What causes difficulty in discriminating non-native contrasts: Is it representation or auditory mapping?

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Second language (L2) learners of English often struggle with discriminating phonological contrasts that are non-native to them, such as the vowel pair in *bend* /ε/ - *band* /æ/ [1,2,3]. This learning difficulty may stem from two possible sources. First, at the *representation* level, learners might fail to establish distinct phonological representations for the two sounds. Second, the difficulty may arise during the *mapping* process, where learners do have two distinct representations but find it hard to map given auditory signals to one of these representations.

Examining responses to auditory stimuli cannot elucidate whether the observed difficulty arises at the representation level or during the mapping process, because data from such experiments inherently result from *mapping* auditory signals to *representations*. An alternative method is to directly tap into the activation of phonological representations without auditory signals. Previous studies have demonstrated that visual recognition of L2 words and their lexical representations is influenced by phonological factors (e.g., [4,5,6]). Therefore, the present study aims to identify the source of this discrimination difficulty by investigating phonological priming effects of near-homophones (minimal pairs on non-native contrasts) during L2 visual word recognition.

Two masked priming experiments were conducted, wherein Korean learners of English judged the wordness of visually presented text strings (e.g., *bend* vs. *hade*). Forty-eight target words (e.g., *bend*) were preceded by a brief presentation of a prime stimulus falling into four types (see Table 1): an identical word (*bend*), a near-homophone of the target word (*band*), forming a minimal pair with the target on one of four phonological contrasts that are absent in Korean, an orthographic control (*bond*), which is orthographically similar to but phonologically distinct from the target, and an unrelated nonword (*trom*). Prime stimuli were presented for 60 ms in Experiment 1 (62 participants) and for 150 ms in Experiment 2 (50 participants). Participants also completed a forced-choice identification task on another set of stimuli (e.g., *set-sat*), as a measure of their ability to discriminate contrasts in auditory words.

Reaction times (RT) to target words in the two experiments are illustrated in Figure 1. Linear mixed-effects regression analyses on logged RT showed that, in both experiments, identical prime words yielded a significantly faster RT than unrelated prime words did (β = -0.12, SE = 0.03, t = -8.80, $p < 0.001$ for Exp 1; β = -0.14, SE = 0.03, t = -9.06, $p < 0.001$ for Exp 2). When the two conditions with orthographically similar primes (near-homophones and orthographic controls) were together compared to the unrelated condition, a significant difference in RT was found in Experiment 1 (β = -0.04, SE = -0.01, t = -3.09, $p = 0.002$) but not in Experiment 2, suggesting that orthographic information of visually similar primes facilitated target word recognition at a relatively early stage of lexical processing. The two experiments also yielded different results in the comparison between the near-homophonic primes and orthographic controls. The result of Experiment 1 indicated no additional priming effect of near-homophones compared to orthographic controls. However, Experiment 2 showed faster RT on target words when a near-homophonic prime word was preceded compared to an orthographic control (β = -0.04, SE = 0.02, t = -2.61, $p = 0.009$), demonstrating a near-homophone effect [5,6]. There was no significant interaction between prime conditions and participants' identification scores.

When compared to the literature on phonological priming effects in monolingual word recognition (e.g., [7,8]), these results indicate that L2 learners use phonological codes of words relatively slowly during visual word recognition than native speakers do. Moreover, the results of Experiment 2 suggest that regardless of their abilities to identify auditory words containing a non-native contrast, the L2 learners employed a single phonological representation to encode phonetically similar pairs that are non-contrastive in their native language. Our findings provide evidence supporting the view that the perception difficulty regarding non-native contrasts mainly occurs at the representation level, as learners fail to establish distinct phonological categories for the target sounds.

Table 1. Experiment conditions and example stimuli

Target pair	Target word	Prime			
		Identical	Near-homophone	Orthographic control	Unrelated nonword
/ɛ/-/æ/	*bend*	*bend*	*band*	*bond*	*trom*
/i/-/ɪ/	*feel*	*feel*	*fill*	*fail*	*vorm*
/l/-/ɹ/	*road*	*road*	*load*	*toad*	*guse*
(word-final) /d/-/t/	*made*	*made*	*mate*	*maze*	*polt*
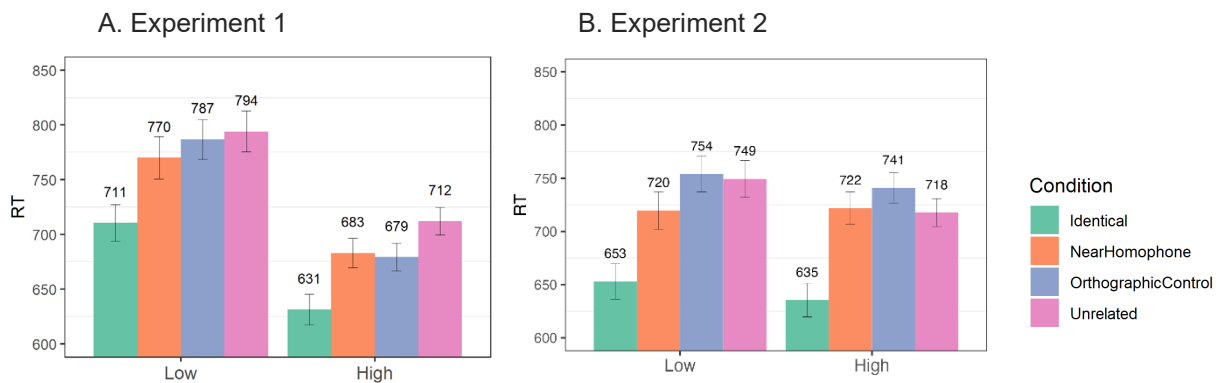
Figure 1. Reaction times (RT) in msec to target words in four prime conditions, grouped by the identification task scores of the participants (Low vs. High).

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