

Do nonwords induce convergence?

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English speakers, after hearing model speech including words beginning with a voiceless stop with longer voice onset time (VOT), lengthen their own VOT (e.g., [1, 4]). This convergence effect, or a change towards the model speech, is not limited to the words of exposure but extended to the unheard words sharing the same phoneme [3, 4]. Also, the convergence effect is influenced by lexical frequency: low-frequency words show a stronger convergence effect than high-frequency ones [1, 4]. The current study aims to investigate whether shadowing nonwords induces the convergence effect in real words, and whether lexical frequency influences the degree of convergence induced by nonwords. Specifically, will speakers produce longer VOT of real words after shadowing nonwords with longer VOT? If so, will the frequencies of the real words, not those of the nonwords being shadowed, influence how much the speakers lengthen the VOT?

To answer these questions, 24 monolingual speakers of American English were tested in an imitation experiment consisting of warm-up, baseline, shadowing, and test blocks. In both the baseline and test blocks, the participants read 40 English words beginning with /p/ mixed with sonorant-initial fillers. Half of the /p/-initial words were of high-frequency (above 50 per million in [2]), while the other half were low (below 5). Between the baseline and test blocks was the shadowing block, in which the participants heard and shadowed 20 nonwords beginning with /p/ with extended VOT along with 10 sonorant-initial fillers (See Table 1). All nonwords conformed to English phonotactics and spelling regulations and were judged to be possible English words by five native speakers. A phonetically-trained male American English speaker recorded these nonwords from the phonetic transcriptions. The VOTs of initial /p/ were then extended by 60 ms, by splicing the medial portions of the aspiration. The mean VOT for the initial /p/ after manipulation was 119.22ms. During the shadowing block, each nonword was repeated 8 times.

pawk [pɔk]	pabdent [ˈpæbdənt]	pattet [ˈpærət]	penogy [ˈpɛnədʒi]	lach [lɔk]	mola [ˈmɒlə]
poice [pɔis]	pabo [ˈpabo]	paygam [ˈpeɪgəm]	perjetal [ˈpɜːdʒətəl]	mult [mʌlt]	ranent [ˈrænənt]
pon [pɔn]	pantot [ˈpæntət]	pidlic [ˈpɪdlɪk]	pertaflast [ˈpɜːrəflæst]	waire [weɪr]	raser [ˈreɪzə]
poud [paʊd]	parswer [ˈpɑːsə]	pustle [ˈpʌsl]	polybid [ˈpɒlibɪd]	labot [ˈleɪbət]	atrulence [ˈætʃʊləns]
pude [pud]	passock [ˈpæsək]	pysin [ˈpaɪsɪn]	pomsanal [ˈpɒmsənəl]	mader [ˈmeɪrə]	irribent [ˈɪrɪbɛnt]

Table 1. The orthography and phonetic transcriptions of the nonwords.

To analyze the degree of convergence in VOT, the percent increase in the VOT between the baseline and test utterances was calculated, as well as the percent increase in duration of the rest of the word (REST). This was to determine whether the increase in VOT, if any, was specific to VOT (evidence for phonetic convergence), or due to overall change in the speech rate. The percent increase, then, was statistically analyzed with a mixed-effect linear regression model. The predictors were Word Part (VOT or REST), Lexical Frequency (High or Low), and their interaction. The results showed that the interaction was not significant [$\beta = 0.99$, $t(1767) = 0.39$,

$p = 0.70$]. The effect of Word Part was significant: the increase in VOT was greater than that in REST [$\beta = -12.30, t(32) = -3.45, p = 0.002$], suggesting that the speakers produced longer VOT after shadowing the nonwords (Fig. 1). The effect of Lexical Frequency, however, was not significant [$\beta = -0.47, t(24) = -0.34, p = 0.74$], suggesting that words of high or low frequency did not differ in terms of how much they change (Fig. 2).

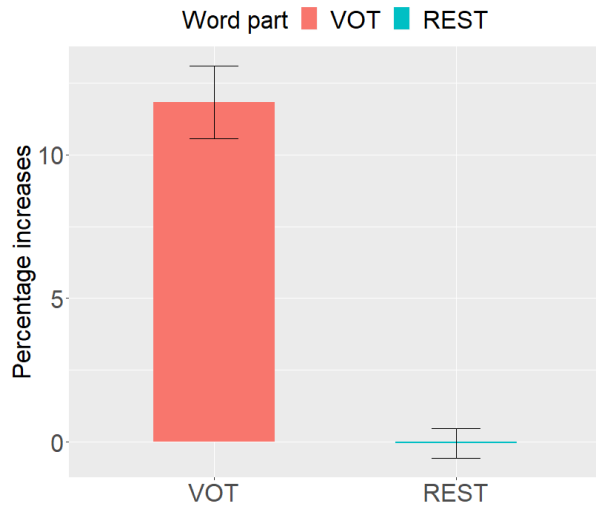


Figure 1. Mean duration changes from the baseline to the test blocks with the error bars representing 95%CI

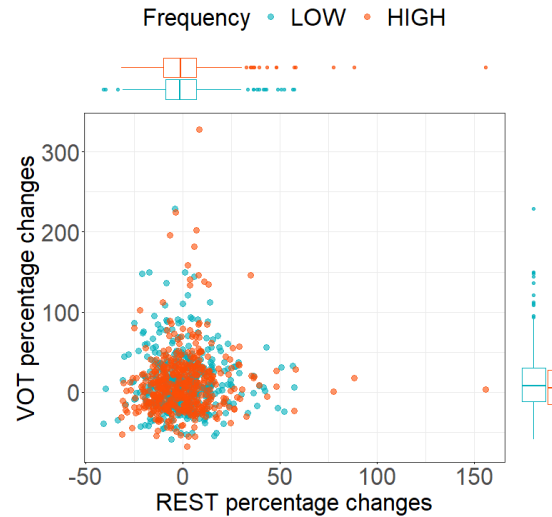


Figure 2. Lexical frequency’s influence on both VOT and REST percentage changes

In conclusion, the current findings indicate that shadowing nonwords with a specific phonetic pattern (extended VOT, in this study) induces convergence effects in subsequent productions of real words. This corroborates the previous findings [3, 4], suggesting that the process of phonetic convergence involves abstract linguistic representations, such as the phoneme /p/ or the feature [-voice]. The abstract representations allow the real words to change after shadowing the model speech that did not contain real meaningful words. Lexical frequency of the real words being produced did not influence the degree of convergence induced by nonwords, all of which had the same frequency of exposure (8 repetitions). This arguably suggests that the lexical frequency influences the degree of convergence only when it is tied to the words being heard or shadowed.

Selected references

- [1] Goldinger, S. D. (1998). Echoes of echoes? An episodic theory of lexical access. *Psychological review*, 105(2), 251-279.
- [2] Kučera, H., & Francis, W. N. (1967). *Computational analysis of present-day American English*. Dartmouth Publishing Group.
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- [4] Nielsen, K. (2011). Specificity and abstractness of VOT imitation. *Journal of Phonetics*, 39(2), 132-142.