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Swedish Quantity: Central Standard Swedish and Fenno-Swedish

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Abstract

The durational realisation of the Swedish complementary quantity contrast was investigated in monosyllabic and disyllabic target words in Central Standard Swedish and in Fenno-Swedish. Several systematic durational differences between the two varieties were observed, most of which can be summarized by stating that speakers of Fenno-Swedish exaggerate, in comparison to Central Standard Swedish speakers, the quantity contrast between the vowel in the stressed syllable and the following consonant, i.e. they make short segments shorter and long segments longer. This we explain as influence on Fenno-Swedish from Finnish, in which vowels and consonants have a binary quantity contrast independent of each other. In speaking and listening to Finnish, bilingual speakers of Fenno-Swedish have come to make larger durational distinctions than occur in Central Standard Swedish.

Keywords:

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1. Introduction

Swedish is a quantity language in which quantity is phonetically contrastive only in stressed syllables. Most varieties of Swedish allow only one of two basic quantity patterns in stressed syllables; a short vowel in a stressed syllable must be followed by a long consonant (or by two qualitatively different consonants) and a long vowel in a stressed syllable must be followed by a short consonant or else be word-final (cf., e.g., Elert, 1964 and Schaeffler, 2005). As a result, closed stressed syllables in Swedish have a complementary durational relationship between the vowel and the following consonant. For example, in *väg* [vɛːg] 'road' the vowel is long and the following consonant is short (VːC), whereas in *vägg* [vɛgː] 'wall' the vowel is short and the following consonant is long (VCː). The varieties in which these restrictions apply do not allow light (short or monomoraic) stressed syllables, so words like *[vɛg] are not permitted.

The two varieties of Swedish under consideration here are Central Standard Swedish (henceforth CS) and Fenno-Swedish (henceforth FS), also known as Finland Swedish. CS adheres quite strictly to the quantity scheme outlined above. In FS the complementary length pattern is dominant, but still there is a limited set of words that have a monomoraic quantity pattern (VC, in which V refers to the word's first vowel), for example the loan words *foto* 'photo' and *kamera* 'camera', the native verbs *göra* 'do' and *fara* 'go', as well as a few function words that are monomoraic when stressed (cf. Kuronen & Leinonen, 2010: 14-15).

All varieties of Swedish have variable lexical stress, so word pairs exist that differ primarily in terms of stress (e.g. *formel* [ˈfɔɹmɛl] 'formula' vs. *formell* [fɔɹˈmɛlː] 'formal'). However, all of our test words have stress on the initial (or only) syllable. The Swedish tonal word accent distinction, referred to as accent 1 vs. accent 2 (or acute accent vs. grave accent), is found in most varieties of Swedish, including CS, but is absent in the FS variety. Monosyllabic words can only have accent 1, but in polysyllabic words the accent varies. Our data only include monosyllabic and disyllabic words. Our monosyllabic test words have accent 1, but the disyllables have accent 2, since this is the accent associated with most base forms of disyllabic words (e.g. verb infinitives and indefinite sg. noun forms).

CS, the Swedish variety spoken in and around Stockholm, descends from dialects spoken in Central Sweden (Svealand) and has become a principal standard variety of Swedish adopted by many non-CS speakers. According to Kuronen & Leinonen (2011), the ancestors of FS speakers first landed on mainland Finland from Sweden in large numbers at the end of the 13th century, from which time to 1809 Finland was part of Sweden; however, the early migration started around the year 1000. Ever since the early immigration, there has been extensive contact between Finnish and the Swedish spoken in Finland. The immigration was motivated by the Swedish kings' wish to establish their power in Finland, by trade, and by poor nutritional conditions in Central Sweden and around Stockholm. In the 16th century, under King Gustav Vasa, a centralized administrative system, with Swedish as the working language, was put in effect across all of Finland, and, as a result, native Finnish officials had to learn Swedish. Gradually, Swedish spread to the whole upper class, largely replacing Finnish; however, the number of native FS speakers has never been greater than 15-20 percent of the population. The first school with Finnish as the working language was established in 1858 before which Latin and increasingly Swedish had been used. This meant that many Finns learned Swedish at school.

Since the 19th century, a Finnish-influenced pronunciation standard (yet unofficial), FS (*finlandssvenska* in Swedish), has been attaining prestige status, and since the 1970s, both Finnish and FS have been compulsory subjects at school for all children. According to the 2006 census, 5.1% (or about 267,750) of the inhabitants in mainland Finland, totaling 5,250,032 inhabitants, were registered as native speakers of FS (see the reference: OSF). Of these, less than 6% lived in monolingual FS municipalities in which less than 6% of the inhabitants speak Finnish, which is then the local minority language (if more than 94% of a municipality's inhabitants speak the same language, the municipality is officially monolingual). In mainland Finland, there are only three such officially monolingual Swedish-speaking municipalities, with a total of approximately 14,600 FS inhabitants. Accordingly, FS is clearly a minority language in most areas in which it is spoken, and most FS speakers understand and speak Finnish more or less daily, and many of them are functionally fully bilingual, although a person cannot officially be registered as bilingual. Given these long and close contacts between speakers of Swedish and speakers of Finnish in Finland it would be surprising if Finnish had not had any influence on the Swedish spoken in the country.

There are many differences in pronunciation between FS and CS. Kuronen & Leinonen (1999, abstract) note that "even though the segmental differences between Finland-Swedish and Sweden-Swedish are clearly audible the main and for the listener most obvious difference is in the prosodic character of these dialects", and in their (2011) publication the authors list (pp. 40-42) 22 prosodic differences (sometimes with subdivisions) between CS and FS, and they explicitly consider differences concerning segment durations to be the result of Finnish influence on FS. A segmental difference that figures in the present comparison is that while CS has postaspiration (e.g. [ˈkʰ ːb]) and optional preaspiration (e.g. [ˈgɭa$^{(h)}$pː]) of fortis stops, FS has neither. A prosodic difference concerns the quantity system: while CS only has the complementary contrast between VC: and V:C, FS has a richer system of contrasts, as discussed below.[2]

Within FS, there is a well-known split (cf., e.g., Reuter 1982) concerning the pronunciation of the word structure represented by, e.g., *baka* 'to bake', i.e. initially stressed disyllabic words with a long vowel followed by a voiceless obstruent (in our materials, a fortis stop). By tradition this medial consonant, following a long vowel as it does, counts as phonologically short, but phonetically FS speakers split into two distinct groups, with one group pronouncing it as short and the other as long. When analyzing and discussing this word structure, therefore, we will divide the FS speakers into two groups, and designate the two groups as BAAKA speakers and BAAKKA speakers. For more details, see below.

In Finnish, quantity is contrastive for both vowels and consonants, independently of each other and of stress (which is fixed on the initial syllable). Thus, Finnish has a four-way quantity contrast in a vowel + consonant sequence irrespective of whether the vowel is in a stressed or unstressed syllable. Table 1 compares the quantity systems of CS and Finnish in disyllabic word structures, ignoring the quantity opposition in the second-syllable vowel. CS only has two possible quantity distinctions, e.g. *baka* 'to bake' vs. *backa* 'to back', i.e. CV:CV vs. CVC:V. Finnish, by contrast, has four possible distinctions exemplified in Table 1 (with syllable boundaries indicated in the phonetic transcriptions).[3] Consequently, e.g. *takka* and *taakka* represent the structures CVCCV and CVVCCV, respectively, following the analysis of contrastively long segments as sequences of two identical phonemes first proposed by Karlsson

(1969); for more information on the phonological interpretation of quantity in Finnish see Suomi, Toivanen & Ylitalo (2008: 39-42) and the references therein.

Table 1: A comparison of the possible quantity distinctions in disyllabic words with initial stress in CS and Finnish. For Finnish, the quantity opposition in the second-syllable vowel is ignored.

CS Swedish	Finnish
	□CVCV *haka* [haka] 'hook'
□CVːCV *baka* [bɒːkɐ] 'bake'	□CVVCV *raaka* [raːka] 'raw'
□CVCːV *backa* [bakːɐ] 'to back'	□CVCCV *takka* [takːa] 'fireplace'
	□CVVCCV *taakka* [taːkːa] 'burden'

The earlier literature points to many shared characteristics between FS and Finnish, both segmentally and prosodically. Reuter (1982: 16) notes that "Finland-Swedish pronunciation, in particular the Helsinki-Swedish pronunciation, exhibits so many similarities to Finnish pronunciation that they cannot be explained as generally peripheral (i.e. dialectal) features but, instead, Finnish influence has to be assumed …" (translation by K. Suomi). More experimentally, Kuronen (2000) shows that FS vowel qualities resemble those of Finnish vowels. In particular, a short vowel allophone in FS is qualitatively very similar to its long counterpart, a circumstance very similar to that obtaining between Finnish short and long (phonologically single and double) vowels. In other Swedish varieties, however, short and long allophones differ considerably in quality. Also, many of the long vowel allophones in CS are quite diphthongized. FS, however, has monophthongal long allophones, much like Finnish long (double) vowels.

Similarly, it has been suggested that FS and Finnish share characteristics with regard to quantity. Kuronen (2000: 59ff) points out, for example, that V/Vː ratios in FS resemble Finnish more than CS. Also, the literature (Itkonen, 1965 and Kiparsky, 2008) suggests that there is more durational variation in the phonetic implementation of quantity in FS than in CS.

Our principal aim in the present paper is to establish, empirically, in which ways, and to what degree, FS differs from CS in the phonetic expression of the quantity contrast, as well as whether these differences can be attributed to influence from Finnish. Our investigation shows that although CS and FS have similar quantity systems phonologically, the phonetic correlates of quantity in these systems differ considerably. Most significantly, the durational distinction between the two contrastive quantity patterns, V:C vs. VC:, is greater in FS than in CS. This means that for V:C, FS has proportionally longer vowels and shorter consonants than does CS, and for VC:, FS has a proportionally shorter vowel and a longer consonant than does CS. Further, we found that durations in FS are far more similar to durations in Finnish than in CS. These findings support the view of Kuronen & Leinonen (2010) that the differences observed between CS and FS are due to the influence from Finnish on the prosodic structure of FS.

Our findings also shed light on earlier descriptions regarding the V/C-ratio in V:C sequences in FS. Kiparsky (2008), citing Itkonen (1965) and Reuter (1982), suggests that the characteristic quantitative properties of Fenno-Swedish are the result of accommodation to one of the two quantitative models available in Finnish words. Consider the CS pronunciation of a V:C word like *baka* 'to bake', phonologically /bɑ:ka/. Kiparsky notes that in such words, the fortis stop is considerably longer than a corresponding lenis stop and that, to Finnish ears, it sounds intermediate between a long (double) and a short (single) stop. He observes that there is an apparent dialect split for such V:C words in FS such that one group of speakers produces a quantity similar to the Finnish VVC quantity while another group of speakers produces a quantity similar to the Finnish VVCC quantity.

Our experimental data support this. First, our data confirm that there is a substantial durational difference between fortis and lenis stops in CS. Second, we found that our FS speakers had differing V-to-C ratios for V:C sequences in words with a fortis stop, some with durations similar to Finnish VVCC while others with durations similar to Finnish VVC.

Finally, a robust *voicing effect* was found for both FS and CS, i.e., we found that vowels were considerably shorter before fortis stops than before lenis stops. We also found substantial differences in the duration of the fortis and lenis stop occlusion durations for both FS and CS. Thus, in both FS and CS, both vowel and stop duration serve as cues to the fortis vs. lenis

contrast. For CS, this means that not only does CS utilize the VOT continuum to a greater extent than many other languages (Helgason & Ringen 2008), but it also appears to use durational differences to cue the fortis-lenis contrast.

2. Method

Helgason & Ringen (2008) and Ringen & Suomi (2012) examined voicing conditions in stops in CS and FS respectively. In the present study we make use of the data sets recorded for these two studies, but instead of examining voicing conditions we now investigate the durational aspects of vowel-stop sequences. The CS and FS data sets in the first two studies were similar, but not fully identical, and for the present study we include only those target words that are shared between the previous two studies. The 43 target words are listed in the Appendix according to type. The vowel in the stressed syllable was followed by a final stop in monosyllabic words or by a medial stop in disyllabic words. These are the VC sequences in which the Swedish quantity contrast is realized. The target words represent the following eight word structures, with the relevant VC sequence underlined (see Appendix for glosses):

Monosyllabic C<u>VC:</u> in which the final stop is lenis, e.g. *dagg*, six words
Monosyllabic C<u>VC:</u> in which the final stop is fortis, e.g. *däck*, six words
Monosyllabic C<u>V:C</u> in which the final stop is lenis, e.g. *väg*, four words
Monosyllabic C<u>V:C</u> in which the final stop is fortis, e.g. *fat*, six words
Disyllabic C<u>VC:</u>V in which the medial stop is lenis, e.g. *ledde*, five words
Disyllabic C<u>VC:</u>V in which the medial stop is fortis, e.g. *bytte*, six words
Disyllabic C<u>V:C</u>V in which the medial stop is lenis, e.g. *leda*, four words
Disyllabic C<u>V:C</u>V in which the medial stop is fortis, e.g. *baka*, six words

The CS data were recorded in an anechoic chamber at the Stockholm University phonetics laboratory (see Helgason & Ringen, 2008 for details). The FS data were recorded in an anechoic chamber at the Centre for Cognitive Neuroscience of Turku University, following the template of the Stockholm recordings as closely as possible (see Ringen & Suomi, 2012 for details). The CS speakers were three female and three male native speakers who have lived in Stockholm most or all of their lives. For the 12 FS speakers, six female and six male, FS was the first language and

the language of education, as it was for both of their parents. The FS speakers came from all three main areas in which Swedish is spoken in mainland Finland: Uusimaa (the southern coast of Finland around Helsinki), Turunmaa (the south-western archipelago near Turku) and Pohjanmaa (Ostrobothnia, middle of the west coast). The FS speakers were all fluent in Finnish. The ages of the speakers in both studies ranged from early twenties to late forties. All speakers were paid for participating in the experiments.

The data were elicited using a word list. The speakers read the word list twice with pauses between the words. The segment durations in the VC sequence, in which the Swedish quantity contrast is realized, were measured i.e. the duration of the vowel in the stressed syllable and the duration of the following stop. For both vowel and stop duration, criteria relating to supralaryngeal aperture were used for durational measurements. Thus we measured stop duration as the period of oral occlusion and vowel duration was measured as the period of oral aperture between the consonants in the CVC sequence. The reason for using these criteria is that CS has frequent occurrences of preaspiration at vowel + fortis stop junctures, i.e. the voice offset for the stop occurs before the stop occlusion gesture. This effect is substantial. Of the six CS speakers, two female speakers had a mean preaspiration duration exceeding 55 ms, two male speakers had a mean preaspiration duration less than 35 ms, and the remaining two speakers (a female and a male) had intermediate preaspiration durations (see Helgason & Ringen 2008 for further details). By contrast, our FS speakers had no such tendency for preaspiration. Thus, while our FS speakers exhibit a very tight coordination between voice offset and stop closure at the onset of fortis stops, our CS speakers separate these events, on average, by 44 ms.

This difference in gestural timing has consequences for the durational comparison between CS and FS, since it is unclear how the preaspirated portions in the CS data should be treated. The approach we adopt here is to compare the timing of the supralaryngeal events (i.e. oral aperture) rather than the glottal events (voice offset/onset) or some combination of the two. Effectively, this means that preaspiration in our CS data is included in the vowel duration. Also, note that in seven of our target words the vowel is preceded by a fortis stop which yields postaspiration in CS (but not FS) and in these cases, following our measurement criteria, postaspiration is included in the duration of the following vowel. Thus the reader should be aware that what we refer to as *vowel duration* in our analysis includes any pre- and postaspiration.

The statistical analyses were conducted as follows. For each of the 18 speakers, means for each of the dependent variables were computed for each word structure. For example, for the monosyllabic words with a short vowel two means of each of the dependent variables were computed for each speaker, one mean across the words ending in a lenis stop (e.g. *dagg*) and another mean across the words ending in a fortis stop (e.g. *däck*). The 36 means so obtained were then submitted to statistical analysis, in which Variety and StopType were treated as fixed factors.

3 Results

3.1 Absolute durational results

Table 2 gives the mean durations of vowel, stop occlusion and combined duration of vowel and occlusion for the different types of words considered. Table 2 clearly reveals that there are two

Table 2: The average duration (in ms) for vowel (V dur), stop occlusion (C dur) and vowel + stop occlusion (V+C) for the different word types in CS and FS. The $ symbol indicates monosyllabic forms and $$ indicates disyllabic forms.

				CS			FS		
Qty	Syl	StopType	Example words	V dur	C dur	V+C	V dur	C dur	V+C
VC:	$	Lenis	*dagg* ‘dew’	166	132	289	120	157	278
	$	Fortis	*däck* ‘deck’	126	222	348	90	228	318
	$$	Lenis	*ledde* ‘led’	127	159	286	98	179	277
	$$	Fortis	*bytte* ‘exchanged’	107	228	335	82	237	319
V:C	$	Lenis	*väg* ‘road’	257	92	349	234	79	313
	$	Fortis	*fat* ‘vat, bowl’	234	179	413	222	130	353
	$$	Lenis	*leda* ‘to lead’	232	71	303	204	52	255
	$$	Fortis	*baka* ‘to bake’	200	164	364	–	–	–
	$$		BAAKA	–	–	–	199	83	282
	$$		BAAKKA	–	–	–	170	170	340

quantity types in CS and FS, short vowels followed by long consonants and long vowels followed by short consonants. For both CS and FS, the mean vowel durations for short vowels are below 170 ms while the mean durations for long vowels are above 170 ms. Fortis and lenis stops differ substantially in duration, with fortis stops being considerably longer than corresponding lenis stops. Thus fortis and lenis stop durations should be considered separately. The short lenis stops in both FS and CS have mean durations below 100 ms and the long lenis stops have mean durations above 130 ms in both varieties. In both CS and FS, the mean durations of short fortis stops are below 180 ms while for long fortis stops they are above 220 ms.

The results for the fortis stops are complicated by the fact that the FS speakers split into two distinct subgroups in their production of disyllabic words with a long vowel and an intervocalic fortis stop (i.e. words with a structure like *baka*). This is unlike CS, where all speakers behave uniformly. The implications of this split are most evident in the stop durations, with the one group, the BAAKA speakers, having a mean stop duration of 83 ms in *baka* type words while the other group, the BAAKKA speakers, have a mean stop duration of 170 ms in such words. Note that although the latter group is represented in transcription with a long stop, this should not be taken to indicate that it is phonologically long, only that it is longer than the stop produced by the BAAKA speakers. This split and possible reasons for it are discussed further in section 4.1.

In addition, Table 2 illustrates that in both CS and FS vowel durations before fortis stops are shorter than before corresponding lenis stops. For example, in CS vowel duration in *dagg* type words is 166 ms while in *däck* type words it is 126 ms, a difference of 40 ms. In FS, the corresponding durations are 120 ms, 90 ms and 30 ms.

The quantity types are well separated in both varieties of Swedish as indicated by the scatterplots in Figure 1. A slight overlap can be observed between *dagg* and *väg* type words in CS, but otherwise the V:C and VC: are completely separated.

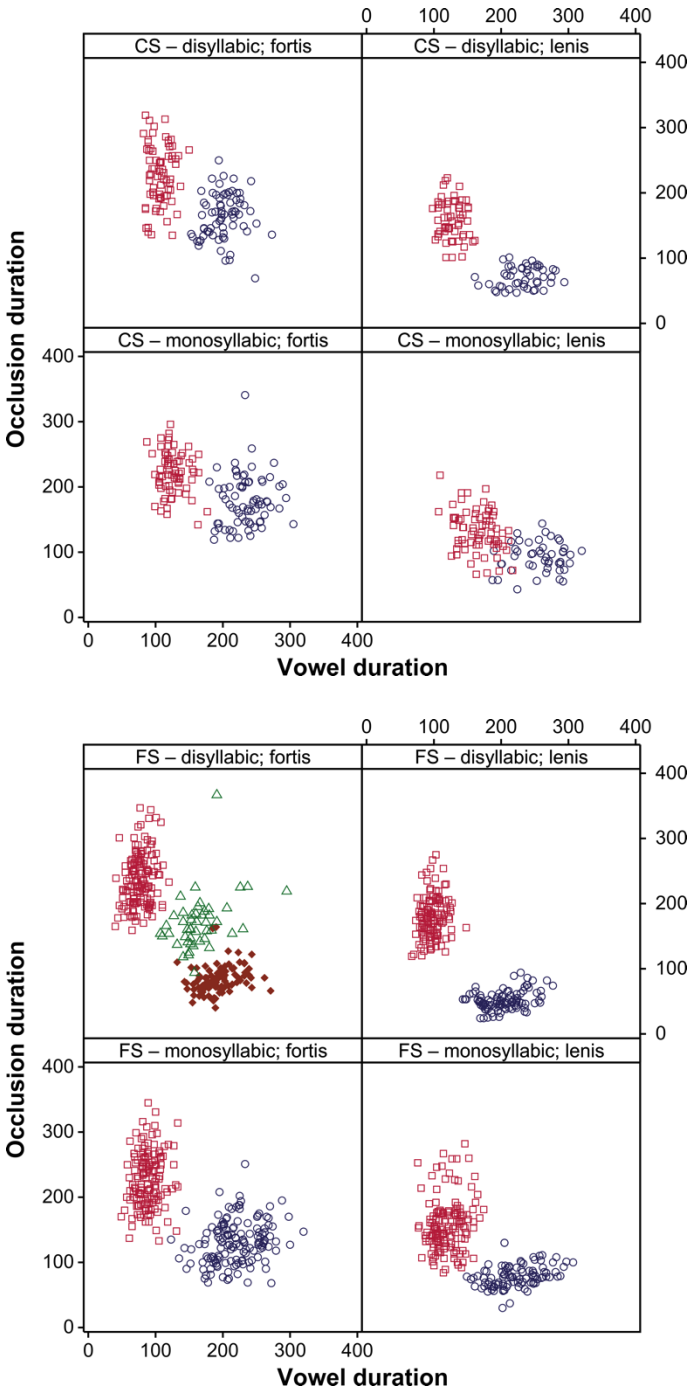

Fig. 1. Scatterplots for CS and FS showing absolute durational measurements for vowels (abscissa) and stop occlusions (ordinate) in monosyllabic and disyllabic words. The unfilled squares (red) indicate VC: sequences and the unfilled circles (blue) indicate V□C sequences. In the FS data, the unfilled triangles (green) indicate BAAKKA speakers and filled rhombs (maroon) indicate BAAKA speakers.

Table 2 shows that the duration of V+C is consistently greater in CS than in FS. This may indicate that there is a difference in speaking rate between the two data sets. Hence, using absolute durations would be unreliable for quantity comparisons. Instead, at least for languages that have complementary length such as Swedish, word-internal comparisons of V and C durations have been shown to be a more reliable indicator of quantity (cf. Pind, 1986 for Icelandic and Bannert, 1979 for Swedish). Durational ratios of segment durations are also standardly used in studies of Estonian and Finnish. Therefore, when comparing FS and CS, we present our data in terms of the proportion of the vowel in the VC-sequence, i.e. V/(V+C), henceforth referred to as V%. This gives a measure of duration that is, by and large, normalized for speaking rate.

3.2 Proportional durations (V%)

Table 3 gives V% for all word types considered in our CS and FS data as well as V% values for comparable VC sequences extrapolated from previous studies of Finnish.

Table 3. Vowel percentages (V%) in VC structures in the FS and CS data. The $ symbol indicates monosyllabic forms and $$ indicates disyllabic forms. For comparison, vowel percentages (converted from V/C ratios) from previous studies of Finnish are given in the far right column, using the smallest and largest means reported in sources (Lehtonen, 1970; Suomi, Toivanen & Ylitalo, 2003; Suomi & Ylitalo, 2004 and Ylitalo, 2009; contrastively accented words in the last reference were excluded).

Qty	Syl	StopType	Example words	CS	FS	Finnish
VC:	$	Lenis	*dagg*	55.9%	43.8%	–
	$	Fortis	*däck*	36.4%	28.4%	–
	$$	Lenis	*ledde*	44.6%	35.5%	–
	$$	Fortis	*bytte*	32.3%	25.7%	29%–33% (CVCCV)
V:C	$	Lenis	*väg*	73.7%	74.8%	–
	$	Fortis	*fat*	57.0%	63.2%	–
	$$	Lenis	*leda*	76.6%	79.8%	–
	$$	Fortis	*baka*	55.3%	–	–
	$$		BAAKA	–	70.7%	66%–73% (CVVCV)
	$$		BAAKKA	–	50.1%	44%–48% (CVVCCV)

In most of the ANOVAs (analyses of variance) reported below, Variety (CS or FS) and StopType (fortis or lenis) were used as fixed factors. In preliminary analyses, we tested for the effects of Sex, but there was never any significant effect. We also tested for the effects of the division of the FS speakers into the BAAKA and BAAKKA groups in each word structure, but the division only had significant effects in the very word structure that prompted this grouping in the first place. That is, apart from the disyllabic words with a medial fortis stop, the two groups did not differ from each other. Below, therefore, we report statistical results without Sex and the BAAKA-BAAKKA division as grouping variables (except for where the latter is directly involved). There was never a significant interaction between Variety and StopType (where such an interaction is possible). In one case this interaction approached significance (see section 3.2.3 below), but otherwise we do not report further on this interaction.

3.2.1 VC: quantity – monosyllabic words

There were 12 monosyllabic words with a short vowel, six ending in a lenis stop (e.g. *dagg*) and six ending in a fortis stop (e.g. *däck*). The words with a final lenis stop had much higher V% values than those ending in a fortis stop for both CS and FS (see Table 3). An ANOVA indicated that StopType was significant [$F(1, 32) = 126.40$, $p < 0.001$]. For both fortis and lenis stops, FS had lower V% values than CS. This effect of Variety was significant [$F(1, 32) = 42.11$, $p < 0.001$].

3.2.2 VC: quantity – disyllabic words

There were 11 disyllabic words with a short vowel in the stressed initial syllable. In five words the medial consonant was a lenis stop (e.g. *ledde*) and in six words it was a fortis stop (e.g. *bytte*). As in the monosyllabic VC: words, the words with a medial lenis stop had much higher V% values than those with in a medial fortis stop for both CS and FS (see Table 3). This effect of StopType was significant [$F(1, 32) = 80.27$, $p < 0.001$]. As in the monosyllabic VC: words, FS had lower V% values than CS, and the effect of Variety was significant [$F(1, 32) = 40.68$, $p < 0.001$].

3.2.3 V:C quantity – monosyllabic words

There were 10 monosyllabic words with a long vowel, four ending in a lenis stop (e.g. *väg*) and six ending in a fortis stop (e.g. *fat*). As in the VC: words, the words ending with a lenis stop had much higher V% values than words ending in a fortis stop (see Table 3). This effect of StopType was significant [$F(1, 32) = 113.22$, $p < 0.001$]. The difference in V% values between the two varieties, FS and CS, was much smaller than in the VC: quantity words, but an ANOVA still indicated that it was significant [$F(1, 32) = 7.41$, $p < 0.01$]. While the numerical values appear to suggest an interaction between Variety and StopType (the variety difference being much smaller before lenis than fortis stops), this interaction is still not significant at the 0.05 level ([$F(1, 32) = 3.68$, $p = 0.064$]).

3.2.4 V:C quantity – disyllabic words

The FS speakers behaved as a homogeneous group when the long vowel of disyllabic words was followed by a lenis stop (e.g. *väga*). However, in the production of *baka* type words, in which the long vowel is followed by a fortis stop, they were clearly divided into two distinct groups, as mentioned above. Eight speakers (the BAAKA group) pronounced *baka* type words with a long vowel and a short consonant, e.g. [baːkɑ], and the other four speakers (the BAAKKA group) pronounced them with a long vowel and a long consonant, e.g. [baːkːɑ]. Therefore, we have divided the presentation of the results of disyllabic words with a long vowel into two subsections, disyllabic words with a medial lenis stop and disyllabic words with a medial fortis stop.

3.2.4.1 V:C quantity – disyllabic words with a lenis medial stop

There were four disyllabic words with a long vowel and a lenis medial stop (e.g. *leda*). The only applicable grouping variable was Variety, which failed to have a significant effect on V%.

3.2.4.2 V:C quantity – disyllabic words with a fortis medial stop

There were six words with a long vowel and a fortis medial stop (e.g. *baka*). Here we divided the speakers into three groups, CS speakers, FS BAAKA speakers and FS BAAKKA speakers. The division of the FS speakers into the BAAKA and BAAKKA varieties was fully categorical: a given speaker used one of the two pronunciations systematically. To the Finnish author, who measured the FS data, the division of the speakers into the two groups was straightforward, even without reference to the results of the measurements, as the two pronunciations sound very much like two

contrastive durational patterns in Finnish, namely CVVCV and CVVCCV (e.g. *raaka* ‘raw’, *taakka* ‘burden’). Variety (CS, FS BAAKA and FS BAAKKA) is the only applicable grouping variable here. The FS BAAKKA speakers had a mean V% of 50.1% and the FS BAAKA speakers had a mean V% of 70.7%. Mean V% for the CS speakers was in between, at 55.3%. An ANOVA indicated that Variety had an effect on V% [$F(2, 15) = 81.29$, $p < 0.001$]. Post hoc tests indicated that all three varieties differed from each other.

4 Discussion

Our major finding is that, although our speakers of both FS and CS have the same complementary quantity contrast in phonological terms, there are substantial differences in the phonetic expression of the quantity contrast that are largely attributable to influence from Finnish.

4.1 The BAAKA ~ BAAKKA split

The variation we observe in *baka* type words is well established in the literature (see e.g. Itkonen, 1965 and Reuter, 1982). According to Reuter (1982), the BAAKA ~ BAAKKA variation is determined by both regional and sociolinguistic factors: the BAAKKA pronunciation is characteristic of upper-class FS speech, primarily in Helsinki, Turku and certain other towns in Southern Finland. However, it is not found in, for example, Vaasa (in Ostrobothnia). Of our four BAAKKA speakers two were born in Turku (Åbo), one in Helsinki (Helsingfors) and one in Tammisaari (Ekenäs), all of which are towns in Southern Finland. The eight BAAKA speakers were born either in smaller localities in Southern Finland or in Ostrobothnia. However, all twelve speakers were living in Turku at the time of the recordings.

Several explanations have been proposed for the BAAKKA type of pronunciation. First, it has been suggested that it is a development that relates to the dismantling of the Old Norse quantity system (see Sjöros, 1917, cited in Reuter, 1982). A second suggestion, noted by one of our reviewers, is that the BAAKKA pronunciation has come about through influence from CS. A third explanation was put forward by Itkonen (1965), who claimed that it is the result of an internal compensation process in FS; we shall discuss Itkonen’s claim as well as the related notion that the BAAKKA pronunciation is a result of a spontaneous, sporadic change in FS. Lastly, it has been

suggested (Hakulinen, 1961) that the BAAKKA pronunciation has come about through influence from Finnish. We shall address these suggestions in turn below.

The suggestion that the BAAKKA pronunciation is a development relating to the dismantling of the older, four-way quantity system of Old Norse is discussed in Reuter (1982; citing Sjöros, 1917). The impetus for this suggestion is the existence in older texts of double consonants in the spelling of words which today have the V:C quantity type in CS, but which had VC quantity in Old Norse (i.e., words such as *baka*). However, as Reuter points out, such spellings are also found for voiced speech sounds, which greatly reduces the force of this evidence. Since there is no support for this suggestion beyond these orthographic observations, the suggestion does not merit further discussion.

To our knowledge, the suggestion of a CS source for the BAAKKA pronunciation has not been previously made. The argument is that upper class Helsinki speakers would look to CS as a kind of standard, in which case the lengthened stop in BAAKKA would be a reflection of the relatively long duration of fortis stops (as compared to lenis stops) after long vowels in CS. However, the circumstances of the contact situation speak against this scenario. The BAAKKA pronunciation was first mentioned in writing by Pipping (1892-97), and it is likely that it had already existed for some time. From 1809 until 1917 Finland was an autonomous Grand Duchy under the Russian Emperor, and, especially in the 19th century, connections with Sweden were scarce and discouraged by Russian authorities. Any influence from CS would involve exposure to CS speech, either through visitors from Sweden or through FS speakers traveling to (and returning from) the Swedish mainland. We find it doubtful that such scarce contacts with CS could have resulted in contact induced change. Also, the V% values for *baka* type words in the FS BAAKKA variety are 5 percentage points lower than in CS (see Table 3). Extrapolating from the comparison of other FS and CS ratios, CS influence should have resulted in a similar (or a slightly higher) ratio for *baka* type words in FS than in CS, not the markedly lower ratios observed.

Itkonen (1965) suggested that an internal compensation process was the cause for the BAAKKA pronunciation, and that it was thus not due to influence from CS or Finnish. He suggested that FS had lengthened the medial obstruent in the BAAKKA type of words in order to enhance the difference between voiced and voiceless obstruents; /s/ and /ʃ/, which lack a voiced counterpart,

would participate in the same pattern of lengthening due to a systemic compulsion, in analogy with the other voiceless obstruents. However, this explanation is hardly credible. From Table 2 it is possible to compute that the duration of the medial stop in BAAKA is 1.6 times longer than the duration of the medial consonant in the *leda* type of words. In the word structures with a short vowel (exemplified by *bytte* and *ledde* in Table 2), the corresponding ratio is 1.3, i.e. smaller. Given this difference, it is unclear why the medial consonant in the BAAKA pronunciation would be lengthened, while *bytte* words, with a smaller ratio, seem to cause no perceptual problems relative to *ledde* words. Moreover, if the lengthening that has taken place in the BAAKKA words had a perceptual motivation, it is unclear why just upper-class speakers of FS in some Southern Finland cities (and only four of our speakers) would require an enhancement of the fortis-lenis contrast, while other speakers of FS (lower-class speakers in some Southern Finland cities, probably all speakers in Ostrobothnia, and eight of our speakers) would find no need for such enhancement.

Another explanation for the observed differences between CS and FS in general, and the BAAKKA pronunciation in particular, is that they are due to spontaneous developments in the two varieties. There is little evidence that the present phonetic (including prosodic) features that differentiate FS from CS could be traced back to the Swedish spoken by the early immigrants and their former neighbors in Sweden, i.e. that a variety like the present-day FS was spoken in Sweden when the migration was in progress hundreds of years ago. However, one might consider whether these developments, including the BAAKKA pronunciation, are due to e.g. universal phonetic forces (which could be deduced from general typological distributions), rather than to influence from Finnish.

Table 4 shows the existing quantity patterns in disyllabic words in CS and FS, together with those in Finnish (for Finnish, Table 4 overlooks quantity contrasts concerning the second-syllable vowel). While CS has only two patterns (V:C and VC:), FS has four. Since the FS patterns V:C and V:C: are sociolinguistically/regionally determined variant pronunciations of the same words (reflecting the BAAKKA–BAAKKA split), there is no genuine opposition between these two structures. Similarly, it is unclear whether there are genuine minimal pairs involving the structures CVCV and CV:CV. Nevertheless, the occurrence of four possible quantity patterns is in stark contrast to CS in which only two patterns are possible. It could be argued that, in the present situation, the door is open in FS for a wider establishment of a three-way, possibly a

four-way quantity opposition (while the door seems to be strictly closed in CS). Thus, a phonological divergence has already emerged in FS, relative to CS. And as Table 4 shows, the divergence is in the direction of Finnish.

Table 4. The existing quantity patterns in disyllabic words in CS, FS and Finnish. For Finnish, quantity patterns concerning the second-syllable vowel are overlooked.

Central Swedish	Fenno-Swedish	Finnish
	CVCV *foto* [foto], *fara* [fɑrɑ]	CVCV
CV:CV *baka* [bɒ:kɐ]	CV:CV [bɑ:kɑ]	CVVCV
CVC:V *backa* [bak:ɐ]	CVC:V [bɑk:ɑ]	CVCCV
	CV:C:V [bɑ:k:ɑ]	CVVCCV

With respect to the quantity patterns that both varieties share, the V:C and VC: patterns, we observed that speakers of FS made a greater durational separation between these patterns than did speakers of CS (a finding to be discussed in more detail in the next section). It is as if speakers of FS were producing durations that would be more appropriate in a language in which quantity distinctions have to be made separately for the V segment and the following C segment, since quantity is contrastive in both segments. Finnish, a language most FS speakers hear daily, is such a language. And in fact, as Table 4 shows, FS itself may be on the way to becoming a similar language (with, however, no quantity oppositions in unstressed syllables).

It is unclear what kind of universal phonetic forces could account for these developments. Surely, since Finnish exists, it is possible for a language to develop a quantity system like the Finnish system. However, if some universal tendencies would favor such a system, it should have emerged in many more languages than it has. In fact, it seems that quantity systems such as that found in Finnish are among the least usual systems from a typological perspective. It thus seems highly unlikely that FS has spontaneously adopted durational patterns that are more appropriate for a quantity system with a four-way contrast than for a system with a two-way

contrast, and we are unaware of any established universal phonetic forces that could have caused the FS quantity system to take its present shape, both phonologically and phonetically.

To return to the present results, note that for VC: quantity types, FS has consistently smaller mean V% values than does CS. For V:C quantity types, FS has greater V% values in *väg, fat* and *leda* type words (see Table 3). Extrapolating from these correspondences, we would expect the mean V% value for FS *baka* to be somewhat higher than CS *baka*, i.e. approximately 60%. Instead, FS shows a split into distinct durational patterns. Four of our FS speakers have a mean V% value of 50% (BAAKKA), and the remaining eight speakers have a mean V% of 71% (BAAKA).

In Finnish two of the four quantity patterns have a long vowel, CVVCV (e.g. *raaka*) and CVVCCV (e.g. *taakka*). In previous studies of Finnish, long, stressed vowels in *raaka* type words have had a mean V% between 66% and 73%, while in *taakka* type words V% has been between 44% and 48% (see Table 3). Our FS BAAKA speakers have a mean V% of 71%, which falls neatly within the range of observed V% values for Finnish *raaka* type words. Our FS BAAKKA speakers have a mean V% of 50%, which approximates the observed values for Finnish *taakka* type words. Thus the most straightforward explanation for the observed durations in FS *baka* is that our FS speakers are influenced by Finnish durational templates in their production of Swedish. Instead of the expected V% value of approximately 60% for the *baka* productions of all the FS speakers, they split into two groups with mean V% values of 50% and 71%, thus approximating the durational templates of Finnish fairly closely.

The split is only observed in *baka* type words, i.e. disyllabic words with a medial fortis stop. If the stop is lenis or if the word is monosyllabic no split occurs. This is entirely consistent with influence from Finnish, since neither lenis stops nor monosyllables are native to Finnish. Thus FS speakers draw on Finnish durational templates only for sequences that have an approximate phonetic correspondence in Finnish.

Our results do not indicate a dialect split in *fat* type words (monosyllabic V:C words with a fortis stop) corresponding to the split observed in the *baka* type words. However, Reuter (in personal communication to K. Suomi) suggests that such a split does exist and Kiparsky (2008) maintains

that the "gemination of word-final consonants is heard clearly when a vowel follows in close contact in the next word." Since our data does not include words in a sentence frame context, we do not have evidence one way or the other.

Reuter (1982) studied the phenomenon in Helsinki, in the speech of six upper-class (social group 1) male speakers, and, for comparison, in the speech of one lower-class (social group 3) male speaker; a three-way social stratification was used. The six upper-class speakers systematically produced the BAAKKA type pronunciation, and the mean V% proportion, computed from Reuter's Table 10.1, was 51%, exactly as in the present experiment. The one lower-class speaker systematically produced the BAAKA type pronunciation, with a mean V% proportion of 72% (Reuter's Table 10.2.), i.e. almost the same as in the present study (73%). Reuter also had two CS speakers for comparison (both had grown up in the Stockholm area). For these speakers the mean V% proportion in *baka* type of words was 56%, again almost identical with the mean observed for our CS speakers (55%). These close correspondences strongly suggest that our speaker groups are representative of their varieties.

To our knowledge, Reuter (1982) and the present study are the only studies that have reported empirical results of controlled experiments concerning the pronunciation of the *baka* type words in both CS and FS. Both studies show that the CS V% proportion in the *baka* type words is between the proportions in the FS BAAKA and BAAKKA pronunciations, even though clearly closer to the latter. This observation is largely consistent with earlier claims (starting with Pipping, 1892-97), which however were based on perceptual impressions and not on any measurements. It has also often been noted, again on impressionistic grounds (e.g. by Itkonen, 1965, pp. 261-262), that the FS BAAKA pronunciation is durationally very similar to that of the Finnish word structure CVVCV, and that the BAAKKA pronunciation is durationally very similar to that of the Finnish structure CVVCCV, something that is highly consistent with our results when they are compared with those in Finnish.

To conclude, we do not claim that Finnish has directly caused the BAAKA – BAAKKA split. But the existence in Finnish of the patterns CVVCV and CVVCCV made such a split possible and provided a familiar pattern. The BAAKKA pronunciation is most reasonably attributed to Finnish influence in this way, on the one hand because of the durational similarities with the Finnish

CVVCCV quantity template and on the other because such a split only shows up in phonological structures that have a direct correspondence in Finnish. The durational ratios observed in the FS BAAKA productions, on the other hand, may not have changed substantially over the past two centuries. We do suggest, however, that recent influence from Finnish has reinforced the retention of the high V% in BAAKA and acted to increase it further. There is ample evidence that the phonetic properties of native language (L1) phoneme categories can be influenced by the phonetic properties of corresponding second language (L2) phoneme categories, see e.g. Caramazza & Yeni-Komshian (1974), Sancier & Fowler (1997) and Chang (2012). There seems to be no reason why L2 could not have a similar influence in prosody. A development in present day FS whereby the V% of BAAKA and BAAKKA productions would merge into an intermediate ratio of approximately 60% (i.e., in line with the other V% values for long vowels in Table 3) should be entirely possible, but we suggest that such a development is highly improbable because quantity in FS is currently under such strong influence from Finnish. Nor is there any evidence, informal or experimental, of such an intermediate ratio.

4.2 The V:C ~ VC: durational separation and long vs. short vowel quality

It was observed that the durational difference between V:C and ~ VC: was greater in FS than in CS. We can estimate the degree of the durational separation between the two quantity types by examining comparable word types for each quantity. Consider first how much the V% differs between *dagg* word types (VC: with a lenis stop) and *väg* word types (V:C with a lenis stop). From Table 3 we can estimate that for CS the durational separation is approximately 18 percentage points (pps), i.e. 73.7% minus 55.9%. In stark contrast, this separation in FS is 31 pps (i.e. 74.8% minus 43.8%). Table 5 shows the degree of durational separation for all word types considered. For *ledde* vs. *leda* word types the separation is approximately 32 pps in CS, but 44 pps in FS. For *däck* vs. *fat* word types the separation is 21 pps in CS, but 35 pps in FS. For *bytte* vs. *baka* the difference is 23 pps in CS, but for FS the situation is complicated by the fact that the FS speakers split into two distinct subgroups; for the short stop speakers (BAAKA) the *bytte* vs. *baka* separation is 45 pps, while for the long stop speakers (BAAKKA) it is 24 pps.

Thus the durational separation between the two quantity patterns is greater in FS than in CS. There are two possible explanations for this, both of which can be traced back to influence from

Table 5. The degree of durational separation between VC: and V:C (as percentage points) for CS and FS for different word types.

	Degree of durational separation between VC: and V:C (as percentage points)	
Example words	CS	FS
dagg vs. *väg*	18	31
ledde vs. *leda*	32	44
däck vs. *fat*	21	35
bytte vs. *baka* CS	23	
bytte vs. BAAKA FS		45
bytte vs. BAAKKA FS		24

Finnish. One explanation is that in Finnish vowels and consonants have a binary quantity contrast independent of each other, which gives rise to a four-way contrast in quantity as opposed to the two-way contrast that is generally found in Swedish (see Table 1). Since most FS speakers are bilingual, and speak and hear Finnish on a day-to-day basis, they are applying durational ratios appropriate for a four-way distinction in quantity. Thus, in a way they have come to make greater durational distinctions than occur in CS Swedish. The effect is an apparent exaggeration of the durational opposition in FS as compared to CS Swedish.

Another explanation draws on the fact that there are *qualitative* differences between long and short allophones in CS Swedish, which may reduce the reliance on durational cues to uphold the quantity contrast. In FS, on the other hand, long and short vowel allophones are *qualitatively* very similar and contribute very little to upholding the quantity contrast. Since it has been suggested that the fact that long and short vowel allophones in FS are so similar in quality is in

itself the result of influence from Finnish (Kuronen & Leinonen, 2011), this explanation ultimately also rests on influence from Finnish.

We note, finally, that our *baka* type words are historically derived from two different quantity types in Old Norse. For example, *baka* in Old Norse had a CVCV structure (i.e. both syllables were "light" or "short") while *köpa* 'buy' had a CVVCV structure. Since our findings for *baka* type words in neither CS nor FS reflect a CVCV structure, our findings cannot be explained with reference to Old Norse structure.

4.3 Comparisons with previous studies of FS quantity

FS dialects are among several Scandinavian dialects associated with the retention of Old Norse short syllable structures, i.e. CVCV (in words such as ON *baka*, Sw *baka*, 'to bake'; cf., e.g., Riad, 1992: 173ff), along with CV:CV structures (ON *hrópa*, Sw *ropa*, 'to shout') and CVC:V structures (ON *hoppa,* Sw *hoppa*, 'to jump'). In almost all other varieties of Swedish, older CVCV structures are, as a rule, reflected as CV:CV. Although the retention of the ON short syllable structure is documented in previous studies of FS (see below), our data do not reflect it.

Kiparsky (2008: 197) presents a table showing the variation in the pronunciation of different word classes across FS dialects (more exactly: syllable types according to weight), based on data from Harling-Kranck (1998). The first row of Kiparsky's table illustrates light stressed syllables in lexical words. The example word *baka* is listed with the pronunciation [bɑkɑ] in four of the dialects and with the pronunciation [bɑɑkkɑ] in two other dialects. We did observe variation precisely in this word structure, but the variation turned out to be different from what Kiparsky reports. The pronunciation [bɑkɑ] was not observed for any of our FS speakers, and the pronunciation [bɑɑkɑ], which was used by the majority of our speakers, is not reported by Kiparsky as occurring in Harling-Krank's data at all; our findings agree with Kiparsky in suggesting that the [bɑɑkkɑ] pronunciation is not the dominant one.

The apparent conflict can, we believe, be explained by three facts. First, our FS speakers' average age at the time of the recordings was 32 years. On average, they were born in 1975, whereas most of Harling-Kranck's speakers were born between 1880 and 1905. Second, Harling-Kranck's speakers all spoke conservative rural dialects, whereas our speakers are mostly

university students or administrators and speak regional standard varieties or "the urban Fenno-Swedish of Helsinki and Turku". Third, Harling-Kranck's speakers were selected from among a larger group of recorded speakers, and the particular speakers were chosen because they were "considered to represent good dialect [and] good story-telling ability" (p. 8, translation by K. Suomi). It is not inconceivable that such a selection by a dialectologist favors speakers who are not necessarily representative of the majority of speakers in a locality, but may instead favor speakers whose speech is considered to be interesting for e.g. historical reasons. In contrast, our speakers were selected if they fulfilled the basic criteria: FS is their native language, the language of their formal education, and the native language of their parents.

Although Kiparsky records the pattern [bɑkɑ][4] for *baka*, where our speakers use [bɑɑkɑ] or [bɑɑkkɑ], Kiparsky does cite another structurally similar word, *ropa* 'to call' with a long vowel: [ruupɑ] or [ruuppɑ], exactly parallel to the variation our speakers exhibited for *baka*. The types of rural dialects investigated by Harling-Kranck still exist today, and the pronunciation [bɑkɑ] can be found in these dialects. In *baka* type words (e.g. [bɑkɑ] 'bake', [hɑkon] 'the chin' and [viku] 'week') the Proto-Nordic [CVCV] structure (with a voiceless medial obstruent) has been preserved by some speakers in some FS dialects. The difference between [bɑkɑ] and [ruup(p)ɑ] is that in Proto-Nordic, there were also words with the structure [CV:CV], and this long vowel has been preserved in modern Fenno-Swedish dialects.[5] So, both the [bɑkɑ] and [ruupɑ] pronunciations are relics from Proto-Nordic that have been preserved in the conservative rural FS. The two have merged in CS Swedish and in Standard Fenno-Swedish. The pronunciations [bɑɑkkɑ] and [ruuppɑ] are, in turn, later developments in Fenno-Swedish. Hence, our characterization of FS, as represented by our speakers, refers to present-day, non-rural varieties spoken by younger speakers.

4.4 Duration as a cue to the fortis–lenis contrast

Segment durations are or may be determined by factors other than quantity, even in quantity languages and in prosodically highly uniform contexts (and such effects should be carefully controlled in any investigations of quantity). The influence of the fortis–lenis contrast on the duration of the preceding vowel, often referred to as the *voicing effect*, has been a widely studied and discussed phenomenon ever since the classic paper by Chen (1970). Our data clearly illustrate the voicing effect in both CS and FS. While absolute vowel durations in CS and FS

differ somewhat, the ratios of mean vowel durations before fortis and lenis stops are very similar (see Table 6). For all word types in both FS and CS the vowel before a fortis stop is shorter than a vowel before a corresponding lenis stop. Some variation is present for different word types but this variation is very similar in FS and CS. For example, in monosyllabic words with a phonologically short vowel, the fortis/lenis ratio is 0.75 for CS and 0.76 for FS, and for monosyllabic words with a long vowel the ratios are 0.91 and 0.95, respectively.

Table 6. The mean duration (in ms) of vowel preceding fortis stops (Vf), of vowels preceding lenis stops (Vl) and the ratio of the two.

	Stop length	Sequence type	V_f dur	V_l dur	V_f dur/V_l dur
	Long	VC: (*däck* vs. *dagg*)	126	166	0.76
	Long	VC:V (*bytte* vs. *ledde*)	107	127	0.84
CS	Short	V:C (*fat* vs. *väg*)	234	257	0.91
	Short	V:CV (*baka* vs. *leda*)	200	232	0.86
	Long	VC: (*däck* vs. *dagg*)	90	120	0.75
	Long	VC:V (*bytte* vs. *ledde*)	82	98	0.84
	Short	V:C (*fat* vs. *väg*)	222	234	0.95
FS	Short	V:CV (*leda vs.* BAAKA)	199	204	0.97
	Short	V:CV (*leda* vs. BAAKKA)	170	204	0.83

What seems to be a much less studied topic than the voicing effect above is the durational difference in fortis and lenis stops themselves. We therefore wish to point out the very large fortis–lenis differences in occlusion duration that were observed for CS. The fortis/lenis occlusion duration ratios (see Table 7) were 1.68 in long final stops in monosyllabic words, 1.94 in short final stops in monosyllabic words, 1.44 in medial long stops in disyllabic words, and 2.31 in medial short stops in disyllabic words. Although place of articulation should be more balanced than it was in the present materials, these ratios are very large. It is as if CS strives for an extremely clear perceptual contrast between its fortis and lenis stops. Utterance-initially (where occlusion duration cannot be estimated), the former are aspirated and the latter are prevoiced, a rare combination in the languages of the world, while medially and finally the fortis

stops are often preaspirated and the lenis stops are fully voiced (Helgason & Ringen 2008). The fortis/lenis occlusion ratios show that in addition the medial and final contrast is supported by a very large durational difference.

Table 7. The mean duration (in ms) of fortis stop occlusions, lenis stop occlusions and their ratio.

	Stop length	Sequence type	Fortis stop	Lenis stop	Fortis/lenis ratio
CS	Long stop	VC: (*däck* vs. *dagg*)	222	132	1.68
	Long stop	VC:V (*bytte* vs. *ledde*)	228	159	1.43
	Short stop	V:C (*fat* vs. *väg*)	179	92	1.95
	Short stop	V:CV (*baka* vs. *leda*)	164	71	2.31
FS	Long stop	VC: (*däck* vs. *dagg*)	228	157	1.45
	Long stop	VC:V (*bytte* vs. *ledde*)	237	179	1.32
	Short stop	V:C (*fat* vs. *väg*)	130	79	1.65
	Short stop	V:CV (*leda vs.* BAAKA)	83	52	1.60
	Short stop	V:CV (*leda* vs. BAAKKA)	170	52	3.27

5 Conclusion

Our main finding is that although CS and FS have similar quantity systems, the durational separation between the two quantity types is greater in FS than in CS. We attribute this difference to influence from Finnish, as the only credible explanation.

The quantity systems exhibited in our FS data differ from those described by Kiparsky (2008). The speakers discussed by Kiparsky were speakers of various conservative rural varieties, born in the late 1800s or early 1900s, whereas our subjects were born in the 1970s and 1980s and speak modern urban varieties. Thus it is not surprising that the quantity patterns we found are different from those discussed by Kiparsky.

We found that our speakers exhibited two different patterns for *baka* type words: The duration of the medial fortis stop for one set of speakers was roughly twice as long as for the other group.

The explanation that has been offered in the literature for this BAAKA ~ BAAKKA split is that a short intervocalic fortis stop in CS is considerably longer than a short stop in Finnish but still shorter than a long Finnish stop. Thus FS speakers influenced by Finnish quantity will tend to have either a shorter or a longer stop than found in CS. Our data support this analysis.

Finally, we found that both FS and CS exhibited a *voicing effect*, i.e., vowels before fortis stops were considerably shorter than before lenis stops. Also, we found that fortis stops were considerably longer than lenis stops, especially in the CS data. Thus, CS utilizes voicing and (pre)aspiration for the fortis-lenis distinction to a greater extent than is found in many languages and the durational difference between the fortis and lenis stops serves to increase this contrast even more.

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Footnotes (page affiliation shown in parentheses)

1. Names in alphabetical order. (p. 1)

2. We use the labels “fortis” and “lenis” to denote the stop series /ptk/ and /bdg/, respectively. This practice has few consequences in the present paper, but the practice helps to avoid potentially confusing statements of the sort that “voiced stops were voiceless under such and such conditions”. (p. 4)

3. In Finnish, the same quantity distinctions are found in unstressed syllables as well. For example, the partitive singular form of the words in Table 1 has a long (i.e. double) /aa/ vowel in the unstressed, final syllable, i.e. CVCVV (*ha.kaa*), CVVCVV (*raa.kaa*), CVCCVV (*tak.kaa*), CVVCCVV (*taak.kaa*). (p. 4)

4. Kiparsky’s transcriptions have [a] which we render as [ɑ] for the sake of clarity. (p. 21)

5. Our *baka* type words (i.e., with a long vowel in a stressed syllable followed by a fortis stop) are historically derived from two different quantity types in Proto-Nordic. Our list of *baka* type words included *baka*, CVCV in Proto Nordic, and *köpa* (like *ropa*), CVVCV in Proto-Nordic. (p. 21)

Appendix.

The Appendix lists the words analysed in this study arranged according to structure and stop type and gives glosses as well as example transcriptions (in broad IPA) for both CS and FS.

The monosyllabic words with a short vowel

Final long fortis stop

Word and gloss	CS transcription	FS transcription
glapp ‘gap, glitch’	[ˈgla$^{(h)}$pː]	[ˈglɑpː]
läpp ‘lip’	[ˈlɛ$^{(h)}$pː]	[ˈlepː]
fött ‘given birth’	ˈ $^{(h)}$]	[ˈføtː]
lett ‘led (SUP)’	[ˈlɛ$^{(h)}$]	[ˈletː]
däck ‘tire (noun)’	ˈ ɛ$^{(h)}$kː]	[ˈdekː]
puck ‘puck’	[ˈp^{h}ɵ$^{(h)}$kː]	[ˈp~~ʉ~~kː]

Final long lenis stop

Word and gloss	CS transcription	FS transcription
klubb ‘club’	[ˈk^{h}lɵbː]	[ˈkl~~ʉ~~bː]
labb ‘lab’	[ˈlabː]	[ˈlɑbː]
bädd ‘(simple) bed’	[ˈbɛ]	[ˈbedː]
sladd ‘cable, cord’	ˈ]	[ˈslɑdː]
dagg ‘dew’	ˈ gː]	[ˈdɑgː]
ägg ‘egg’	[ˈɛgː]	[ˈegː]

The monosyllabic words with a long vowel

Final short fortis stop

Word and gloss	CS transcription	FS transcription
gap ‘gap (n.)’	[ˈgɒː$^{(h)}$p]	[ˈgɑːp]
rep ‘rope’	[ˈɾeː$^{(h)}$p]	[ˈreːp]
fat ‘barrel’	[ˈfɒː$^{(h)}$]	[ˈfɑːt]
prat ‘talk (n.)	[ˈp^{h}ɾɒː$^{(h)}$]	[ˈprɑːt]
tak ‘roof’	ˈ ɒː$^{(h)}$k]	[ˈtɑːk]
vrak ‘(ship)wreck’	[ˈvɾɒː$^{(h)}$k]	[ˈvrɑːk]

Final short lenis stop

Word and gloss	CS transcription	FS transcription
kub ‘cube (n.)’	[ˈkʰ ːb]	[ˈkʉ ːb]
tub ‘tube’	[ˈ ʰ ːb]	[ˈtʉ ːb]
lag ‘team (n.)’	[ˈlɒːg]	[ˈlɑːg]
väg ‘road, way’	[ˈvɛːg]	[ˈveːg]

The disyllabic words with a short vowel

Medial long fortis stop

Word and gloss	CS transcription	FS transcription
släppa ‘release (vb.)’	[ˈslɛ(h)pːɐ]	[ˈslepːɑ]
tappa ‘lose (vb.)’	[ˈ (h)pːɐ]	[ˈtɑpːɑ]
byte ‘exchange (n.)’	[ˈbʏ(h) ɛ]	[ˈbytːe]
skötte ‘took care of’	[ˈ (h) ɛ]	[ˈʃøtːe]
kläcka ‘hatch (vb.)’	[ˈkʰlɛ(h)kːɐ]	[ˈklekːɑ]
packa ‘pack (vb.)’	[ˈpʰa(h)kːɐ]	[ˈpɑkːɑ]

Medial long lenis stop

Word and gloss	CS transcription	FS transcription
gubbe ‘old man’	[ˈgəbːɛ]	[ˈgʉbːe]
födde ‘gave birth’	[ˈ ɛ]	[ˈfødːe]
ledde ‘led’	[ˈlɛ ɛ]	[ˈledːe]
bygga ‘(to) build’	[ˈbʏgːɐ]	[ˈbygːɑ]
slägga ‘sledgehammer’	[ˈslɛgːɐ]	[ˈslegːɑ]

The disyllabic words with a long vowel

Medial short fortis stop

Word and gloss	CS transcription	FS BAAKA transcr.	FS BAAKKA transcr.
kapa ‘hijack’	[ˈkɒː(h)pɐ]	[ˈkɑːpɑ]	[ˈkɑːpːɑ]
köpa ‘buy (vb.)’	[ˈ øː(h)pɐ]	[ˈtʃøːpɑ]	[ˈtʃøːpːɑ]
byta ‘change (vb.)’	[ˈbyː(h) ɐ]	[ˈbyːtɑ]	[ˈbyːtːɑ]

sköta ‘take care of’	[ˈxʷøːˑ˞]	[ˈʃøːtɑ]	[ˈʃøːtːɑ]
baka ‘bake’	[ˈbɒːˑkɐ]	[ˈbɑːkɑ]	[ˈbɑːkːɑ]
läka ‘make whole, heal’	[ˈlɛːˑkɐ]	[ˈleːkɑ]	[ˈleːkːɑ]

Medial short lenis stop

Word and gloss	CS transcription	FS transcription
föda ‘give birth’	[ˈføːˑ˞]	[ˈføːdɑ]
leda ‘lead (vb.)’	[ˈleːˑ˞]	[ˈleːdɑ]
väga ‘weigh’	[ˈvɛːgɐ]	[ˈveːgɑ]
öga ‘eye (n.)’	[ˈøːgɐ]	[ˈøːgɑ]

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