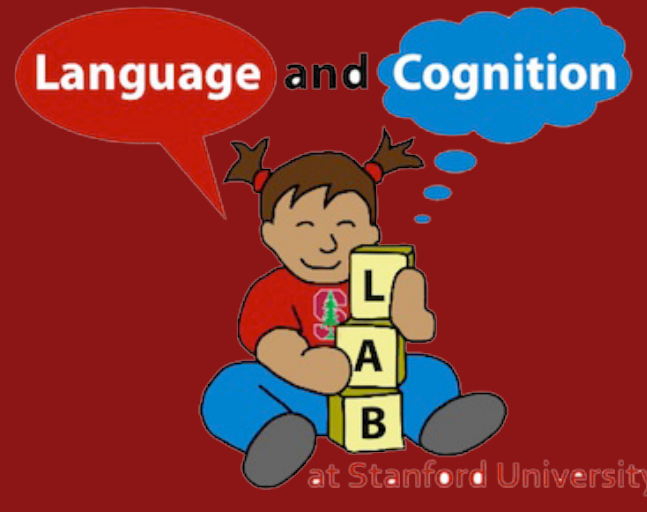


Preschool children reason about third-party goals when evaluating acoustic environments



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Introduction

Children as flexible learners

- Learning flexibility in children includes:
 - Adjusting attention to stimuli that is learnable (Gerken et al., 2011; Kidd, 2011)
 - Using emotional expressions as cues for novel object exploration (Wu & Gweon, 2021)
 - Reasoning about environmental structure and goals to determine approach strategies (Meder et al., 2021)

Background noise and learning

- Acoustic noise is ubiquitous
- Repeated noise exposure influences learning and development in critical ways:
 - Reduces speech perception and word recognition (Klatte et al., 2013; Bjorklund et al., 1990)
 - Decreases word learning (McMillan & Saffran, 2016)
 - Impinges on already limited cognitive resources for adaptive strategy building (Loh et al., 2022)

(Ecological) Active learning

- Traditional active learning:
 - Learners interact with individual stimuli within their environment (Settles, 2009)
 - Accurate stimuli labeling is a primary goal
- Ecological active learning:
 - Children learn by tracking environmental features and adapt their exploration strategies accordingly (Ruggeri, 2022)
 - Exploratory strategies for learning are context-dependent
 - Exploit statistical regularities in the environment to reduce demands on cognition

Environmental selection

- Learners preferentially select acoustic environments that align with a set of goals
- Emphasizes acoustic information
- Goal-directed
- Addresses variabilities across environments
- Children can rely exclusively on acoustic information to make exploration decisions

Research Question

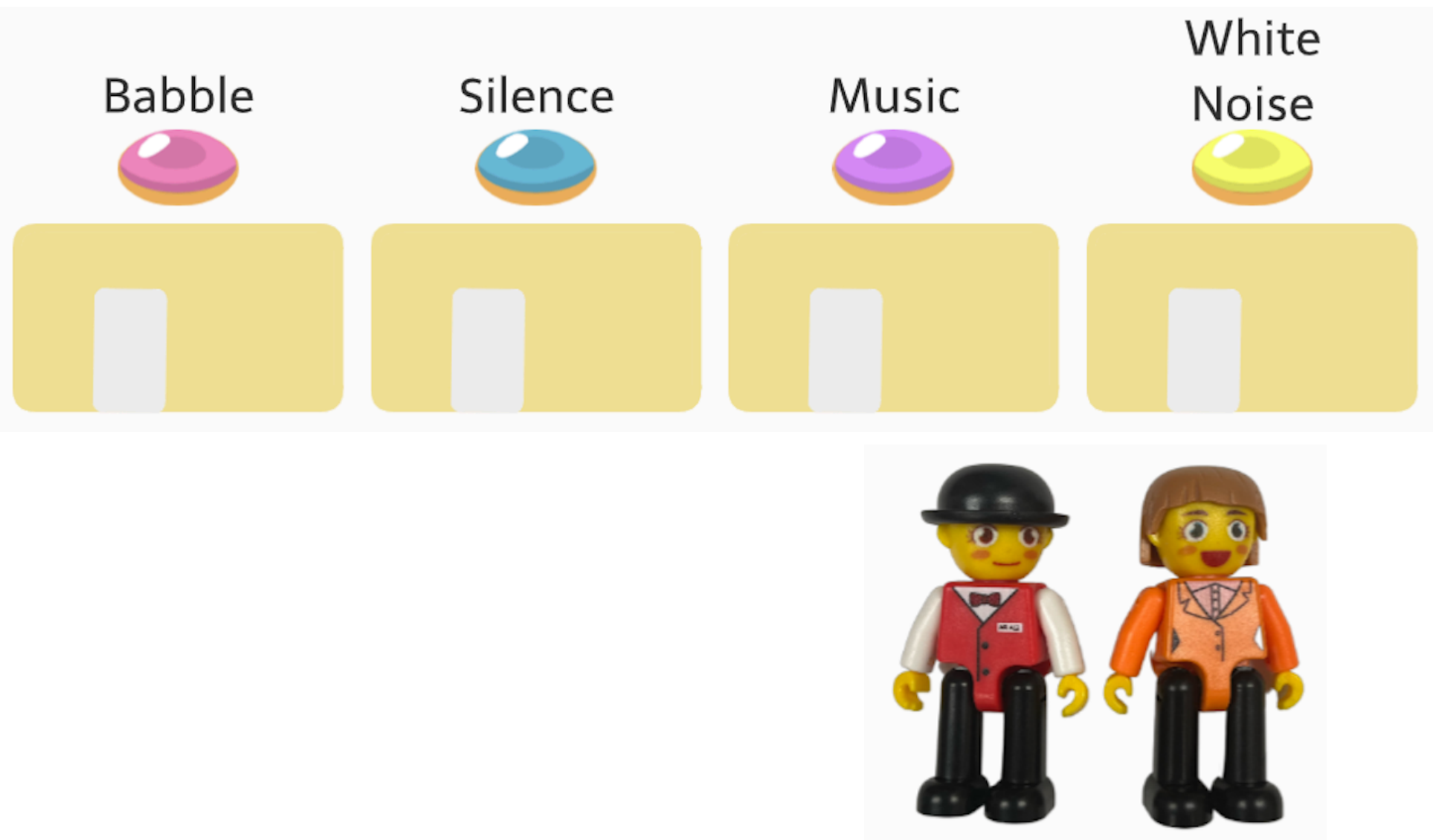
To what extent do preschool children use environmental selection as an adaptive strategy for learning in noisy acoustic environments?

Hypothesis

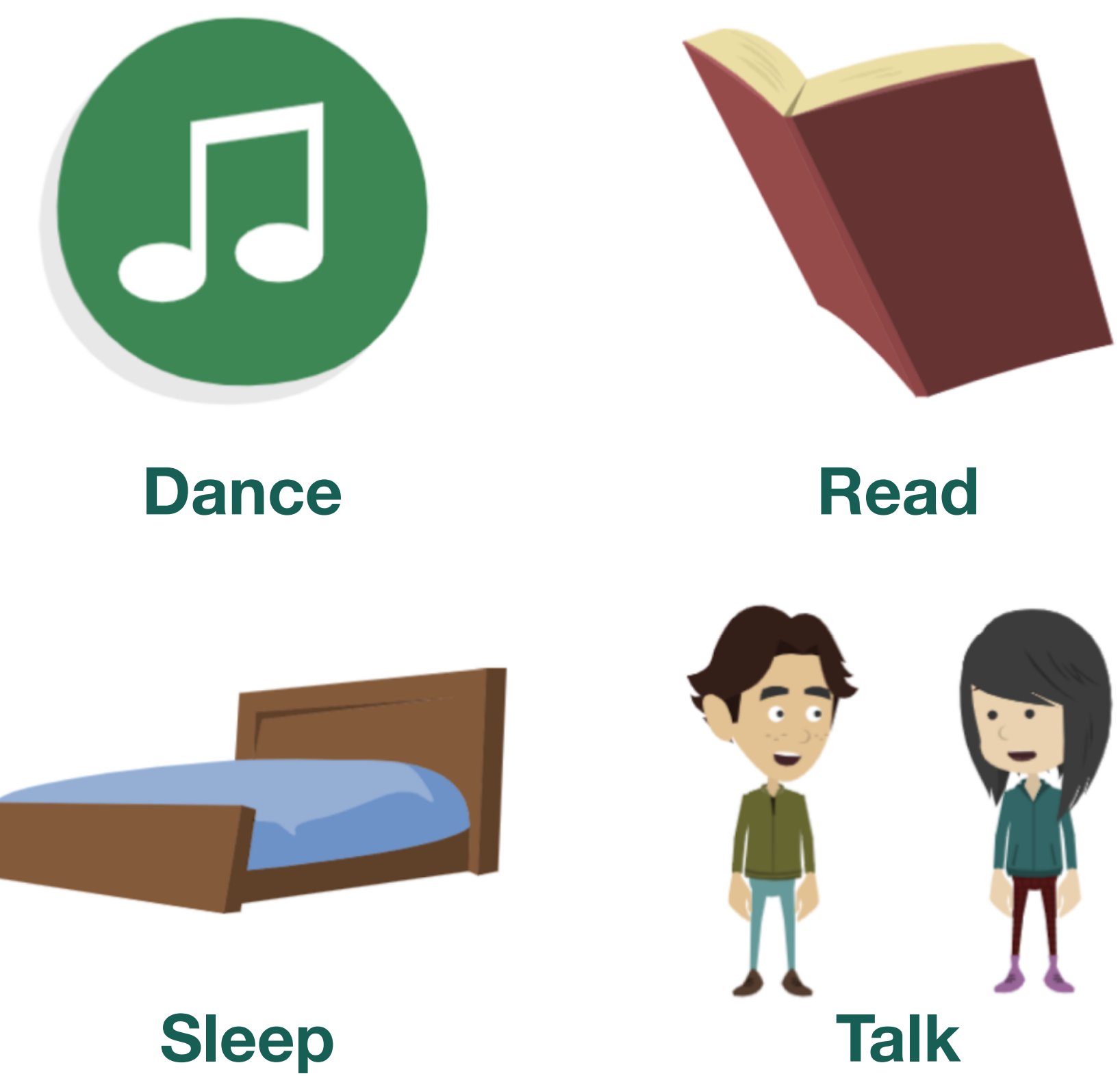
If children use acoustic information to make decisions about how to better maximize goal outcomes, they should also match such goals with acoustic environments that better maximize output.

Methods

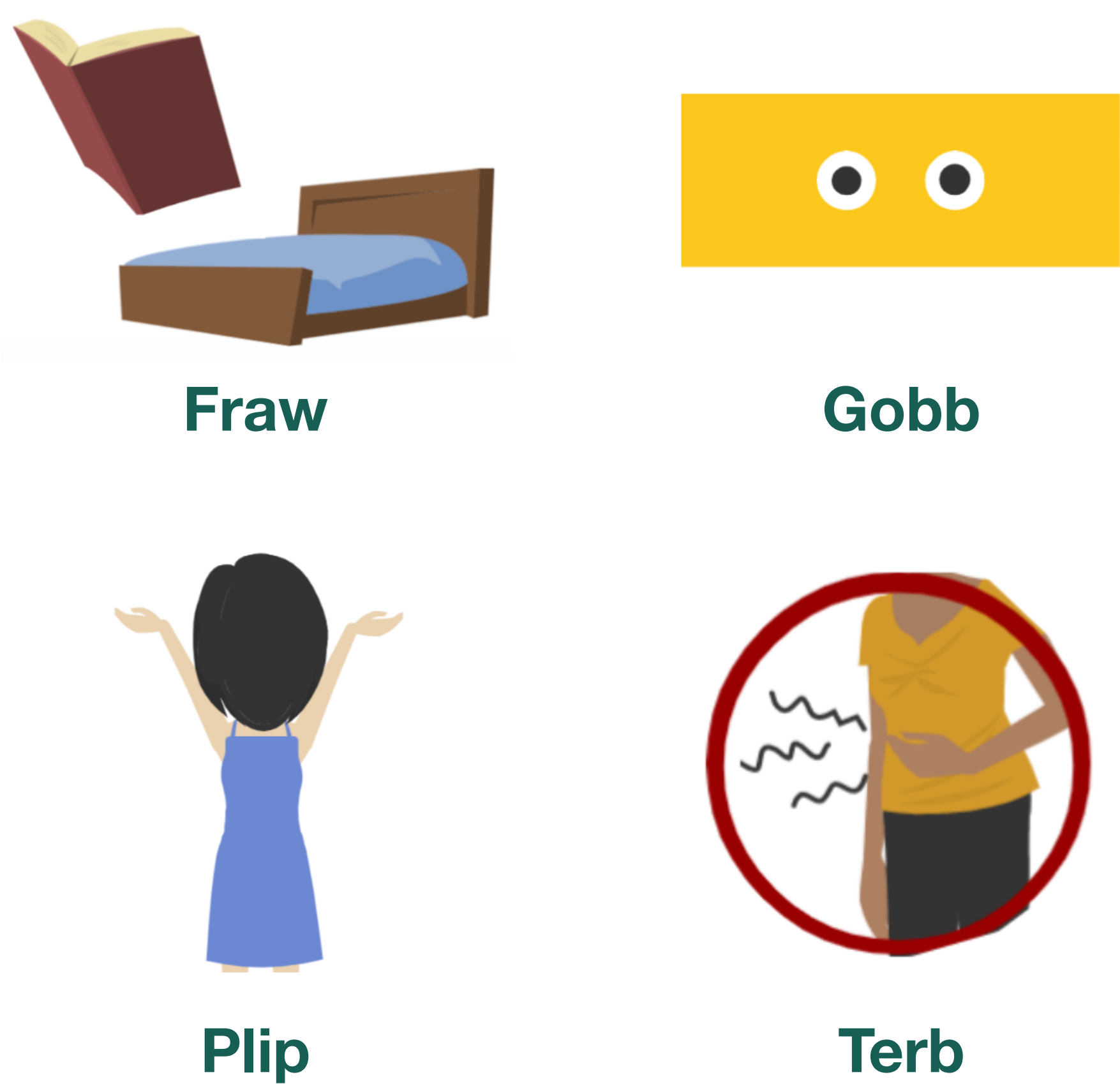
	Experiment 1		Experiment 2	
	Children	Children	Adults	
Sample Size	72	54	37	
Mean Age	4.46 years	4.55 years	40.43 years	
African American/Black	4.2%	3.7%	5.4%	
Asian American/Pacific Islander	23.6%	37%	10.8%	
Caucasian/White	27.8%	31.5%	73%	
Hispanix/Latinx	8.3%	7.4%	8.1%	
Multiracial	26.4%	20.4%	2.7%	
Other	8.3%	0%	0%	



Experiment 1



Experiment 2



Results

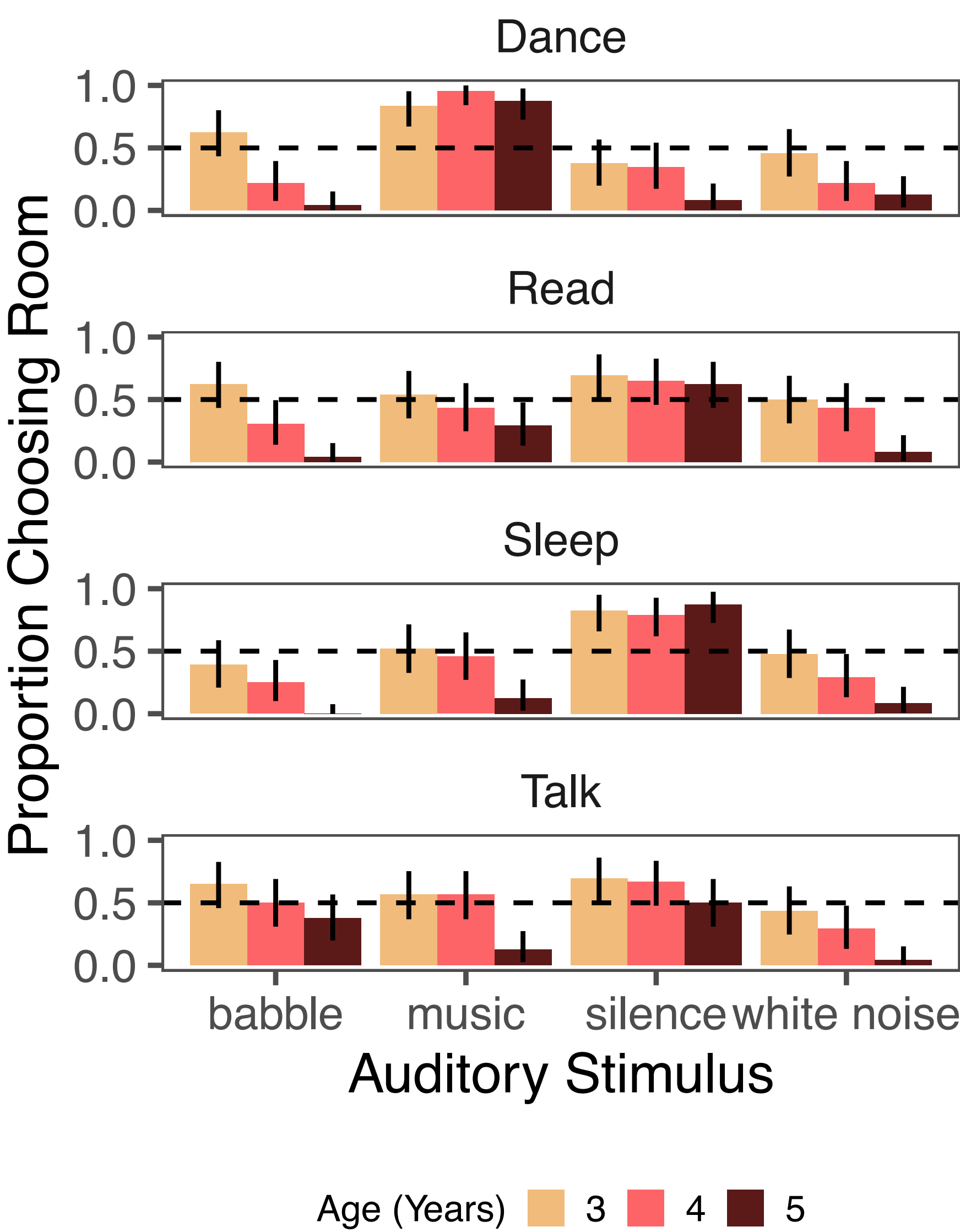


Figure 2: Results from Experiment 1. Participants' rating of the appropriateness of an auditory stimulus and activity pairing. Individual bars correspond to one age bin of 3, 4, or 5. A rating score of 0 indicates a rejection of the pairing [Joe and Mandy should not complete a particular activity in this environment] while a score of 1 indicates an affirmation of the pairing (Joe and Mandy should complete a particular activity in this environment), at 50%. Error bars show 95% confidence intervals.

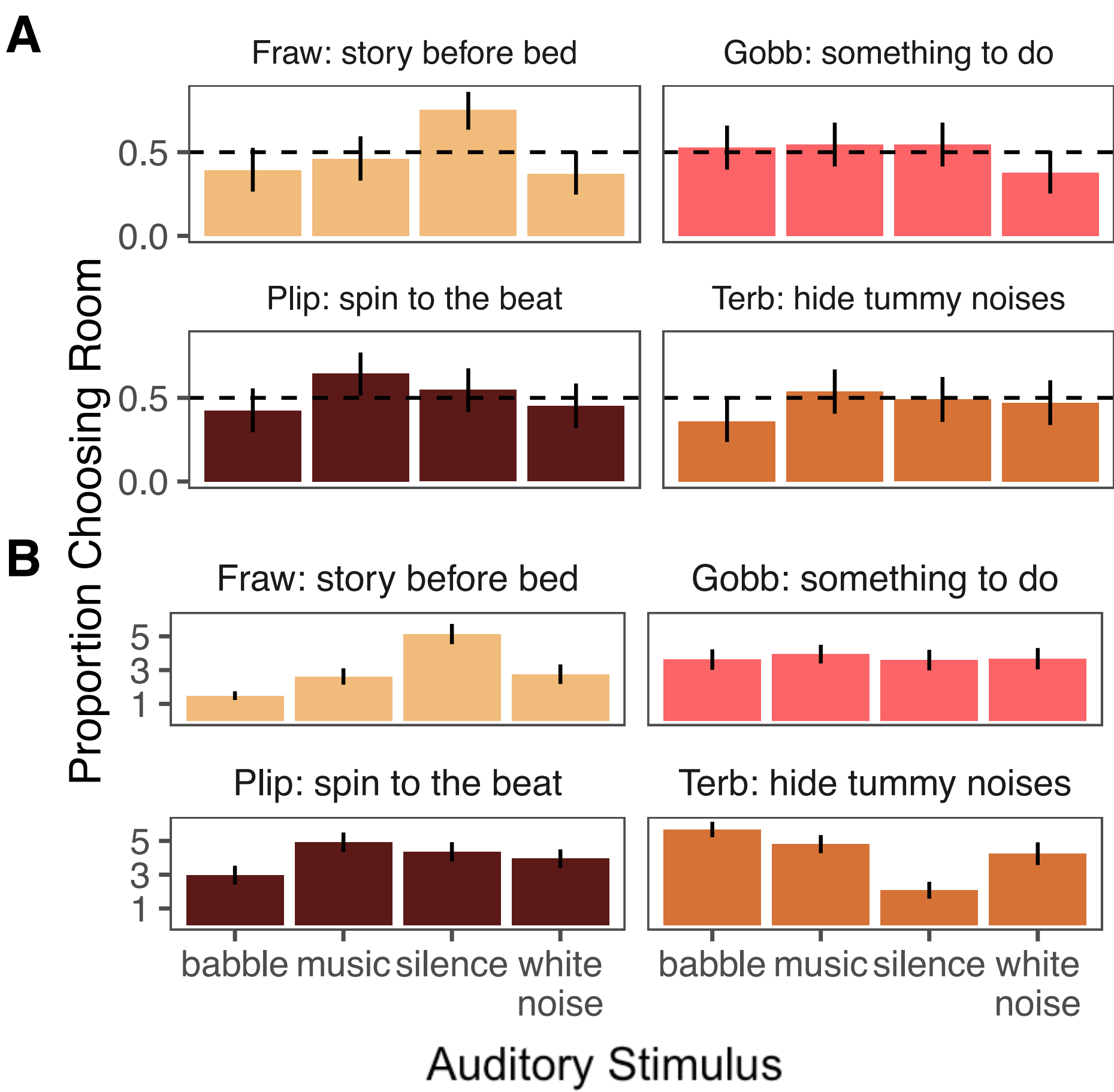


Figure 3: Results from (A) children and (B) adults in Experiment 2. While children made binary judgments, adults used a seven-point Likert scale indicating complete match (7) to complete mismatch (1) between sounds and activities.

Discussion

- Preschool children reliably matched acoustic environments with third-party goals, regardless of age
- Preschool children generally matched unfamiliar activities with third-party goals as well as adults
- By age 5, young children can adjust their interpretation of more efficient exploration with acoustic input
- Supports an ecological active learning theory in the auditory domain

References

Bjorklund, D. F., & Harnishfeger, K. K. (1990). *Developmental Review*; Gerken, L., Balcomb, F. K., & Minton, J. L. (2011). *Developmental Science*; Kidd, C., Piantadosi, S. T., & Aslin, R. N. (2012). *PloS One*; Klatte, M., Bergstrom, K., & Lachmann, T. (2013). *Frontiers in Psychology*; Loh, K., Fintor, E., Nolden, S., & Fels, J. (2022). *Developmental Psychology*; Meder, B., Wu, C. M., Schulz, E., & Ruggeri, A. (2021). *Developmental Science*; McMillan, B. T., & Saffran, J. R. (2016). *Child Development*; Ruggeri, A. (2022). *Current Directions in Psychological Science*; Settles, B. (2009). *Computer Sciences Technical Report*; Wu, Y., & Gweon, H. (2021). *Child Development*