

The influence of phonemic vowel length on the voicing effect

Rebeka Campos-Astorkiza, University of Southern California, rebekaca@usc.edu

This study explores the influence of phonemic vowel length on the realization of the voicing effect, i.e., the phonetic process by which vowels tend to be longer before voiced obstruents than before voiceless ones. The aim of this paper is to experimentally test whether the presence of phonemic vowel length in a language attenuates the degree of the voicing effect. In general, the experimental results contribute to the understanding of the influence of phonemic contrasts on phonetic realization and point to the role of minimal contrast in the phonological representation.

The literature on the voicing effect has identified a number of factors that influence the degree of this effect. These include word size, inherent vowel duration, place of articulation and syllabic affiliation of the obstruent, stress, speech rate, and position of the word in the utterance (Hussein 1994). Furthermore, there is another group of language-specific factors: the voicing contrast precise realization (Kohler 1984), the language rhythm (Port et al. 1980) and the presence of phonemic vowel length (Keating 1985). The hypothesis about the influence of phonemic vowel length has been previously discussed but there appear to be no published reports of experiments to test this claim.

To test the hypothesis that the presence of phonemic vowel length attenuates the voicing effect, it is necessary to isolate phonemic vowel length from other possible conditioning factors. This can be done by testing a language where length is contrastive for a subset of its vowel qualities, i.e., a language that has some *unpaired* vowel for the long-short contrast. The prediction is that the vowel without a short/long counterpart will exhibit a stronger voicing effect than vowels part of a long/short contrast. Lithuanian shows such an asymmetrical system. Lithuanian mid vowels lack a contrast for duration; they are always long. Morphological alternations support the long/short relationship within the high and low vowels.

Table I. Lithuanian vowel inventory

	Front	Back
High	/i/ /i:/	/u/ /u:/
Mid	/e:/	/o:/
Low	/ɛ/ /æ:/	/a/ /ɑ:/

Thus, the hypothesis is that the voicing effect will be greater for /e:, o:/ than for the other vowels. This reflects the idea that the presence of phonemic vowel length attenuates the voicing effect. Acoustic data from native speakers of Lithuanian was collected. The stimuli consisted of bisyllabic non-sense words of the shape CV₁C₁C₂V, where V₁ could be any of the Lithuanian vowels and the sequence C₁C₂ was either /kʃ/ or /gʒ/. The results show that the difference in vowel duration before voiced obstruents and before voiceless ones, i.e., the voicing effect, is greatest for /e:/ and /o:/ (p<.05), compared to the other vowels.

Our experiment concludes that the vowels unpaired for length (/e:, o:/) are more impacted by the voicing effect. Vowels with a long/short counterpart are influenced to a lesser degree. This supports the hypothesis that the presence of phonemic vowel length attenuates the voicing effect. More generally, this conclusion provides evidence for the influence of phonemic contrast on phonetic realization, previously discussed in relation to coarticulation (Manuel 1999) and the cues to stress (Berinstein 1978). Furthermore, the asymmetrical Lithuanian system suggests the importance of minimal contrast in the phonological representation. If a vowel differs from another vowel only in length, then it minimally contrasts for length. Our experiment shows that vowels minimally contrastive for length behave differently from vowels that do not minimally contrast for length (i.e. /e:, o:/).