

Fenno-Swedish VOT: Influence from Finnish?

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Abstract

This paper presents results of an investigation of VOT in the speech of twelve speakers of Fenno-Swedish. The data show that in utterance-initial position, the two-way contrast is usually realised as a contrast between pre-voiced and unaspirated stops. Medially and finally, the contrast is that of a fully voiced stop and a voiceless unaspirated stop. However, a large amount of variation was observed for some speakers in the production of /b d g/, with many tokens being completely voiceless and overlapping phonetically with tokens of /p t k/. Such tokens, and the lack of aspiration in /p t k/, set Fenno-Swedish apart from the varieties spoken in Sweden. In Finnish, /b d g/ are marginal and do not occur in many varieties, and /p t k/ are voiceless unaspirated. We suggest that Fenno-Swedish VOT has been influenced by Finnish.

Method

Twelve native speakers of Fenno-Swedish (6 females, 6 males) were recorded in Turku, Finland. The ages of the male speakers varied between 22 and 32 years, those of the female speakers between 24 years and 48 years. Fenno-Swedish was the first language and the language of education of the subjects, as well as of both of their parents. The speakers came from all three main areas in which Swedish is spoken in Finland: Uusimaa/Nyland (the southern coast of Finland), Turunmaa / Åboland (the south-western coast) and Pohjanmaa / Österbotten (the western coast, Ostrobothnia). The speakers are all fluent in Finnish. There were 68 target words containing one or more stops. A list was prepared in which the target words occurred twice, with six filler words added to the beginning of the list. The recordings took place in an anechoic chamber at the Centre for Cognitive Neuroscience of Turku University. The words were presented to the subjects on a computer screen. The subjects received each new word by clicking the mouse and were instructed to click only when they had finished uttering a target word. The subjects were instructed to speak naturally, and their produc-

tions were recorded directly to a hard disk (22.5 kHz, 16 bit) using high quality equipment. Measurements were made using broad-band spectrograms and oscillograms.

Results

The full results, including the statistical tests, are reported in Ringen and Suomi (submitted). Here we concentrate on those aspects of the results that suggest an influence on Fenno-Swedish from Finnish.

The set /p t k/

The stops /p t k/ were always voiceless unaspirated. For the utterance-initial /p t k/, the mean VOTs were 20 ms, 24 ms and 41 ms, respectively. These means are considerably less than those reported by Helgason and Ringen (2008) (49 ms, 65 ms and 78 ms, respectively) for Central Standard Swedish (CS Swedish), for a set of target words that were identical to those in our, with only a few exceptions. On the other hand, the mean VOTs of Finnish word-initial /p/, /t/ and /k/ reported by Suomi (1980) were 9 ms, 11 ms and 20 ms, respectively (10 male speakers). These means are smaller than those of our Fenno-Swedish speakers, but the difference may be due to the fact that while the initial stops in our study were utterance-initial, the Finnish target words were embedded in a constant frame sentence.¹

In medial intervocalic position, the mean of VOT was 10 ms for /p/, 18 ms for /t/ and 25 ms for /k/. In Helgason and Ringen (2008), the corresponding means for CS Swedish were 14 ms, 23 ms and 31 ms, and in Suomi (1980) 11 ms, 16 ms and 25 ms for Finnish. The differences are small, and there is the difference in the elicitation methods, but it can nevertheless be noted that the Fenno-Swedish and Finnish figures are very close to each other, and that the CS Swedish VOTs are at least numerically longer than the Fenno-Swedish ones. At any rate, these comparisons do not suggest that Fenno-Swedish and Finnish are different with respect to the VOT of medial /p t k/. (Our Fenno-Swedish speakers produced medial intervocalic /p t k/ in quantitatively two ways:

either as short or long, e.g. *baka* was pronounced as either [baaka] (eight speakers) or [baakka] (four speakers). However, this alternation had no effect on VOT.) Word-final /ptk/ were fully voiceless. To the ears of the second author, the Fenno-Swedish /p t k/ sound very much like Finnish /p t k/.

The set /b d g/

In the realization of the utterance-initial /b d g/, there was much variation among the speakers. For eight of the twelve speakers, 95.2% of the utterance initial lenis tokens were prevoiced, whereas for the remaining four speakers, only 70.6% of the tokens were prevoiced. Half of the speakers in both subgroups were female and half were male. For the group of eight speakers, the mean VOT was -85 ms, and the proportion of tokens with non-negative VOT was 4.8%. The results for this group are similar to those of Helgason and Ringen (2008) for CS Swedish who observed the grand mean VOT of -88 ms and report that, for all six speakers pooled, 93% of the initial /b d g/ had more than 10 ms prevoicing. For the CS Swedish speaker with the shortest mean prevoicing, 31 of her 38 initial /b d g/ tokens had more than 10 ms of prevoicing. For our group of eight Fenno-Swedish speakers and for all of the six CS Swedish speakers in Helgason and Ringen, then, extensive prevoicing was the norm, with only occasional non-prevoiced renditions.

For the group of four Fenno-Swedish speakers the mean VOT was only -40 ms, and the proportion of tokens with non-negative VOT was 29.4%. For an extreme speaker in this respect, the mean VOT was -28 ms and 38% of the /b d g/ tokens had non-negative VOT. In fact, at least as far as VOT is concerned, many /b d g/ tokens overlapped phonetically with tokens of /p t k/. A linear discriminant analysis was run on all initial stops produced by the group of eight speakers and on all initial stops produced by the group of four speakers to determine how well the analysis can classify the stop tokens as instances of /p t k/ or /b d g/ on the basis of VOT. For the group of eight speakers, 97.3% of the tokens were correctly classified: the formally /p t k/ stops were all correctly classified as /p t k/, 4.8% of the formally /b d g/ stops were incorrectly classified as /p t k/. For the group of four speakers, 82.9% of the tokens were correctly classified: 1.0% of the formally /p t k/ stops were incorrectly classified as /b d g/, and 29.4%

of the formally /b d g/ stops were incorrectly classified as /p t k/. For these four speakers, then, /b d g/ often had positive VOT values in the small positive lag region also frequently observed in /p t k/.

Medial /b d g/ were extensively or fully voiced. In 9.4% of the tokens, the voiced proportion of the occlusion was less than 50%, in 10.4% of the tokens the voiced proportion was 50% or more but less than 75%, in 10.4% of the tokens the voiced proportion was 75% or more but less than 100%, and in 70.0% of the tokens the voiced proportion was 100%. Thus, while the medial /b d g/ were on the whole very homogeneous and mostly fully voiced, 3.6% of them were fully voiceless. These were nearly all produced by three of the four speakers who also produced many utterance-initial /b d g/ tokens with non-negative VOT values. The fully voiceless tokens were short and long /d/'s and short /g/'s; there was no instance of voiceless /b/. A discriminant analysis was run on all medial stops, with closure duration, speaker sex, quantity, place of articulation, duration of voicing during occlusion and positive VOT as the independent variables. 96.4% of the tokens were correctly classified (98.7% of /p t k/ and 94.5% of /b d g/). The order of magnitude of the independent variables as separators of the two categories was duration of voicing during occlusion > positive VOT > closure duration > place > quantity: sex had no separating power.

Great variation was observed in both short and long final /b d g/, and therefore the speakers were divided into two subgroups both consisting of six speakers. This was still somewhat Procrustean, but less so than making no division would have been. For group A the mean voiced proportion of the occlusion was 89% (s.d. = 18%), for group B it was 54% (s.d. = 31%). As the standard deviations suggest, there was less inter-speaker and intra-speaker variation in the A group than in the B group. Among the group A speakers, mean voiced proportion of occlusion across the places of articulation ranged from 73% to 98% in the short /b d g/ and from 63% to 99% in the long /b d g/, among the group B speakers the corresponding ranges were 36% to 62% and 46% to 64%. An extreme example of intra-speaker variation is a male speaker in group B for whom four of the 24 final /b d g/ tokens were completely voiceless and nine were completely voiced. Discriminant analyses were again run on all final stops, separately for the two groups. For group B, with voicing duration during the occlusion,

occlusion duration and quantity as independent variables, 96.5% of the tokens were correctly classified (99.4% of /p t k/ and 93.1% of /b d g/). For group A, with the same independent variables, all stops were correctly classified (100.0%). For both groups A and B, the order of strength of the independent variables as separators of the two categories was: voicing duration > closure duration > quantity.

Phonological conclusions

Fenno-Swedish contrasts voiced /b d g/ with voiceless unaspirated /p t k/. On the basis of our acoustic measurements and some knowledge of how these are related to glottal and supraglottal events, we conclude that the contrast in Fenno-Swedish is one of [voice] vs no laryngeal specification. Note that our definition of voiced stops refers, concretely, to the presence of considerable prevoicing in utterance-initial stops, and to extensive voicing during the occlusion in other positions with, at most, a short positive VOT after occlusion offset. What we refer to as voiceless stops, in turn refers, again concretely, to short positive VOT in utterance-initial stops, to voiceless occlusion in medial stops and final stops (allowing for a very short period of voicing at the beginning of the occlusion, if the preceding segment is voiced), with at most a very short positive VOT.

Suomi (1980: 165) concluded for the Finnish voiceless unaspirated /p t k/ that their “degree of voicing [is] completely determined by the supraglottal constrictory articulation”. These stops have no glottal abduction or pharyngeal expansion gesture, a circumstance that leads to voicelessness of the occlusion (p. 155ff). Despite the different terminology, this amounts to concluding that the Finnish /p t k/ have no laryngeal specification. Thus in the two studies, thirty years apart, essentially the same conclusions were reached concerning Fenno-Swedish and the Finnish /p t k/.

Stop clusters

Four cluster types investigated: (1) /kt/, /pt/ (as in *läkt*, *köpt*), (2) /kd/, /pd/ (as in *väckte*, *köpte* which, on a generative analysis, are derived from *vä/k+d/e* and *kö/p+d/e*), (3) /gt/ (as in *vägt*, *bygggt*) and (4) /gd/ (as in *vägde*). Clusters (1) – (2) were always almost completely voiceless, and consequently there is no phonetic evidence that the two types are distinct. The cluster /gd/ was usually nearly fully voiced

throughout. But in the realisation of the /gt/ cluster there was again much variation among the speakers. The /t/ was always voiceless, but the /g/ ranged from fully voiceless (in 43% of the tokens) to fully voiced (33%), and only the beginning of /g/ was voiced in the remaining 24% of the tokens. For two speakers all six tokens of /g/ were fully voiceless, for three speakers four tokens were fully voiceless, and for five speakers, on the other hand, four or more tokens were fully voiced. As an example of intra-speaker variation, one speaker produced two fully voiced, two partially voiced and two fully voiceless /g/ tokens. On the whole, the speakers used the whole continuum, but favoured the extreme ends: /g/ was usually either fully voiced or fully voiceless, the intermediate degrees of voicing were less common. This dominant bipartite distribution of tokens along a phonetic continuum is very different from the more or less Gaussian distribution one usually finds in corresponding studies of a single phonological category.

Contact influence?

Historically, Finnish lacks a laryngeal contrast in the stop system, the basic stops being /p t k/, which are voiceless unaspirated. In the past, all borrowed words were adapted to this pattern, e.g. *parkki* ‘bark’ (< Swedish *bark*), *tilli* ‘dill’ (< Sw. *dill*), *katu* ‘street’ (< Sw. *gata*). Standard Spoken Finnish (SSF) also has a type of /d/ which is usually fully voiced. However, this /d/ is not a plosive proper, but something between a plosive and a flap, and is called a semiplosive by Suomi, Toivanen and Ylitalo (2008). Its place is apical alveolar, and the duration of its occlusion is very short, about half of that of /t/, *ceteris paribus* (Lehtonen 1970: 71; Suomi 1980: 103). During the occlusion, the location of the apical contact with the alveoli also moves forward when the preceding vowel is a front vowel and the following vowel is a back vowel (Suomi 1998).

What is now /d/ in the native vocabulary, was a few centuries ago /ð/ for all speakers. When Finnish was first written down, the mostly Swedish-speaking clerks symbolised /ð/ variably, e.g. with the grapheme sequence <dh>. When the texts were read aloud, again usually by educated people whose native tongue was Swedish, <dh> was pronounced as it would be pronounced in Swedish. At the same time, /ð/ was vanishing from the vernacular, and it was either replaced by other conso-

nants, or it simply disappeared. Today, /ð/ has vanished and the former /ð/ is represented by a number of other consonants or by complete loss, and /d/ does not occur. But /d/ does occur in modern SSF as a result of conscious normative attempts to promote “good speaking”. The second author, for example, did not have /d/ in his speech in the early childhood but learnt it at school. In fully native words, /d/ occurs only word medially, e.g. *sydän* ‘heart’; in recent loanwords it is also found word-initially, e.g. *demokraatti*, *desimaali*, *devalvaatio*, *diktaattori*.

Under the influence of foreign languages, nowadays most notably from English, /b/ and /g/ are entering Standard Spoken Finnish as separate phonemes in recent loanwords, e.g. *baari*, *bakteeri*, *baletti*, *banaani*; *gaala*, *galleria*, *gamma*, *gaselli*. But such words are not yet pronounced with [b] and [g] by all speakers, nor in all speaking situations. On the whole, it can be concluded that /d/ and especially /b/ and /g/ must be infrequent utterance initially in Finnish discourse, especially in informal registers, and consequently prevoicing is seldom heard in Finnish. Instead, utterance-initial stops predominantly have short-lag VOT. Even word-medially voiced stops, with the exception of the semiplosive /d/, are rather infrequent, because they only occur in recent loanwords and not for all speakers and not in all registers. Word-finally — and thus also utterance-finally — voiced plosives do not occur at all because loanwords with a voiced final stop in the lending language are borrowed with an epenthetic /i/ in Finnish, e.g. *blogi* (< Engl. *blog*).

Our Fenno-Swedish speakers’ /p t k/ had short positive VOTs very similar to those observed for Finnish, assuming that the differences between our utterance-initial /p t k/ and the word-initial Finnish /p t k/ reported in Suomi (1980) are due to the difference in position in the utterance. In utterance-initial position, the Fenno-Swedish /p t k/ are unaspirated while the CS Swedish /p t k/ are aspirated. We suggest that the Fenno-Swedish /p t k/ have been influenced by the corresponding Finnish stops. Reuter (1977: 27) states that “the [Fenno-Swedish] voiceless stops *p*, *t* and *k* are wholly or partially unaspirated [...]. Despite this, they should preferably be pronounced with a stronger explosion than in Finnish, so that one clearly hears a difference between the voiceless stops and the voiced *b*, *d* and *g*” (translation by KS). As pointed out by Leinonen (2004b), an implication of this normative exhortation is that

speakers of Fenno-Swedish often pronounce the voiceless stops in the same way as do speakers of Finnish. Leinonen’s own measurements suggest that this is the case.

Many of our Fenno-Swedish speakers exhibited instability in the degree of voicing in /b d g/. We suggest that this, too, is due to influence from Finnish.

The Fenno-Swedish speakers’ medial short and long /d/ had considerably shorter closure durations than did their medial /b/ and /g/. In word-final position, this was not the case. The Finnish semiplosive /d/ occurs word-medially, as does geminate /dd/ in a few recent loanwords (e.g. *addikti* ‘an addict’). But the Finnish semiplosive does not occur word-finally. Thus, both short and long Fenno-Swedish /d/ have a relatively short duration in medial position, exactly where Finnish /d/ and /dd/ occur, but do not exhibit this typologically rare feature in final position where Finnish could not exert an influence. With respect to voicing, the Fenno-Swedish short medial /d/ behaved very much like Finnish /d/. The mean voiced proportion of the occlusion was 90%, and in Suomi (1980: 103), all tokens of the medial Finnish /d/ were fully voiced. According to Kuronen and Leinonen (2000), /d/ is dentalveolar in CS Swedish, but alveolar in Fenno-Swedish. Finnish /d/ is clearly alveolar and apical (Suomi 1998). Kuronen & Leinonen have confirmed (p. c.) that they mean that Fenno-Swedish /d/ is more exactly apico-alveolar.

Against a wider perspective, the suggestion that the Fenno-Swedish /p t k/ have been influenced by the corresponding Finnish stops is not implausible. First, it should be impressionistically apparent to anyone familiar with both Fenno-Swedish and CS Swedish that, on the whole, they sound different, segmentally and prosodically; for empirical support for such an impression, see Kuronen and Leinonen (2000; 2008). Second, it should also be apparent to anyone familiar with both Finnish and Swedish that CS Swedish sounds more different from Finnish than does Fenno-Swedish; in fact, apart from the Fenno-Swedish segments not found in Finnish, Fenno-Swedish sounds very much like Finnish. Third, Leinonen (2004a) argues convincingly that CS Swedish has no influence on Fenno-Swedish pronunciation today. Leinonen compared what are three sibilants in CS Swedish with what are two sibilants and an affricate in Fenno-Swedish. He observed clear differences among the varieties in each of these consonants, and found little support for an influ-

ence of the CS Swedish consonants on these consonants in Fenno-Swedish. Thus, to the extent that Fenno-Swedish differs from CS Swedish (or, more generally, any varieties of Swedish spoken in Sweden), a very likely cause of the difference is influence from Finnish. In addition to the influence of the Finnish /p t k/ on the Fenno-Swedish /p t k/, we suggest that any variation towards voiceless productions of /b d g/ is also due to Finnish influence.

Our results for utterance-initial stops in a language in which /b d g/ stops are predominantly prevoiced are not altogether unprecedented. They resemble the results of Caramazza and Yeni-Komshian (1974) on Canadian French and those of van Alphen and Smits (2004) for Dutch. Caramazza and Yeni-Komshian observed substantial overlap between the VOT distributions of /b d g/ and /p t k/: a large proportion (58%) of the /b d g/ tokens were produced without prevoicing, while /p t k/ were all produced without aspiration. The authors argued that the Canadian French VOT values are shifting as a result of the influence of Canadian English. van Alphen and Smits observed that, overall, 25% of the Dutch /b d g/ were produced without prevoicing by their 10 speakers, and, as in the present study, there was variation among the speakers: five of the speakers prevoiced very consistently, with more than 90% of their /b d g/ tokens being prevoiced, while for the other five speakers there was less prevoicing and considerable inter-speaker variation; one speaker produced only 38% of /b d g/ with prevoicing. van Alphen & Smits' list of target words contained words with initial lenis stops before consonants, which ours did not. They found that the amount of prevoicing was lower when the stops were followed by a consonant. If we compare the results for the prevocalic lenis stops in the two studies, the results are almost identical (86% prevoicing for van Alphen & Smits, 87% for our speakers). The authors are puzzled by the question: given the importance of prevoicing as the most reliable cue to the voicing distinction in Dutch initial plosives, why do speakers not produce prevoicing more reliably? As a possible explanation to this seemingly paradoxical situation, van Alphen and Smits suggest that Dutch is undergoing a sound change that may be caused or strengthened by the large influence from English through the educational system and the media. It may be, however, that van Alphen and Smits' speakers have also been in contact with speakers of dia-

lects of Dutch with no prevoicing (and aspirated stops) or by contact with speakers of German.

There is evidence that speakers are very sensitive to the VOTs they are exposed to. Nielsen (2006, 2007) has shown that speakers of American English produced significantly longer VOTs in /p/ after they were asked to imitate speech with artificially lengthened VOTs in /p/, and the increased aspiration was generalised to new instances of /p/ (in new words) and to the new segment /k/. There is also evidence that native speakers of a language shift VOTs in their native language as a result of VOTs in the language spoken around them (Caramazza and Yeni-Komshian, 1974; van Alphen and Smits, 2004). Sancier and Fowler (1997) show that the positive VOTs in the speech of a native Brazilian Portuguese speaker were longer after an extended stay in the United States and shorter again after an extended stay in Brazil. The authors conclude that the English long-lag /p t k/ influenced the amount of positive VOT in the speaker's native Brazilian Portuguese.

All of our Fenno-Swedish speakers, like the majority of Fenno-Swedish speakers, are fluent in Finnish (as was observed before and after the recordings). Fenno-Swedish is a minority language in Finland, and hence for most speakers it is very difficult not to hear and speak Finnish. Consequently, most speakers of Fenno-Swedish are in contact, on a daily basis, with a language in which there is no aspiration and in which prevoicing is not often heard. On the basis of information available to us on our speakers' place of birth, age and sex, it is not possible to detect any systematic pattern in the variation in the degree of voicing in /b d g/ as a function of these variables.

In brief, the situation in Fenno-Swedish may be parallel, *mutatis mutandis*, to that observed in Canadian French and Dutch. Assuming that prevoicing in Fenno-Swedish /b d g/ has been more systematic in the past than it is among our speakers (which can hardly be verified experimentally), influence from Finnish is an explanation for the variability of prevoicing in Fenno-Swedish that cannot be ruled out easily. Without such influence it is difficult to see why speakers would choose to collapse phonemic categories in their native language.²

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Notes

1. We use the broad notations /b d g/ and /p t k/ to refer to the phonetically more voiced and to the phonetically less voiced stops of a language, respectively, without committing ourselves to any claims about cross-linguistic similarities. E.g., when we talk about /p t k/ in Fenno-Swedish and about /p t k/ in English, we do not claim that the consonants are alike in the two languages. Similarly the notation /t/ as applied to Finnish overlooks the fact that the Finnish stop is laminodentalveolar.

2. The fact that there was phonetic overlapping between tokens of /b d g/ and /p t k/ with respect to parameters related to voicing does not exclude the possibility that the two sets were still distinguished by some properties not measured in this study. Nevertheless, overlapping in parameters directly related to the laryngeal contrast is very likely to reduce the salience of the phonetic difference between the two sets of stops.

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