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Implicit Learning in Preschoolers with Developmental Language Disorder

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IDENTIFYING THE CORE IMPAIRMENT IN LANGUAGE LEARNING FOR DEVELOPMENTAL LANGUAGE DISORDER MAY LEAD TO MORE EFFECTIVE INTERVENTION STRATEGIES.

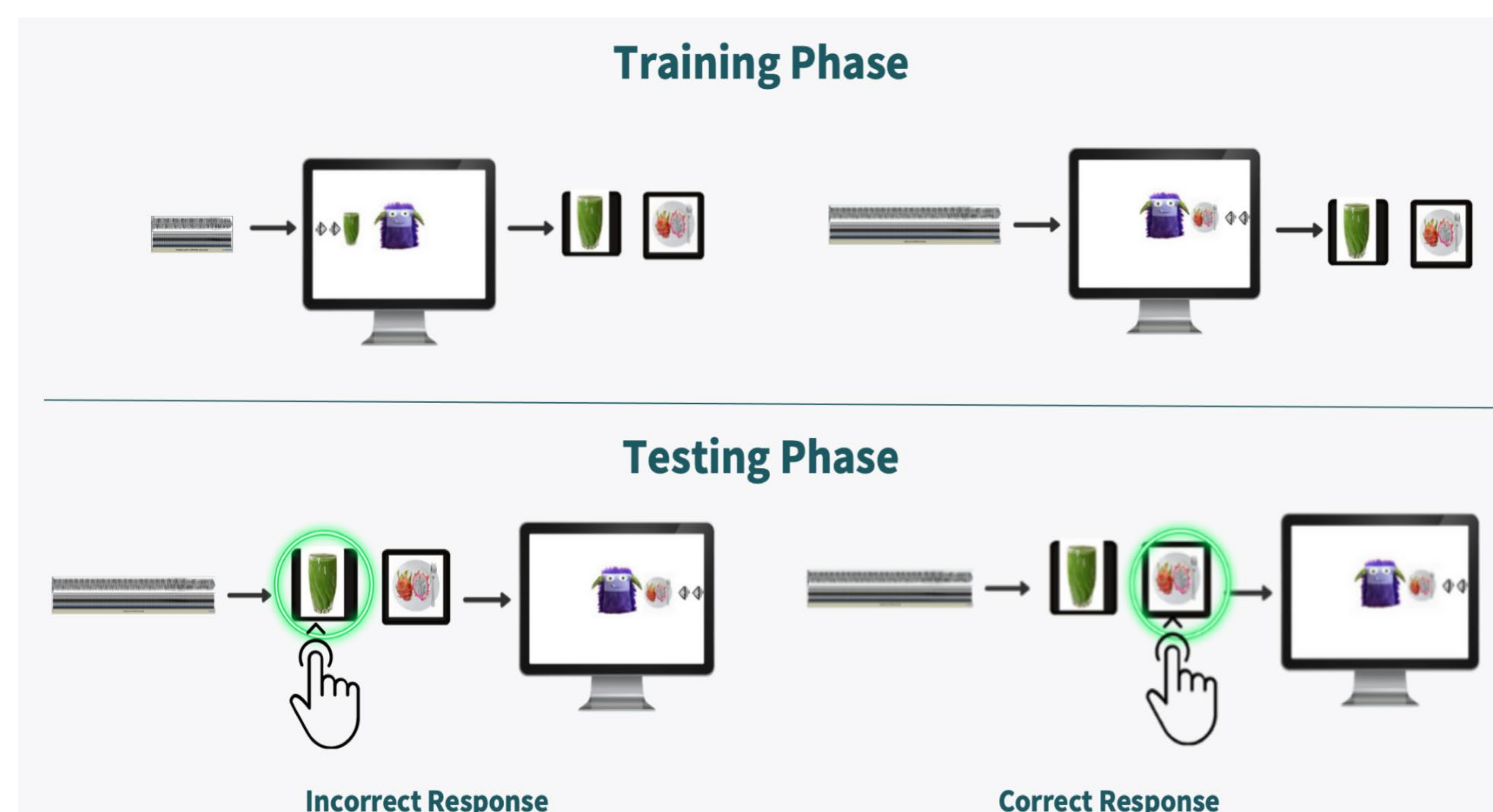


Figure 1. Top: Sequence of each training trial. In the duration condition, if the monster made a short sound (depicted in the left panel), the drink would then appear from the left side, while a long sound (depicted in the right panel) predicted the food would appear from the right side. Participants then pressed the corresponding button.
Bottom: Sequence of each test trial, where objects did not appear until the participant made a guess about which one the monster was asking for. Depicted are an incorrect response (left) and correct response (right) to a long-duration sound. (Image reprinted with permission from Tolomei et al. 2021)⁴

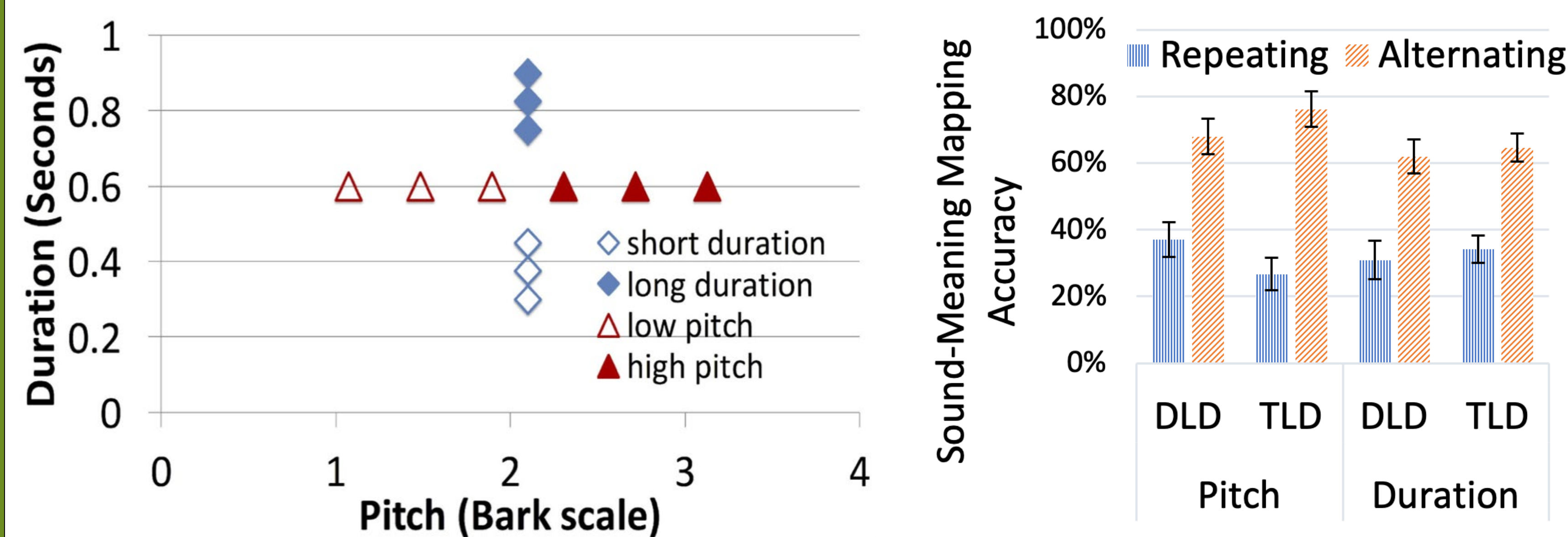


Figure 2. Sound categories differed in either duration (blue diamonds) or pitch (red triangles) with short or low sounds indicating the drink; and long or high sounds, the food. (Image reprinted with permission from Quam et al. 2021)²

Figure 3. Sensitivity to target-side alternation across groups and cues. (Image reprinted with permission from Tolomei et al. 2021)⁴

Implicit Learning In Preschoolers with Developmental Language Disorder (DLD)

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Abstract

- The Procedural Deficit Hypothesis (PDH) proposes that implicit learning is the core impairment in developmental language disorder (DLD).
- To test the PDH, we compared implicit learning in 26 preschoolers with DLD to 26 preschoolers with typical language development (TLD). We predicted children with DLD would show impairments in a test of implicit learning, and no impairments in explicit learning (which was tested in another experiment²).
- First, participants completed hearing screening and standardized testing to confirm eligibility. Following confirmation of eligibility, participants completed a sound discrimination task to assess baseline sensitivity to pitch and/or duration.
- Next, participants completed a computer-based training session. Here, participants were presented with a monster, Leonard, and told that Leonard would make sounds to ask for the food or the drink. Then, they heard the monster make sounds of varying pitches and durations and watched as he subsequently received food or drink. This was followed by a computer-based testing session, in which participants had to decide whether a sound of a given pitch or duration indicated that the monster was requesting food or drink.
- In an unintended experimental-design issue, the target picture switched sides between experimental trials nearly 2/3 of the time. Eye-gaze data indicated that participants anticipated the target side would alternate. Thus, we unintentionally investigated sensitivity to two competing cues: our target variable (pitch or duration) and target-side alternation. All participants relied on target-side alternation cues, rather than pitch and duration cues.
- In a second experiment, the flaw in the experimental design was fixed and 29 children with TLD successfully discriminated across pitch and duration categories. Participants learned pitch categories significantly better than duration categories.
- In the next phase of this second experiment, we plan to recruit children with DLD to compare to the children with TLD, and examine whether the two groups show any differences in implicit learning.

Results and Discussion

- Based on prior work³, we expect that children with DLD will not demonstrate successful learning of pitch or duration categories
- We conducted univariate ANCOVAs on participants' implicit-task accuracy
- Our results suggested that children with TLD "learned sound-object pairings" instead of pitch or duration categories, as eye gaze analysis suggested an alternative reason for accuracy.
 - Eye gaze data was coded manually at 30 frames per second using Adobe Premiere Software
 - Custom awk and perl scripts⁵ combined information on the start and end times of left and right looks with trial-order information about the target side on each trial, to indicate when each child was fixating the target side vs. the other side of the screen at each point in each trial
 - Post-hoc analyses comparing each group of children's performance to chance (but not splitting by cue, because of the alternate explanation for above-chance accuracy described below) indicated that typically-developing children's accuracy was significantly above chance in the implicit task.
- As a follow-up study, we fixed the flaw in the experimental design that allowed participants to anticipate target side
 - Results from this study showed that 29 children with TLD successfully discriminated across pitch and duration categories.
 - Participants learned pitch categories significantly better than duration categories.
 - In the next phase of this second experiment, we plan to recruit children with DLD to compare to the children with TLD
- In future work, using naturally recorded whole words, instead of synthesized isolated vowels, could boost performance in the auditory duration condition.

Contacts and Thanks

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