

Effects of lexical status and competition on the production of voicing contrasts in Japanese: An experimental study

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Phonetic realization of phonological contrasts is influenced by lexical effects such as word frequency/familiarity and presence of lexical neighbors/competitors. For example, VOT in word-initial voiceless stops is longer when a voiced minimal-pair competitor exists than when it does not [1,4], resulting in phonetic enhancement of the contrast. Likewise, high-frequency words undergo greater phonetic reduction than do low-frequency words [3,5]. However, lexical effects are not consistent across contexts; they are absent for voiced stops which have shorter VOT, and reversed for word-final stops [6]. Moreover, lexical effects may not be consistent across languages either. To investigate this, the present study focuses on Japanese, whose voiceless stops have shorter VOT, thus potentially leaving little room for lexical effects. A corpus-based study on spoken Japanese suggested that lexical effects do not affect VOT but instead affect the following vowel duration [7]. The present study asks whether a similar null result for VOT along with an effect on neighboring segment duration is observed in a more controlled lab speech setting.

A speech production experiment was conducted following the design of Celata et al. [4]. Target stimuli were organized into quadruplets of noun minimal pairs contrasting in word-initial /k/ vs. /g/ (Table 1). Velar stops were used because they formed many minimal pairs without allophonic variations. Each quadruplet consisted of one real-word pair, e.g. *kara* “emptiness” vs. *gara* “pattern”, one nonword pair, e.g. **kapa* vs. **gapa*, and two minimal pairs containing a real word and a nonword, e.g. *kana* “Japanese syllabary” vs. **gana*, and **kaka* vs. *gaka* “artist”. Items that were paired with real words were said to have a lexical competitor, half of which were real words (*kara*, *gara*) and half were nonwords (**gana*, **kaka*). Likewise, items that were paired with nonwords were said to have no competitor, half of which were real words (*kana*, *gaka*) and half were nonwords (**kapa*, **gapa*). Along with these unaccented items, a quadruplet with initially accented items were included. This design enabled orthogonal manipulation of lexical status (real word vs. nonword) and competition (with vs. without competitor). Native Japanese college students (n = 32) each produced two repetitions of eight target items interspersed with filler items. Minimal pairs were split into separate lists so that each speaker produced only one member of each pair. VOT of the word-initial stop and duration of the following vowel were measured using Praat [2], and analyzed using mixed effects models with lexical status and competition as fixed factors and by-subject intercept as a random factor. Separate analyses were conducted for voiced and voiceless stops.

VOT results for word-initial /k/ (Figure 1(a)) revealed a significant interaction between word status and competition. Nonwords showed a shorter VOT when they had a competitor than when they did not, while real words showed no such difference. In contrast, VOT for word-initial /g/ showed no significant lexical effects. As for vowel duration (Figure 1(b)), vowels following /k/ and /g/ both showed a significant word-status-by-competition interaction. Real words showed a longer vowel duration when they had a competitor than when they did not, while nonwords showed no such difference.

Taken together, VOT results from the present study are similar to those reported in English [1,6] in that lexical effects are observed in voiceless but not voiced stops. However, the direction of the effect for voiceless stops is opposite; that is, VOT is reduced in Japanese, while it is enhanced in English, when the word has a lexical competitor, suggesting that lexical effects do not always

work to enhance lexical contrasts. In addition, a novel result reported here about Japanese is that lexical effects on voicing contrasts systematically affect the following vowel duration (cf. [7]), suggesting that lexically conditioned phonetic variation is not localized to particular segments that directly participate in the lexical contrast. Further work is needed to determine whether lexical effects potentially span whole words, and how widely the effects differ across languages.

Table 1. Sample quadruplet of minimal pairs. Each pair consisted of either real words or nonwords. Following each word, (y) indicates that the word has a real-word minimal-pair competitor, and (n) indicates that it does not have such a competitor.

voiceless		voiced	
real word	nonword	real word	nonword
kara (y)		gara (y)	
	*kapa (n)		*gapa (n)
kana (n)			*gana (y)
	*kaka (y)	gaka (n)	

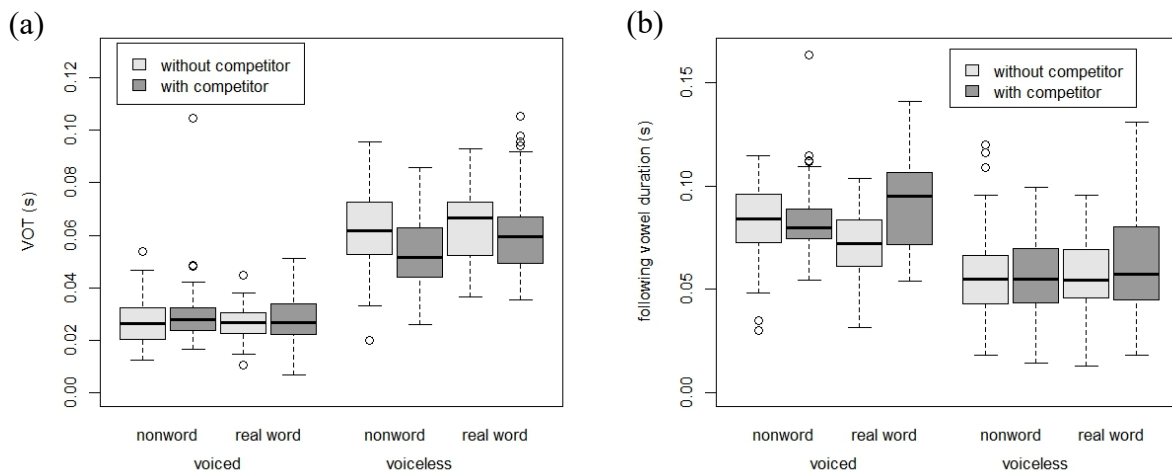


Figure 1. Boxplots of VOT (panel (a)) and following vowel duration (panel (b)) for voiced and voiceless stops as a function of word status and competition.

References

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