

# Challenges to Speech Perception Impair Phonological Short-Term Memory

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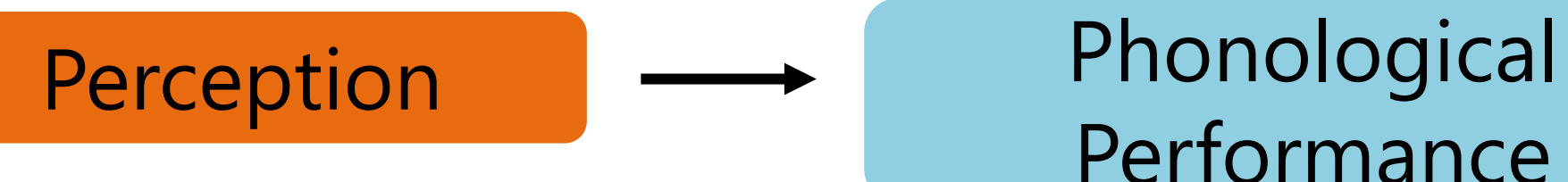
## BACKGROUND

Poor performance on phonological tasks is a key feature of neurodevelopmental language disorders (Snowling, 1998; Ramus et al., 2013).

**Perceptual deficit accounts** link phonological dysfunction to deficits in speech-sound discrimination at lower levels of the speech processing hierarchy.

A cognitively realistic pathway from speech perception to phonological performance has not been sufficiently established. We assessed this relationship in typical adults by experimentally disrupting speech-sound discrimination in a phonological short-term memory (pSTM) task.

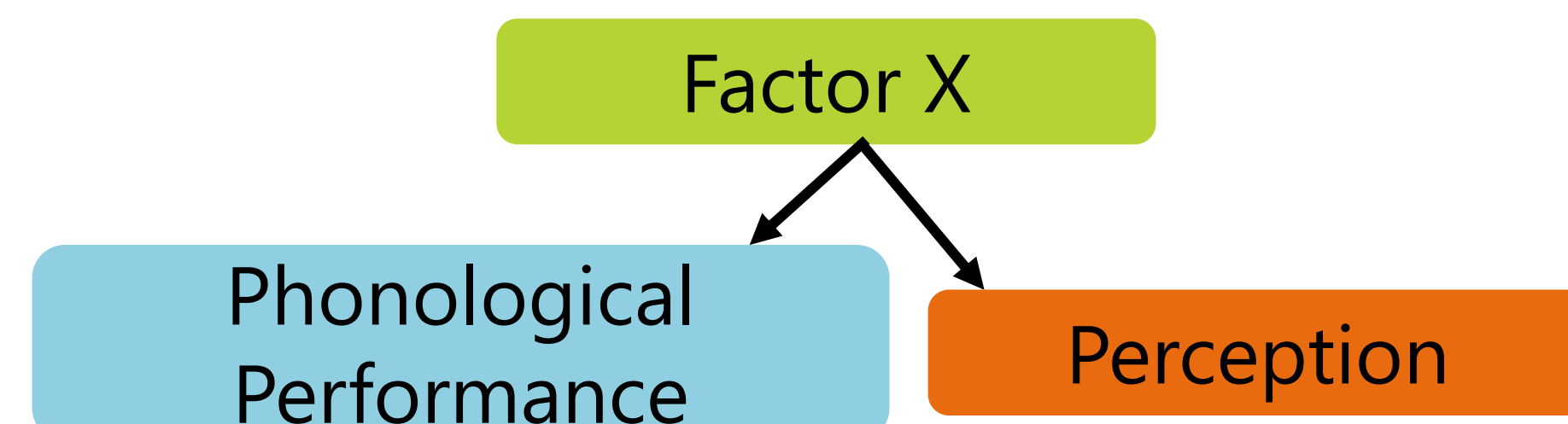
### Causal Model



### Consequence Model



### Correlation Model

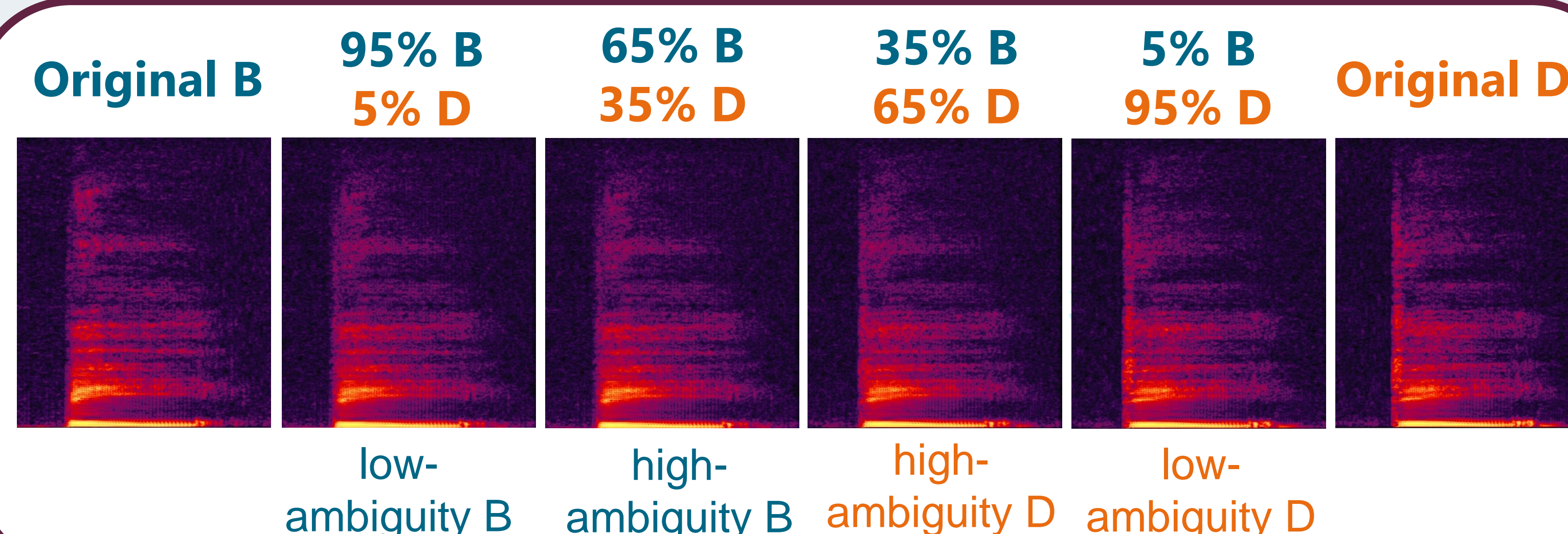


Q: Are more ambiguous speech sounds harder to maintain in short-term memory?

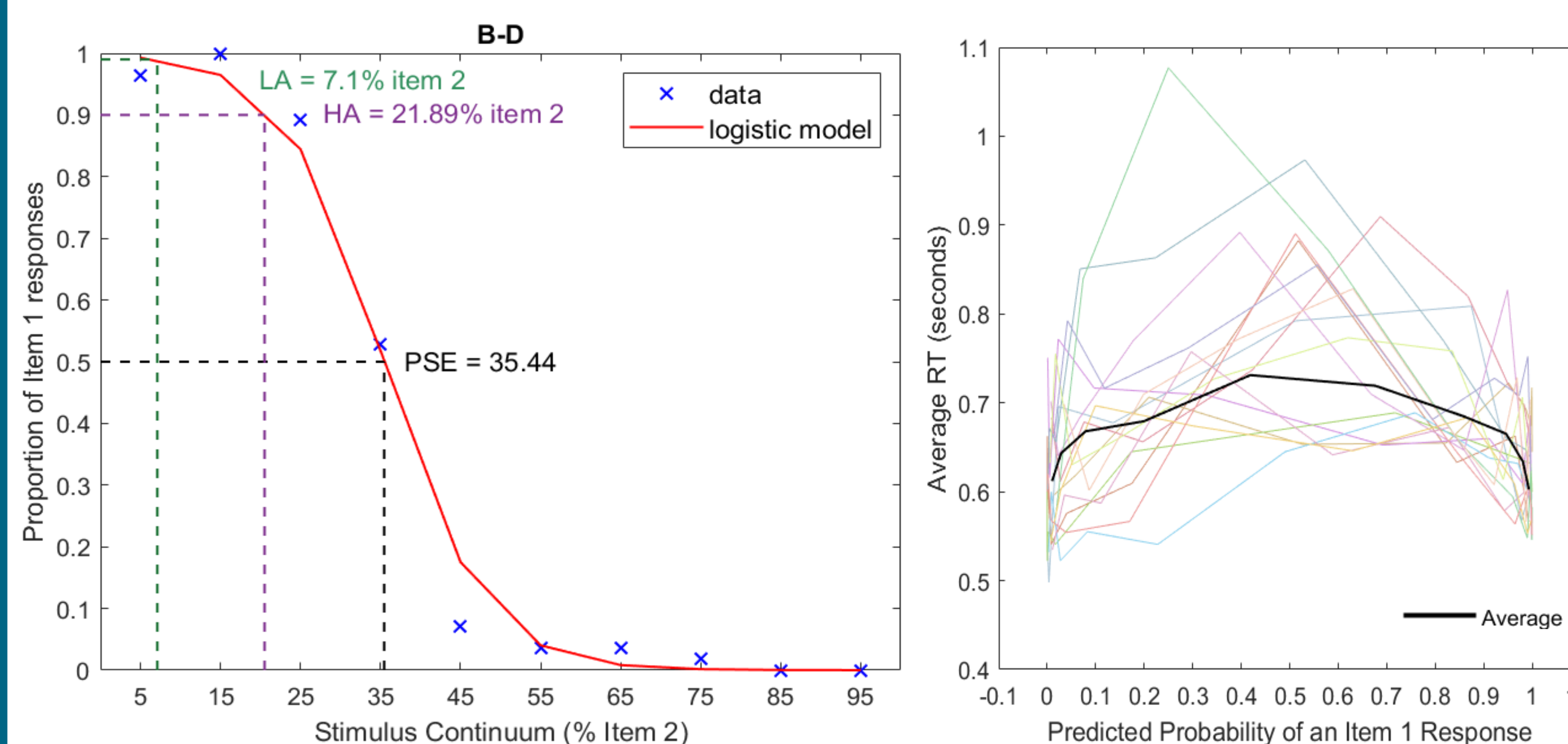
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We used an **automated audio-morphing method** (Rogers and Davis, 2014) to create intermediate speech tokens that are a blend of two natural speech signals.

We generated phonetic continua between 10 pairs of letters that differed in one phonetic feature (e.g. 'B' and 'D') and 10 pairs of a letter and a word with the same constraints (e.g. 'B' and 'we').



We pretested identification accuracy for the new tokens in a **two-alternative forced choice task** (N=28). For example, participants judged the identity of an intermediate token constructed of 15% 'B' and 85% 'D'.



We chose letter stimuli with **high** and **low** ambiguity from each continuum, as indexed by predicted probability of a correct response (0.99 for low ambiguity items, 0.9 for high ambiguity).

## PROCEDURE

**36** British English-speaking adults with no history of language disorder completed an auditory letter-span task.

Participants attempted to recall lists of letters in the order that they heard them. 3 conditions were manipulated:

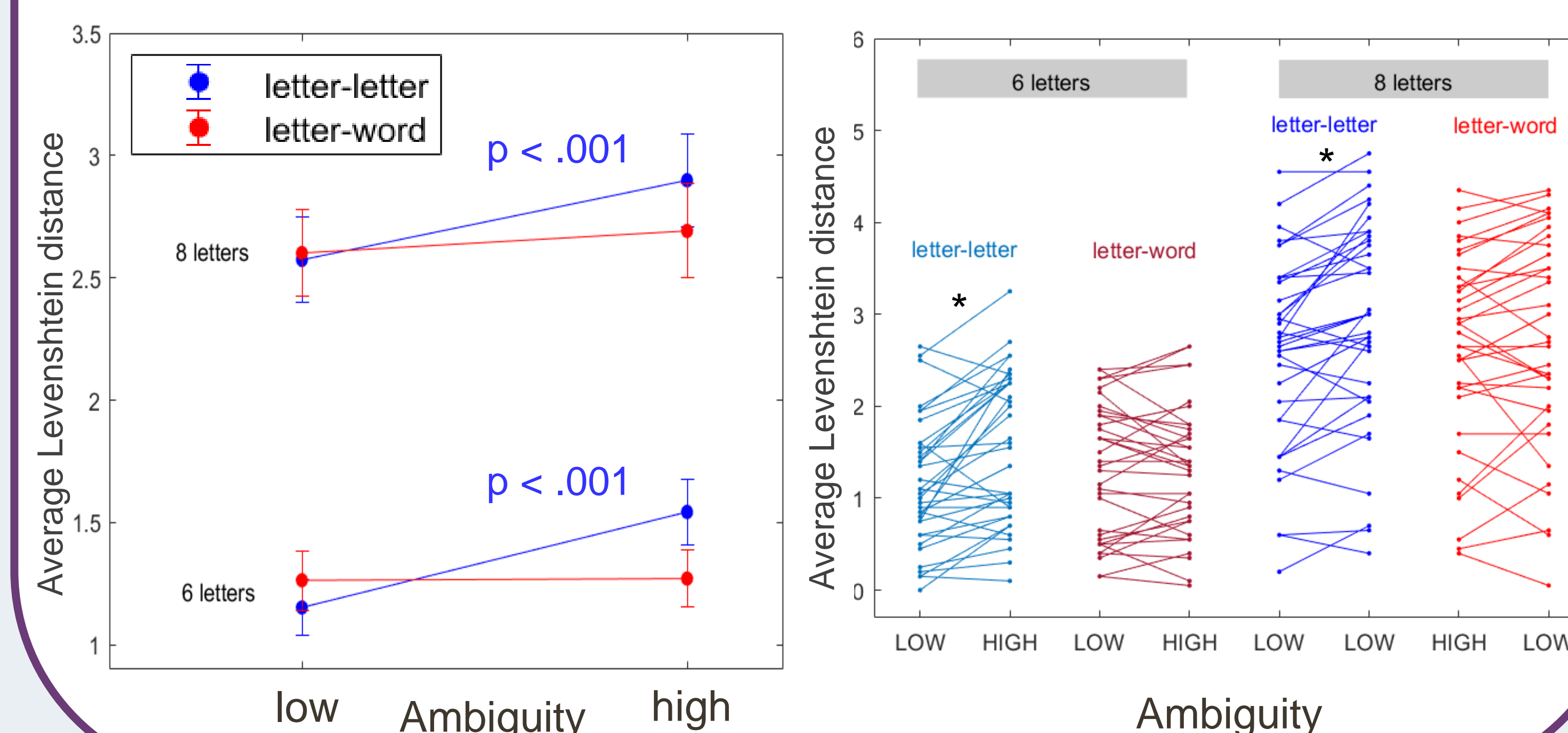
1. 6- or 8-letter lists
2. Letter stimuli with high or low ambiguity
3. Stimuli from letter-word or letter-letter continua

within-subjects

## RESULTS

**Levenshtein distance\***: *a string metric for quantifying the difference between two sequences*

Recall of low-ambiguity sequences was better than recall of high-ambiguity sequences, but only when ambiguous items were drawn from letter-letter continua (2-way interaction).



## CONCLUSIONS

Recall of speech is impaired by phonological ambiguity – but only when ambiguity is task-relevant  
Highlights potential causal pathway from speech perception to phonological task performance.