Cross-situational word learning in late talking toddlers: A pilot study

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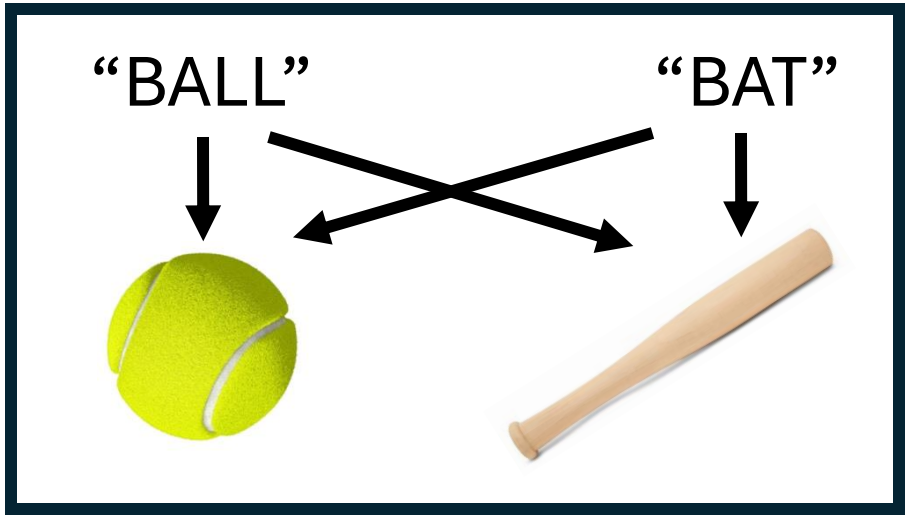
Statistical learning overview

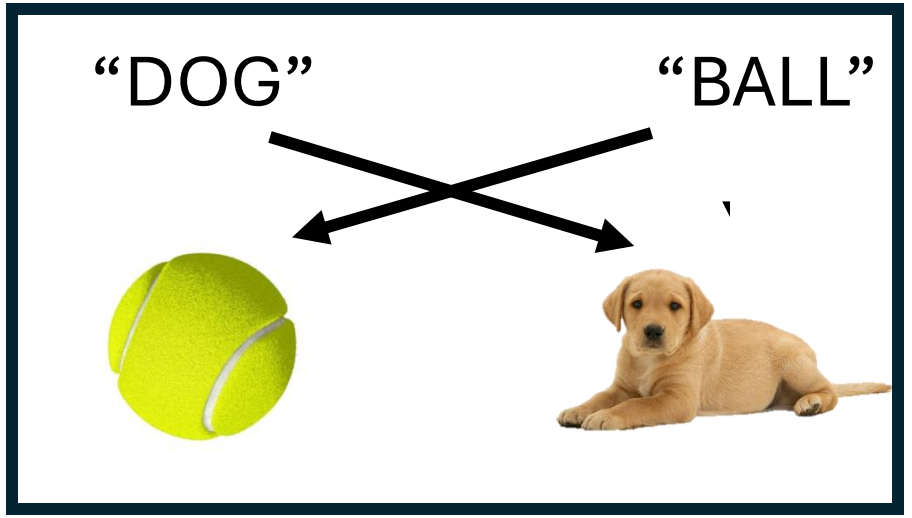
- A form of *pattern detection*
- Domain general mechanism (Fiser & Aslin , 2002)
- Implicit learning that supports language acquisition
  - Segmentation of the speech stream (Saffran et al., 1996)
  - Linking spoken words with their referents (Yu & Smith, 2007)

Statistical word learning: Overview

- **Cross-situational statistical word learning:** Tracking of co-occurrences between words and their referents across ambiguous contexts (Smith & Yu, 2008)

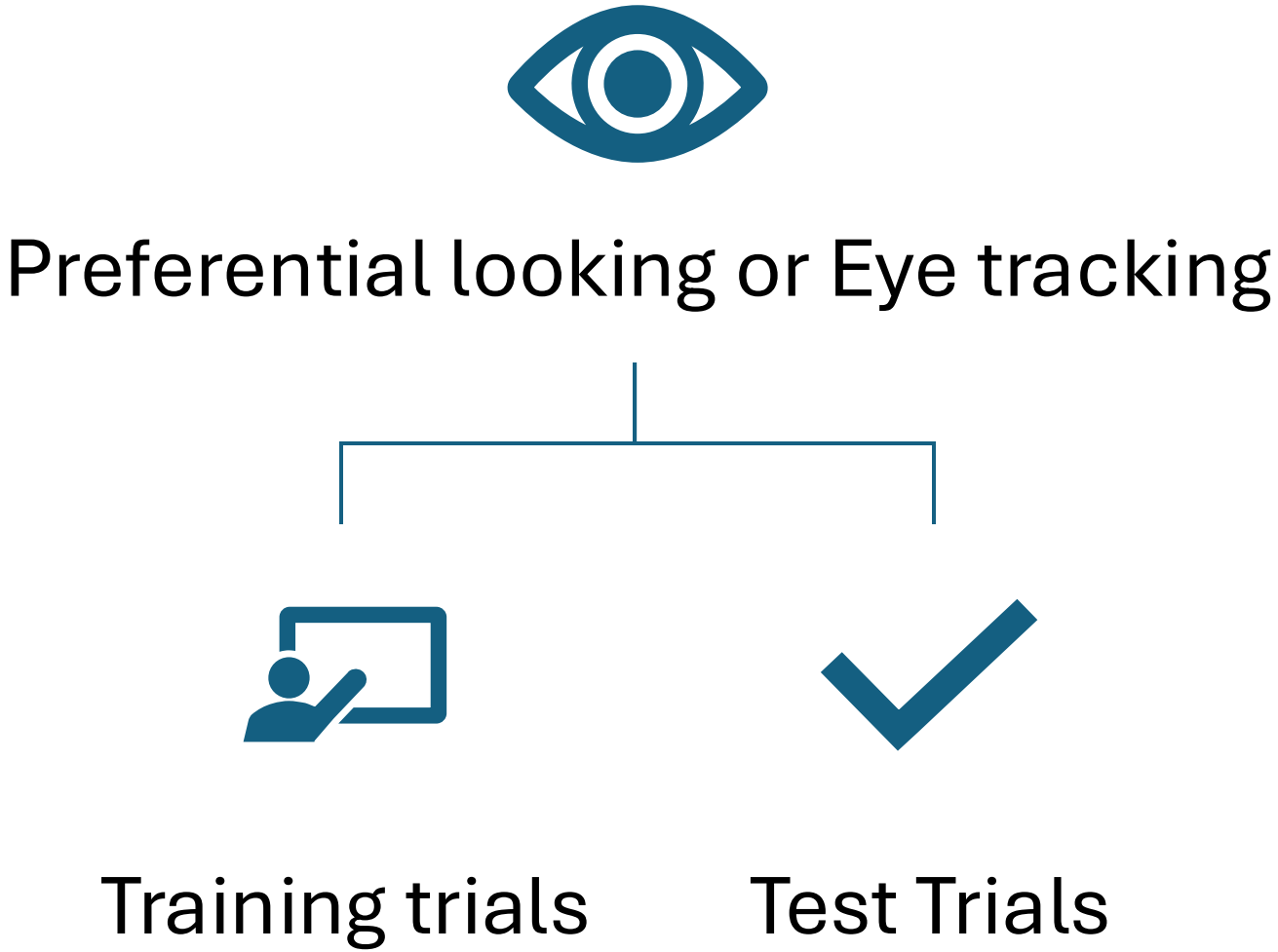


Context 1



Context 2

Statistical word learning: Lab-based experiments



Statistical word learning: Typical toddlers

- Infants as young as 12-months of age learn word-object mappings via cross-situational statistical learning (Smith & Yu, 2008; Smith & Yu, 2013; Yu & Smith 2011)
- Older toddlers 17-months and19-months of age acquired novel, phonetically similar word-object mappings (Escudero et al., 2016)

Word learning in late talkers

- Toddlers with late language emergence, referred to *late talkers* (Paul, 1992)
  - 18 – 35 months of age
  - Small expressive vocabularies
- Heterogeneity in outcomes (Rescorla, 2009)
- Less efficient word learning in fast mapping paradigms:
  - Noun-object pairs (Asadi et al., 2019; MacRoy-Higgins & Dalton, 2015; Rujas et al., 2019; Ellis-Weismer et al., 2011)
  - Verb-action pairs (Asadi et al., 2019; Rujas et al., 2019)

Statistical word learning: Language disorders

- No known studies of statistical learning in late talkers
- Children with DLD:
  - Less able to identify word boundaries based on transitional probabilities (Evans et al., 2009; Haebig et al., 2017; Lukács et al., 2021)
  - Learn fewer word-object mappings in cross-situational word learning tasks (Ahunfinger et al., 2021) and require more exposure to learning the mappings (McGregor et al., 2022)

Current study

- Purpose: Evaluate cross-situational word learning in typically developing and late talking toddlers

Primary prediction

Proportion of looking time	
Late Talkers (LT)	**Typical Talkers (TT)**
Targets ≅ Distractors	Targets > Distractors

Exploratory prediction

Word-referent pair mappings
LT group < TT group

Methods: Study Platform

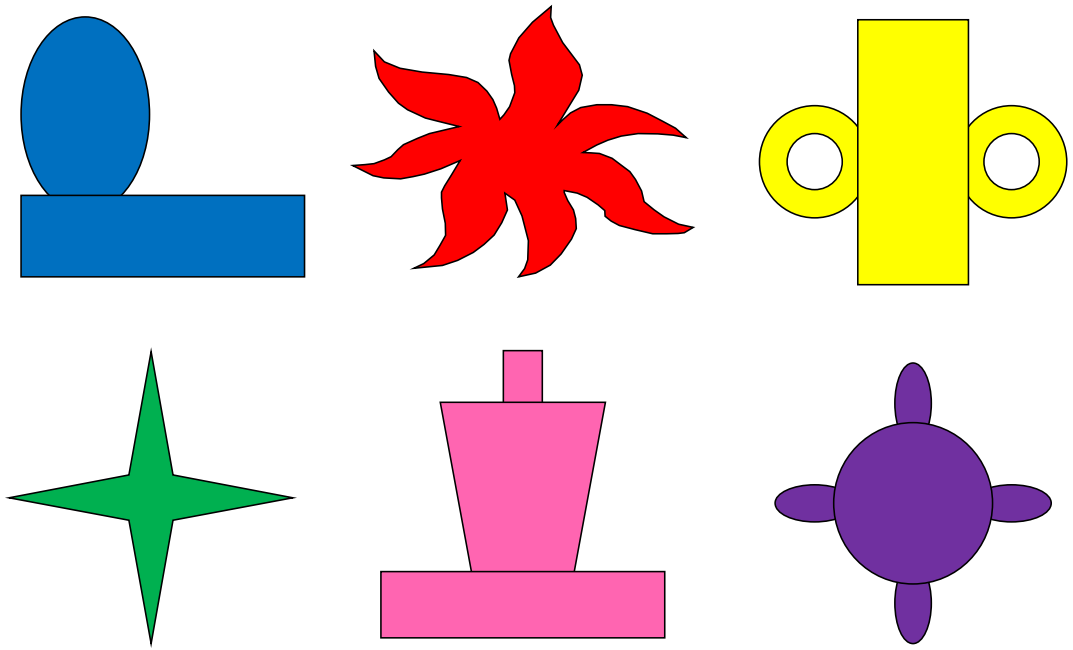
- All procedures were approved by the IRB prior to data collection
- Data collected on Lookit- Children Helping Science (Scott & Schultz, 2017)

Methods: Participants

	GROUP		
	Typical talker (*n*=15)	Late talker (*n*=15)	*p*
Age in months *(SD)*	29.00 (5.07)	26.40 (5.33)	.20
Percent Male	53%	67%	.27
# words on MB-CDI (*SD)*	558 (204)	127 (90)	<.001
Percent with primary caregiver with college or greater	93%	80%	.61

Methods: Stimuli

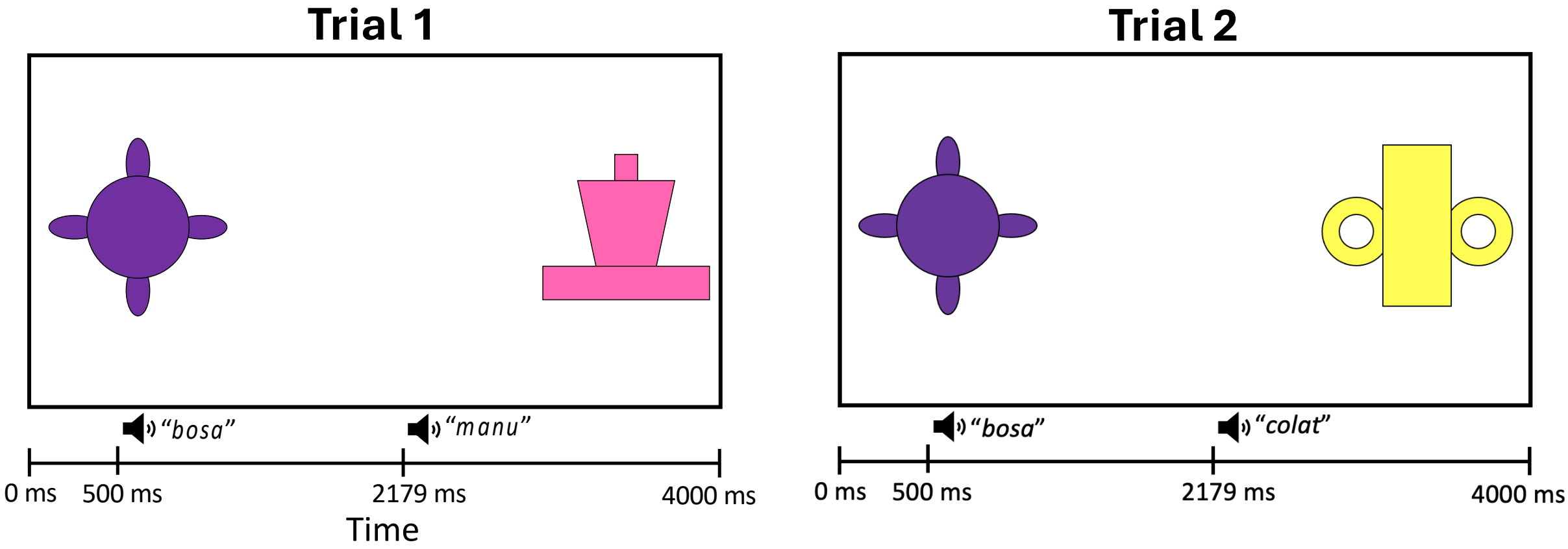
- Six novel word-referent pairs
- **Novel words:** Bisyllabic, trochaic stress, phonotactically legal
- **Referents:** Brightly colored shapes controlled for size and luminance



Methods: General procedures

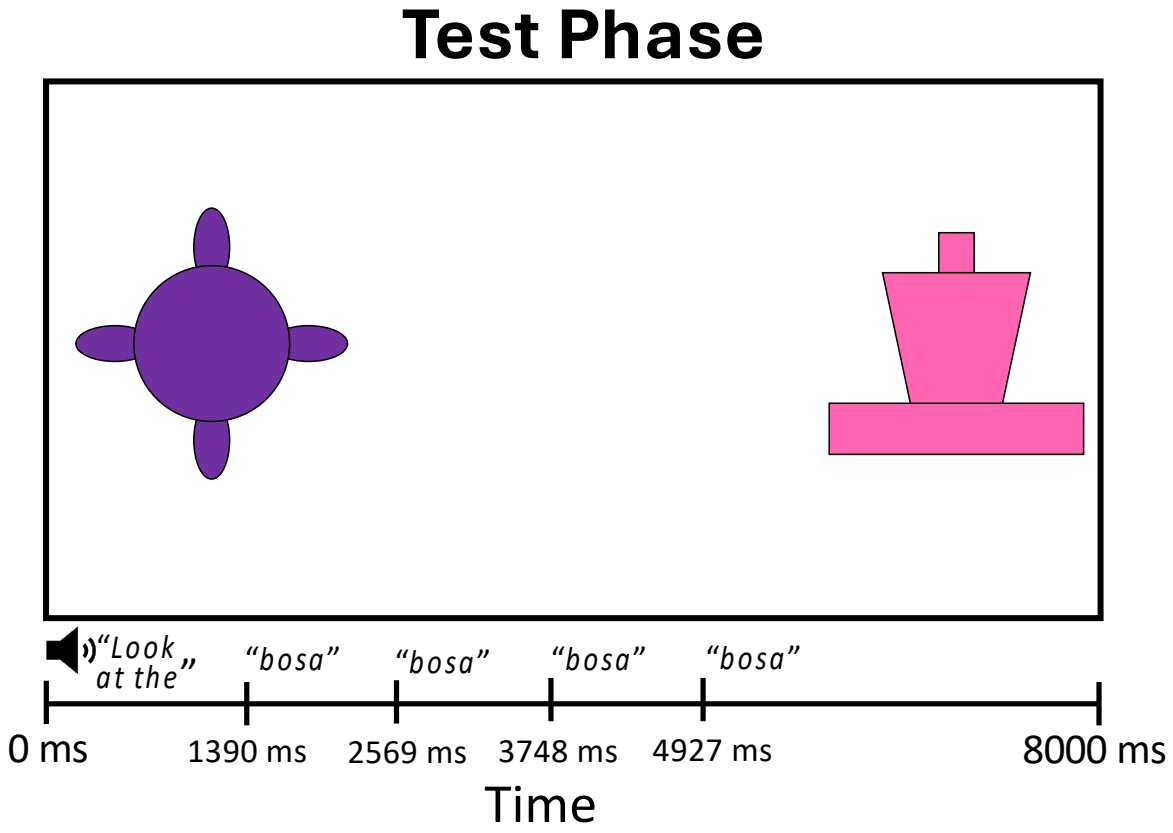
- Seated on parent's lap or in highchair
- Gaze was recorded throughout the experiment
- Cross-situational statistical word learning task (Smith & Yu, 2008)
  - Training phase
  - Test phase
- Participants randomly assigned to one of two lists with unique pairings of word-forms and visual referents

Methods: Experiment, Training Phase



- 30 training trials: Each word-object pair presented 10 times

Methods: Experiment, Test phase



- 12 test trials
  - Each word tested twice

Methods: Gaze coding

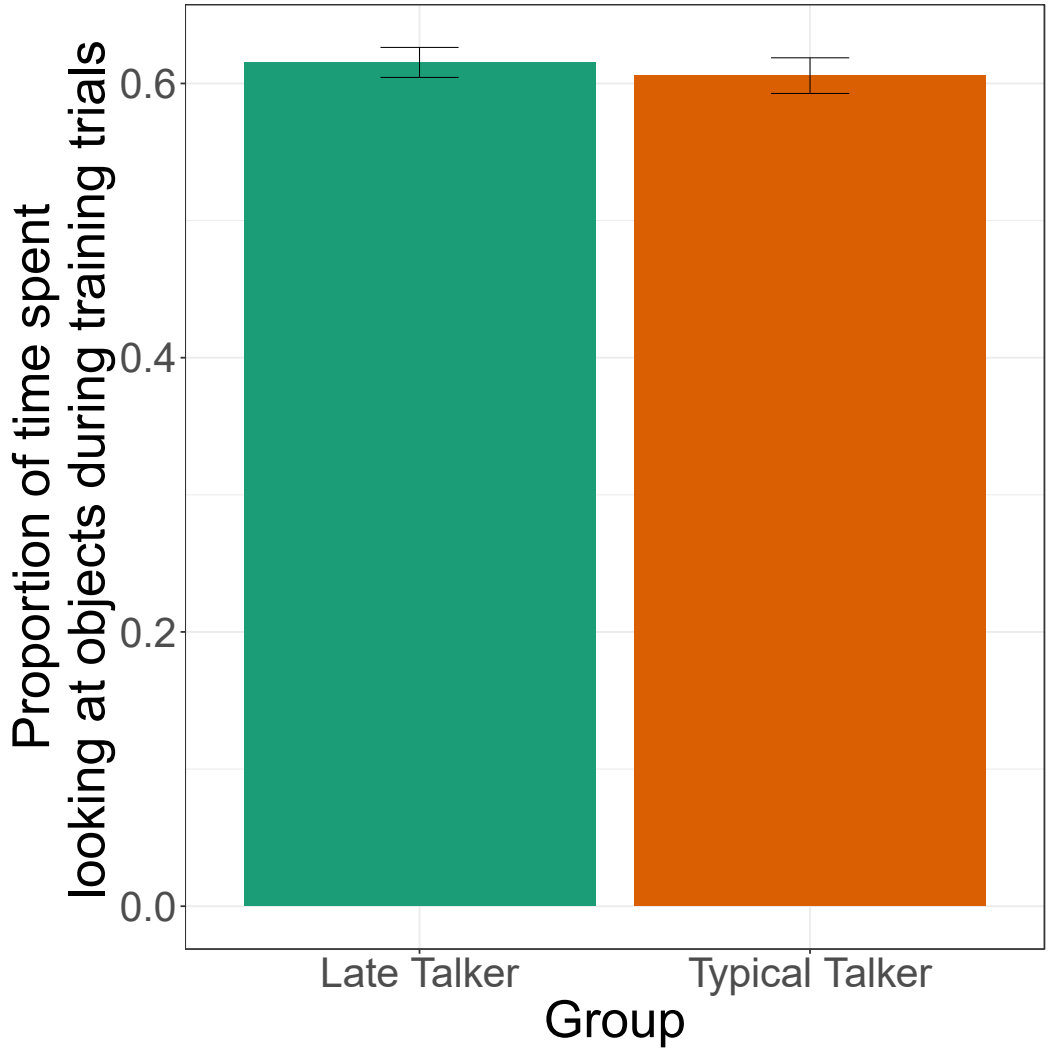
- Research assistant coded looking locations for training and test trials
- Looks were categorized based on direction of gaze – either left or right
- Looks off screen and ambiguous looks were not coded
- A random 20% of the sample was recorded for reliability with agreement of >95% for direction of gaze

Methods: Analysis Plan

- Calculated the mean proportion of time spent looking during window of interest (1,700-8,000 ms):
  - Training phase: Referents
  - Test phase: Targets (named referents) and distractors (unnamed referents)
- Linear mixed effects models or t-tests to evaluate group level differences in looking

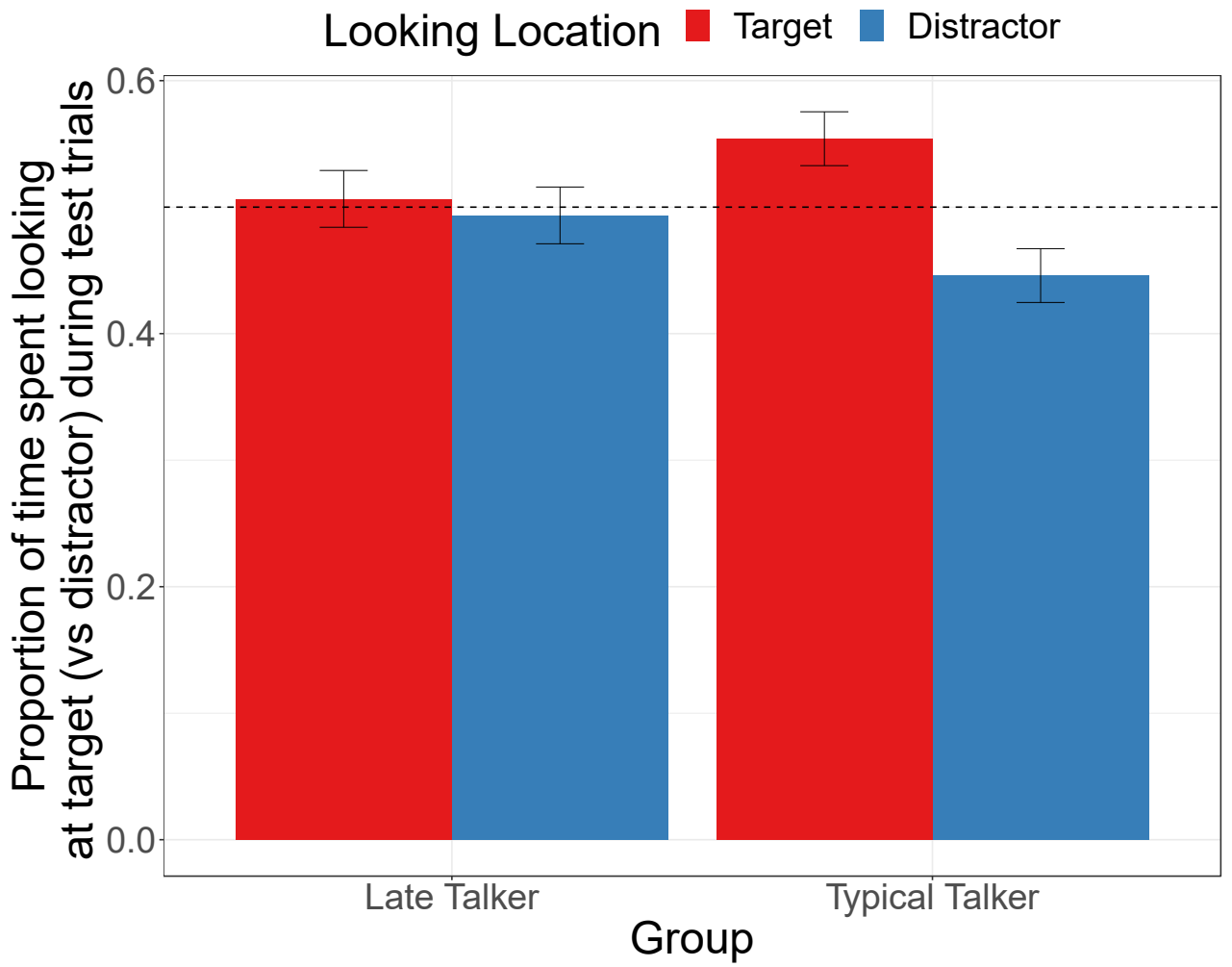
Results: Training phase

- No main effect of Group (p = .78)
- Both groups spent a similar amount of time looking at referents during training trials

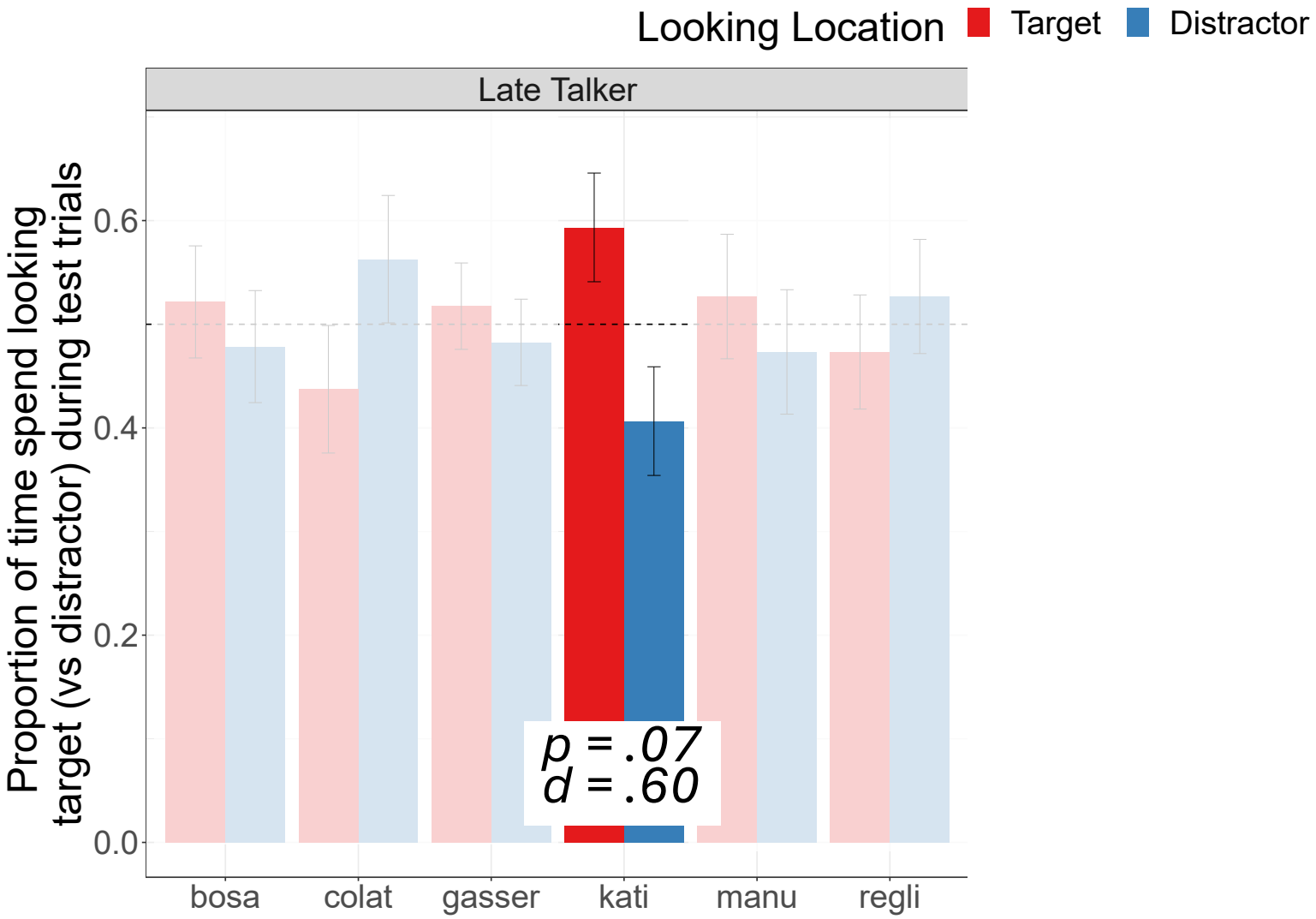


Primary Results: Test phase

- No main effect of Group (p = .12) or Looking Location (p = .68)
- Significant interaction of Group x Looking Location (p = .03)
  - TT group spent significantly longer looking at targets vs. distractors (p = .002)
  - LT group did not show this effect (p = .68)



Exploratory Results: By-word



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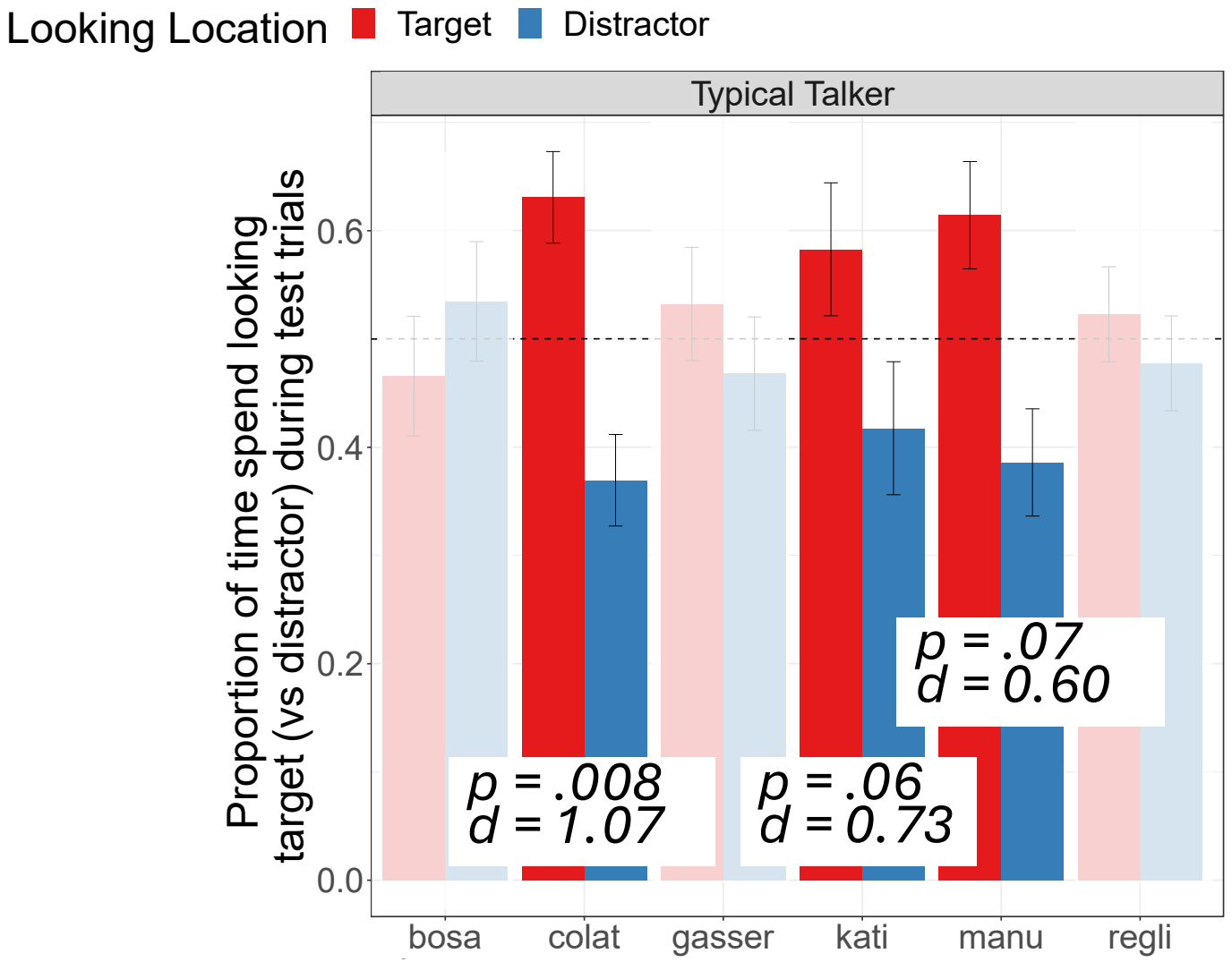

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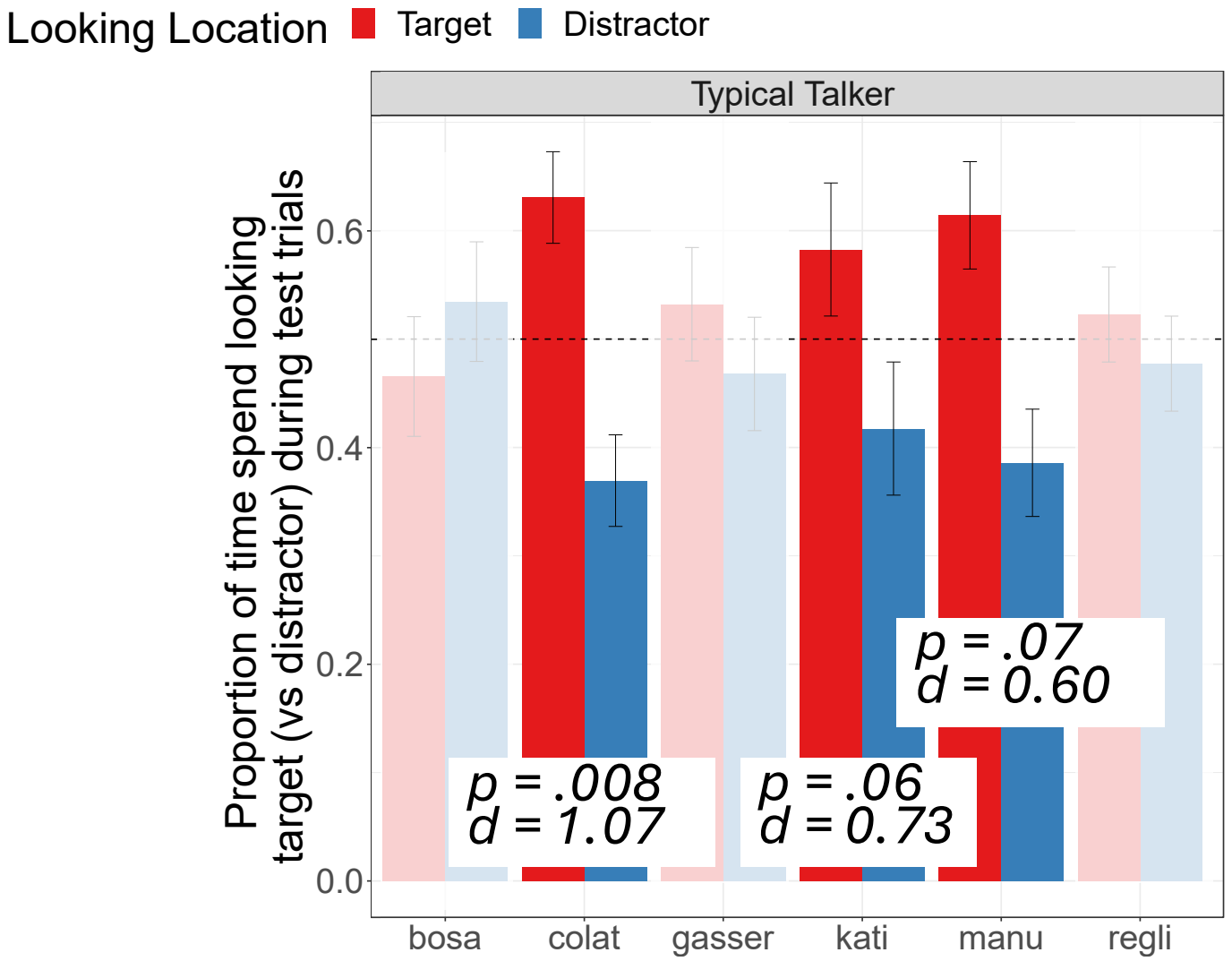

Discussion

- The typical talkers spent more time looking at targets during test trials compared to the late talkers, suggesting some learning of word-referent mappings.
  - LTs did not show this pattern, despite similar visual attention to objects during exposure
  - Reduced attention to auditory stimuli like older children with DLD? (Spaulding et al., 2008; Victorino & Schwartz, 2015)

Discussion (continued)

- The late talkers linked fewer word-referent pairs than did typical peers
  - Effects of phonotactics (Ellis-Weismer et al., 2013; Gray et al, 2014; McGregor et al., 2022; Simmons & Paul, 2024)
  - More input required (Alt et al., 2014; Simmons & Paul, 2024)

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Toddler Language Development Laboratory

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Children Helping Science
Powered by Lookit

Children Helping Science-Lookit and the families who participated in this research

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Thank you!