Semantic relatedness effects in early word learning

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BACKGROUND

- Word comprehension improves over infancy
  (Dale & Fenson, 1996; Fernald et al, 1998)
- Unclear *what* is improving with age
- Two possibilities:
  - *changes in the input data*
  - *changes in the learner*

RESEARCH QUESTIONS

1) How does ***word comprehension*** change with age?
   - Semantic competition: Do infants know how words are related? (Arias-Trejo & Plunkett, 2010; Huettig & Altmann, 2005)

2) Does the ***home linguistic environment*** change month-to-month?
   - Does infants' exposure to common nouns change in terms of
     - quantity? (Weisleder & Fernald, 2013)
     - talker variability? (Rost & McMurray, 2009)
     - object co-presence? (Medina, Snedeker, Trueswell, & Gleitman, 2011; Yurovsky, Smith, & Yu, 2013; McGillion et al., 2013)
     - type of utterance? (Brent & Siskind, 2001; Seidl & Johnson, 2006; (Debaryshe, 1993; Montag, Jones, & Smith, 2015)

METHOD

Analysis from 44 infants, from 6-18 months (SEEDLingS corpus)

1) Word comprehension data (eye-tracking)
   - 6, 12, 18 months

2) At-home exposure data (home recordings)
   - Monthly, 6-17 months

IN-LAB WORD COMPREHENSION: EYETRACKING

- **Outcome measure:** baseline-corrected prop. target looking

IN-LAB WORD COMPREHENSION

- Tested 16 **semantically related** & **semantically unrelated** word pairs

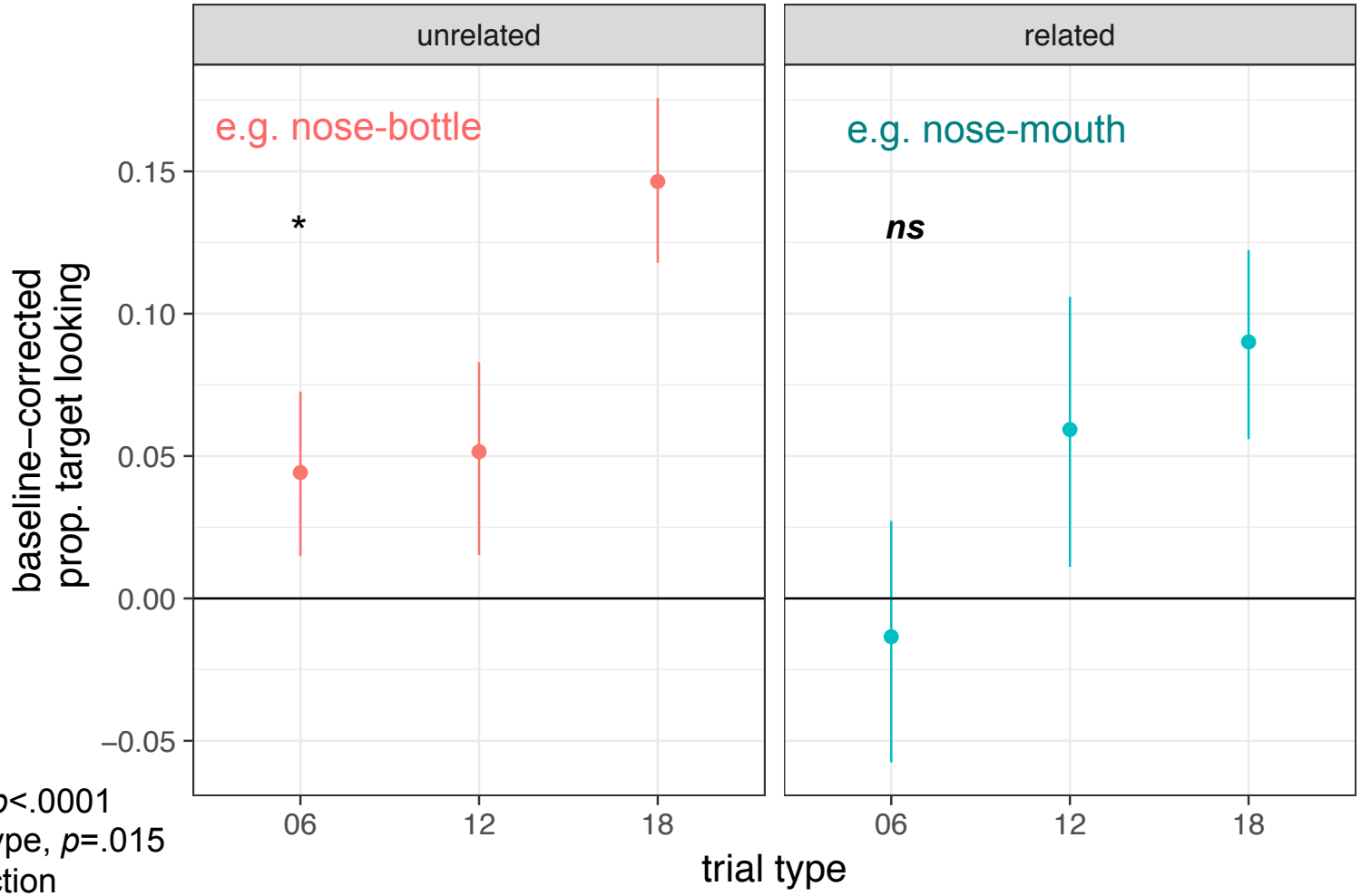
Prediction: If infants' word representations ≈ toddlers' & adults', then **related condition** < **unrelated condition**

IN-LAB WORD COMPREHENSION: STIMULI

Related pairs

Unrelated pairs

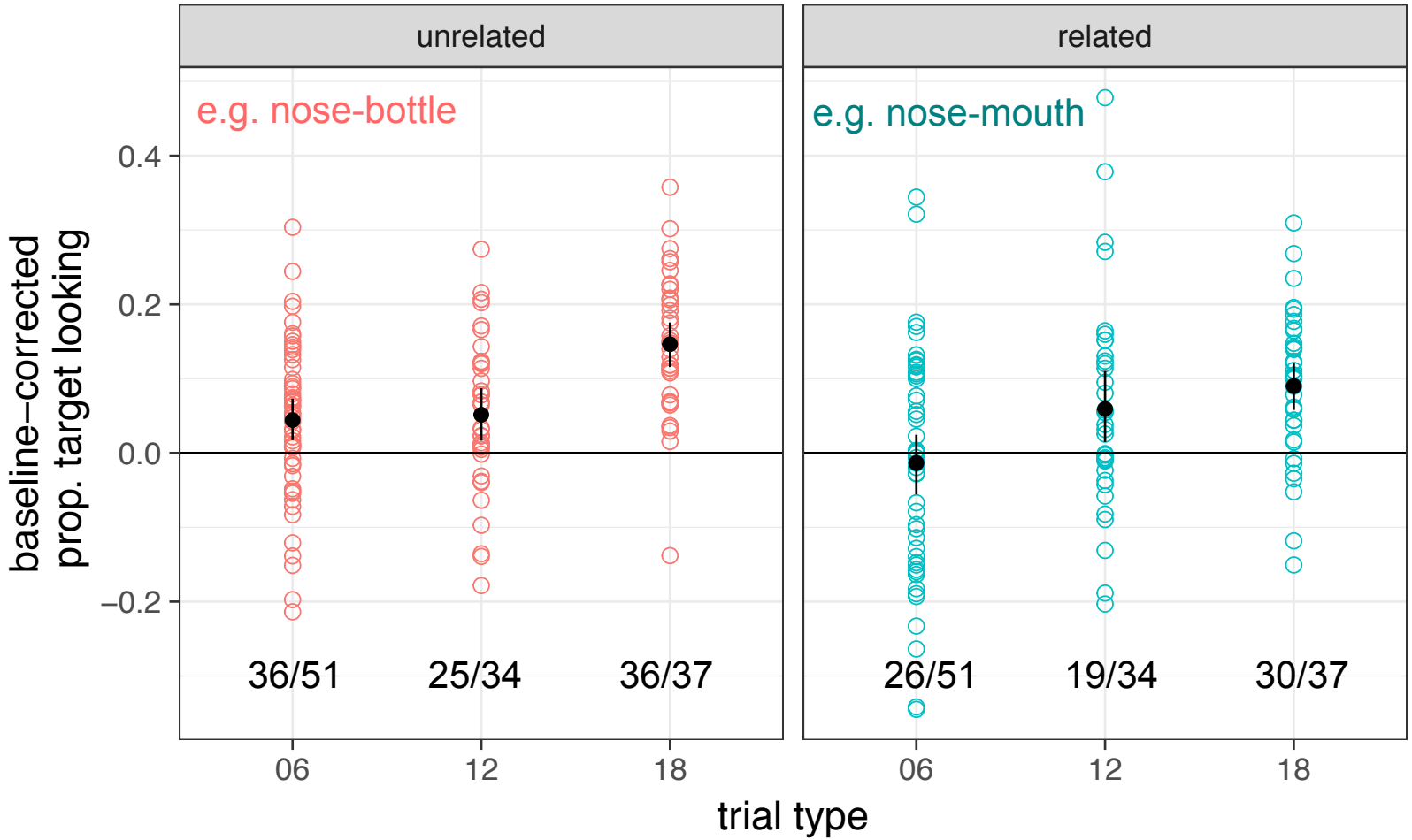
IN-LAB WORD COMPREHENSION: SUBJECT MEANS



ME age, $p<.0001$
ME trial type, $p=.015$
no interaction

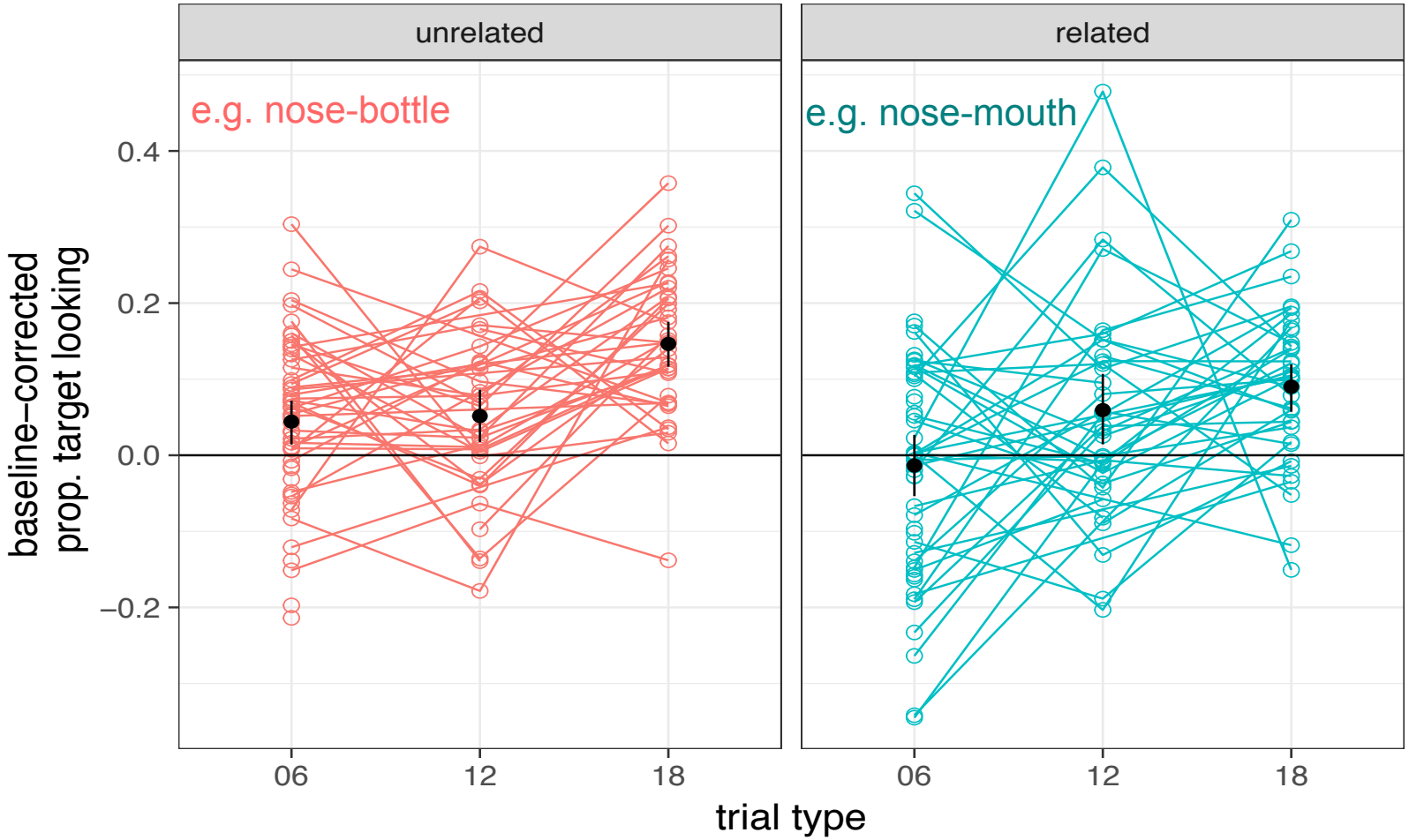
- Boost for **unrelated** pairs
- Improvement with age

IN-LAB WORD COMPREHENSION: SUBJECT MEANS



- Boost for **unrelated** pairs
  p<.05 by binomial test
- Improvement with age

IN-LAB WORD COMPREHENSION: SUBJECT MEANS



Improvement with age, but **no** cross-age correlation

HOME LINGUISTIC ENVIRONMENT

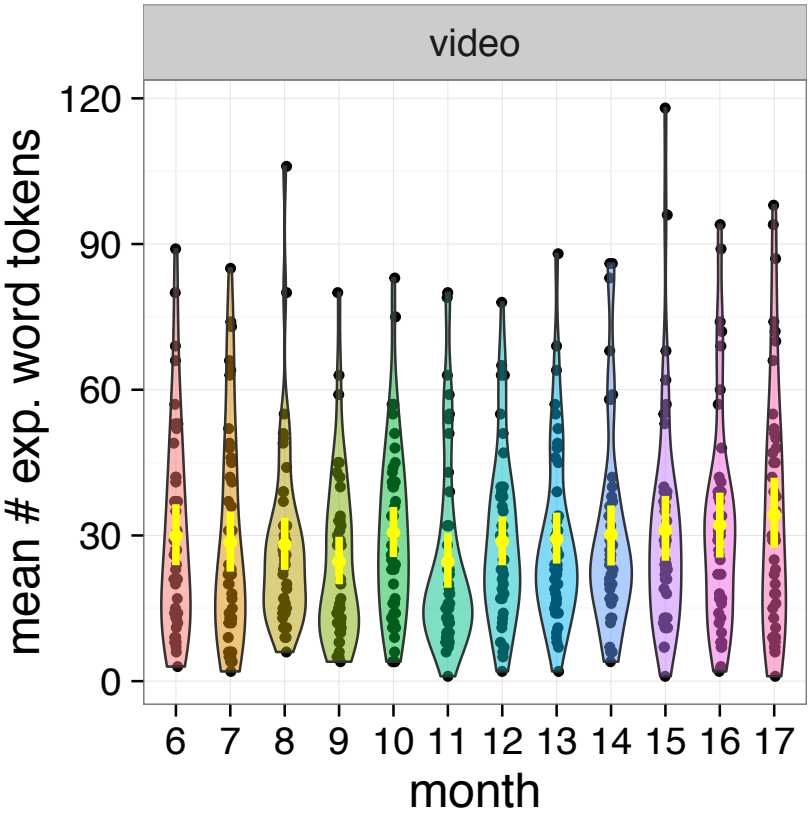
Monthly daylong audio and hour-long video recordings in the home (n=12 per child)

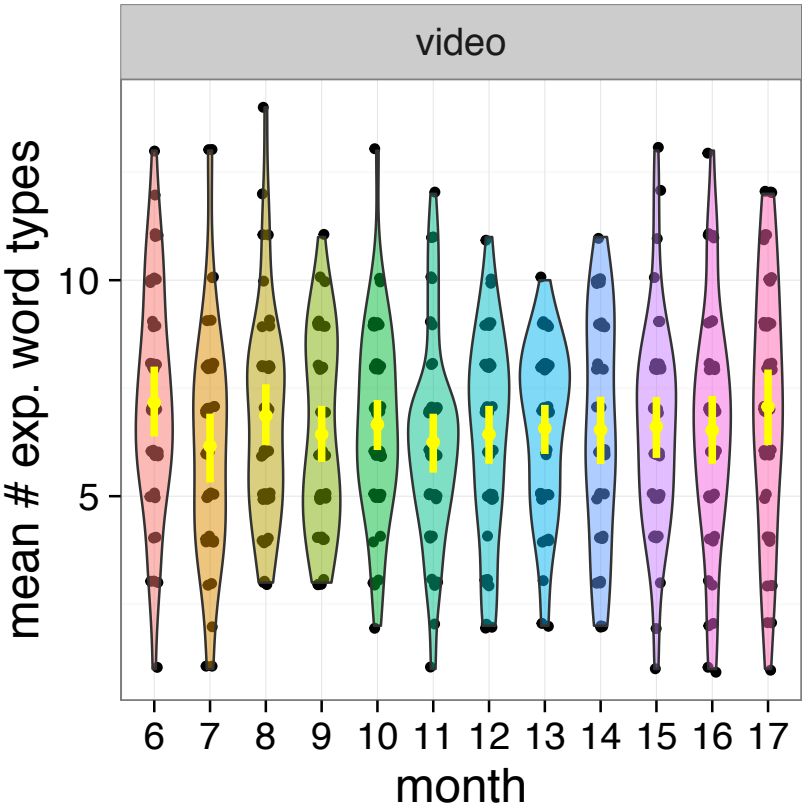
- >500 audio recordings, >500 video recordings
- ~8,000 hours

Annotated ***child-directed object words***, along with 3 properties of each:

- type of utterance (e.g. command, question)
- object co-presence (present & attended to)
- speaker

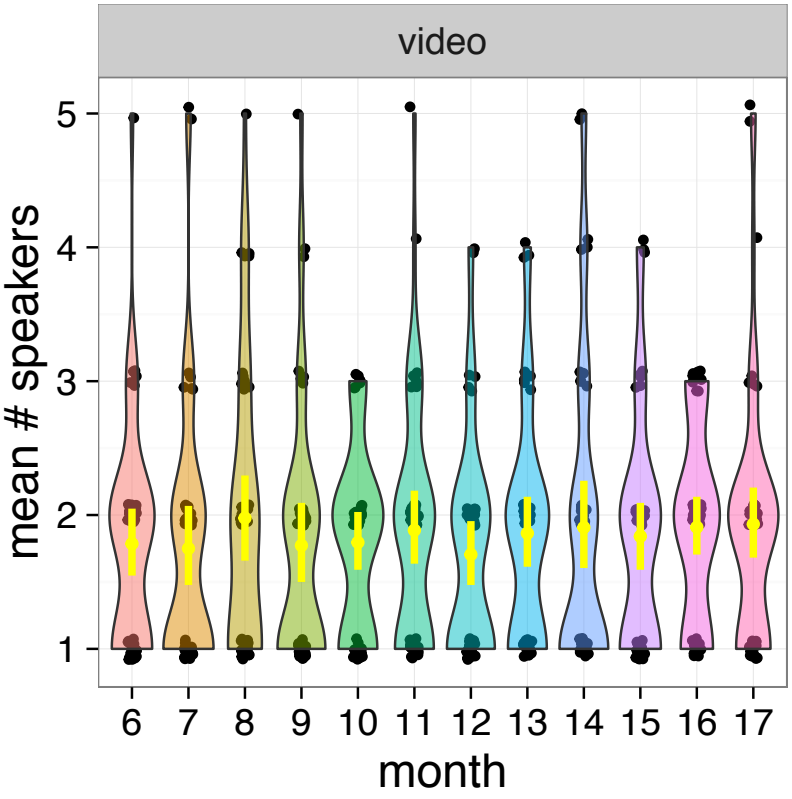
WORD TYPES & TOKENS STABLE MONTH-TO-MONTH

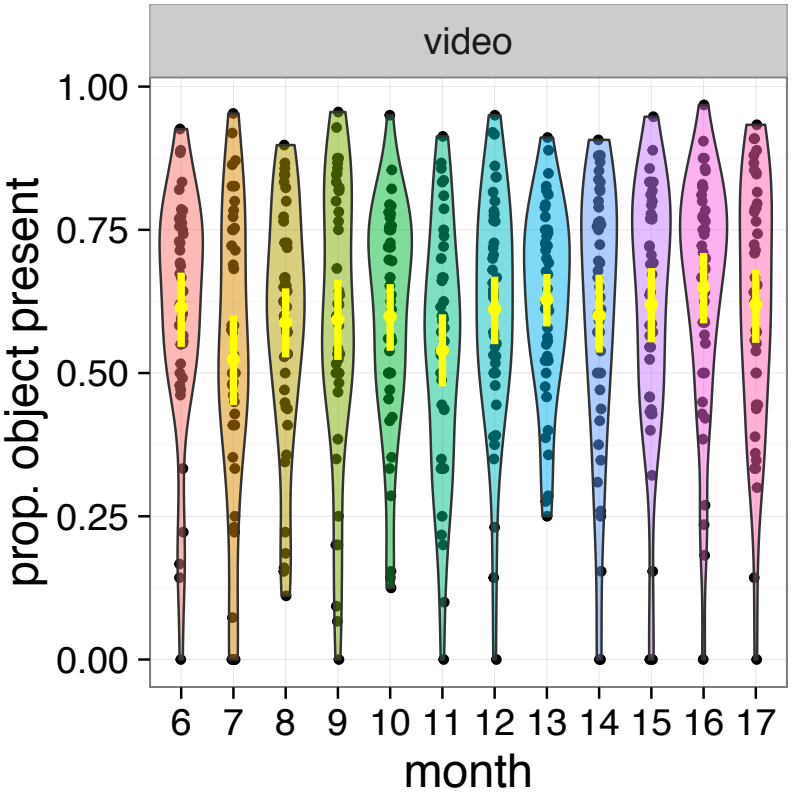




~50% tested words occurred in each hour-long video

SPEAKERS OBJECT CO-PRESENCE STABLE MONTH-TO-MONTH





- ~2 speakers
- Object co-present and attended to 60% of the time

RESEARCH QUESTIONS

1) How does ***word comprehension*** change with age?

- Infants understand the tested words better as they get older.
- Comprehension at 6,12, and 18 months is not correlated.
- Understanding words in **semantically-related** visual contexts is more challenging for for infants, as with toddlers (Arias-Trejo & Plunkett, 2010).

2) Does the ***home linguistic environment*** change month-to-month?

- The input for these words is incredibly stable month-to-month.

CHANGING LEARNER VS. CHANGING DATA

- Little support for a ***changing data*** account.

- Results are compatible with two flavors of a ***changing learner*** account:
  - *"More data"* account: accrual of similar learning instances
  - *"Better learner"* account: linguistic, cognitive, & social growth

NEXT STEPS

- Links to early production
  - Parents talk differently to talkers!
- Links to non-linguistic development (e.g. pointing)
  - Pointers have bigger vocabs (Colonnesi, et al., 2010)
  - Infants point to learn words (Lucca & Wilbourn, 2016)
- Modeling semantic similarity
  - Quantifying ‘relatedness’ computationally, through LSA-type approaches (GLoVE vectors) over early learned words

CONCLUSIONS

- Infants' word comprehension improves (noisily) with age
- Semantic context effects found in the earliest lexicon (**related** < **unrelated**)
- Home linguistic environment stable month-to-month, suggesting improvement stems from changing *learner*

THANK YOU!

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- Duke University Psychology & Neuroscience department
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