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Publication date

2019

Document Version

Final published version

Published in

Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019

[Link to publication](#)

Citation for published version (APA):

Horslund, C. S. (2019). VOT in loanwords in Finnish: Evidence for prevoicing of initial /b, d, g/. In S. Calhoun, P. Escudero, M. Tabain, & P. Warren (Eds.), *Proceedings of the 19th International Congress of Phonetic Sciences, Melbourne, Australia 2019: ICPHS2019 : 5-9 August 2019, Melbourne Australia* (pp. 1605-1609). Australasian Speech Science and Technology Association Inc.
https://assta.org/proceedings/ICPhS2019/papers/ICPhS_1654.pdf

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VOT IN LOANWORDS IN FINNISH – EVIDENCE FOR PREVOICING OF INITIAL /b, d, g/

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ABSTRACT

This study examines Voice Onset Time (VOT) in Finnish /b, d, g/ and /p, t, k/ in initial position. The study aims to investigate whether a contrast is observed between phonological voiced (borrowed) stops versus voiceless (native) stops in initial position, and if so whether it is manifested as a phonetic VOT contrast. The status of /b, d, g/ and especially of the borrowed /b, g/ has been the topic of some debate, but not many empirical studies on the phonetic properties of these phones exist. This exploratory study shows that young speakers with knowledge of English and (Fenno-)Swedish show a tendency of prevoicing /b, d, g/. Prevoicing the /b, d, g/ series could stem from influence from (Fenno-)Swedish or simply from the need to keep /b, d, g/ separate from the native voiceless unaspirated /p, t, k/ series.

Keywords: Voice Onset Time, loanwords, Finnish, plosives, language contact.

1. INTRODUCTION

The consonant inventory of Finnish contains the native phonemes /p, t, d, k, m, n, ŋ, l, r, s, v, j, h/ and the borrowed phonemes /b, g, f, j/ [7]. The present study is concerned with the Voice Onset Time (VOT) in the two stop series /b, d, g/ and /p, t, k/. The aim is to investigate whether a contrast is observed between phonological voiced (borrowed) stops versus phonologically voiceless (native) stops in initial position, and if so whether this contrast is manifested phonetically as a VOT contrast.

The phonemes /b, g/, which occur in recent loanwords only [3], are regarded as “foreign” by native speakers of Finnish and often substituted by /p, k/ respectively [7]. The phoneme /d/ is regarded as more “native” than /b, g/ but is still considered “strange” and often not pronounced or replaced by /t/ or /r/ in casual speech [7]. Historically, /d/ derives from the voiced dental fricative /ð/. The use of the grapheme <d> in the standardisation of Finnish orthography, which was led by the Swedish elite, who pronounced /ð/ as [d], may have played a role in the change from a fricative to a stop [3].

In native words, the phonological distribution of /d/ is limited to medial position where /d/ primarily occurs as the weak grade of /t/ in morphophonological alternations [3]. The marginal role of /d/ is reflected in first language acquisition. Cross-linguistically, /d/ is typically acquired early due to ease of articulation, but in Finnish, /d/ is among the last consonants to be acquired [7, 8]. In initial position, /b, d, g/ only occur in recent loanwords [14]. In older loans, /d/ was replaced with /t/ and spelled with <t>, e.g. *tilli* from Swedish *dill* (dill) [16]. Examples such as *penkki* from Swedish *bank* (bench) suggest that this may have been a general way of incorporating loanwords that contain voiced stops in the source language.

The functional load is low for /b, d, g/, and interestingly, lower for the native /d/ than for the borrowed /b, g/ [17]. Suomi, Toivanen & Ylitalo [16] note that speakers who have /d/ in their inventory do not necessarily also have /b/ or /g/. The borrowed stops /b, g/ are most common among young, well-educated speakers who live in urban areas and speak a foreign language containing a laryngeal contrast for stops, such as English or Swedish. Furthermore, /b, d, g/ are mostly used when speaking slowly in a formal register [16].

The /p, t, k/ series are voiceless unaspirated with a weak release burst [16]. Despite the fact that /t/ is typically voiceless while /d/ is typically voiced, the /t/-/d/ contrast is not a simple voicing contrast. /t/ is a laminal dentalveolar [t̪], whereas /d/ is an apical alveolar [d̪]. Moreover, /d/ has very short occlusion and can be categorized as something in-between a flap and a plosive [16]. Ogden [10] argues that occlusion duration may be the primary cue to the /t/-/d/ contrast in medial position, whereas Hänninen [5] and Suomi, Toivanen & Ylitalo [16] argue that the primary difference between Finnish /t/ and /d/ is in place of articulation.

According to a small study of one speaker from Tampere by Brown & Koskinen [3], VOTs are consistently negative for /b, d, g/ and positive for /p, t, k/. The only example provided is the contrast between *taite* (fold) and *taide* (art), so it is unclear whether all stops in this study were medial. The present study extends our knowledge of the phonetic properties of the Finnish plosives by examining 11 speakers' VOTs in /b, d, g/ and /p, t, k/ in initial

position, where /d/, as well as /b, g/, only occurs in recent loanwords.

2. METHODS

11 native speakers of Finnish (11 F, mean age = 25.1 years) participated in the study. They lived in and around Jyväskylä, Central Finland. All speakers were current or former university students and had learned at least English and Swedish in school and most of them also German and/or another foreign language.

The recordings were elicited by means of a self-paced picture naming task. The participants were not informed about the focus of the study. Instead, they were told that the study was on picture recognition. Speakers were recorded individually in a silent room at Jyväskylä University and were compensated with lunch coupons or a movie ticket.

Sixteen pictures were presented on a computer screen in random order. Eight pictures depicted a loanword beginning with one of the voiced stops /b, d, g/, two nouns for each stop. Five pictures depicted nouns beginning with /p, t, k/. The remaining pictures, which worked as fillers, depicted loanwords and native words beginning with other consonants or a vowel.

The pictures did not always elicit the expected word. For example, the picture depicting a bulldog was expected to elicit the loan *doggy*, but none of the speakers said *doggy*. Two speakers said *bulldog* and the remainder said *koira* (dog). Productions were included in the analysis, in so far as the produced word started with a plosive.

VOTs were measured manually in Praat [2]. Figures 1 and 2 show a prevoiced *banaani* token and a voiceless *banaani* token, respectively. Two tokens had to be removed due to background noise and one due to an instance of creaky voice that made reliable VOT measurement impossible. Table 1 presents an overview over the tokens in the final dataset.

Table 1: Number of tokens, by word and plosive.

/b/	24	/p/	28
banaani	11	purjevene (sailboat)	7
baletti	8	pyramidi	10
ballarina	3	poliisi	11
bulldog	2		
/d/	10	/t/	11
dalmatialainen	10	tennis	11
/g/	17	/k/	20
gondoli	8	kissa (cat)	11
golf	10	koira (dog)	9

Figure 1: *Banaani* with negative VOT (-75 ms).

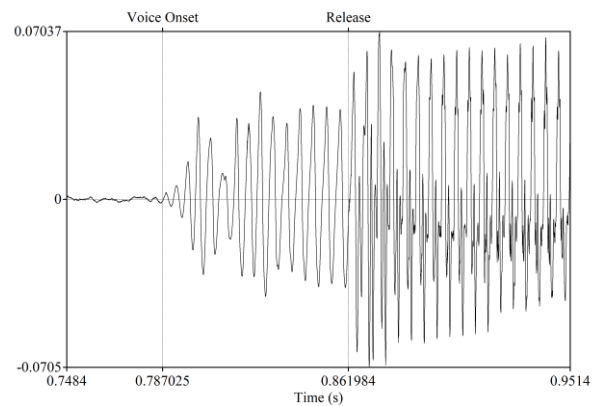
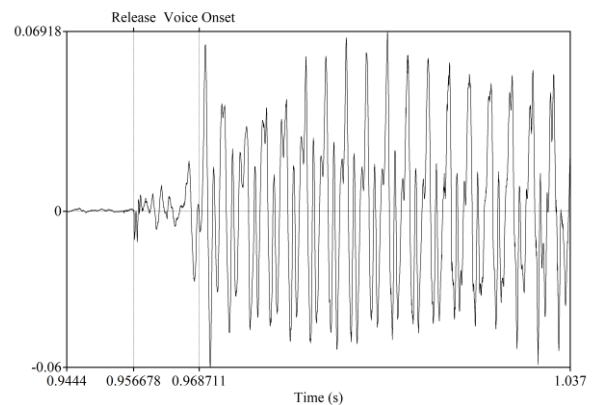


Figure 2: *Banaani* with positive VOT (12 ms).



3. RESULTS

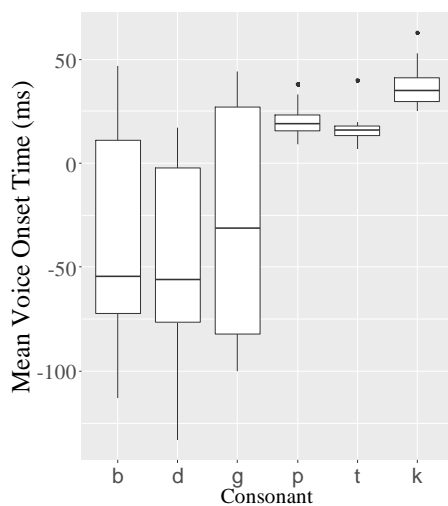
As expected, all voiceless stops had positive VOTs. The grand mean (see Table 3) is negative for all voiced stops, suggesting a tendency for prevoicing of /b, d, g/, but there is considerably more variation in VOT for /b, d, g/ than for /p, t, k/ (see Figure 3), and not all voiced stops have negative VOTs.

The data was subjected to a linear mixed effects model in R [12] with the help of the lme4 package [1]. The model had an interaction term between the two fixed effects *phonological voicing* and *place of articulation* and a maximum random effects structure (random intercepts for *word* and *speaker* and random speaker-slopes for the fixed effects and their interaction). Differences in VOT between voiced and voiceless stops and between different places of articulation were tested by means of orthogonal contrasts. Table 2 shows an overview over the statistics of this model, and the model formula was:

```
lmer (VOT ~ Voicing * Place + (1|Word)
+ (Voicing * Place|Speaker))
```

The model showed a significant difference in VOT between the phonologically voiced stops and the phonologically voiceless stops ($p = 0.001$), suggesting that VOT is generally lower for the /b, d, g/ set than for the /p, t, k/ set. The model moreover showed a significant VOT difference between coronals and dorsals ($p = 0.004$), while labials did not differ significantly from the average of the other two places of articulation. These results suggest that when controlling for the effect of phonological voicing, VOT is generally lower for coronals than for dorsals. The interaction between place of articulation and phonological voicing was not significant.

Figure 3: Boxplot of VOT for each plosive.



While there is an overall tendency for prevoicing in the phonologically voiced stops, there is some degree of variation between and within speakers (see Table 3). Four speakers (HO, IMR, JI, ML) consistently prevoiced the voiced stops, three speakers (MPL, SM, TK) consistently produced the voiced stops with positive VOTs, and the remaining four speakers

Table 2: Estimates, standard errors, 95% confidence intervals, t -values, and p -values (confidence intervals and p -values based on profile) for the mixed effects model testing the effects of phonological voicing and place of articulation on VOT. Significant differences (at the 0.05 level) are highlighted in light grey.

	Estimate (ms)	Std. Error (ms)	95% Confidence interval (ms)	t	p
Effect of Voicing	56	13.6	+28 ... +83.6	4.129	0.001
Coded as + 1/2 voiceless – 1/2 voiced					
Effect of Place (Labial vs. Coronal & Dorsal)	5.8	4.9	-4.3 ... +16	1.183	0.236
Coded as -2/3 labial + 1/3 coronal + 1/3 dorsal					
Effect of Place (Coronal vs. Dorsal)	26.6	7.3	+10.7 ... +41.6	3.658	0.004
Coded as -1/2 coronal + 1/2 dorsal					
Voicing * Place (Labial vs. Coronal & Dorsal)	3.7	10	-16.7 ... -24.6	0.368	0.701
Voicing * Place (Coronal vs. Dorsal)	-12.542	15.274	-46 ... -18.8	-0.821	0.407

(ELH, EH, MPR, SL) prevoiced some tokens but not others. One of these speakers (SL) prevoiced /d/ but not /b, g/, but note that there is only one /d/ token per speaker, so this observation may not reflect a systematic pattern. Of the three other speakers, who all showed variation within the categories of /g/ and /b/, two prevoiced /d/ (MRP, EH).

Table 3: Mean VOT by consonant and speaker.

Mean Voice Onset Time (ms)						
Speaker	b	d	g	p	t	k
ELH	-63	8	22	15	17	32
EH	-64	-116	-22	17	19	33
HO	-71	-79	-86	12	11	57
IMR	-76	-69	-92	21	17	35
JI	-63	-33	-35	20	14	37
ML	-83	-133	-79	15	7	40
MPL	12	8	27	18	16	29
MPR	-27	-54	-6	33	14	31
SL	13	-58	41	24	13	46
SM	34		41	23	40	37
TK	15	17		18	20	34
Across speakers	-37	-51	-23	20	17	37
Min	-113	-133	-100	9	7	25
Max	47	17	44	38	40	63

4. DISCUSSION

This exploratory study examined Voice Onset Time in Finnish /b, d, g, p, t, k/ in 11 young speakers and found a tendency for prevoicing in the /b, d, g/ series, which replicates the findings from the one-speaker study by Brown & Koskinen [3]. The present study also found a tendency for VOTs to be lower in coronals than in dorsals, which corroborates the well-established fact that VOTs are generally longer for velars than for anterior plosives [4, 9].

The mean VOTs obtained in the present study for /p, t, k/ (see Table 3) are slightly longer than the values Suomi [15] reported (9 ms for /p/, 11 ms for /t/, and 20 ms for /k/). These longer positive VOT values may reflect recent changes in Finnish towards more aspiration of the /p, t, k/ series, which could be due to influence from English.

The observed difference in VOT between /b, d, g/ and /p, t, k/ amongst the speakers of the present study supports prior research [16] regarding the socio-demographics of the use of the borrowed phonemes. The speakers examined here were all young and well-educated (or on their way to become so), lived in an urban area (Jyväskylä) and spoke at least two foreign languages containing /b, g/ and initial /d/ (English and Swedish). They thus fall within the socio-demographic group most likely to produce a contrast between /b, d, g/ and /p, t, k/ and some of them do. Four speakers showed a consistent contrast in VOT, three speakers showed a consistent lack of contrast in VOT and four speakers exhibited a contrast in some instances but not in others.

Prior research [16] has found that the borrowed phonemes are more likely to be used in slow speech and formal registers. This study aimed to create a situation that would encourage the use of borrowed phonemes without directing participants' attention to these phonemes. The picture naming task was self-paced, so participants were able to control their speaking rate, and it can be argued that experimental setups generally call for some degree of formality.

When /b, d, g/ were pronounced differently from /p, t, k/, /b, d, g/ were prevoiced, suggesting that the phonological voicing contrast is being manifested in Finnish as a phonetic contrast between prevoiced stops and voiceless, unaspirated stops.

Despite the recent increase in English loanwords in Finnish [11], this implementation of initial /b, d, g/ as prevoiced cannot be attributed to influence from English, since these stops are voiceless unaspirated in English [9], much like the Finnish /p, t, k/ series. Influence from (Fenno-)Swedish, however, may account for the use of prevoicing, since /b, d, g/ are prevoiced in both Standard Swedish [6] and Fenno-Swedish [13]. Fenno-Swedish is a minority language spoken by approximately 5.1% of the Finnish population, who live primarily along the coast [13], so the exposure to Fenno-Swedish in the area around Jyväskylä should be at a minimum. However, due to the official status of Fenno-Swedish, Swedish has been a compulsory school subject since the 1970s [13], and all participants of the present study reported having learned Swedish in school.

The finding that the Finnish realization of /b, d, g/ resembles that of (Fenno-)Swedish more than that

of English need not be due to a stronger or longer influence from (Fenno-)Swedish, but may simply be the result of the need to maintain a contrast with the /p, t, k/ series. Since English /b, d, g/ are voiceless unaspirated just like Finnish /p, t, k/, an English-inspired pronunciation of /b, d, g/ would not create a contrast with /p, t, k/ in Finnish. It is of course possible to aspirate /b, d, g/ in order to create a contrast with /p, t, k/, but while that would result in a series of unaspirated stops and a series of aspirated stops like in English, this realization would pair aspirated stops with the graphemes <b, d, g> and unaspirated stops with the graphemes <p, t, k>, which is the exact opposite of the phoneme-grapheme pairing in English. Since /t/ and /d/ differ in place of articulation in medial position in Finnish (/t/ is a laminal dentalalveolar [t̪] and /d/ is an apical alveolar [d̪]), the initial /t/-/d/ contrast could also be incorporated as a place contrast rather than a voicing contrast. And while a similar type of place contrast could be imagined for the /k/-/g/ pair, it is hard to imagine how the /p/-/b/ pair could contrast in place of articulation. Prevoicing therefore seems like a more fruitful way of maintaining a contrast between the /b, d, g/ series and the /p, t, k/ series.

5. CONCLUSION

This study presents evidence of prevoicing in initial /b, d, g/ in loanwords in Finnish, suggesting that the contrast between initial /p, t, k/ and /b, d, g/ is being manifested in Finnish as a genuine voicing contrast. All participants in the study were young and well-educated (or on their way to become so), lived in an urban area and had knowledge of at least two foreign languages employing /b, g/ and initial /d/, which are speaker characteristics that have previously been found to increase the likelihood of the use of borrowed phonemes in Finnish. Since this is a small-scale study, replication of these result with a larger group of speakers is required in order to thoroughly establish if Finnish is developing a voicing contrast for plosives. Future research should moreover investigate if the tendency for prevoicing in /b, d, g/ is spreading to older speakers, speakers with less knowledge of foreign languages, and speakers living in rural areas. Different speech styles should also be studied in order to investigate whether the tendency for prevoicing in /b, d, g/ is spreading to more casual registers and to faster speaking rates. Finally, the pronunciation of the borrowed fricatives /f, ʃ/ should be examined to see if the incorporation of /b, d, g/ as distinct phonemes is a plosive-specific change or if Finnish is generally becoming more open to foreign sounds.

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ⁱ The data was collected as part of my PhD at Aarhus University. The remainder of the study was funded by the Independent Research Fund Denmark (grant number: 7023-00067B).