Individual differences in perceptual adaptation to unfamiliar lexical stress contrast

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Introduction. This study investigates listeners' perceptual adaptability and flexibility to unfamiliar lexical stress contrasts. Listeners exhibit remarkable flexibility in speech perception, rapidly adjusting cue weighting to accommodate unfamiliar patterns of variation in speech input [1, 2, 3]. While previous research has predominantly examined segmental contrasts (e.g., English stop voicing contrast), there has been limited investigation into perceptual adaptability in the context of lexical stress contrasts. This study aims to broaden our understanding of listeners' perceptual adaptability by examining native English listeners' processing of unfamiliar lexical stress contrasts. By taking an individual-differences approach, we specifically investigated how individuals adjust their reliance on a secondary acoustic dimension when a primary dimension is no longer informative in the input signal. This study also investigated whether listeners' reliance on secondary cues measured by a cue-weighting task possibly accounts for individual variability in speech adaptation patterns.

Methods. We selected a stress minimal pair in English, *DEsert* vs. *deSSERT* and created the auditory stimuli continuum consisting of seven equidistance steps of vowel quality and pitch (step 1 being *DEsert*) (Fig. 1) [4]. Native English listeners (n = 66) completed two speech perception tasks: (1) a cue-weighting task (CW) and (2) an adaptation task (ADT). During the CW, listeners listened to each manipulated stimulus and then selected either *DEsert* vs. *deSSERT*. We analyzed individual listeners' responses and calculated beta-coefficients to quantify their initial reliance on the secondary pitch cue before the ADT (i.e., larger coefficients indicate more reliance on pitch). The ADT used only a subset of the manipulated stimuli (Fig. 2). The Baseline blocks included 14 stimuli, containing the full range of vowel quality steps at two different pitch steps (14 stimuli × 7 repetitions). The Exposure block consisted of 4 stimuli of ambiguous vowel qualities and 8 adjacent stimuli (12 stimuli × 18 repetitions). The Exposure stimuli were selected to reduce the informativeness of vowel quality (primary) in speech input and encourage listeners to adapt by increasing their reliance on pitch (secondary). The Baseline and Exposure blocks included the Test stimuli (red square and blue triangle) that were ambiguous in vowel quality. To examine the adaptability in the use of pitch cues, we compared listeners' proportion of *DEsert* responses to the Test stimuli across ADT blocks.

Results. The results of the ADT on a group-level did not find listeners' adaptability to the unfamiliar lexical stress contrast (Fig. 3A). No significant differences were observed between responses to the low and high pitch Test stimuli during the Exposure compare to the Baseline blocks. Yet, we found considerable individual variation in listeners' adaption patterns (Fig. 3B). While some listeners increased their reliance on pitch cues in Exposure compared to Baseline 1, others exhibited minimal change in their reliance on pitch. Notably, a substantial proportion of participants reduced their reliance on pitch (Fig. 3B). The correlation analysis revealed that more reliance on pitch cues in the CW is related to an increase in reliance on those cues in Exposure relative to Baseline 1 during the ADT (r = .49, p = .026) (Fig.4). This relationship was found only among listeners who utilized pitch cues in a canonical manner (identifying higher pitch step stimuli to *deSSERT* and lower pitch step stimuli to *DEsert*) in the CW, not among those who mapped pitch cues in a reversed way (Fig. 4).

Discussion. The current study found that perceptual adaptability to changes in the informativeness of primary and secondary cues in the input signal may not necessarily extend to lexical stress contrasts. However, we found considerable variability in individuals' adaptation patterns to unfamiliar speech. We suggest that this adaptation variability may be to some extent related to individual differences in the initial secondary cue (i.e., pitch) reliance. It should be noted that this relationship may be confined to listeners who canonically map pitch cue information in the input signal in identifying lexical items in stress contrasts.

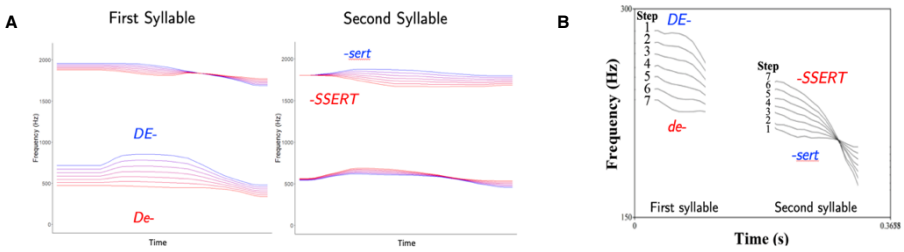

Fig. 1 Illustration of the auditory stimuli manipulation of vowel quality (A) and pitch (B).

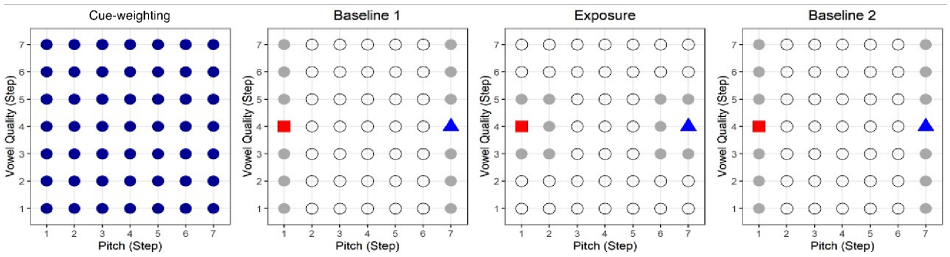

Fig. 2 Illustration of the auditory stimuli for the cue-weighting and the adaptation tasks. Baseline was repeated after Exposure (as in Baseline 1 and Baseline 2).

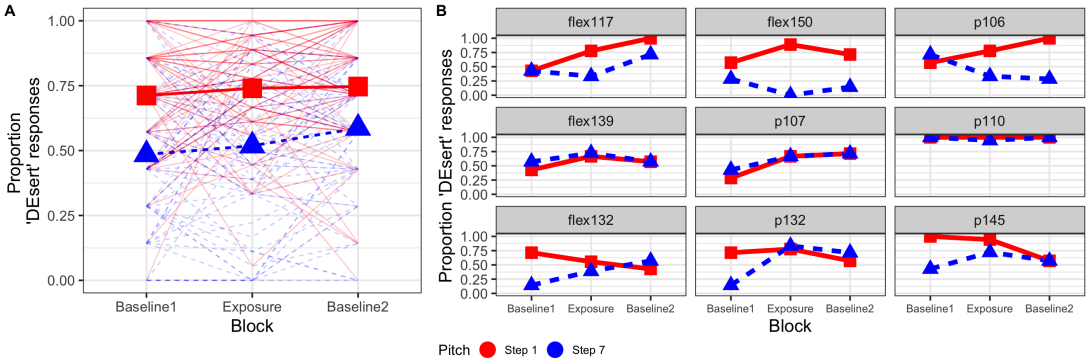

Fig. 3 Participants' responses to the adaptation task (A) and representative participants' responses across blocks for different adaptation patterns (B, top: increased pitch cue use, middle: minimal change in pitch cue use, bottom: reduced pitch cue use).

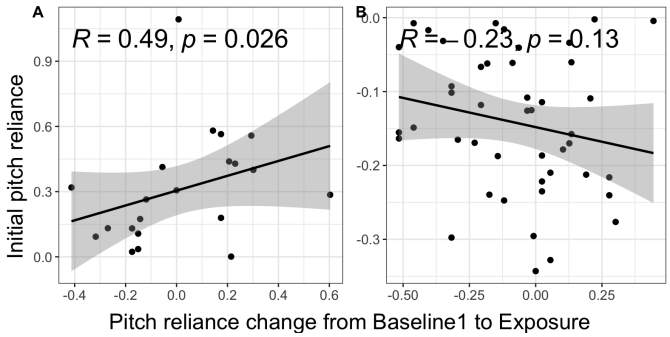

Fig. 4 Relationship between initial pitch cue reliance measured in the CW and change in pitch cue reliance in Exposure relative to Baseline 1 in the ADT. Each dot represents participants with canonical use of pitch in (A) and participants with non-canonical use of pitch in (B).

References

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