

2011

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Original Publication Citation

Brown, J. & Koskinen, P. (2011). On voiced stops in Finnish. *Linguistica Uralica*, 47 (2) doi:10.3176/lu.2011.2.02

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ON VOICED STOPS IN FINNISH

Abstract. There is a common crosslinguistic claim about stop inventories, that if a language has a velar voiced stop, it also has coronal and a labial; that if a language has a voiced coronal stop, it also has a labial, etc. Thus, an unexpected inventory would contain only a voiced coronal and/or dorsal stop. We present data from Finnish which stands as a counterexample to this universal, where a voiced coronal stop, but no other, exists in the inventory. We attribute the existence of this exceptional stop to historical and sociolinguistic factors.

Keywords: Finnish, voicing, stops, consonant inventory.

1. Introduction

There is a common claim about stop inventories, that if a language has a velar voiced stop $[g]$, it also has coronal $[d]$ and labial $[b]$. Likewise, if a language has coronal $[d]$, it has labial $[b]$. There are various phonetic motivations for this cross-linguistic claim, and the markedness scale $b > d > g$ has recently been formalized in Optimality Theory as a reflection of this implicational relationship. This rigid formalism predicts that there should be no inventories with a lower member on the scale without also having a higher member. A specific prediction, and the one germane to this paper, is that there should be no voiced stop inventories with $[d]$ but lacking in $[b]$. Our claim is that there is evidence from Finnish which stands as a counterexample to this generalization. Finnish has only $[d]$ as a member of the voiced stop series and lacks $[b]$. We argue that Finnish, and languages exhibiting similar inventory structures, are better explained by appealing to what have typically been considered "extra-grammatical" factors such as language change, sociolinguistic factors, and language contact phenomena.

2. Segment Inventories

A common claim in the literature is that voiced stop inventories are implicationally ordered (Gamkrelidze 1975; Sherman 1975; etc.). That is, if an inventory has one voiced stop, it will be $[b]$, if two, $[b, d]$, if three, $[b, d, g]$. In other words, gaps in voiced stop inventories will be found at the

most posterior place of articulation possible. This implicational ordering can be schematized as in (1):

- (1) $b \supset d \supset g$

There is a well-known phonetic basis for inventory gaps like these. In order to maintain voicing at all, airflow is required across the glottis. Since there is more volume, and more compliant tissue, available in the oral tract for a bilabial closure than an alveolar closure, voicing is more easily maintained for $[b]$ than for $[d]$ (and likewise for stops articulated at the velar point of articulation, $[g]$) (Ohala, Riordan 1979; Westbury 1979). The compliancy of tissue allows for more cavity expansion, which in turn allows for longer durations of vocal fold vibration during more anterior plosives. This phonetic motivation has recently been incorporated directly into the substance of constraints in Optimality Theory by Hayes, Steriade 2004. According to their approach, there are markedness constraints regulating voicing on $[-\text{son}]$ segments that are relativized to place of articulation, and are assumed to be arranged in a fixed ranking. This is illustrated below:

- (2) $*[+\text{voice}]: \{g < d < b\}$

The problem with this approach is that it predicts no exceptions; since the constraints are in a fixed hierarchy, there is no constraint ranking that will both respect the fixed ranking and at the same time derive an inventory with an exceptional gap. The empirical problem with this approach is that there are sporadic languages which defy this prediction.¹

We present evidence from Finnish which suggests that its inventory stands as a counterexample to the predictions of the Hayes and Steriade approach. Finnish has a voiced stop inventory which has only $/d/$; $[b]$, $[g]$ are marginal in the language, and only occur in loans.² The Finnish stop inventory (Hakulinen, Vilkuna, Korhonen, Koivisto, Heinonen, Alho 2004) is presented in (3):

- (3) Finnish stop inventory:

$/p \ (b) \ t \ d \ k \ (g)/$

In accounting for the structure of the Finnish stop inventory, we are in agreement with Blevins (2004; 2006a; 2006b; 2008), who claims that there are other possible sources of inventory structure, such as natural sound change³ and what can be termed "external" factors, such as language contact, language prestige, or other sociolinguistic factors.

¹ We take this to be an actual prediction of the theory. We are assuming that the hierarchy could not be occluded by highly ranked constraint such as $*[b]$, or another similar constraint. We are assuming that constraints like $*[b]$ are not atomic constraints, but are rather shorthand for things like $*[+\text{voice}, -\text{son}, \text{LAB}]$, which fits directly into the hierarchy.

² Hayes, Steriade (2004) note that some languages exist with $[d]$ but not $[b]$. They claim it is likely that in these cases, $[d]$ is a flap with shorter duration than a voiced stop. This, however, does not necessarily explain the lack of $[b]$, as the voiced stop series is not being compared to the voiceless stop series, in VOT or duration. Furthermore, $[d]$ in Finnish is not a flap for most dialects (Huotari 1995; Nuutinen 1994).

³ The scope of our investigation is in a larger sense limited; for a full range of explanations for recurrent sound patterns, see especially Blevins (2004).

3. Finnish [d]

The empirical claim of this paper is that Finnish has a voiced coronal stop that is present in its core vocabulary (and phonology), while voiced labial and dorsal stops are marginal and found only in loans. The primary evidence for this claim is in minimal pairs found in native Finnish words between the voiced and voiceless coronal stops:

(4) Native words, minimal pairs:

taide — *taite* 'art' : 'fold'
vaade — *vaate* 'demand' : 'piece of clothing'

There is robust evidence language-internally as well as in a Finno-Ugric comparative context that speaks to the stability of [d] in the language. Häkkinen (1990) and Lehtinen (2007) identify modern Finnish words with a voiced [d] that can be reconstructed to Proto-Uralic:

(5) *sydän* — **šidä*, **šüdä* 'heart'
kadota — **kaða* 'to disappear'

Further cognates, including artefacts / cultural items, body parts and verbs, can be found in Hungarian and Volgaic languages (SKES). These indicate that stop voicing is a stable feature, or at least one that is manifested in a subset of the lexicon with a substantial time-depth.

(6) Words shared with Hungarian:

edelle — **eðe* 'before, to the front'
uudin — **uðe* 'curtain'
vuode — **oðe* 'bed'
ydin — **wiðe* 'marrow'

(7) Words shared with Volgaic languages:

kide 'crystal'
rohðin 'linen, etc. fibers'
säde 'ray of light'
voida 'to be able to'
voide 'ointment, salve'

Phonologically speaking, the distribution of [d] is limited; it only occurs word-medially, as evidenced in the above words. [d] is also partly restricted in its morphological distribution. It primarily occurs as the weak grade of /t/ in derived forms (as in 8), but is also found in underived forms such as those listed above in (4, 5, 6, 7).

(8) Derived words:

kaksi — *kahden* 'two' : 'of two'
käsi — *käden* 'hand' : 'of the hand'
pato — *padon* 'dam' : 'of the dam'

Articulatorily speaking, while [t] is typically dental, [d] is alveolar (Sulkala, Karjalainen 1992). This, however, should have no bearing on the account proposed by Hayes and Steriade (2004), as the voiced series of stops is never being directly compared to the voiceless series. Instead, a

voiced stop is compared in terms of markedness to another voiced stop at a different place of articulation. Thus, we can be descriptively accurate in noting that in most dialects it is dental, but it makes no difference whether it is dental or alveolar for the aspects of the phonology that we are investigating.

There is no consensus in the literature as to the exact phonetic properties of [d] in Finnish. There is historical evidence to suggest a natural explanation as to why modern [d] would be voiced, as it is historically derived from the voiced dental fricative [ð] (Virtaranta 1958; Vesterinen 1980). There have also been several synchronic accounts of the stop series. Karlsson (1983) describes the pronunciation of [d] as voiced, though notes that voicing is not the only difference between /t/ and /d/, since words like *taide* 'art' and *taite* 'fold' can be distinguished even if they are whispered. Ogden (1996) reaches a similar conclusion, noting that voicing is phonetically present for [d],⁴ though closure duration (which is much shorter for [d] than for [t]) may be the primary cue. The same conclusion is reached by Suomi (1980). Lahti (1981) presents VOT values for five speakers, where there is an appreciable difference between the voiced and voiceless stop:

- (9) [d] = avg. 30.4 msec VOT
[t] = avg. 12.4

Jarva (1997) notes that there is variation in voicing in the voiced stop series, and that [b] and [g] are typically half-voiced or voiceless. Jarva's ultimate claim is that [b] and [g] do not share the same phonemic status in the language as [d].

It has been claimed that there is variation in the place and manner of articulation of /d/ across Finnish dialects. For instance, it is often claimed that /d/ is phonetically a flap (e.g. Suomi 1980); however, the manner of articulation for (at least) the dialect of the second author is a plosive, and not a flap (as confirmed in an ultrasound study by the authors).

In order to provide some instrumental support to the claim that the phoneme [d] is actually voiced in a given dialect of Finnish, a small phonetic study was conducted. This involved recording several words differing minimally or near-minimally in stop voicing. The speaker producing the items was the second author, from Tampere. Results indicate that VOT values for voiced stops are consistently negative, and those for voiceless stops are all consistently positive. The figures below illustrate the difference in VOT for the stops in *taide* vs. *taite*.

It is also important to keep in mind that [b] and [g] entered the language through loans. A preliminary investigation of the Basic Finnish Dictionary (Suomen kielen perussanakirja 1990–1994) reveals that and <g> are very sporadic in occurrence compared to other sounds. For instance, there are 1300 words that contain and 1600 that contain <g>. <d> appears in 7000 unconjugated stems. This can be compared to the labial fricative <v> and voiceless labial stop <p>, which each have around 20,000 words containing them (Hakulinen, Vilkuna, Korhonen, Koivisto, Heinonen, Alho 2004).

⁴ Ogden's study revealed that voicing is sometimes even realized on [t] in connected speech, a fact that further supports our overall claims.

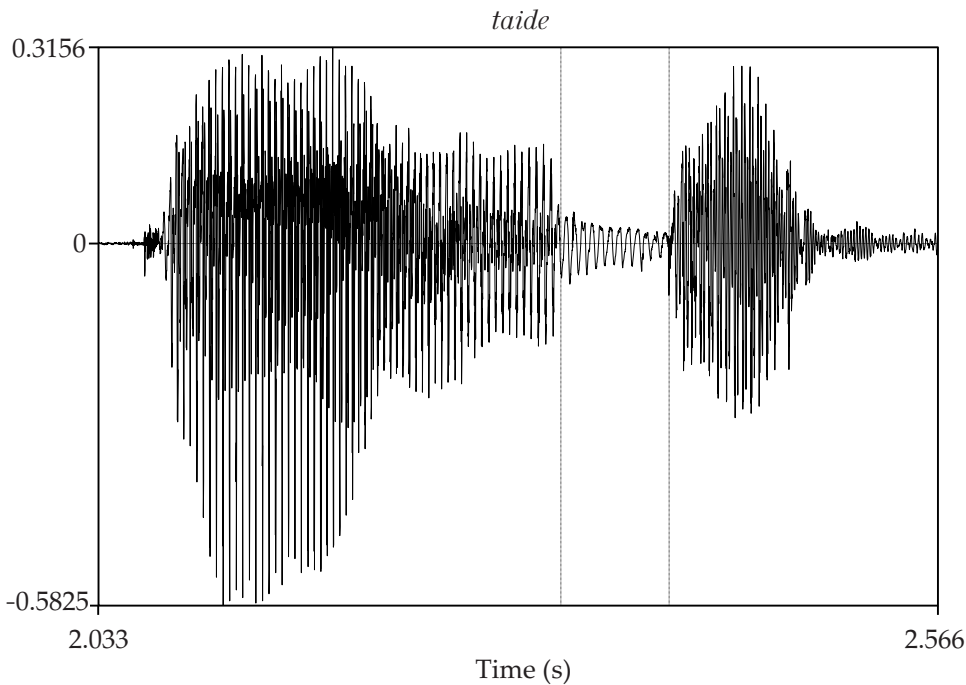


Figure 1. Waveform for *taide*; VOT is indicated with dashed lines.

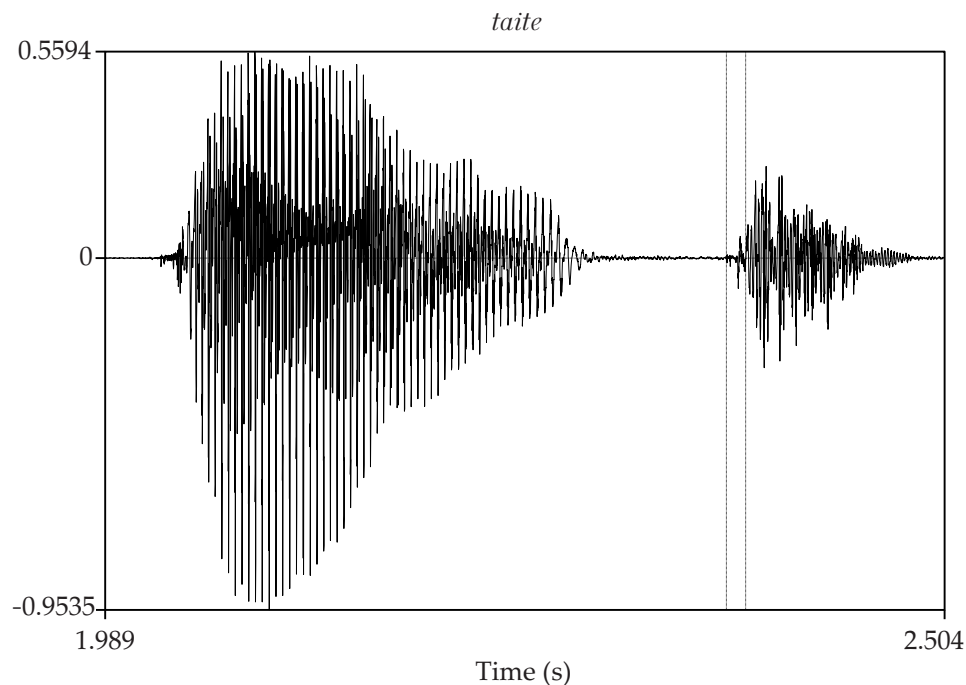


Figure 2. Waveform for *taite*; VOT is indicated with dashed lines.

4. An Alternative Explanation

Given the asymmetrical status of [d] vs. [b] and [g], is there a way to account for this type of "unexpected" inventory? In other words, is there a clear explanation for how a language could have /d/ without having /b/ or /g/? We claim that there indeed is, and that the explanation lies in both diachronic and sociolinguistic factors. We also note that these sources of explanation are consistent with types of explanation available in Evolutionary Phonology (Blevins 2004; 2006a; 2006b; 2008). We adopt Evolutionary Phonology in favor of a strictly synchronic account that incorporates the implicational hierarchy in (1) directly into the substance of the grammar (e.g. Hayes, Steriade 2004).

4.1 Diachronic Explanation

There is widespread agreement that /d/ in Finnish is the product of changes that resulted in consonant gradation. The specific historical changes are either through lenition (as assumed by most scholars) or fortition (Gordon 1998). We make no claims here as to whether the consonant gradation in the language is due to a historical lenition or fortition; since both lenition and fortition are common sound changes (Blevins 2004), either one could be responsible for the resulting sound patterns with the same impact on our proposals. The fact that this historical explanation for /d/ is virtually uncontested leaves little for us to comment on here.

4.2. Social Factors

The influence of writing systems as well as of norms and standards fall under the category of unnatural histories in Evolutionary Phonology (Blevins 2006b). In addition to the historical developments that helped to introduce [d] into the morphological process of consonant gradation, there are sociolinguistic factors that helped to cement /d/ into the phonemic inventory of the language. We illustrate how the role of orthographic standardization, alongside the pressure exerted by Swedish speakers helped to shape the present day stop inventory.

As mentioned in section 3, present day Finnish exhibits a great deal of dialectal variation with respect to /d/. Historically, the segment in question was phonetically a voiced dental fricative [ð] (Virtaranta 1958; Vesterinen 1980). The reason behind the eventual settling on variants such as [d] is strongly tied to the development of literacy.

The first text published in Finnish was Mikael Agricola's translation of the New Testament in 1548. Since no orthography existed for the language prior to this, Agricola made use of Swedish, German and Latin conventions. These languages did not contain the voiced interdental fricative [ð], and Agricola represented it with the graphemes <d> and <dh>: *meidhen*, *meiden* /*meiðän*/ (Laitinen 1981). Swedish was the language of the governing elite class in Finland under the rule of Sweden from 1155 until 1809 when Finland was handed over to Russia; Latin the language of the Christian religion introduced to Finland by the Swedes. Only 174 Finnish books were published during that time (Lehtonen 1978). Throughout the Swedish

rule, Swedish and Latin remained the languages of literary culture in Finland. The spelling patterns of these two languages shaped the development of Finnish orthography.

The orthography of the earliest Finnish texts was neither phonemic nor standardized. The Finnish writing system was finally regularized in late 1800s. At the forefront of the standardization were the educated Swedish-speaking elite, who for idealistic reasons chose to learn Finnish as a second language. The mostly Swedish-speaking scribes had represented the Finnish [ð] as <d> or <dʰ> in the existing, mostly religious, early Finnish literature. Phonetically, orthographic <d> in Swedish is [d]. When the erudite elite, mostly native Swedish-speakers, read Finnish aloud, they pronounced the sound as it would be in Swedish. Native Finnish speakers slowly adopted this pronunciation of the grapheme, and [d] became standardized in this way⁵ (Lehikoinen, Kiuru 1993). Even today some colloquial varieties resist standardization and variable pronunciations of [d] persist. In informal usage [d] may be replaced by [l, r, v, j, t, h] or not be pronounced at all (Itkonen 1983).

Current research (Jarva 1997; Lappalainen 2001) reports that among young and middle-aged speakers [d] has been fully standardized. The same is not true of [b, g]. In official settings the voiced pronunciation of [b, g] is a marker of prestige and the unvoiced pronunciation stigmatized, but outside of public situations norm-based usage is rare and socially marked (Sajavaara, Dufva 2001⁶; Mantila 2004).

5. Conclusion

We have shown that at least one dialect of Finnish (from Tampere) provides a counterexample to the claim that voiced stop inventories are organized by the implicational hierarchy $b \supset d \supset g$ by having [d] but no [b]. In contrast to this claim, phonemic inventories of this type are to be expected within a framework such as Evolutionary Phonology, where sound patterns are shaped by both natural and unnatural histories. In the case presented above, the natural explanation lies in the sound changes that have derived [d] through lenition; the unnatural component to the history of Finnish [d] is the adoption of the orthographic form <d> for a voiced dental fricative, with the subsequent influence from Swedish speakers living in Finland. In this sense, the phonemic inventory is partly shaped by diachrony and sociolinguistic forces (such as literacy and language contact). These natural and unnatural histories of Finnish [d] argue strongly for an Evolutionary approach to the voiced stop inventory of the language.

⁵ An expectation is that remote dialects of Finnish may still use the dental fricative in pronunciation. This is indeed the state of affairs in some South-Western rural dialects (cf. e.g. Itkonen 1983).

⁶ While Sajavaara and Dufva (2001) note some of the same differences between [d] and [b, g] that we have above, they ultimately grant the same phonological status to all three stops.

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