Implicit Learning in Preschoolers with and Without Developmental Language Disorder

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Training Phase

Testing Phase
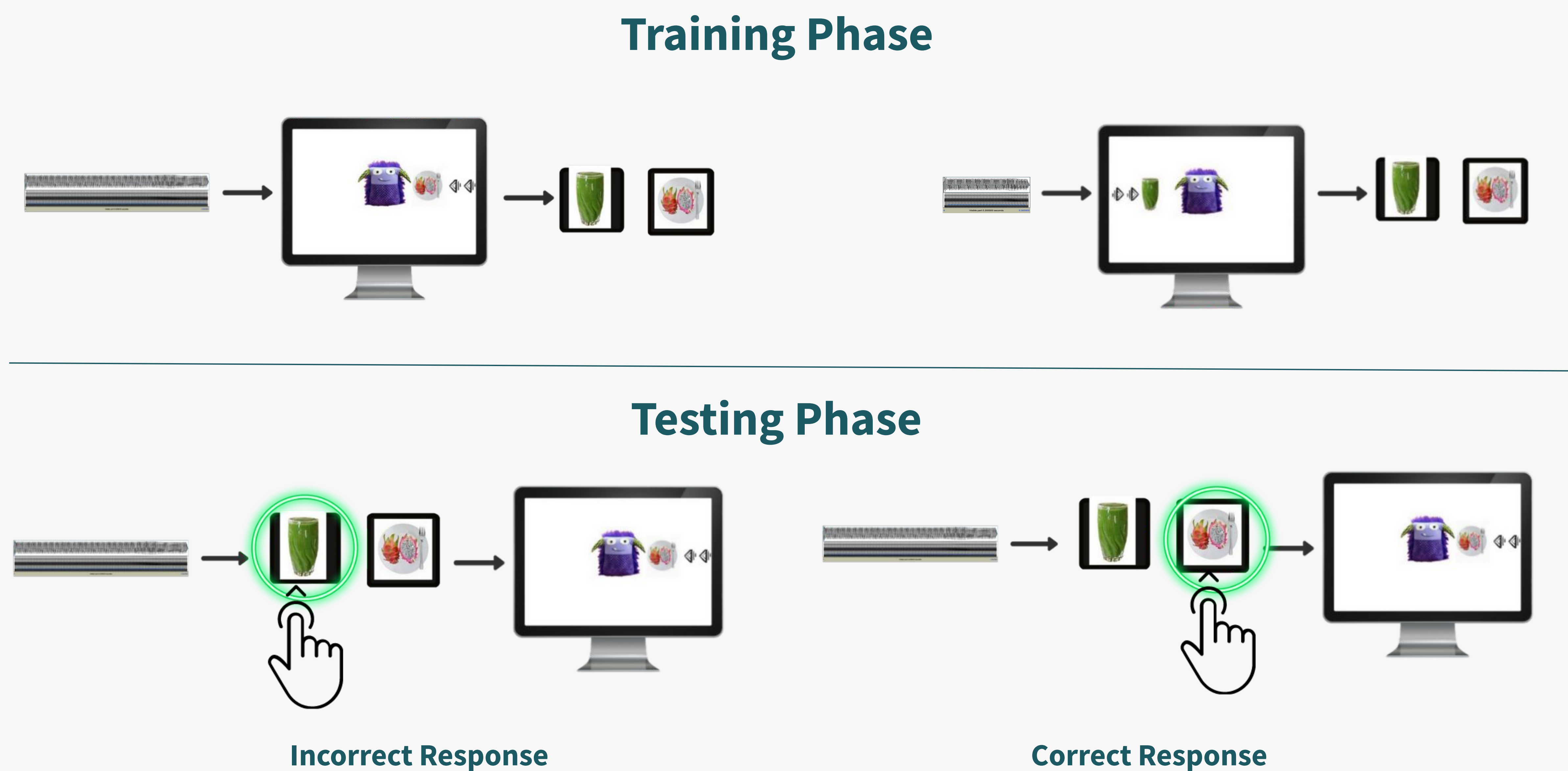
Incorrect Response

Correct Response

Figure 1. Top: Participants were introduced to a monster, Leonard, in a training session. They were shown his favorite food and his favorite drink, and explained that he would ask for what he wanted by making his "special sound" for the food or his "special sound" for the drink, and then the object he'd asked for would "magically appear." In each training trial, a sound played and then the correlating image moved in from the left (drink) or the right (food). In the duration condition, short sounds predicted the drink and long sounds predicted the food. In the pitch condition, low sounds predicted the drink and high sounds predicted the food. Participants were instructed to give Leonard what he was asking for as soon as possible.
Bottom: During the testing phase, Leonard made a sound and the participant pressed a button for the drink or the food. Then, the correct object moved in from the left (drink) or right (food). The above example simulates an incorrect and correct response to a long-duration sound. No explicit feedback was provided on the participant's responses in either phase.

Abstract

- The purpose of this study was to compare implicit learning of sound-meaning mappings in preschoolers with and without developmental language disorder (DLD), in order to test the Procedural Deficit Hypothesis.

- The Procedural Deficit Hypothesis (PDH) argues that procedural memory, the basis for implicit learning, is the core deficit in DLD (Lum et al., 2012).

- We predicted that children with DLD would show deficits in implicit learning when compared to children with typical language development (TLD). A companion study (Quam et al., 2021) had predicted no deficits in explicit learning, but did find learning impairments in an explicit task.

- An unintended study design feature resulted in two cues being presented implicitly, the sound-meaning correspondence and a tendency for target pictures to alternate sides rather than repeat. Children in both groups learned the target-side alternation implicitly, contradicting the predictions of the PDH.

Methods

- We tested 52 preschoolers in total, 26 with TLD and 26 with DLD.
- Preschoolers participated in a computer-based task assessing implicit linking of sounds to meanings (see **Figure 1**).
- Participants were asked to listen to pitch- or duration-differentiated sounds (see **Figure 2**) and guess which object Leonard the monster wanted. Short or low sounds predicted the drink, while long or high sounds predicted the food.
- The target picture unintentionally switched sides between experimental trials (vs. repeating) roughly 65% of the time.
- Participants noticed this alternating pattern and relied on it, rather than the sounds, to predict where the target would appear. This represents a form of implicit learning--just not the one we intended to probe.
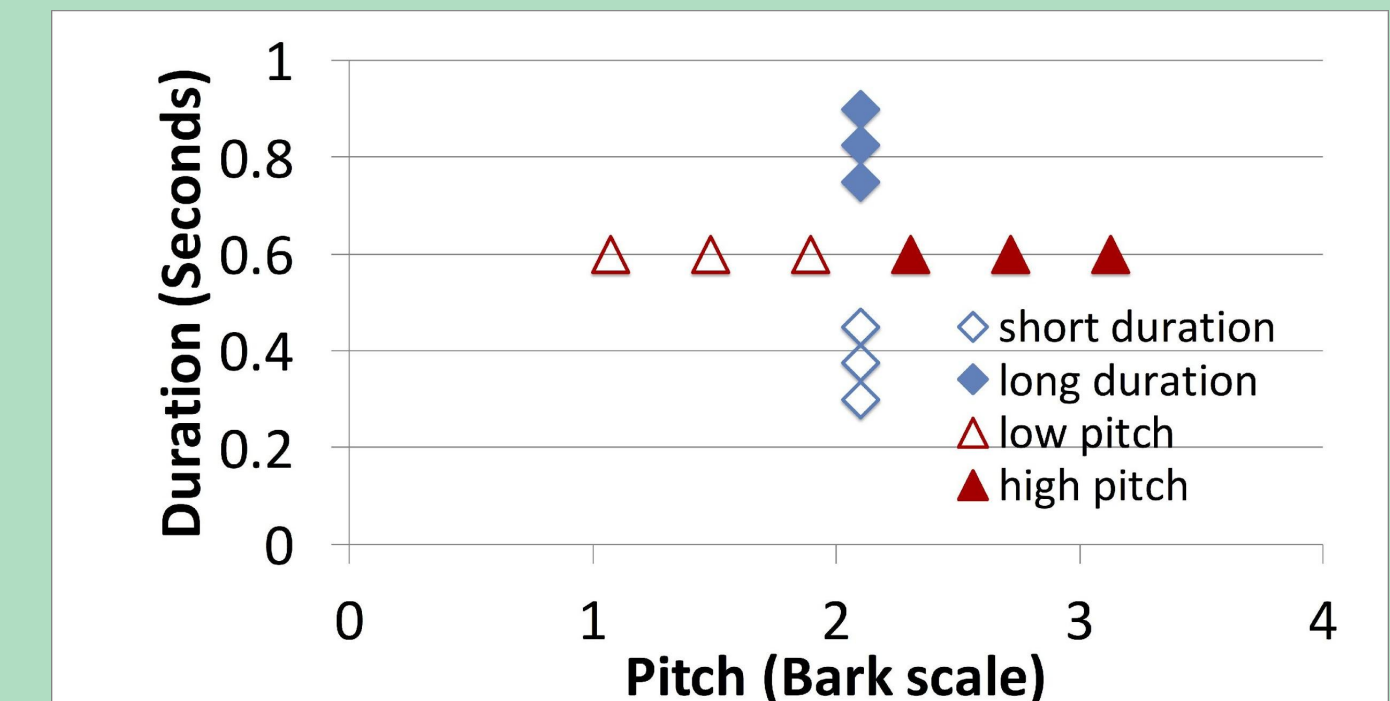
Figure 2. Sound categories. Reprinted with permission from Quam et al. (2021).

Results and Discussion

- A first MANOVA and follow-up t tests investigated effects of Group (TLD, DLD), Cue (pitch, duration), and Alternation Trial Type (alternating, repeating) on children's sound-meaning mapping accuracy. **Figure 3** shows that both groups of children showed sensitivity to the Alternation Trial Type (significantly higher accuracy in alternating vs. repeating trials) in both the pitch and duration conditions, all $t > 3.5$, all $p < .005$, but sensitivity to the alternation pattern was stronger for TLD children than DLD children in the pitch condition, $F(1,22) = 5.00$, $p = .036$.

- A second MANOVA re-coded the dependent variable so that accuracy was based on the alternation cue (the "correct" answer was the alternating side from the previous trial). Predictors were Group, Cue, and Cue Convergence (sound converged or sound conflicted with the alternation cue). There were no effects of Cue Convergence, indicating children did not rely on the sounds.

- Results do not support the PDH because both groups of children displayed successful implicit learning of the alternation pattern.

- A follow-up experiment with TLD kids (Wanchi, 2020) showed they could learn sound-meaning mappings when the alternation cue was removed, suggesting the alternation cue competed with attention to the sound-meaning mappings.
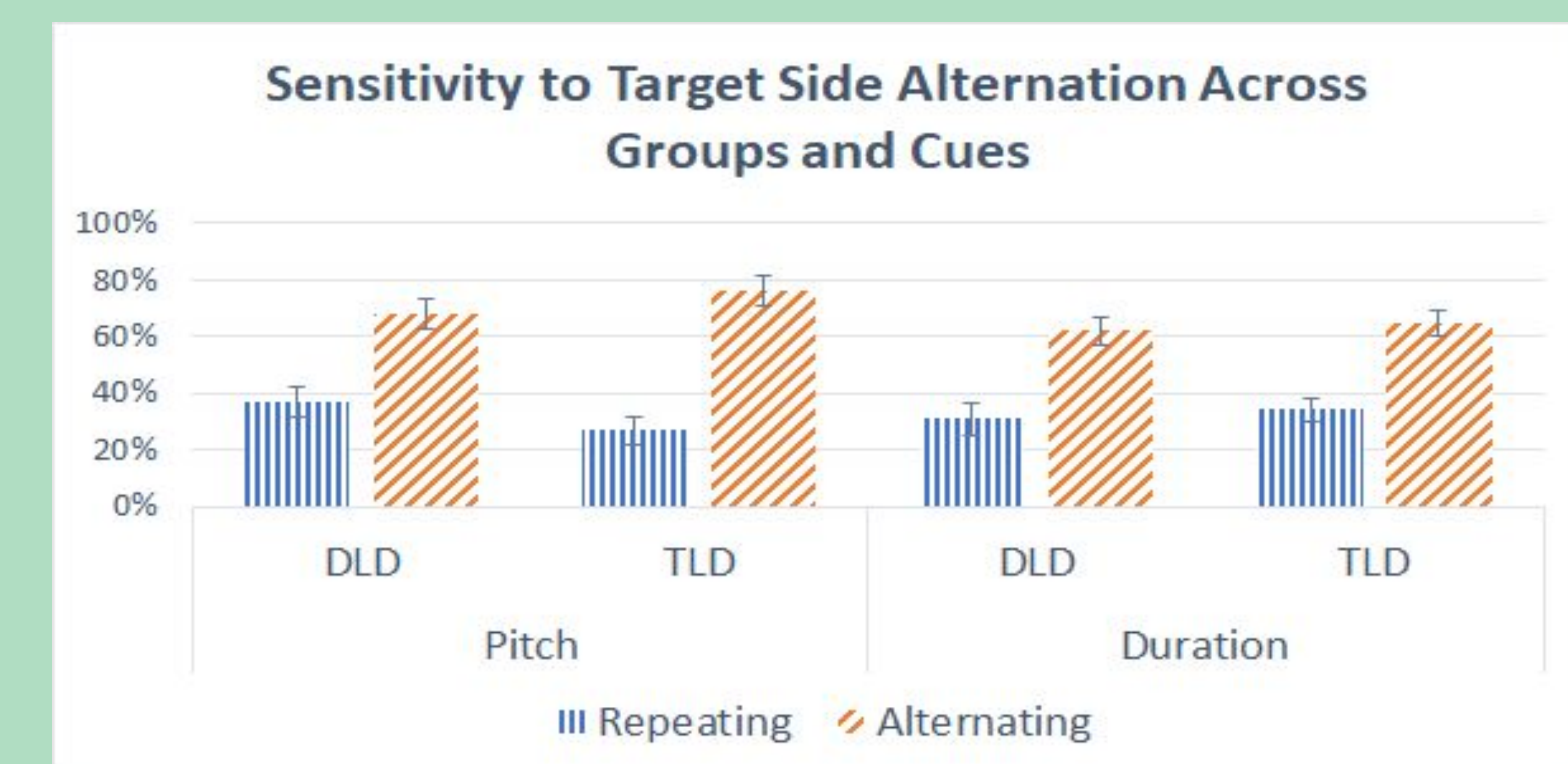
Figure 3. Sensitivity to target side alternation across groups and cues.

Lum, J. A. G., Conti-Ramsden, G., Page, D., & Ullman, M. T. (2012). Working, declarative and procedural memory in specific language impairment. *Cortex, 48*, 1138–1154.

Quam, C., Cardinal, H., Gallegos, C., & Bodner, T. (2021). Sound discrimination and explicit mapping of sounds to meanings in preschoolers with and without developmental language disorder. *International Journal of Speech-Language Pathology, 23(1)*, 26-37.

Yu, Wanchi, "Implicit Learning of Children With and Without Developmental Language Disorder Across Auditory and Visual Categories" (2020). *Master's Thesis.* Paper 5588. Retrieved from https://pdxscholar.library.pdx.edu/open_access_etds/5588/. https://doi.org/10.15760/etd.7460