An Acoustic Analysis of Vowel Pronunciation in Swedish Dialects
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Chapter 8

Discussion

Below, the results from the three previous chapters are discussed and related to each other. In § 8.1 the acoustic method is evaluated. In § 8.2 the dialectological conclusions about Swedish dialects that can be drawn taking both the analysis on the variable level and the aggregate level into account are discussed. Finally, in § 8.3, the strengths and limitations of analysis of variables and aggregate analysis are discussed.

8.1 Acoustic analysis

The most common method used in variationist linguistics for assessing vowel quality acoustically has been formant measurements. In this study another approach was chosen. Vowel spectra were filtered with Bark filters up to 18 Bark and subsequently the filter bank representation was reduced to articulatory meaningful principal components (PCs) by means of principal component analysis (PCA). The method has previously been used for large-scale analysis of geographic and social variation in Dutch vowel pronunciation by Jacobi (2009).

Bark filters correspond to the auditory filters of human hearing, which means that a Bark filter representation of vowels models human perception. Formants, on the other hand, are resonant frequencies in the vocal tract and measuring formants hence is an articulatory model. A strong association between the two models was shown by high correlations between PCs and formants in § 5.2.1. The correlation between the second component (PC2) and F2 was, however, somewhat weaker than the one between the first component (PC1) and F1.

Bark filtering can be automated more reliably than formant measurements. Automated formant measurements always include wrong values that have to be corrected manually. In addition to the perception-based merits of a filter bank representation, the load of manual work was reduced significantly by the choice of method for acoustic analysis. Nonetheless, one should bear in mind that a considerable amount of manual work was needed, too, to make this study possible. Preceding the acoustic
analysis, all the vowel data had been manually segmented in the SweDia project.

How to reduce the effect of speaker-dependent variation is a problem for all studies dealing with acoustic speech samples (see §§ 2.4.3 and 2.4.4). Due to anatomical/physiological differences, the overall size of the vowel space varies significantly across speakers. A number of normalization procedures have been developed for formant measurements, but none of them work well when one wants to compare vowels from varieties that are not phonologically comparable. Jacobi (2009) solved the problem by relating the measurements of each vowel to the speakers' point vowels /i/ and /a/. Jacobi studied the variation in Dutch diphthongs and long vowels. Relative measures of vowel quality could be used because the Dutch point vowels are considered to be stable across all varieties of Standard Dutch.

Among the Swedish vowels, stable point vowels could not be found for all speakers, which excluded the possibility to use a relative measure of vowel quality. Instead, speaker-dependent variation was evened out by averaging over a number of speakers per variety. However, the number of male and female speakers was not equal for each variety, which meant that the systematic differences in the vowel spaces of male and female speakers due to anatomical/physiological differences had to be removed in order not to bias the results. A normalization of the differences between male and female voices was obtained by applying PCA separately to vowels produced by men and women. This procedure effectively removed differences in PC scores between men and women (§ 5.1.5). Of the point vowels only [u:] showed a significant difference on one of the two extracted PCs after applying PCA separately to men and women. Before normalization, that is, when including vowels produced by men and women in one single PCA, all four point vowels ([i:], [æ:], [ɑː]/[ɑ:] and [u:]) showed significant differences between men and women in one or two of the extracted PCs. This possibility to normalize for the effect of speaker-sex in the PCs, something which has been notoriously difficult in formant measurements, turned out to be a big advantage of the acoustic method chosen.

Using a so-called whole-spectrum method undoubtedly includes more information from the acoustic signal than only cues directly related to the articulation of vowels. The signal-to-noise ratio in the recordings has been shown to influence PCs extracted from band-pass filtered spectra both in the present study (dialect speakers recorded in their homes vs. speakers of Standard Swedish in a studio, see § 5.1.6) and by Jacobi (2009, 59–63). When using this method one should therefore either pay attention to all recordings being made in as similar conditions as possible, or alternatively find some stable point vowels which can be used for normalizing for the effect of noise.

Regional differences were detected in the PCs that did not seem to be connected to formants and vowel articulation. This spectral feature was connected to PC2 of all front vowels and an assumption is that voice quality differences would have caused this regional variation in the PCs. The exact nature of the spectral feature connected to PC2 of front vowels could, however, not be verified in this study, but should be studied further. A factor analysis applied to the data seemed to be able to separate this spectral feature from other variation in the data (§ 6.3.2).
In the analyses of dialectal variation, average values of the PCs for each variety were used. For example, in the analysis of pure geographic variation, average values were computed for each site (that is, average PCs of twelve speakers for most of the sites). In a number of analyses social variation was accounted for as well. When the data was split up into two age groups the groups on average included six speakers, while a further division according to gender led to even smaller groups (on average three speakers per gender per age group per site). Since all speaker-dependent variation could not be removed from the acoustic PCs, the influence of individual differences in the overall size of the vowel space on the group averages is greater the smaller the group is. Especially in the division into four groups per site (older women, older men, younger women, younger men), where each group included on average only three speakers, some caution should be taken when interpreting the results. Still, also this division into the smallest groups showed very similar results to the other analyses. Most notably the differences between the two age groups was much greater than the differences between men and women, with especially the younger women and younger men showing very similar results. This can be seen as an additional confirmation of a successful reduction of differences related to the anatomical/physiological differences between men and women in the acoustic measure.

The PCs extracted from the Bark-filtered vowel spectra were used in a number of analyses of dialectal variation (Chapters 6 and 7). Several features which have previously been described in the Swedish dialect literature were identified. The results from previous studies could hence be supported by acoustic data and the geographic distribution of dialectal features across a large number of sites in the Swedish language area could be established. The PCs offered an interpretation of the data in terms of vowel height and advancement. A complete articulatory description of vowels can, however, not be inferred from the PCs, since for example vowel roundness is not represented in a simple way in the PCs.

Since using PCA of band-pass filtered vowel spectra can be automated more reliably than formant measurements, it can be regarded as well-suited for large-scale analyses of phonetic variation in vowel quality. Moreover, the method turned out to offer a possibility to normalize for the systematic difference between male and female voices, something which has always been regarded as difficult in formant measurements. The perceptual and articulatory correlates of PCs of Bark-filtered vowel spectra should still be studied further. Especially the variance in PC2, which was somewhat less dependent of formants than the variance in PC1, should be studied in more detail in future research.

8.2 Dialectological results

This section includes a discussion of the dialectological results of Chapters 6 and 7. The dialect areas identified in the aggregate analysis are described linguistically in § 8.2.1 below, and in § 8.2.2 some explanations to the observed language change are
discussed. Before going on with the dialectological results some general issues about the representativeness of the data should be addressed.

Language change was studied by comparing an older and a younger group of speakers at every site. A question to be asked is whether the observed differences between speaker groups in apparent time correspond to a real linguistic change. In the SweDia project the age range of the younger speakers was chosen so that the language recorded would not be the youth language of teenagers, which is likely to change when the speakers get older. A somewhat older group comprising speakers in their 20s or early 30s was recorded. Nordberg (2005, 1765) has pointed out that several studies from the Swedish area have shown that “young adults and people in early middle age stand out as comparatively more standard-speaking than other age groups, probably because this is the period of life when careers are built up and the values of the larger society become important.” On the other hand, Sundgren (2002) studied language change in Eskilstuna with access to language data for both an apparent time and a real time study. She could conclude that both the study in apparent time and the study in real time showed the same development and that the two methods would not lead to different conclusions about ongoing changes.

Another concern would be to what extent the recording situation would influence the dialect speakers and whether older and younger speakers would make different accommodations to the language of the interviewers. The risk of the speakers being influenced by the speech variety of the interviewers is especially high in sites where the speakers are used to switch between or use a gliding scale between the local dialect and Standard Swedish. At some locations the interviews were carried out by a speaker of the local dialect while at other locations the interviewers talked a variety representative for a larger region. In all cases, the speakers were encouraged to think about how the words would be pronounced in the local vernacular. The impression is that this strategy was successful in most cases. At some sites, however, the resistance against speaking the local dialect to a stranger was exceptionally strong. This was perceived to be the case at least for many of the speakers in Snappertuna in Finland. The speakers from this particular site should therefore be regarded as speakers of the regional standard language and not of the local dialect. It cannot be ruled out that the dialect speakers have made linguistic accommodations towards the language of the interviewers at some other sites, too.

One should keep in mind that the varieties analyzed are a sample of 98 sites from the Swedish language area. All possible linguistic variation can therefore not be accounted for. A few sites which are well known for their well-preserved divergent rural dialects (Orsa and Älvdalen) have been excluded from the current analysis. This is because they were already considered so different from other dialects during the SweDia fieldwork that a completely different word list was used for eliciting vowel sounds in these dialects.
8.2. Dialectological results

8.2.1 Dialect areas

The results of multidimensional scaling (MDS) to three dimensions in § 7.2.1, where average linguistic distances between sites were analyzed, showed that even if the distribution of dialectal features is continuous, some more coherent dialect areas can be detected. The map in Figure 7.3 (p. 135) displaying the MDS results is very similar to the traditional divisions proposed by Wessén (1969) and Elert (1994) (Figure 2.2, p. 14).

Acknowledging the fact that the borders between the Swedish dialect areas are not abrupt, but form a continuum, Wessén (1969) did not propose any borders between dialect areas, but only gave a rough sketch of a dialect division. This is similar to what the map displaying the results of MDS shows. There are definitely areas within the Swedish language area which differ from each other considerably when it comes to vowel pronunciation, but between these areas there are no abrupt borders, only gradual transitions.

Wessén (1969) classified the Swedish traditional rural dialects, while the classification of Elert (1994) was one of regional varieties of Standard Swedish. The classification by Wessén (1969) was based on phonetic, phonological and morphological features while Elert (1994) used mainly intonation and differences in vowel pronunciation for grouping varieties of the Swedish spoken language. Both scholars considered vowel pronunciation an important characteristic for dialects and regional varieties of Swedish. The data of the present study is collected only at rural sites, but the data is about a hundred years younger than the data that Wessén (1969) worked with. Because of the large-scale dialect leveling that has affected Sweden during the last half of the 20th century, traditional rural dialects have been preserved only in very few areas. The data of this thesis include more dialectal features than the varieties in Elert’s classification, but more leveled dialects than the ones that Wessén wrote about. The varieties studied in this thesis could be called modern rural varieties of Swedish. The results in § 7.2.2 showed that even if there is considerable dialect leveling going on in the Swedish language area, the geographic areas that can be identified are still very similar for older and younger speakers. Based on the analysis of the separate vowels in Chapter 6 the areas detected by the aggregate analysis in Chapter 7 can be described linguistically:

The most prominent feature of South Swedish varieties is the diphthongization of long vowels. The close long vowels in dis, typ, bus and sot have the strongest diphthongization, which was identified by the second factor of the factor analysis (FA) in § 6.3. But also the mid vowels in leta, nät, söt, dør and lát are diphthongized, especially in Skåne. The South Swedish varieties have relatively high PC2 values (that is, a more fronted pronunciation than Standard Swedish) in the long and short a vowels in lat and lass.

In Götaland a more close pronunciation than in Standard Swedish was noted for the vowels in dør and lär. This is also the case for younger speakers to a greater extent than in most parts of the language area. The open pronunciation of söt which is spreading among younger speakers in central Sweden is only found in the coastal
areas of Götaland but not land inwards. In many sites in Götaland a more open pronunciation than in Standard Swedish is found for the vowel in *lus*. Many younger speakers also have a relatively open pronunciation in *dis* and *typ*. On the west coast and in Dalsland the pronunciation of the *disk* vowel is more open than elsewhere. In Småland and Östergötland a diphthongization of the vowel in *sot* can be found.

_Svealand_ is characterized by a spectral feature which distinguishes it from the varieties in Götaland and Norrland. This spectral feature, identified by the first factor of the FA (§ 6.3.2), might be related to voice quality, and should be studied further. Uppland is characterized by a very close pronunciation in *nät* and an open pronunciation of the vowels in *lär* and *dör*. However, younger speakers in Uppland have a more open pronunciation in *nät* compared to the older speakers. An open pronunciation in *söt*, which is not common among older speakers, is used by younger speakers in the whole East Central Swedish area. In Närke a relatively open pronunciation of the vowels in *dis* and *typ* is found for younger speakers.

Features that are found mainly in sites close to the Norwegian border are an open pronunciation of the vowel in *flytta* and for the more northern varieties a fronted pronunciation in *lott*. A relatively close pronunciation in *lär* and *dör* is found for both older and younger speakers in this area.

In _Norrland_ large linguistic distances between dialects are still found. However, in the most divergent areas, Norrbotten and Jämtland, the younger speakers show a considerable convergence to Standard Swedish. Among older speakers in Norrbotten, both Proto-Nordic diphthongs and secondary diphthongs are still found, but most younger speakers are not using the diphthongs. For many sites in Norrland a more open pronunciation than in Standard Swedish is found in *lus* and a relatively fronted pronunciation of the *a* vowels in *lat* and *lass*.

The varieties in the southern parts of _Finland_ share a spectral feature (which might be connected to voice quality) with dialects in Svealand. In most varieties in Finland the vowel in *lus* is a central vowel and not a front vowel as in Standard Swedish. Most sites, but not all, have a relatively close vowel in *nät* and an open vowel in *lär*. Proto-Nordic diphthongs are found in Houtskär (Åboland) and in Österbotten and secondary diphthongs primarily in Österbotten. A more fronted pronunciation than in Standard Swedish is found in *lus* and a relatively fronted pronunciation of the *a* vowels in *lat* and *lass*.

Gotland is mainly characterized by the rich number of diphthongs—both Proto-Nordic and secondary diphthongs are found. The pronunciation of the vowels in *lär* and *dör* is open, and the vowel in *lat* is more fronted on Gotland than in Standard Swedish.

Two features which are considered characteristic for the vowel pronunciation of regional varieties of Swedish were not identified in the analyses in this thesis. These are Central Swedish diphthongization (§ 2.3.2.2) and the occurrence of a semi-vowel or fricative ending in long close vowels in central Sweden (§ 2.3.2.4). The reason that these features were not identified in the present data set could have to do with the choice of sampling points in the vowel segments. The first sampling point was at 25% of the vowel duration and the last at 75%, so it is possible that diphthongization
in the very first and last part of the vowel segments is missed. However, Central Swedish diphthongization is considered prosodically conditioned and is strongest in stressed vowels and in the end of sentences, while the semi-vowel or fricative ending in vowels is most noticeable in word final position and before another vowel. Due to these facts the two types of diphthongization might not be prominently present in the data set. The speakers were pronouncing words in isolation, which would exclude many prosodic features, and all vowels were in a C__C context, which is not favorable for the semi-vowel or fricative ending.

Comparison with results from other studies where data from the SweDia database have also been used, makes it possible to draw conclusions about associations between different linguistic levels. The intonational typology by Bruce (2004) (see the description in § 2.2.3) largely corresponds to the dialect areas described by Wessén (1969) and Elert (1994), and hence also to the areas detected in the present thesis. The intonational variation and the variation in vowel pronunciation seem to have very similar geographic distributions.

Schaeffler (2005) made a typology of phonological quantity in Swedish dialects, also using SweDia data. The three main types identified by Schaeffler form rather different geographic areas than the ones identified based on vowel pronunciation. In Schaeffler's study, Sweden was divided into a southern and a northern area with the border between the two areas approximately following the border between Svealand and Norrland. A transitional dialect border between Svealand and Norrland can be supported by the aggregate analysis in the present study. However, the differences between and within Svealand and Götaaland are too large for grouping the dialects in these areas into one class based on vowel pronunciation. The third type identified by Schaeffler comprised the mainland Finland-Swedish varieties, which clearly form a separate group also in the present study. The dialects on Åland belong to the northern type in Schaeffler's study. The present thesis also shows that the varieties on Åland share more vowel features with varieties in Sweden than with the Finland-Swedish dialects, but in contrast to Schaeffler's results, Åland is more similar to Uppland than to the dialects in Norrland when it comes to vowel pronunciation.

Hopefully more analyses of additional linguistic levels will be carried out in the future using data from the SweDia database. Quantitative comparisons of data from different linguistic levels could show interesting interactions and form the basis for linguistic typologies.

8.2.2 Change and leveling

The comparisons of the vowel pronunciation of older and younger speakers in this thesis (§ 6.2.2 and § 7.2.2) suggest large-scale dialect leveling; the linguistic distances between sites are shorter for younger speakers than for older speakers. The aggregate analysis revealed that the sites that show the largest amount of change are many of the most central ones close to the biggest cities, while many of the peripheral dialect areas, which are most divergent from Standard Swedish, are relatively stable when it comes to vowel pronunciation.
The aggregate analysis as such does not provide an explanation for why the central dialects are changing the most. In order to find an answer, the variation and change on the variable level has to be studied. The analysis in § 6.2.2 showed that the vowels responsible for the largest amount of change are the vowels in the words lär, nät, lös, dör, lett and söt. The analysis of each of the vowels in § 6.1 showed that the patterns of change look quite different for some of these vowels.

Even though one neutral variety of Standard Swedish hardly exists, there are still variants that are more or less associated with a Standard Swedish pronunciation. An example is the open pronunciation of the phonemes /e:/ and /oː/ before /r/, which is associated with Central Standard Swedish pronunciation (Bruce, 2010, 118, Grönberg, 2004, 139). The open variants of /e:/ and /oː/, that is [æː] and [œː], were elicited with the words lär and dör in the present study. The analyses showed that older speakers in large parts of Sweden have a much more close pronunciation than the Standard Swedish one. An open pronunciation corresponding to the Standard Swedish one is found among older speakers mainly in eastern parts of the language area, for example in the surroundings of Stockholm where the open pronunciation of these vowels has been a part of the rural dialects. Among younger speakers the open pronunciation has become much more widespread, so for these two vowels there seems to be a clear case of convergence to Standard Swedish.

For the vowel in nät the pattern of change is different. The traditional pronunciation in Stockholm and the surrounding dialects has been [ɛː], while the pronunciation generally accepted as Standard Swedish and the pronunciation in most dialectal varieties of Swedish is [ɛ]. The Stockholm pronunciation is the result of a merger of the phonemes /ɛː/ and /eː/, which has never been accepted as Standard Swedish (Elert, 2000, 46). However, the merger is not a complete one, since in front of /r/ the two vowels are kept apart also in Stockholm and surrounding dialects.\footnote{There is a distinction between /le:ra/ [le:ra] `clay’ and /le:ra/ [lɛːra] ‘learn’, but not between /le:ka/ [le:ka] ‘play’ and /le:ka/ [lɛːka] ‘heal’.
}

For the nät vowel the present data set shows that older speakers around Stockholm have a much more close pronunciation than most other varieties of Swedish (except from varieties on Gotland and in Finland). In the younger generation the sites close to Stockholm have a more open pronunciation than in the older generation. For the nät vowel, there is a change towards Standard Swedish, but the sites that are changing the most and giving way for the Standard Swedish pronunciation are the ones closest to Stockholm. At the same time the pronunciation of the nät vowel also seems to be becoming even more open in many parts of the language area, approaching [æː].

For the vowels in söt and lös yet another geographic pattern of change is found. In both these words the Standard Swedish vowel phoneme is /oː/.\footnote{Some dialects have preserved a Proto-Nordic diphthong in lös, and in these dialects the words söt and lös have different vowel phonemes.
}

1

The data shows that while the older speakers at most sites have a relatively close pronunciation of the söt vowel, younger speakers in a large east central area have a more open pronunciation. A change towards a more open vowel is also found on the west
8.2. Dialectological results

coast and even among the speakers who represent Standard Swedish in the SweDia database.

The vowel in *lett*, for which a large degree of change was noted in § 6.2.2, too, seems to show a similar change in the whole language area. At almost all sites in the data set the pronunciation is more open among younger speakers than among older speakers.

In summary, the vowels in *lär*, *dör* and *nät* all show convergence to Standard Swedish. The dialect area surrounding Stockholm has traditionally had a standard-like pronunciation of *lär* and *dör* and therefore does not show much change in these two vowels. In *nät* the dialects close to Stockholm have a more close pronunciation than the standard pronunciation among older speakers, but young speakers seem to converge towards the Standard Swedish pronunciation. At the same time a change is found in the vowels in *nät*, *söt* and *lett*, which cannot be seen as a convergence to the standard language but it is a relatively new feature in Swedish. These vowels have a more open pronunciation among younger speakers than among older speakers. The vowels in *nät* and *lett* seem to become more open in the Swedish dialects in general. For the vowel in *söt* (for most varieties of Swedish equal to the vowel in *lös*) the change towards a more open pronunciation is strongest in central Sweden and on the west coast, while some more peripheral areas are less affected by the change.

There is hence a complex situation lying behind the maps in Figure 7.9 (Chapter 7, p. 141), which show that dialects in central Sweden and on the west coast are the ones that are changing the most, while several peripheral dialects seem more stable. Convergence to the standard language partly explains the change, but the diffusion of a new more open pronunciation of some of the front vowels among young speakers, which is not a change towards what traditionally has been considered Standard Swedish, also explains a large part of the change.

The lowering of /ɛː/ and /ɔː:/ has been noted by scholars before. Especially the local vernacular of Eskilstuna has been the subject to many studies, and the lowering of /ɛː/ and /ɔː:/ in Eskilstuna has been described by Nordberg (1975), Hammermo (1989) and Aniansson (1996). Kotsinas (1994) has described the use of the more open variants of these vowels among teenagers in Stockholm, and Andersson (1994) noted the spread of an open /ɔː:/ in Göteborg. Grönberg (2004) considered the open variant of /ɔː:/ as a marker of general Swedish youth language and particularly of the vernaculars of the cities. In Grönberg’s study of teenagers in Västergötland the frequency of open /ɔː:/ was generally low, but the frequency grew higher the closer the subjects lived to Göteborg, which indicated diffusion from the city.

8.2.2.1 Diachronic view

In § 6.1.11, Nordberg’s (1975) explanation for the emergence of a more open pronunciation of /ɔː:/ in Eskilstuna was described. Initially it was a “socio-linguistic hypercorrection” that occurred among lower-class speakers when the speakers, who in their own dialect only had a close variant of /ɔː:/, wanted to imitate the more open pronunciation [œː] used before /r/ in Standard Swedish. The hypercorrection
Table 8.1. Older Swedish vowel system with ten long vowels.

<table>
<thead>
<tr>
<th></th>
<th>front</th>
<th>central</th>
<th>back</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>−round</td>
<td>+round</td>
<td></td>
</tr>
<tr>
<td>close</td>
<td>i</td>
<td>y</td>
<td>u</td>
</tr>
<tr>
<td>mid</td>
<td>e</td>
<td>ø</td>
<td>o</td>
</tr>
<tr>
<td>open</td>
<td>e</td>
<td>øø</td>
<td>a</td>
</tr>
</tbody>
</table>

Table 8.2. The Swedish long vowel system after /œ:/ had merged with /œ:/.

<table>
<thead>
<tr>
<th></th>
<th>front</th>
<th>central</th>
<th>back</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>−round</td>
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<tr>
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<td>y</td>
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<td>mid</td>
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<td>ø</td>
<td>o</td>
</tr>
<tr>
<td>open</td>
<td>e</td>
<td>øø</td>
<td>a</td>
</tr>
</tbody>
</table>

occurred when the dialect speakers did not restrict themselves to using the open variant only before /r/ but in all contexts. In a second stage of the change, the open pronunciation in other than pre-/r/ context diffused to speakers of all social-classes in a change from below (Nordberg, 1975), and some decades later entered Stockholm youth language (Kotsinas, 1994).

Nordberg (1975) goes one step further back in the language history in order to explain the development of the more open pronunciation of /œ:/: Until the mid 18th century Swedish had ten long vowel phonemes, which formed the symmetrical phonological system in Table 8.1. There was a separate phoneme /œ:/ which in the middle of the 18th century merged with /œ:/: The disappearance of the phoneme /œ:/ left a hole in the phonological system, as can be seen in Table 8.2.

The hole left in the Swedish long vowel system by the disappearance of /œ:/ was filled by the emergence of a more open allophone of /œ:/, which had until then been one uniform sound without any allophones in complementary distribution (Nordberg, 1975). In the latter half of the 18th century /œ:/ was lowered before /r/ in the spoken language of the higher social classes in Central Sweden. A similar allophonic variation is found for /ɛ:/ (⁄ɛ:/ → [æː] / __/r/). To fit in the pre-/r/ variants of both /œ:/ and /ɛ:/ in the vowel system a fourth degree of vowel height is needed for front vowels.

The Standard Swedish vowel system with nine long vowels and pre-/r/ variants of /œ:/ and /ɛ:/ has been difficult to describe phonologically, as already explained in § 2.3.1. One reason for this is that sometime during the 19th century /œ:/ lost its central position in Table 8.1 and became a phonetically front vowel, which made the close front part of the vowel system very crowded. Articulatory and acoustically /œ:/ was distinguished from /y:/ and /œ:/ by another type of rounding; /œ:/ has been described as in-rounded while /y:/ and /œ:/ are out-rounded. Constructing a simple symmetric phonological system with distinctive features was impossible taking phonetic facts and phonological variations into account. Table 8.3 shows two examples of distinctive features for Swedish long vowels that have been proposed.

In many Swedish dialects the phoneme /œ:/ was preserved much longer than
8.2. Dialectological results

Table 8.3. Two examples of the numerous different structural descriptions of the Swedish long vowels that have been proposed (allophonic variants are not included).

Malmberg (1956):

<table>
<thead>
<tr>
<th>close</th>
<th>mid</th>
<th>open</th>
</tr>
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<tbody>
<tr>
<td>front</td>
<td>round₀</td>
<td>round₁</td>
</tr>
<tr>
<td>i</td>
<td>y</td>
<td>u</td>
</tr>
<tr>
<td>e</td>
<td>ø</td>
<td>u</td>
</tr>
<tr>
<td>ε</td>
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<td>a</td>
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</table>

Traunmüller & Öhrström (2007):

<table>
<thead>
<tr>
<th>front</th>
<th>back</th>
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</thead>
<tbody>
<tr>
<td>round₀</td>
<td>round₁</td>
</tr>
<tr>
<td>i</td>
<td>y</td>
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<tr>
<td>e</td>
<td>ø</td>
</tr>
<tr>
<td>ε</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.4. Long vowel system in Eskilstuna (Nordberg, 1975).

<table>
<thead>
<tr>
<th>close</th>
<th>mid</th>
<th>open</th>
</tr>
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<tbody>
<tr>
<td>front</td>
<td>−round</td>
<td>+round</td>
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<tr>
<td>i</td>
<td>y</td>
<td>u</td>
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<td>e</td>
<td>ø</td>
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</tbody>
</table>

in the standard language. In these dialects there was no room for a lowering of /ø:/ before /r/, because /œ:/ occupied the place in question in the vowel space. Therefore the pronunciation of /ø:/ remained more close than in Standard Swedish in all phonetic contexts in many dialects.

A diachronic study by Nordberg (1975) shows that the lowering of /ø:/ in Eskilstuna started after /œ:/ had disappeared as a separate phoneme, which happened later in dialects surrounding Eskilstuna than in the standard language spoken in Stockholm. The lowering started in pre-/r/ context, and after that the more open pronunciation started to occur in all positions. Due to “socio-linguistic hypercorrection” the pronunciation of /ø:/ in Eskilstuna developed a step further than in Standard Swedish and the pronunciation became [œ:] in all positions instead of maintaining two allophones in complementary distribution. In Eskilstuna after /œ:/ had been lowered, /u:/ was lowered, too, in a classical drag chain. In addition /u:/ became less labialized and started to sound more like the original /ø:/.

Through this drag chain the phoneme system, which had become asymmetrical by the loss of /œ:/, became symmetrical again, as can be seen in Table 8.4.

The role of /ɛ:/ in this chain shift has been less well described. Standard Swedish has two allophones of /ɛ:/, but in contrast to /ø:/ there has not been any loss of an unrounded open front vowel which would have left room for allophonic variation of /ɛ:/ in the phoneme system. An approximate date for the emergence of the two allophones of /ɛ:/ is hard to find in the literature.

Nordberg (1975) mentions that in Eskilstuna the variation across age groups and social groups in /ɛ:/ seemed to be similar as the one found for /ø:/.

That is, the highest social group followed the Standard Swedish norm by using a close variant and a more open pre-/r/ variant. In the lower social group younger speakers used [æ:] in all context, while older speakers used [ɛ:] in all contexts. The co-variation of /ɛ:/ and /ø:/ in Eskilstuna was shown quantitatively in an factor analysis by Hammermo (1989).
8.2.2.2 Restructuring of the phoneme system

A word which would include the older phoneme /œː/ (which might still be preserved in some dialects) is unfortunately not included in the data set of this thesis. Therefore it is not possible to use the present data set for evaluating to what extent the emergence of a more open pronunciation of /œː/ is a consequence of the disappearance of /œː/. Historical data provides some background. For example, the works of Götlind & Landtmanson (1940–50, Vol. 1) and Landtmanson (1952) show that a phoneme /œː/ has been present in the dialects in Västergötland, where a close pronunciation of /œː/ was found in this thesis. Grönberg (2004, 114–115) mentions that the diffusion of the open pronunciation of /œː/ might have been slowed down in Västergötland by the fact that the phoneme /œː/ has been considered a negative dialect marker that people have wanted to avoid.

In the present data set it is interesting to explore which varieties show allophonic variation in /ɛː/ and /œː/ with more open variants occurring before /r/. Figure 8.1 shows the acoustic distance between the vowels in nät and lär, and Figure 8.2 the distance between the vowels in söt and dör for older and younger speakers at each site as measured near the onset of the vowels. Green means that the distance is

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**Figure 8.1.** Euclidean distance between the vowels in nät and lär measured with two PCs at 25% of the vowel duration. Green: distance = 0.

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3The distance is measured as the Euclidean distance of PC1 and PC2 as measured at 25% of the vowel duration.
8.2. Dialectological results

**Figure 8.2.** Euclidean distance between the vowels in söt and dör measured with two PCs at 25% of the vowel duration. Green: distance = 0, while magenta indicates a large distance. The six older and six younger speakers that are considered speakers of Standard Swedish are included in the maps as rotated squares above left.

The older speakers of Standard Swedish have a moderate distance between the pre-/r/ variants and the neutral variants. The difference is somewhat larger for /øː/ than for /ɛː/. These six older standard speakers can be considered to represent what has been regarded as standard pronunciation of these vowels.

It is clear that most dialects have a smaller distance between /ɛː/ and /øː/ and their respective pre-/r/ variants than the older speakers of Standard Swedish have, which suggests a vowel system without allophonic variants.

The largest distances are found among older speakers in Uppland, Gotland and Finland (except for Åland and Houtskär). In Uppland there is a drastic change between older and younger speakers. For both /ɛː/ and /øː/ the distance between the variants of the vowels in the two allophonic contexts is much smaller for younger

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Total vowel duration, which makes the distance equal to the difference in color that can be observed when comparing the maps of vowel quality close to onset of the two vowels in Appendix C. The picture of the distance between the vowels in söt and dör is complicated somewhat by the fact that dör has preserved a Proto-Nordic diphthong in some varieties. In these varieties, found mainly in Norrland and Finland, the measure is not a direct measure of /øː/ in different contexts.
speakers than for older speakers. On Gotland and in Finland the distance between the two allophones of /ø:/ seems to decrease more than for /ɛ:/.

In an area south-west of Stockholm comprising the provinces Södermanland, Närke and Östergötland, both older and younger speakers have a small distance between the pre-/r/ variants and the neutral variants. But a comparison with the maps of each vowel in Appendix C still shows a big difference between older and younger speakers. Younger speakers have an open pronunciation in both contexts while older speakers have a close pronunciation in both contexts. The same seems to be the case for sites on the west coast, close to Göteborg. In these areas there seems to be little allophony, but there is a shift from more close front vowels to more open ones.

In a western area around lake Vänern and close to the Norwegian border, relatively close pronunciations of /ɛ:/ and /ø:/ seem to be common in both phonological contexts, and the shift between older and younger speakers is not that big.

In Småland there is an area where the older speakers have a close pronunciation of the vowels, but where the younger speakers have shifted towards a more standard-like system with a larger distance between the pre-/r/ variants and the other variants.

The distance between the two allophones of both phonemes is smaller for the younger Standard Swedish speakers than for the older. Nordberg (1975, 602) predicted that the situation with two allophones of /ø:/ in Standard Swedish was only a temporary stage, which was the result of the disappearance of the phoneme /œ:/. This stage had, according to Nordberg (1975), been maintained for a quite long period because it happened to represent a prestigious standard norm. In Eskilstuna, on the contrary, the development from a close vowel /ø:/ to a more open pronunciation in all phonetic contexts happened relatively fast. The present data set shows that the difference between pre-/r/ variants and /ø:/ and /ɛ:/ in other contexts seems to be decreasing in Standard Swedish.

In many dialects the system with allophones in complementary distribution of these two vowels has not existed. In some of these areas all speakers of the present study still use close variants of these vowels; in others the younger speakers have adopted the more open pronunciation in all contexts. The close pronunciation seems to be persistent especially in the provinces Västergötland and Dalsland. Grönberg (2004, 344) has proposed that the close pronunciation might continue to be a part of a West Swedish regional standard also in the future, since this feature seems to be preserved in the dialects while other dialectal features are disappearing rapidly. In Småland there is an area where younger speakers make a larger distinction between the allophones than the older speakers do. Hence, the younger speakers in Småland have oriented themselves towards what, at least, used to be seen as Standard Swedish. Unless other linguistic or extra-linguistic factors change the development, one could predict that the next generation of speakers in Småland will use the open variants in all contexts.

In order to see the effect of the lowering of front vowels on the whole long vowel system, Figure 8.3 repeats Figure 6.1 (p. 87) but with older and younger speakers separated. One should keep in mind that the ellipses include vowels from many
8.2. Dialectological results

Figure 8.3. The 19 vowels of older and younger speakers in the PC2/PC1 plane. The one standard deviation ellipses are drawn based on the average PC values of the two speaker groups at each site measured at the temporal midpoint of each vowel.
different varieties of Swedish and that these varieties differ from each other both subphonemically and phonemically. Still, the general trend can be seen very clearly: except from the leveling of dialects (smaller ellipses with less overlap for younger speakers) there is a general lowering of front vowels going on. Especially the vowels in dör, lär, lös, nät and söt are being lowered and are thereby filling a place in the vowel space that was not previously filled by any Standard Swedish long vowel phoneme.

Not all Standard Swedish short vowels are represented in the data set, which makes the picture of short vowels incomplete. Of the short vowels included in the data set the vowel in lett shows the most lowering in Figure 8.3.

Auer (1998) discusses the relationship between endogenous (“natural”) and contact-induced changes in dialect-standard language settings. In addition to direct convergence to standard, dialects sometimes converge to the standard language or to each other as a consequence of internal restructuring and innovation. The innovations can at the same time be triggered by dialect contact. Regional dialect leveling can share features with koinéization, especially with respect to simplification (Kerswill, 2002, 672). Simplification can involve increase in regularity, decrease in markedness or the loss of categories (Kerswill, 2002, 671). A loss of allophonic variants of /ø:/ and /ɛ:/ means a simplification of the Standard Swedish vowel system in the sense that the vowel inventory becomes smaller. It can also be seen as a removal of marked forms, since the allophonic variants have been used only in a small part of the whole language area and can therefore be considered marked (Trudgill, 1986, 98). In the data set the dialects in Uppland show simplification by the loss of allophonic variants, and, in addition, there seems to be a demerger of /ɛ:/ and /ɛː:/ going on in Uppland. The marked situation where the distinction between /ɛː:/ and /ɛː:/ was maintained only before /r/ would hence be solved.

For the dialects which have not had any allophonic variants of /ø:/ and /ɛː/: the introduction of the open pronunciation means in a sense a convergence to Standard Swedish, because that is the variety that the open variants have been associated with. But at the same time the dialects keep their original internal structure by not introducing allophonic variation but by lowering the vowels in all contexts.

For the chain shift described by Nordberg (1975) to be complete /uː/ should be lowered, too. Figure 8.3 shows a decrease in the dialectal variation in lus particularly on PC1, but no large-scale lowering in general. However, in the analysis of the vowel in lus in § 6.1.7 a lowering was noted especially in Svealand and western parts of Norrland. In other areas a more open pronunciation was found to be common in both generations of speakers.

The chronology of the chain shift is debatable. Is /uː/, which has been considered the most problematic vowel of the Swedish vowel system, pushing the chain, or is the chain being dragged by the hole left when /øː:/ merged with /øː/? The mechanisms might be different in different parts of the language area depending on the phoneme systems of the local rural dialects.

For Standard Swedish the vowel shift certainly means that a phoneme system which has been very difficult to describe structurally is being simplified, as the vowel
8.3 Analysis of variables vs. aggregate analysis

inventory becomes both smaller and more symmetrical. This simplification can be interpreted as contact-induced. As Linell (1973, 12) has pointed out: the vowels that have presented a problem for the phonological description of Standard Swedish are the same that show considerable variation across Swedish dialects. That is most likely no coincidence. Nordberg (1975, 602) predicted that Standard Swedish had frozen in a temporary stage of a vowel shift. Due to dialect contact the development in Standard Swedish now seems to be proceeding into the next stage. This opening up for a change in Standard Swedish might be connected to the attitudinal change towards linguistic variation in public language that has been noted since the 1970s (see § 2.1.1). The symmetric structural description of the Swedish vowel system in Table 2.2 (p. 19), identical to the one Nordberg (1975) proposed for Eskilstuna (Table 8.4), which did not correspond to articulatory and acoustic facts in Standard Swedish a few decades ago, may correspond better to young people’s speech today.

The dialect leveling process that the Swedish dialects are involved in shows complex mechanisms of convergence to Standard Swedish with simultaneous restructuring towards a more “natural” vowel system. In linguistic changes involving innovations it is not uncommon to find that innovations diffusing from the center reach peripheral parts much later (if at all). This is exactly the pattern that can be observed in the maps in Figure 7.9 (p. 141). Areas that do not show much aggregate change in vowel pronunciation are for example Skåne, Gotland and the Swedish dialect area in Finland. Edlund (2003, 28) has pointed out that Skåne and Gotland are Swedish regions with a strong regional identity. The identity is enhanced by an awareness of the historical developments that have formed these areas (Skåne was part of Denmark for a long time, while in medieval times Gotland was independent from Sweden and had an important position in the Hanseatic League), and by local traditions and cultural heritage. The province of Skåne has its own flag and there is a strong separatist movement. The Swedish language areas in Finland are separated from the rest of the Swedish dialects not only by the sea and a different political history, but also by a national border. Local identity is manifested through language use, and a strong identity serves to preserve characteristic features in the language. The regional varieties spoken in the three mentioned areas do not have a symbolic value only for the speakers themselves in these areas, but these varieties are also easily recognizable to other Swedes.

8.3 Analysis of variables vs. aggregate analysis

In the previous chapters dialectal variation in vowel pronunciation has been analyzed both on the variable level and by using an aggregating technique. The former approach is the one that has traditionally been used by dialectologists, while the latter one is the one preferred in dialectometry. To what extent can these two approaches supplement each other, and to what extent are they redundant? I think that the discussion above about changes in Swedish vowel pronunciation has shown that both approaches are needed for an exhaustive view of dialectal variation.
The aggregate analysis by means of multidimensional scaling (MDS) showed that even if the distribution of the separate linguistic variables is gradual, taking all available information into account some more coherent dialect areas can be detected. Techniques like MDS allow for great quantities of data to be taken into account (even if the number of linguistic variables in this particular study was not very large, restricted to 19 vowels). The analysis of large amounts of data with computational techniques makes it possible to detect relationships which no dialectologist could identify with manual methods.

Data-driven analysis of large amount of data reduces the influence of subjective choices of the researcher. Nonetheless, the data given as input to the analysis will of course determine the outcome, and data for quantitative analyses should be chosen carefully. A very frequent feature in the data will naturally explain most of the variance and hence come out as the most important factor. In the present study this was shown by the fact that the first dimension of the MDS as well as the first factor of the factor analysis (FA) were largely determined by a spectral feature which influenced all front vowels in the data set in a similar way. This spectral feature was not connected to the articulation of specific vowels, but was assumed to be related to voice quality differences which would influence the speech signal as a whole. Because the feature is present in many vowels it will also explain most of the variance in the data. Whether an omnipresent spectral feature is also a salient feature in perception of dialectal differences, and if it should be considered the most important factor when, for example, making a dialect division, can be discussed.

Andersson (2007, 40–41) discusses the fact that the linguist’s view of a dialect is usually a set of linguistic details, while laymen generally have a holistic view of how a specific dialect sounds without necessarily any idea of how specific vowels or consonants are being pronounced. One could say that the aggregate dialectometric analysis models the layman’s view. The relationships between varieties are studied by analyzing all the available linguistic features as a whole, and the view of the relationships between varieties in a dialectometric analysis does not include any detailed description of linguistic features. Dialectologists are generally still also interested in describing dialect areas linguistically and finding causal relationships for the observed distribution patterns. This information is not directly available in the results of an aggregate analysis like MDS.

The analysis on the variable level in Chapter 6 of the present thesis has shown the variation in separate variables as well as the presence of co-occurring features. Visualization of the geographic distribution of specific variables (§ 6.1) can be compared to the isoglosses of traditional dialectology, while the analysis of co-occurring features by means of FA (§ 6.3) can be compared to isogloss bundles. But contrary to drawing isoglosses FA is completely data-driven with automatic recognition of co-occurring features. The use of a numeric measure of vowel quality made it possible to visualize not only abrupt linguistic borders, but also continua and gradual borders in the data as well as non-continuous areas.

By reducing the data into a fewer number of dimensions than FA, MDS cannot give an account for all different underlying linguistic distribution patterns. On the
other hand, sites with some amount of missing data could be included in the MDS but not in the FA. The aggregate relationships between dialects can be studied even if a few variables are unknown for some varieties. The differences and similarities between FA and MDS was shown by a correlation of the results of the two methods in § 7.2.3.

The second factor of the FA showed the co-occurrence of a number of variables which characterize the South Swedish varieties—particularly diphthongization of long close vowels. This factor explained 9.1% of the total variance in the data. By MDS the effect of these variables was distributed over all three dimensions of the analysis, which means that any direct conclusions about specific variables distinguishing South Swedish varieties could not be made with only the results from MDS at hand.

The third dimension of the MDS could be interpreted as a peripherality dimension. This dimension correlated significantly with a number of factors from the FA which showed different distribution patterns, all being mostly related to some more peripheral dialects. Variables related to these factors were, for example, different kinds of diphthongization. In MDS, these different distribution patterns were not separated, but the effect of these variables, which explain a relatively small amount of the total variance in the data, were joined into one dimension which distinguished peripheral more divergent dialects. Varieties grouped together by the third dimension of the MDS hence share the fact that they all have a large linguistic distance to more central varieties, rather than that they would be linguistically very similar to each other.

The sixth factor of the FA did not correlate significantly with any of the dimensions of the MDS. The sixth factor identified a few variables which show similar geographic and generational distribution in the data but for which the differences across varieties are small. These differences were too small to be counted in heavily in an aggregate analysis. The reason that these variables turned up as a more significant factor in FA is probably that the FA was built on a correlation matrix, which makes all original variables count equally despite different ranges of the values on the original variables. If a variance-covariance matrix would have been used instead of a correlation matrix in the FA, these variables would probably have counted less.

A kind of opposite effect was found, too, where an object which was not detected to deviate strongly from other varieties in the analysis of the separate variables was pointed out as an outlier by the MDS. The younger speakers in Löderup were assigned extremely high values in the second dimension of the MDS. Even if this group of speakers did not deviate heavily from surrounding varieties concerning the separate variables, there must be an accumulated effect of several small differences which makes this object an outlier in the MDS.

Even if multivariate statistical analyses helps the researcher to find regularities in complex data, the discussion above in § 8.2.2 has shown that in order to explain ongoing linguistic changes, relationships that are not revealed by either MDS or FA have to be taken into account. Language change can be the result of very complex interactions between intra-linguistic and extra-linguistic factors. Analyses that take
a number of sociolinguistic variables as well as language historical developments into account can help to show what the mechanisms behind a language change are.

The analysis of gender- and age-related variation in § 7.2.4 showed that there is a larger difference in vowel pronunciation at the aggregate level between women and men in the older generation than in the younger generation. The difference showed up in the second dimension of the MDS, which is also the main separator of older and younger speakers. Since the older men were assigned more similar values to the younger speakers compared to the older women, a conclusion on a superficial level could be that the older women are more conservative than the older men. To be able to make any conclusions like that, one would, however, need to know more about which variables are the ones explaining the difference between older women and older men, and to analyze these variables in a sociolinguistic context.