LUND UNIVERSITY

South Swedish diphthongisation: an articulographic and acoustic study of /u:/ in the Malmöhus dialect

Frid, Johan; Schötz, Susanne; Löfqvist, Anders

Published in:
Proceedings from FONETIK 2012

2012

Link to publication

Citation for published version (APA):
Frid, J., Schötz, S., & Löfqvist, A. (2012). South Swedish diphthongisation: an articulographic and acoustic study of /u:/ in the Malmöhus dialect. In *Proceedings from FONETIK 2012* (pp. 85-88). University of Gothenburg.

Total number of authors:
3

General rights
Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.
• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: https://creativecommons.org/licenses/

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

South Swedish diphthongisation: an articulographic and acoustic study of /u:/ in the Malmöhus dialect

Johan Frid[1], Susanne Schötz[1], Anders Löfqvist[2]
[1] Humanities Lab, Centre for Languages and Literature, Lund University
[2] Department of Logopedics, Phoniatrics and Audiology, Lund University

Abstract

We investigated lip and tongue movements of diphthongisation of /u:/ in the Malmöhus dialect, which is spoken in the very south of Sweden. Articulographic and acoustic data of ten native speakers were collected and analysed. Acoustic analysis revealed fairly stable F1 and F3, but a considerable F_2 movement throughout the diphthongisation, indicating that /u:/ is realised dynamically. Articulographic results confirmed the acoustic results, showing significant differences in tongue displacement throughout the diphthong for all speakers, whereas lip displacement differences were significant for fewer speakers.

Introduction

Within the project VOKART (Exotic vowels in Swedish: an articulatory study of palatal vowels) (Schötz et al., 2011), we are recording and analysing lip and tongue movements of vowels, including vowel dynamics (diphthongisation) in three Swedish dialects. To facilitate our articulatory analyses, we developing an analysis tool, which is partly based on the existing tool Mview (Tiede, 2010). The aim of the present paper is two-fold: to explore the vowel dynamics of /u:/ in the Malmöhus dialect, and to show how our analysis tool can be used to visualise the dynamics of vowel articulation (diphthongisation) in Swedish.

Malmöhus diphthongisation

Diphthongs are defined as the dynamic sequence of two adjacent and different vowel sounds occurring within the same syllable (Ladefoged and Maddieson, 1996, Bruce 2000). In contrast to its neighbouring languages, Swedish has – with only a few exceptions – no true phonological diphthongs. However, there are many examples of diphthongisation in Swedish dialects. Diphthongisation is the phonetic realisations of dynamic vowels that phonologically speaking can be either monophthongs or diphthongs. They contribute highly to the characteristics of a dialect (Engstrand, 2004). In Swedish, especially the South Swedish Gotland and Scanian (skånska) dialects are known for their diphthongised long vowels. Scanian diphthongisation is a dialectal feature, although its phonetic realisation varies between the local varieties. Today diphthongisations are most apparent in the western and southern parts of Scania, the so-called Malmöhus dialect area (Bruce, 2010).

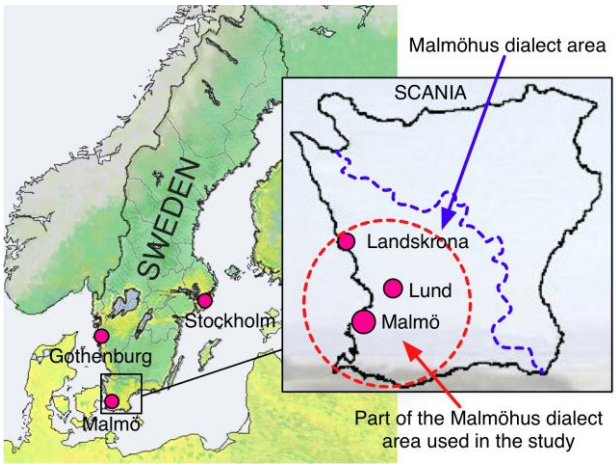

Figure 1: Map of Sweden, Scania, and the part of the Malmöhus dialect area investigated in this study.

Diphthongisation is similar in this area, though minor variations in vowel quality may occur. Unstressed vowels are generally realised as monophthongs, but all of the nine Swedish long vowels are more or less diphthongised in primary or secondary stressed syllables in the Malmöhus dialect. Usually the first vowel is more central, i.e. closer to [ə], while the second vowel is more peripheral. The two vowels tend to be equally prominent and clearly distinguishable vowel qualities connected by a glide. Moreover, long vowels are closing diphthongisations, i.e. the second vowel is closer than the first one. The three back vowels /u:, o:, ɔ:/ have a more front first vowel, while the second vowels are produced further back and with lip rounding (Bruce, 1970, 2010). Figure 2 shows the systematics of the Malmöhus diphthongisation according to Bruce (2010).

Bruce (2010) argued that diphthongisation and the temporal dimension of phonetic studies of vowels in different languages is undervalued and not considered enough, and this also ap-

plies to the Swedish dialects. He also suggests that diphthongisation is much more common in Swedish dialects than reported and described in earlier studies. This study is a first attempt to investigate vowel dynamic articulation of diphthongisation in Swedish. Here, our focus is on the Malmöhus dialect diphthongisation of /uː/. Bruce (1970) examined diphthongisation in the Malmö dialect. He found that the realisation of the phoneme /uː/ started with the highest F_2 of all vowels examined, but with a comparatively low F_3, and suggested the transcription [e͡u].

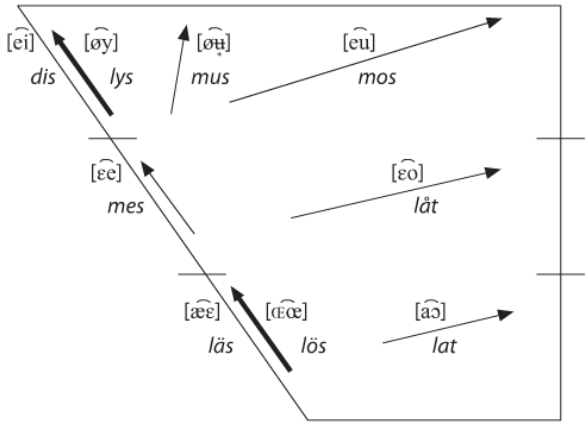

Figure 2: Malmöhus diphthongisation of long vowels. Arrows indicate the direction of each diphthongisation in the vowel space. Thick arrows show the direction of two vowels simultaneously, e.g. /iː/ and /yː/ (Bruce 2010).

Material and method

Tongue and lip movements of ten native speakers of the Malmöhus dialect were recorded along with a microphone signal using the Carstens Articulograph AG500. Sensors were placed on the lips, jaw and tongue, and also on the nose ridge and behind the ear to correct for head movements. Figure 3 shows the sensor positions and one subject with sensors glued to the tongue. The speech material consisted of about 20 repetitions from each speaker of /uː/ in carrier phrases of the type "De va inte hVt utan hVt ja sa" (It was not hVt, but hVt I said), where the target words containing the vowels were pronounced with prosodic contrastive focus. All vowels were manually segmented using the waveform and spectrogram of the microphone signal using Praat (Boersma and Weenink, 2012).

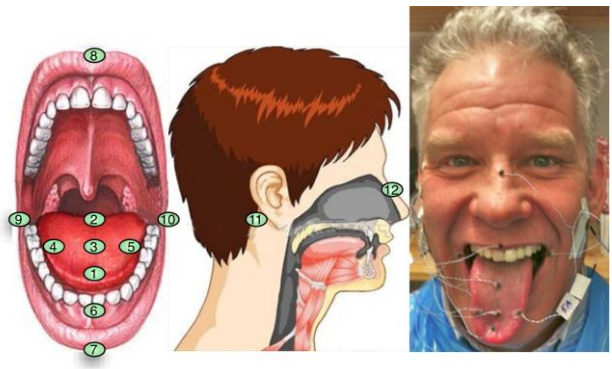

Figure 3: The 12 sensor positions used in the study and one subject with sensors attached.

Articulographic and acoustic analysis

Analysis of the tongue and lip movements in the vowel segments was done using an in-house MATLAB tool based on Mview (Tiede, 2010), which enables examination of the data in three dimensions. Since the recorded sensors were aligned along the tongue on the same axis, we focussed on the lip and tongue movements in three planes: (1) midsagittal (median), (2) coronal (frontal), and (3) transverse (horizontal) plane. We selected five articulatory measurement samples at 0, 25, 50, 75 and 100 percent of the vowel duration of each diphthongisation to capture the dynamic properties. Mean and median values for lip and tongue positions in the 25 % intervals of the total duration of the diphthongisations were calculated for each subject. Then we compared the distance between (1) the tongue body and the reference point on the nose (positions 3 and 12 in Figure 3), (2) the upper and lower lip (8 and 7), and (3) the left and right corner of the mouth (9 and 10). Acoustic analysis and F_1/F_2 plots were done in Praat. Formant frequencies (F_1-F_3) were extracted for sample points at 0, 25, 50, 75 and 100 percent of the vowel duration, i.e. the same time intervals as in the articulatory analysis.

Results

Figure 4 shows, for one speaker, the median sensor positions measured at the five 25% intervals in the diphthongised vowel /uː/. Sensor data is plotted from three different views. When following the articulation of the lips and tongue, we can observe that the tongue moves in a backwards, forwards trajectory, whereas the lips seem to move to a lesser degree.

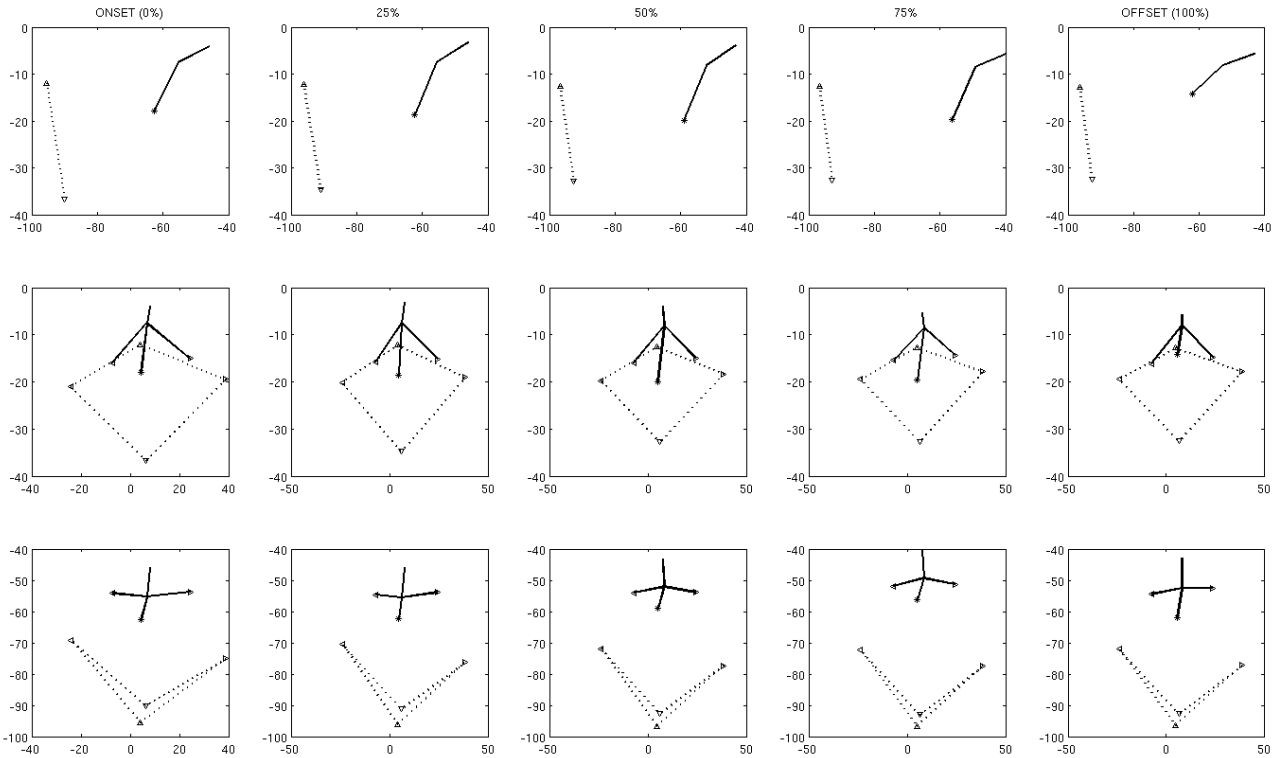

Figure 4: Median sensor positions at five 25% measurement sample points (0, 25, 50, 75, and 100) for twenty repetitions of /u:/ [ʉ̞͡ʊ] for one male speaker of Malmöhus Swedish. From top to bottom: midsagittal, coronal, and transversal views. Solid lines: tongue, dotted lines: lips.

Table 1: Number of subjects for which the distance between two given sensors differ significantly between two consecutive sample points.

Interval	*25%-0%*	*50%-25%*	*75%-50%*	*100%-75%*
Tongue body-Nose ridge	9	10	9	9
Upper lip-Lower lip	8	5	4	5
Left/Right mouth	5	7	5	8

Table 2: Mean formant frequencies (F_1-F_3) for Malmöhus Swedish diphthongisation of /u:/ [ʉ̞͡ʊ] of female and male speakers in the five 25% measurement sample points.

Interval	*0*	*25%*	*50%*	*75%*	*100%*
Mean F_1 (female/male)	320/321	392/329	365/314	364/314	365/345
Mean F_2 (female/male)	2136/1920	1576/1720	1063/1216	1013/1090	1464/1445
Mean F_3 (female/male)	2810/2425	2701/2325	2705/2342	2730/2438	2914/2596

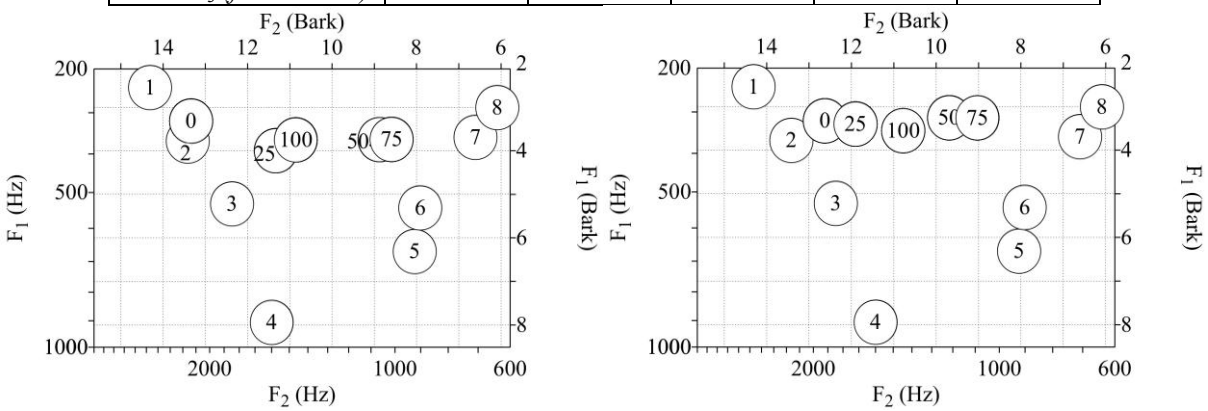

Figure 5: Mean F_1/F_2 plots for Malmöhus Swedish diphthongisation of /u:/ [ʉ̞͡ʊ] of female (left) and male (right) speakers in the five 25% measurement sample points (0, 25, 50, 75, and 100) together with the eight primary cardinal vowels (1-8) as pronounced by Daniel Jones. Each circle is one Bark in diameter.

For each speaker and sample point, the mean (of 20 repetitions) distance between each of the sensor pairs mentioned above was calculated. The means for each sample point was then compared with the next consecutive one. The results are shown in Table 2. We see that for the tongue the distance difference is significant for all speakers for the 50%-25% sample points and for all but one speaker for the other cases. For the lips, the distance differences are not significant for all speakers. In some cases, not more than half of the speakers have significant differences.

The acoustic results are shown in Table 2 anFigure 5. Table 2 gives the mean values for F_1-F_3 for female and male speakers in the five values for F_1 and F_2 plotted together with the eight primary cardinal vowels as pronounced by Daniel Jones (see e.g. Wikipedia, 2012). As can be seen, the vowel height is fairly similar throughout the five intervals, while the front-back dimension is highly varied for both female and male speakers. The diphthongisation begins as a front vowel with an [ɪ] like vowel quality, then moves back to a fairly back [ʊ] quality at 75%, but returns to a central [ɵ̞] like vowel at 100%. The movement can be described as a front-central-back-back-central one.

Discussion

In the Malmöhus dialect the phoneme /uː/ is realised as an [ɪ͡ʊ] or possibly [ɪ͡u] diphthongisation in Malmöhus Swedish, with distinct dynamic features. There were clear differences in the five 25% intervals in the lip as well as in the tongue movements. The tongue starts at a close front position and moves back, and finally front again. Lip rounding is less evident and seems less evident and not consequent for all speakers.

When comparing the F_1/F_2 movements of Figure 5 with the ones of the perceptual vowel space in Figure 2, a number of differences can be observed. The diphthongisation seems to be bidirectional, moving from front to back, then somewhat front again, ending in a comparatively central position in the F_1/F_2 vowel space. One possible explanation for this is the effect of coarticulation with the following /t/ consonant in the carrier phrase. Another difference is the phonetic symbols chosen to represent this particular diphthongisation: [e͡u] in Figure 2; [ɪ͡ʊ] in Figure 5, which is based on the position relative to the cardinal vowels in the F_1/F_2 space. Engstrand (2004:116) suggested that the first element of this diphthongisation could also be written as [ɪ]. The alternative symbols chosen here seem to be more in line with acoustic results and also with the authors' perceptual impression og the vowel qualities. However, the [e͡u] realisation of /uː/ is still widely spread, especially for elderly speakers and in the very south of the Malmöhus dialect area, from which no speakers were included in the present study. Future work includes studies of diphthongisation in other vowels as well as a comparison of Stockholm, Gothenburg and Malmöhus Swedish diphthongisation.

Acknowledgements

This work is supported by a grant from the Swedish Research Council, grant no. 2010-1599. We also would like to thank Mark Tiede for his kind permission to let us use Mview.

References

Boersma, P., Weenink, D. (2012) Doing phonetics by computer [Computer program]. Version 5.3.11, retrieved 3 April 2012 from http://www.praat.org/.

Bruce, G. Diphthongization in the Malmö dialect. (1970) Working papers 3, Phonetic Laboratory, Lund University, 1–19.

Bruce, G. (2000) Skånska fonetiska genvägar. I P. Meurling (red.) Från fästig till bredband. Malmö: Skånska Akademien och Akademiförlaget Corona, 140–146.

Bruce, G. (2010) Vår fonetiska geografi. Lund: Studentlitteratur.

Engstrand, O. (2004) Fonetikens grunder. Lund: Studentlitteratur.

Ladefoged, P., Maddieson, I. (1996) The Sounds of the World's Languages. Oxford: Blackwell.

Schötz, S., Frid, J., Löfqvist, A. (2011) Exotic vowels in Swedish: a project description and an articulographic and acoustic pilot study of /iː/. Proceedings of Fonetik 2011, Speech, Music and Hearing, KTH, Stockholm, TMH-QPSR, Vol. 51. pp. 25 - 28.

Tiede, M., (2010) MVIEW: Multi-channel visualization application for displaying dynamic sensor movements," In development.

Cardinal Vowel, In *Wikipedia.* Retrieved April 24, 2012 from http://en.wikipedia.org/wiki/Cardinal_vowel.