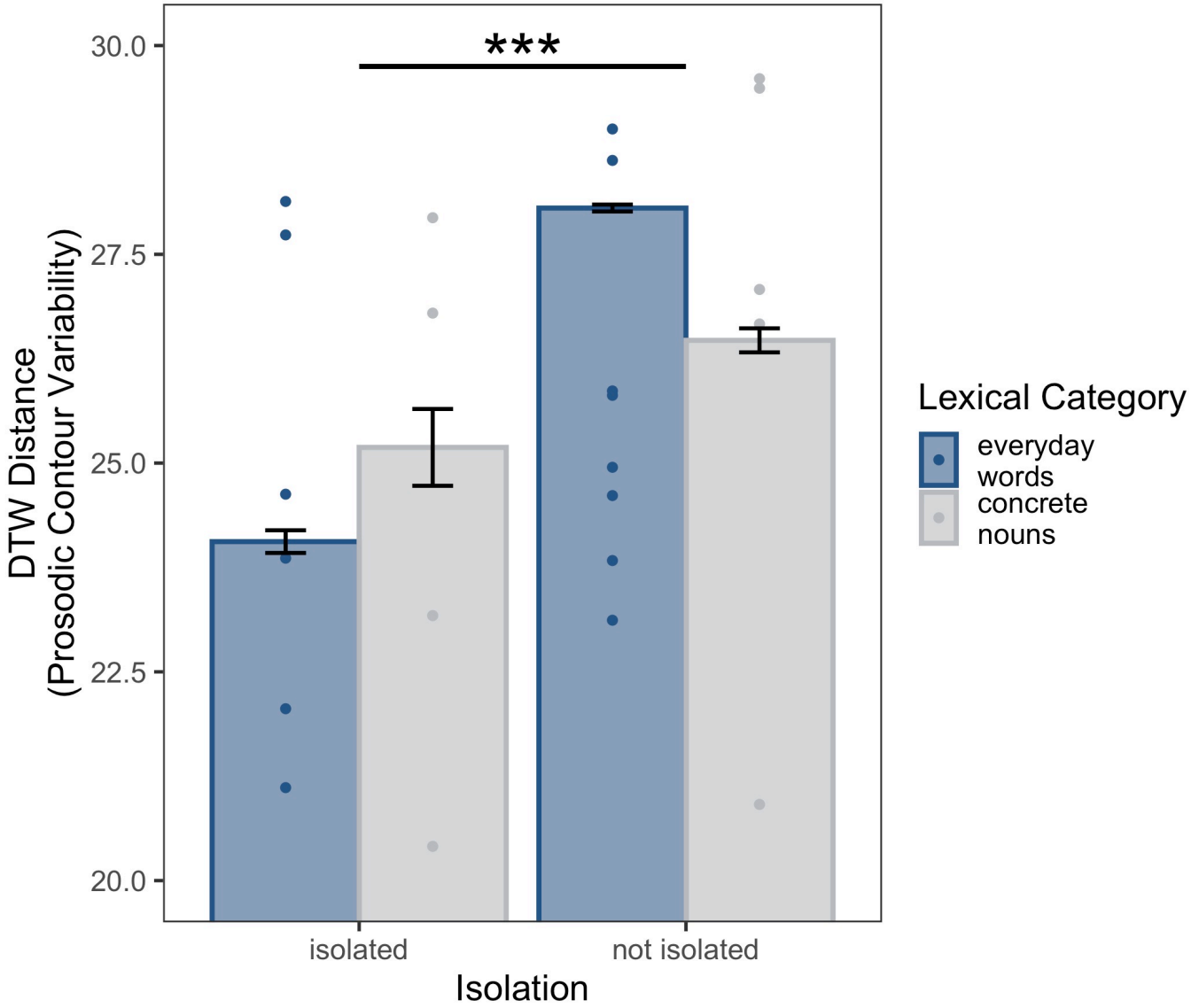
*frequency- and AoA-matched



Isolation may be helpful for several reasons

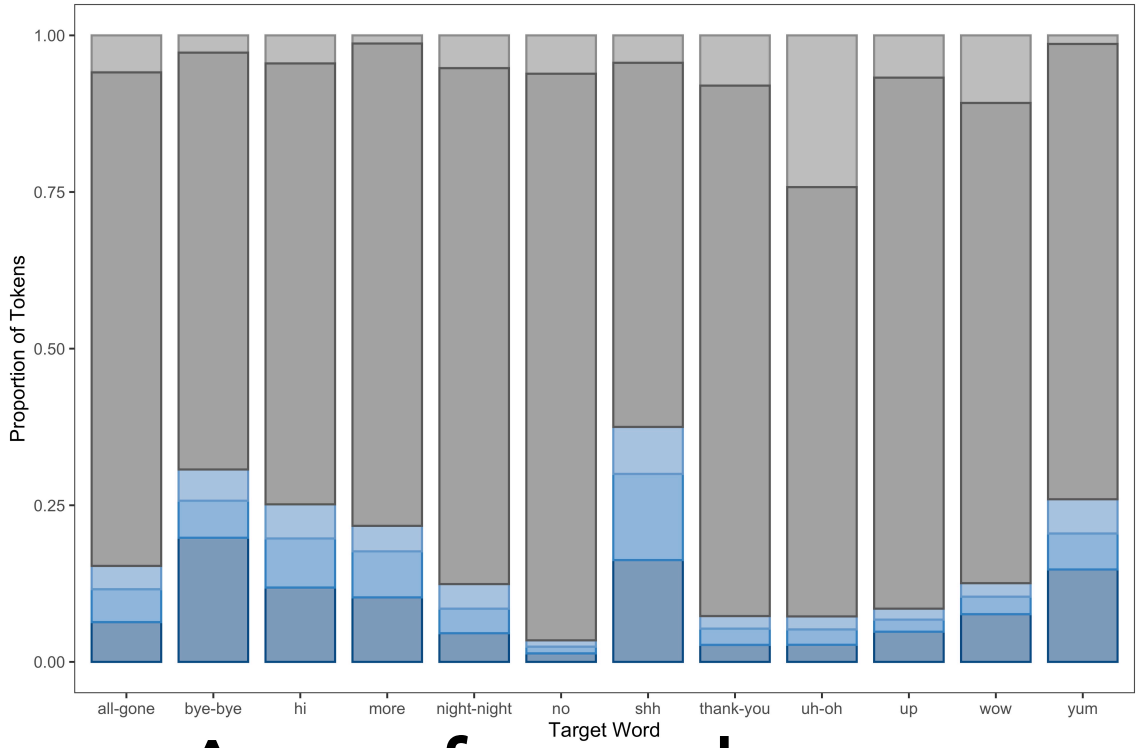
- Clearly segmentable word boundaries
  (e.g., Lew-Williams et al., 2011)
- More consistent prosodic contours



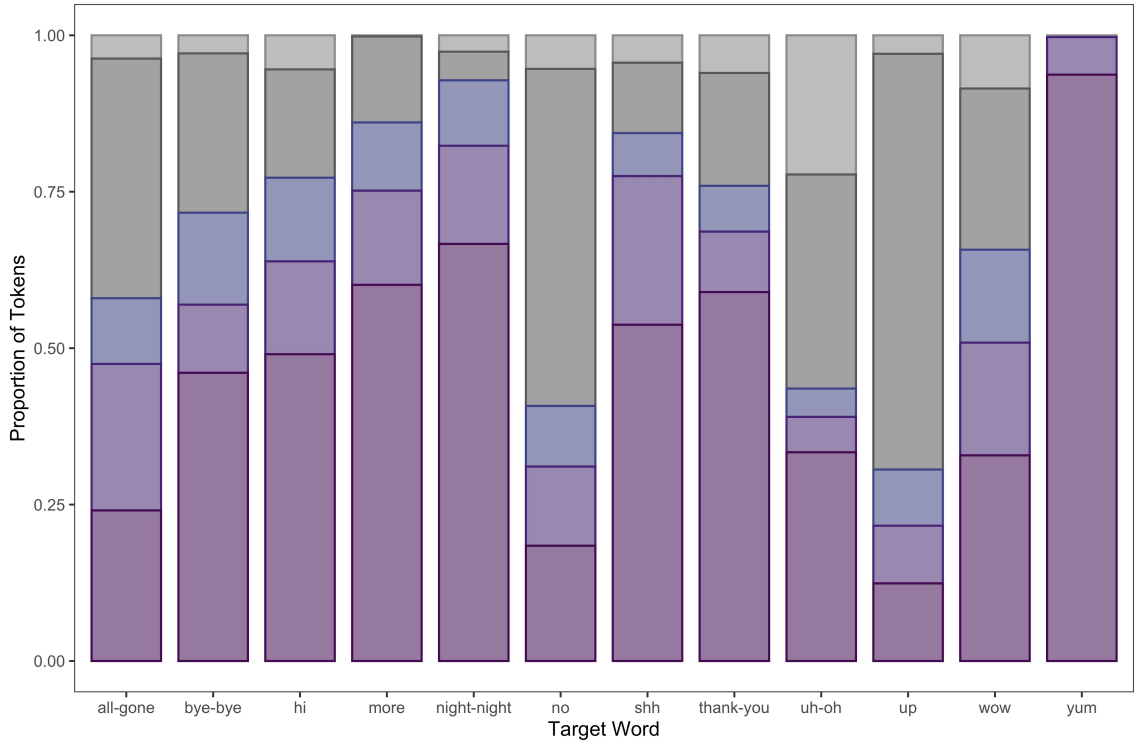


Using naturalistic data to refine theories and methods

Lack of visual stability



Some situational stability



- **A way forward:** Naturalistic video corpora, including headcam data
  (e.g., Bergelson et al., 2019; Sullivan et al., 2021)

Acknowledgments

Princeton Baby Lab

Dr. Christine E. Potter
University of Texas at El Paso

Mira Nencheva
Princeton University

Dr. Casey Lew-Williams
Princeton University

Dr. Erica H. Wojcik
Skidmore College

Funding
NICHD (F32 HD093139, R01HD095912)

OUR Office of Undergraduate Research

Program in Cognitive Science

Princeton University Linguistics

Ellie Breitfeld
Matthew Weatherhead

Participating families