

English listeners' perceptual adaptation to unfamiliar lexical suprasegmental contrast

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Introduction. The current study investigates listeners' perceptual adaptation and flexibility to unfamiliar lexical suprasegmental contrast. Listeners are remarkably flexible and rapidly make modifications to accommodate unfamiliar speech patterns in speech perception [1,2,3]. Most prior studies have focused on segmental contrasts (e.g., English stop voicing contrast), whereas listeners' flexibility in the perception of suprasegmental contrasts has been understudied. This study aims to extend the scope of listeners' perceptual flexibility to the suprasegmental contrast by testing native English listeners' processing of unfamiliar lexical stress contrast. More specifically, we encouraged English listeners to adapt to the unfamiliar contrast by increasing their reliance on the secondary dimension (i.e., pitch) and examined individual variability in adaptation patterns (for cue weightings of English stress contrast, see [4,5]). The research questions of this study are as follows: (i) are previously observed listeners' flexible adaptation to unfamiliar segmental contrasts extended to suprasegmental contrasts? (ii) are individual differences in speech adaptation associated with their use of the secondary cue? (iii) are individual differences in speech adaptation and categorical gradience associated with individual listeners' domain-general cognitive abilities (e.g., inhibitory control)?

Methods. Twenty-eight native English listeners completed a Visual Analog Scaling (VAS) task, followed by a language background questionnaire, an adaptation task, a Stroop task (inhibitory control measurement), and a cue-weighting speech perception task. The lexical item used in the VAS, the adaptation, and the cue-weighting tasks was a stress minimal pair in English, *DEsert* vs. *deSSERT* [5]. The vowel quality and pitch of the recorded item were manipulated into seven equidistance steps (step 1 being *DEsert*), respectively. The duration and intensity of the contrast were neutralized across syllables. The stimuli for the Baseline and Exposure of the adaptation task were a subset of the VAS stimuli (Baseline: 14 stimuli with 7 repetitions; Exposure: 12 stimuli with 18 repetitions) (Fig. 1). The Test stimuli (a red square and a blue triangle in Fig. 1) were the most ambiguous step in vowel quality but with canonical steps in pitch.

Results. The results of the VAS task (Fig. 2, left panel) showed extensive individual variabilities, with some being more categorical listeners and others being more gradient listeners. The results of the cue-weighting task (Fig. 2, middle panel) replicated those of earlier studies [4,5] in that English listeners use vowel quality as a primary cue ($\beta = -0.72$, $z = -16.76$, $p < .001$) and pitch as a secondary cue ($\beta = -0.1$, $z = -2.4$, $p < .05$) for perceiving lexical stress contrasts. Notably, for the results of the adaptation task (Fig 2, right panel), the mixed-effects logistic regression model found a marginal interaction of Block (Exposure vs. Baseline 1) \times Pitch ($\beta = 0.54$, $z = 1.95$, $p = .05$), indicating that listeners are more likely to use pitch dimension to process lexical stress contrast in Exposure block more than they did in Baseline 1. Additionally, listeners with higher inhibitory control (i.e., lower Stroop interference) made more categorical responses to the VAS task (Fig. 3, left panel). There was no remarkable correlation between inhibitory control and listeners' response in the adaptation task (Fig. 3, right panel).

Discussion. The current results demonstrate that previously observed listeners' flexibility to unfamiliar speech patterns extends to the lexical suprasegmental contrasts, suggesting that the speech perception system adjusts to the acoustic consequences of changes in the relative informativeness of acoustic dimensions. Although the results of this study are in line with the previous findings, the degree of listeners' flexibility was not large enough as compared to the other studies that examined segmental contrast [1,2,3], presumably due to the nature of the acoustic cues involved in the lexical stress contrasts. Our results also suggest that listeners with higher cognitive abilities to suppress goal-irrelevant information are more likely to process the lexical stress contrasts in a categorical manner. However, listeners' perceptual adaptability may not necessarily be associated with their inhibitory control.

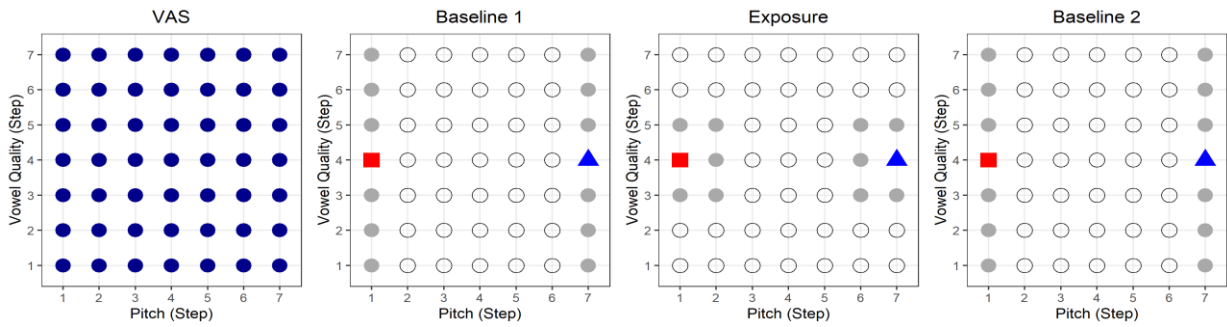


Fig. 1 Illustration of the auditory stimuli of the VAS and the adaptation task

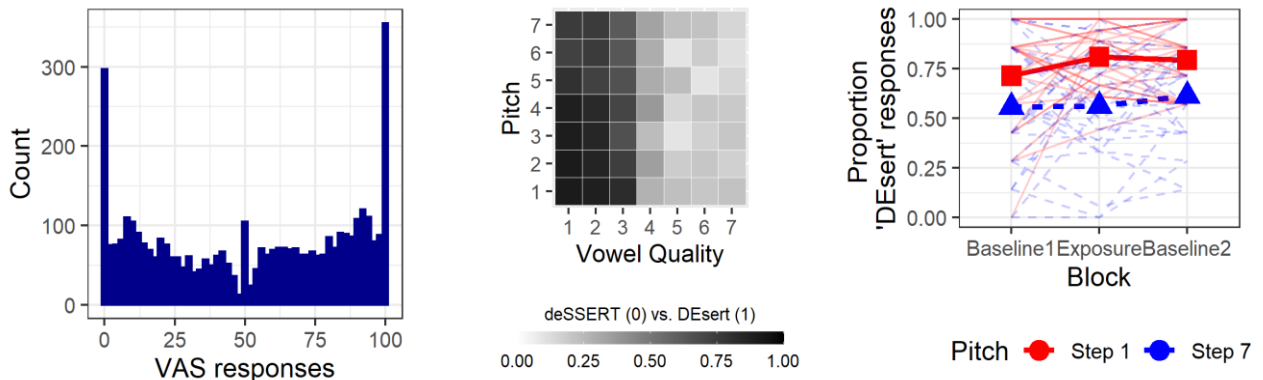


Fig. 2 Participants' responses to the VAS task (left panel), the cue-weighting task (middle panel), and the adaptation task (right panel)

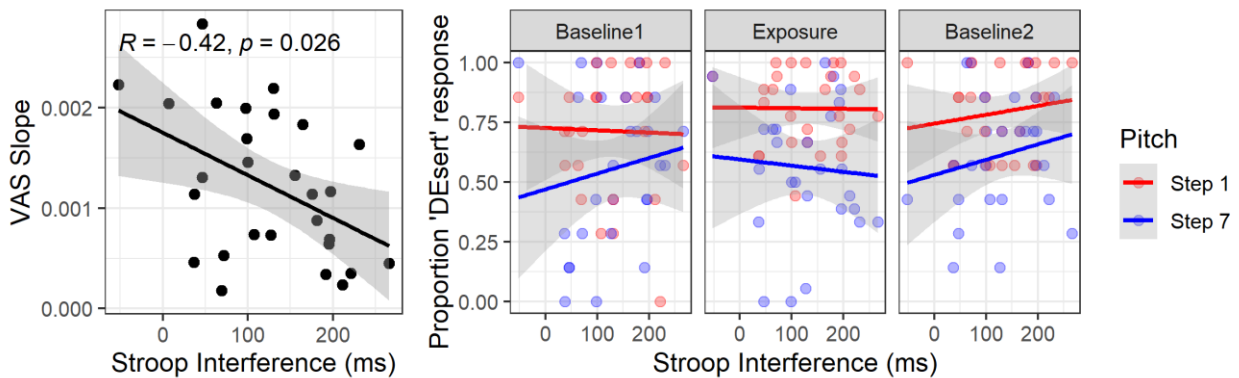


Fig. 3 Relationship between inhibitory control and categorical gradience (left panel) and categorization responses across blocks of the adaptation task (right panel)

References

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