#5aSC14

Quantifying expressive word learning in the presence of background speech

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Background

Fast-mapping is the ability to map novel word-object pairs with very few exposures (Carey & Bartlett, 1978), and is thought to underlie language acquisition. However, language learning often happens in natural environments that contain competing sounds. Previous studies examining whether competing sounds affect fast-mapping yielded inconsistent results. Specifically, previous work has suggested that background noise had little effect on the *comprehension* of words; however, it had a detrimental effect on accurate *production* of novel words (Riley & McGregor, 2012). Given these methodological differences, the best way to quantify fast-mapping in children in different listening environments is still an open question.

The present study aims to:

1. Examine how the presence or absence of a **speech competitor** impacts **fast-mapping of novel word-object pairs.**
2. Determine optimal ways to quantify **expressive** word learning in 3 to 4-year-old children.

Methods

Participants: Thirty children (N=16 females, age range 42.7–54.2 mos., mean 47.2 mos.) were recruited to participate in the study. All participants were monolingual English speakers with no prior history of speech and language services. All procedures were approved by the Institutional Review Board at Northwestern University.

Stimuli

Target stimuli: Six novel disyllabic pseudo words were used for the novel labels (Horst & Hout, 2015) Target stimuli were scaled to yield an overall intensity level of 60 dB SPL.

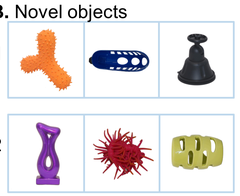
Two-talker babble: Pre-recorded sentences from the Harvard IEEE corpus (Rothauser et al., 1969) spoken by an adult male and digitally overlaid. Sentences were scaled to yield an overall intensity level of 58 dB SPL.

Visual stimuli: Six novel objects for which there is no formal label, were selected to pair with the novel words. Two groups of three objects were generated and combined with the two word groups to create four different word-object pairings.

A. Novel labels in IPA

1	/paɪɪə-/ /modi/ /wɑso/	2	/kolɑt/ /vɜ-rdɛks/ /tibu/

B. Novel objects



Procedure

Training: Participants were presented with a 3 by 1 object array on a 21.5” Dell touchscreen monitor and were instructed to choose one object to learn about. The selected object moved around the screen while a female talker described it. Participants were exposed to each word-object pairing twice and heard the label 8 times. Participants completed two training phases, one in quiet and one in the presence of two-talker babble (at a +2 dB SNR).

“Look at the **modi**!”
“This **modi** can bounce!”
This **modi** can jump around!”
“Do you want to play with the **modi**?”

Testing: Following each training phase, participants were assessed with a tiered recall task:

Open	Cued	Closed
Participants must say the name of the novel object presented.	If incorrect in open recall, participants were cued with the target label’s initial CV segment.	Participants were presented with a 3-dot array. The experimenter pointed to each dot and said a label choice. The participant either produced or pointed to their choice.
What is this? 	It starts with a /**mo**/	Is this a… 

Novel Word and Phoneme Production varies by recall task but not by background noise

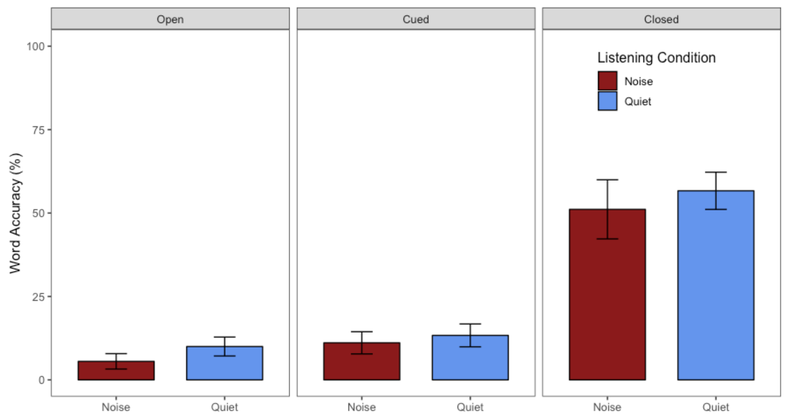


Figure 1. Accuracy (mean ± SE) on the recall task based on whether the participant produced the novel label correctly. A 2 (Listening Condition: Quiet, Noise) × 3 (Recall Task: Open, Cued, or Closed set recall) way repeated measures analysis of variance (ANOVA) showed a significant main effect of test type, where children had an improved performance in closed set recall ($F[2,28] = 63.7$, $p < 0.01$, $\eta^2 = 0.47$). However, there was no main effect of listening condition ($p = 0.27$).

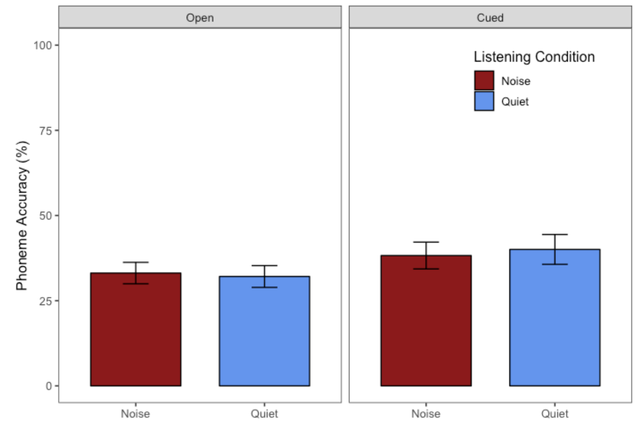


Figure 2. Accuracy (mean ± SE) of phonemes produced on each expressive recall task in quiet and noise. Scoring was based on how many phonemes were produced correctly compared to the target novel label. Closed set recall was excluded from this task since children received all phonemes during this task and the participant could point to the corresponding dot in the dot paradigm instead of producing the label. A 2 (Listening Condition: Quiet, Noise) × 2 (Recall Task: Open, Cued) way repeated measures ANOVA showed a main effect of test type ($F[1,29] = 4.4$, $p < 0.05$, $\eta^2 = 0.04$). There was no main effect of background noise ($p = 0.9$) or significant interactions.

Tiered Recall improves response rate

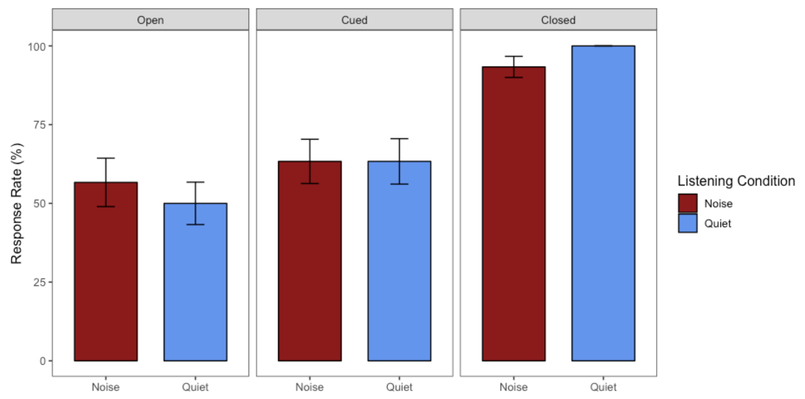


Figure 3. Proportion (mean ± SE) of responses by task. “No response” in the present study is defined as the participant not attempting to produce an answer or saying “I don’t know” during the task. Participants’ responses did not change in quiet versus noise. There was a significant main effect of test type, where the closed set recall yielded the lowest no response rate compared to the other two recall tests ($F[2,28]=27.9$, $p < 0.01$, $\eta^2 = 0.38$). Post-hoc t-tests (Bonferroni corrected for multiple comparisons) showed a significant difference in response rate between Open and Closed set recall ($t[59] = -8.4$, $p < 0.001$) but no statistical difference in response rate between Open and Cued recall ($p = 0.03$).

Discussion & Summary

Speech Competitors & Fast-Mapping

- The current paradigm does not show a difference in performance when comparing across listening conditions, replicating prior literature.
- Current work is investigating how listening environment impacts word learning across multiple training sessions (see 5aSC7).
- Future work will develop a scoring system that more closely accounts for phonetic features in production.

Quantifying Expressive Word Learning

- Test method consistently impacted task performance.
- The Open recall task yields the worst performance. This may be driven by a low response rate in these tasks.
- A significant effect of test type in when comparing the phoneme scores across tasks suggests that Cued recall may facilitate phoneme production.
- The Closed Set recall task provided scaffolding for participants that increased response rate.
- Above chance performance in Closed Set recall suggests that this paradigm may better quantify recall performance for our young age group.

Acknowledgements

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