Towards a Typology of Phonological Quantity in the Dialects of Modern Swedish

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ABSTRACT

This study examines phonological quantity and its phonetic outcome in a large range of modern Swedish dialects. It focusses on the so-called complementary quantity pattern and the accompanying differences in vocalic quality. The results show that the amount of complementarity in quantity distinctions varies systematically across the dialects. This is due to reduced differences between long and short consonants. Furthermore we found some indication that the spectral difference between long and short vowels increases when the degree of complementarity decreases.

1 INTRODUCTION

This study focusses on the realisation of complementary quantity, that is the complementary relationship between vowel length and consonant length in Swedish. Complementary quantity is often seen as a quite unique characteristic of the Scandinavian languages (except Danish) and marks therefore a natural point of departure for the construction of a typology of phonological quantity in modern Swedish dialects.

1.1 THE PROJECT "SweDia 2000"

The project "SweDia 2000" is a joint project of the Phonetics sections of the universities of Stockholm, Lund and Umeå (for a detailed description of the project, see e.g. [1]). Between 1998 and 2000 recordings were made at about 100 locations all over Sweden and the Swedish speaking parts of Finland. For each location recordings of 3 elderly women, 3 elderly men, 3 younger women and 3 younger men have been made. The material includes recordings of several quantity minimal pairs, where, normally, each speaker produced each word five times in a row.

1.2 QUANTITY IN SWEDISH

Central Standard Swedish (CSS) restricts the use of phonological quantity to lexically stressed syllables. Under stress, long vowels are either syllable-final or followed by a short consonant (V:C), while short vowels are followed by a long consonant (VC:) or a consonant cluster. Because of this alternating pattern in the length of vowels and consonants, CSS quantity is usually called "complementary". Measurements by Elert [2] showed clear durational differences between long and short vowels and between the consonants following them. With that, /V:C/ sequences and /VC:/ sequences tend to be of equal length. However, the difference between the vowels is somewhat greater than the difference between the consonants. Therefore /VC:/ sequences are usually slightly shorter than /V:C/ sequences in CSS (cf. [2], p. 158). The complementary pattern has been opposed to quantity patterns in languages like German and Danish, where only the vowel changes its duration (see e.g. [3], p. 23). Similar relationships with only a slight difference of consonant duration after long vs. short vowels have also been reported for one dialectal region in Southern Sweden, namely Skåne (see [4], p. 27-28).

1.3 THE ORIGIN OF COMPLEMENTARITY

The origin of the complementary pattern has been attributed to diachronic changes of syllable structure. It seems to be mostly a consequence of the elimination of so-called "short" /VC/ and "over-long" /V:C:/ sequences during the "Scandinavian quantity shift" (see e.g. [5]). In Standard Swedish, the elimination of the short and over-long sequences is complete, while some dialects kept the short sequences, mostly in bi-syllabic words. A few dialects even seem to have preserved over-long sequences (cf. [6], [7], [8]). In dialects that kept short or over-long sequences, vowel and consonant quantity is not just complementary, but consonant duration functions partly independent of vowel duration.

1.4 QUANTITY AND QUALITY

The quantity distinctions of vowels in CSS are accompanied by differences in the vocalic timbre. In [9] we have investigated spectral and durational differences between the long and the short variant of the vowel /a/ in Northern Swedish dialects (with partly the same material as in this study). We found some indications for a possible trading relationship between the spectral and the durational difference of the vowels. However, the effects were rather weak and only observable for "extreme" cases, i.e. for dialects that had exceptional

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high durational or spectral differences.

1.5 AIMS OF THE STUDY

The first aim of the present study was to find out, up to which degree the complementary pattern is realised in the dialects of modern Swedish. Therefore we examined the durational differences between the /V:C/ and the /VC:/ sequence of a minimal pair, together with the difference between the long and the short vowel and the difference between the post-vocalic consonants. The second aim was to examine vocalic timbre differences between the long and the short variant of the vowel, and to look for possible relations to durational differences.

2 METHOD

2.1 DIALECT AREAS

As a geographical basis for the analysis of the dialectal patterns we used a traditional classification in major areas, that has been developed by Swedish dialectologists (see e.g. [10]). According to this, Swedish is roughly divided into 6 dialect areas, namely "Östsvenska mål" (Eastern Swedish variety, EV - comprising the Swedish dialects spoken in Finland), "Norrländska mål" (Northern Swedish variety, NV), "Sveamål" (Svea variety, SV), "Götamål" (Göta variety, GV), "Sydsvenska mål" (Southern Swedish variety, SoV), and "Gotländska mål" (Gotlandic variety, GotV). As a seventh category we added the variety spoken on the island "Öland" (Öland variety, OeV). For the analysis, all recording locations were assigned to a dialect area. The numbers of speakers per dialect area are given below.

2.2 SUBJECTS AND MATERIAL

The study was based on the comparison of one minimal pair, produced by 147 speakers of the category "elderly men" in the Swedia database. The speakers came from 66 different locations in Sweden and the Swedish speaking parts of Finland. The minimal pair used was "tak" (roof) vs. "tack" (thank you). "Tak" has a /V:C/ structure, while "tack" has a /VC:/ structure in CSS. The segmentation of the sounds followed usual criteria like increase and decrease of formant energy, periodicity in the time signal etc. (see [8] for a more thorough description). The end of the final plosive was always marked immediately *before* the burst. In some cases, a preaspiration phase was marked between the vowel and the following plosive. Those tokens have been excluded from the current investigation. Detailed accounts on preaspiration in our material can be found in [11] and [12].

2.3 MEASUREMENTS

Only data of those speakers was used who produced both words and repeated both more than once without a preaspiration phase. The measured variables were averaged for every speaker, so that each speaker was represented with one value per variable. For the spectral analysis we performed the following measurements: F0, F1 and F2 were measured in the middle of each vowel. For each speaker and vowel category, the mean values of F0, F1 and F2 were calculated. To get an approximate estimation of the perceptual difference of the two vowels, these values were bark-transformed and for each vowel the differences B2-B1 and B1-B0 were calculated. Then the euclidean distance between the location of the long and the short vowel in the (B1-B0) over (B2-B1) space was calculated.

3 RESULTS

3.1 DURATIONS

For each of the seven dialect areas, table 1 provides the number of speakers and the means and standard deviations for the long and short vowels, for the long and short consonants and for the respective VC-sequences. The dialect areas have been roughly ordered from north-east to south. Table 2 shows the mean differences, and standard deviations, between the /V:C/ and the /VC:/ sequence (δ_{VC}), the long and the short vowel (δ_V) and the long and the short consonant (δ_C).

	n	***V:***	***C***	***V***	***C:***	***V:C***	***VC:***
EV	12	233 (64)	157 (43)	136 (48)	258 (60)	390 (76)	394 (95)
NV	27	199 (35)	162 (23)	113 (22)	218 (56)	361 (48)	331 (62)
SV	29	194 (34)	166 (35)	117 (28)	214 (46)	360 (57)	331 (64)
GV	38	204 (42)	160 (38)	125 (32)	185 (52)	363 (58)	310 (71)
SoV	25	214 (55)	177 (48)	134 (24)	196 (54)	392 (81)	330 (69)
GotV	8	186 (30)	156 (37)	107 (25)	175 (41)	342 (38)	283 (42)
OeV	8	201 (43)	138 (42)	140 (27)	143 (45)	339 (69)	283 (65)

Table 1: Mean durations and standard deviations (in brackets) for the minimal pair tak-tack. Values for the vowels, the following consonants and the whole sequences.

The mean values for vowel duration and consonant duration are also graphically represented in figure 1 and 2. Table 2 shows that the regions differ in δ_{VC}. In the Eastern Swedish sample, the difference between the /V:C/ and the /VC:/ sequence is virtually 0 (-4 ms). In the Göta varieties and the Svea varieties, the mean difference between the two sequences is around 30 ms. In the remaining areas, δ_{VC} is around 60 ms. For each

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	δ_{VC}	δ_V	δ_C
EV	-4 (55)	97 (30)	101 (53)
NV	30 (49)	86 (31)	56 (49)
SV	28 (39)	77 (25)	49 (31)
GV	54 (38)	79 (24)	25 (37)
SoV	62 (48)	80 (44)	19 (32)
GotV	59 (25)	79 (29)	19 (17)
OeV	56 (39)	61 (26)	5 (44)

Table 2: Mean differences between the /V:C/ and the /VC:/ sequence, long and short vowels and long and short consonants.

dialectal area a repeated-measurements t-test was calculated for the difference between the /V:C/ and the /VC:/ sequence. With the exception of the Eastern Swedish region, all differences were significant on the 5% level.

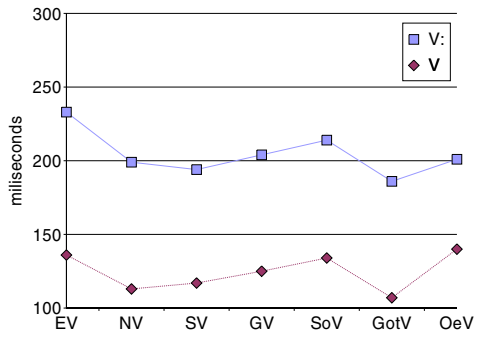

Figure 1: The duration of /V:/ and /V/ sequences in the seven dialect areas

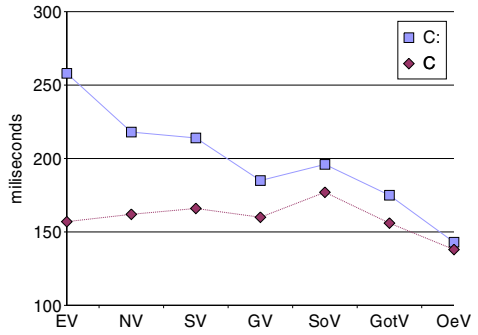

Figure 2: The duration of /C:/ and /C/ sequences in the seven dialect areas

The /V:C/ sequence is thus longer than the /VC:/ sequence in all but one area. The figures 1 and 2 show that the main cause for the shorter /VC:/ phase lies in the consonant. While the differences in vowel duration seem to be quite equal across the regions, the mean differences of the consonant durations vary between 101 ms (Eastern Swedish) and 5 ms (Öland variety). A Median test showed that δ_V differed not significantly on the 5% level across the groups (a non-parametric test was chosen here and in the following if the samples differed significantly in variance according to a Levene test). A one-way ANOVA revealed a significant difference of δ_C across the regions (F=9.478, p<0.000). A post-hoc test (Tukey HSD) showed a significant difference on the 5% level between EV and all other regions, NV differed significantly from GV, SoV and also from OeV. Other differences were close to significant like those between SV and SoV (p=0.079) or SV and GV (p=0.174). These results suggest three different patterns: A large difference between /C/ and /C:/ of around 100 ms (EV), a medium difference of around 50-60 ms (NV, presumably also SV) and a low difference of around 30 ms or less (all remaining regions). If the absolute durations of long and short consonants across these three groups are compared, it becomes evident that the decrease of δ_C is an effect of a shortened /C:/ (see figure 2). The long consonant is the only segment that shows remarkable significant differences in absolute duration across the regions (one-way ANOVA, F=5.846, p<0.000). Neither differences in absolute /V:/ duration nor differences in /C/ duration turned out to be significant across the regions. /V/ showed an overall significance (F=2.538, p=0.023), but no significant differences (Tukey HSD) between two single groups. The figures 1 and 2 show that the minor (and mostly not significant) differences in /V/, /V:/ and /C/ duration (and also parts of the variation in /C:/) seem to co-vary. In our interpretation, this points towards speech rate differences across the speakers in the different groups rather than towards dialectal patterns (although speech rate might be a dialectal feature as well).

	δ_{bark}
EV	0.63 (0.29)
NV	1.56 (0.52)
SV	1.37 (0.51)
GV	1.76 (0.72)
SoV	1.70 (0.53)
GotV	1.02 (0.85)
OeV	1.82 (0.65)

Table 3: Mean spectral distance in bark (standard deviations in brackets) for the dialectal areas

3.2 SPECTRAL DIFFERENCES

Table 3 shows the mean spectral distance δ_{bark} for the seven regions. There is an overall significant difference in δ_{bark} across the regions (Median test, χ^2=25.214, p<0.000). The mean values suggest a main difference between EV and the other regions. EV has by far the lowest value for δ_{bark}, followed by GotV. The two /a/ qualities seem to be much more similar in these two regions than in the other two regions. SV and NV values are still somewhat lower than GV, SoV and OeV. The durational differences between long and short /a/

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across the regions are so similar, that a strong connection between durational and spectral differences is unlikely (though minor effects might be possible). However, lower values of δ_{bark} correspond with higher values of δ_C, with the exception of GotV.

4 DISCUSSION

The data on segment durations in the seven regions show a clear pattern. The most important result is the great and systematic variation in the durational difference between consonants after long and short vowels. At least three different classes of δ_C can be found: Class I shows great differences of around 100 ms, class II shows medium differences of around 50-60 ms and class III shows differences lower than 30 ms. The low differences have been found in the Southern Swedish dialect areas, which fits quite well with the earlier mentioned reports about the lack of complementary quantity in Skåne. The reduced consonant differences are caused by the duration of the consonant following the short vowel, leading to overall shorter /VC:/ sequences. It was mentioned before, that /VC:/ sequences in CSS are slightly shorter as well. We can thus conclude that CSS lies somewhere in between the patterns found in the dialects. Post-vocalic consonant differences in CSS are not as high as in class I and not as low as in class III. The mentioned existence of an independent length contrast of consonants in some dialects could help to explain the great differences in class I. If consonant quantity is used independently, the differences necessary to express the distinction might be greater than those found with complementary quantity. This assumption is supported by the fact that we found the greatest consonant differences in the Finnish Swedish area (EV), which is known for its conservation of Old Swedish quantity patterns (see also [7] and [8]).

The spectral and durational differences of vowels showed no obvious connections. The consonantal difference, on the other hand, might be connected to the spectral differences. There is a tendency for spectral differences between long and short /a/ to be higher in those dialects where post-vocalic consonant differences are low, although this relationship is not exceptionless as the values for the Gotland area (GotV) show. Here, δ_{bark} as well as δ_C is comparatively low. There is certainly more research necessary before a satisfying explanation for this observation can be given.

5 CONCLUSION

We have presented stable differences in the quantity systems of different dialects of modern Swedish. These differences are important categories for a phonetic typology of quantity. It must be taken into consideration, though, that we have, up to now, only investigated a single minimal pair. It is quite possible that other consonants and consonant-vowel combinations behave differently in view of complementarity and spectral differences. This will be the subject of future research.

ACKNOWLEDGMENTS

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