

The roles of cognitive resources and L2 proficiency in L2 perceptual cue weighting

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Second language (L2) learners often have difficulties in differentiating some phonological contrasts, as they may not adopt nativelike strategies of weighing the various acoustic dimensions cuing the phonological identity of L2 sounds. For instance, native speakers of English use spectral quality as the primary cue and duration as the secondary cue in English vowel perception. But L2 English learners may weigh the cues differently; some learners even prioritize the perceptually salient feature of duration, leading to degraded perceptual performance. The L2 cue weighting strategy might be more compromised when the task imposes a high cognitive load on L2 listeners, or when they could not efficiently inhibiting misleading cues. This reasoning had not been directly tested, but was only inferred from the literature on first language (L1) speech perception, where L1 speakers may reduce reliance on primary cues and increase attention to secondary cues when cognitive load rises (e.g., [1]), and where L1 speakers with stronger inhibitory control utilize the primary cue more effectively than those with weaker inhibitory control [2]. Therefore, this study is one of the very few attempts to investigate the influence of cognitive load and inhibitory control on cue weighting in L2 speech perception, and how such influence is modulated by L2 proficiency.

To investigate L2 perceptual cue weighting, we examined the perceptual identification performance of 35 Chinese-English bilinguals (aged 18-24), who were intermediate learners of English from a university in China. The sound contrast was manipulated in spectral quality (7 steps) and duration (5 steps), yielding a 35-step /həd/-/hæd/ continuum. The sound tokens on this continuum were aurally presented to participants, who judged whether a given token was *head* or *had*. Participants performed this identification task under a high-load condition (i.e., completing a secondary task of dot-pattern memorization) and a low-load condition (i.e., no extra task). Also, participants' individual differences in cognitive resources were assessed by a reading span task and a Stroop task. Their L2 proficiency was measured using LexTALE.

The results of mixed-effects modeling with 34 participants (1 outlier participant excluded) revealed that participants generally utilized spectral quality as the primary cue and duration as the secondary cue in vowel identification, and that higher L2 proficiency was associated with increased reliance on spectral quality. Importantly, participants reduced their reliance on spectral quality under the high-load condition compared to the low-load condition. Participants with better inhibitory control prioritized spectral cues when these two cues were conflicted (e.g., /ɛ/-like sounds with long duration), suggesting their higher ability to suppress over-reliance on the misleading secondary cue and to focus on spectral quality. Moreover, the inhibitory control ability modulated the relationship between L2 proficiency and L2 cue weighting – the use of spectral quality was less efficient if participants' proficiency was lower, but this was mainly found for participants with lower inhibitory control ability.

Our study yielded three key findings: 1) As L2 proficiency increases, L2 learners' perceptual cue weighting strategy becomes more nativelike by increasing reliance on the primary cue; 2) L2 learners' use of the primary cue is less effective under high cognitive load; 3) The inhibitory control ability may compensate for low L2 proficiency by enabling L2 learners to allocate attention towards the more informative cue while inhibiting attention towards the less informative cue, particularly when there is ambiguity, hence reducing the discrepancy in cue weighting efficiency between learners of different proficiency levels. These findings shed light on the cognitive mechanisms and individual differences in L2 speech perception, and have pedagogical implications for L2 phonetic training in different learning conditions.

References

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