# A change in the openness of two vowel phoneme pairs in eastern Icelandic: An acoustic analysis of /œ:/ vs. /ʏ:/, and /ɛ:/ vs. /ɪ:/

*Guðlaug Hilmarsdóttir*
*Centre for Languages and Literature, Lund University*

### Abstract

*The number of Icelanders lacking the distinction between /ɛ:/ and /ɪ:/, and between /œ:/ and /ʏ:/ is decreasing. Since Guðfinnsson's study (1964), and up to Árnason and Þráinsson's study (Árnason and Pind 2005), speakers found in the capital region, and in eastern Iceland, are maintaining the distinction between the rounded, and between the unrounded vowel phonemes to a greater degree. This study serves to test the proposition from the previous researches. Overall results show that the participants in eastern Iceland have a mixed pronunciation, i.e. the participants partly lack the distinction between /ɛ:/ and /ɪ:/, and between /œ:/ and /ʏ:/, and partly maintain it. The mergers result in sounds close to /e:/ and /ø:/ respectively. This was also the case with the speakers from the capital region. Overall, the lack of distinction was less apparent amongst the young speakers from the East than in the capital region.*

## Introduction

Icelandic has several dialect features, found in different regions of the country. These are features such as vowel phoneme mergers, diphthongization of monophthongs, monophthongization of diphthongs, and harder, or softer, pronunciation of certain consonants.

The number of Icelanders lacking the distinction between /ɛ:/ and /ɪ:/, and between /œ:/ and /ʏ:/, however, is decreasing. Since Guðfinnsson's (1964) study, and up to Árnason and Þráinsson's (Árnason and Pind, 2005) study, speakers found in the capital region, and in eastern Iceland, are moving towards a general pronunciation, i.e. more speakers are maintaining the distinction between the two unrounded vowel phonemes, and between the two rounded vowel phonemes.

This study serves to test the proposition from the previous researches, with the following research question:

> Do young speakers in eastern Iceland lack the distinction between /ɛ:/ and /ɪ:/, and between /œ:/ and /ʏ:/, as has been found in the capital region in previous research?

This is an empirical acoustic investigation with a comparative approach, which contributes phonological data to the field of general linguistics and Icelandic dialectology. The quality of the two vowel phonemes within each pair are compared between eastern Icelandic and the Icelandic found in the capital region. It is expected that the young speakers in the East, and in the capital region, will lack the distinction between /ɛ:/ and /ɪ:/, and between /œ:/ and /ʏ:/ in part. Also, it is expected that the young speakers in the capital region will lack this distinction to a larger degree than the young speakers in the East.

## Background

### Icelandic vowel phonemes and their acoustic properties

Vowel quality is described with whether they are front, back or central; and with the degree of opening, i.e. close, close-mid, open-mid, and open. Icelandic has eight vowel phoneme pairs as monophthongs:

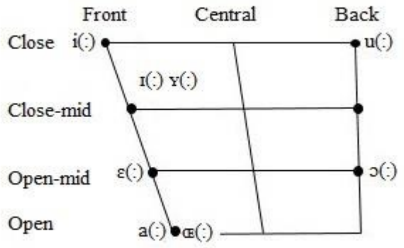


*Figure 1. The eight Icelandic vowel phoneme pairs.*

Figure 1 shows that the Icelandic vowel phoneme pairs spread on six locations in the vowel square. These locations are descriptive of the highest point of the tongue in the oral cavity. Figure 1 shows that Icelandic has six front vowel phoneme pairs, these being /i/ and /i:/, /ɪ/ and /ɪ:/, /ʏ/ and /ʏ:/, /ɛ/ and /ɛ:/, /a/ and /a:/, and /œ/ and /œ:/. Examples of these vowel phoneme pairs are in words such as *nýttir* (Eng. *made use of*) and *nýtir* (Eng. *make use of*), *fylla* (Eng. *fill*) and *fila* (Eng. *blanket*), *munnur* (Eng. *mouth*) and *munur* (Eng. *difference*), *vellur* (Eng. *boils*) and *velur* (Eng. *chooses*), *fatta* (Eng. *figure out*) and *fata* (Eng. *bucket*), and *völlur* (Eng. *field*) and *völur* (Eng. *pebbles*). Out of these, two vowel phoneme pairs are not as front, these being /ɪ/ and /ɪ:/, and /ʏ/ and /ʏ:/. Figure 1 also shows that Icelandic also has two back vowel phoneme pairs, where one is close, and the other open-mid, i.e. /ɔ/ and /ɔ:/, and /u/ and /u:/ respectively. Examples of the back allophone pairs are in words such as *hoppa* (Eng. *jump*) and *hopa* (Eng. *regress*), and *húkka* (Eng. *catch (a ride)*) and *húka* (Eng. *squat*).

Vowels are also described with the degree of openness of the oral cavity. Figure 1 shows that there are two close allophone pairs, two open mid, and two open. Then, two allophone pairs are halfway between being close and close-mid, i.e. /ɪ(:)/ and /ʏ(:)/. This also describes how high or low the highest point of the tongue is:

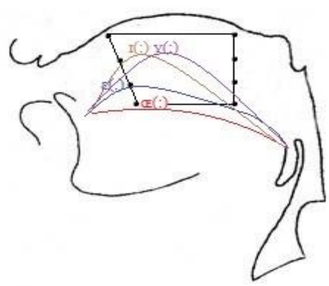


*Figure 2. The degree of opening for /œ(:)/, /ɛ(:)/, /ɪ(:)/, and /ʏ(:)/.*

Figure 2 shows how tongue position varies between the rounded and the unrounded vowel phonemes. Lindblad (2010: 93) notes that in general, a change in the form of the vocal tract can affect formant frequencies. However, different changes in the form of the vocal tract affects formant frequencies in a different manner. As an example, a decrease in the degree of openness, i.e. when the tongue moves higher up, can lead to a higher correlation between the first formant and the pharynx, and a higher correlation between the second and the third formant and the oral cavity. Nevertheless, Lindblad (2010: 93) notes that this cannot be generalized, since many vowels differ in their degree of openness.

However, Lindblad (2002: 94) offers five points as guidelines for analysing the relationship between formant frequencies and the form of the vocal tract:

1. Lip rounding or other hinders lower formant frequencies.
2. The smaller degree of openness, the lower the frequency of the first formant.
3. The closer the narrowest passage between the tongue and the roof of the oral cavity is to the mouth opening, the higher the frequency of the second formant, and also the third formant, but to a lesser extent.
4. The larger the degree of openness under the tongue, the lower the frequency of the third formant.
5. The longer the vocal tract, the lower the frequencies of the different formants.

These five points will guide the analysis of the formant frequencies in the results section.

Lindblad's (2002: 94) five points, together with Figure 2, can be used to predict what a merger between /œ:/ and /ʏ:/, and between /ɛ:/ and /ɪ:/, would result in, in terms of the change in the form of the vocal tract and the affect these changes have on formant frequencies.

In a merger within each vowel phoneme pair, a change to a less open vocal tract (/œ:/ to /ʏ:/, /ɛ:/ to /ɪ:/) would result in lower frequency values of the first formant (Lindblad's second point). On the contrary, a change to a more open vocal tract (/ʏ:/ to /œ:/, /ɪ:/ to /ɛ:/) would result in higher frequency values of the first formant (opposite of Lindblad's second point). The position of the narrowest passage of the tongue is responsible for the second formant value. As both vowel phoneme pairs are considered front vowel phonemes, the effect of F2 variation will be included impartially.

### Vowel phoneme mergers

One of the dialect features found in certain areas of Iceland, is the merger between /œː/ and /ʏː/, and between /ɛː/ and /ɪː/. Mergers occur over time, when two or more sounds that once were distinguished by speakers, merge, in a certain dialect or language, and therefore become one sound (Hickey, 2004: 125). Hickey further notes that the merged sounds can later move together to a different location on the vowel square, which is termed as a shift (2004: 125).

Vowel phonemes can be affected by other sounds in the context, both by consonants and other vowels phonemes (Árnason and Pind, 2005: 253). Hickey notes that vowel phoneme mergers, where the vowel phonemes are sensitive to context, are often determined by a following sonorant, i.e. /n, l, r/ (2004: 127). Furthermore, mergers of this type do not seem to be determined by a following obstruent, e.g. /t, k, p/. Hickey claims that the reason for the effect from sonorants is because how alike the quality of a sonorant is with that of a vowel (2004: 127). Also, "it is […] known that the coda sonorants tend to become absorbed into the nucleus of the syllable they occupy" (Hickey, 2004: 127).

The *flámæli* (Eng. *flayspeech*) dialect feature in Iceland is an example of spontaneous changes. Árnason and Pind note that flayspeech is a dialect feature where the close-mid vowel phonemes /ɪ/ and /ʏ/ become more open, or diphthongize to /ɪɛ/ and /ʏœ/, or /ɛ/ and /œ/ (2005: 254).

## Methodology

The reading method was chosen over elicitation, even though the latter might be more descriptive of natural speech. By choosing the reading method, it was possible to control for the appearance of both vowel phonemes.

### Structuring the sentences

The four phonemes, i.e. /ɛː/, /œː/, /ɪː/, and /ʏː/, served as the main guidelines in finding key words to build up sentences that the participants to read. The dictionary *Íslensk Orðabók* (1997) was used to find words with these vowel phonemes in stressed position. The words within each phoneme pair, i.e. within /ɛː/ and /ɪː/, and within / œː/ and /ʏː/, were almost identical, except for that single vowel phoneme. Example words are those such as, *sögu* (Eng. *story*), and *sugu* (Eng. *sucked*). Random sentences were created manually, written on separate pieces of paper, and laminated in order to prevent unnecessary noise in the recordings. The following is the final set of keywords that were used in constructing the sentence pairs:

*Table 1. List of key words with the unrounded vowel phonemes in stressed position.*

| /ɛː/ | /ɪː/ |
|---|---|
| beðin | biðin |
| betur | bitur |
| pela | pila |
| dekillinn | dikillinn |
| fela | fila |
| fetað | fitað |

*Table 2. List of key words with the rounded vowel phonemes in stressed position.*

| /œː/ | /ʏː/ |
|---|---|
| sögu | sugu |
| röðullinn | ruðullinn |
| rösull | rusull |
| nötur | nutur |
| mösull | musull |
| föður | fuður |
| börur | burur |

### Participants

Twenty speakers, aged between 16-20 years old, participated in this research. Half of the participants came from eastern Iceland, which served as the focus group, while the other half came from the capital area, which served as a control group. Each group was balanced for gender.

### Recording sessions

A microphone was connected to a laptop and the speakers were recorded with Praat. The participants came in to a room, one by one, and sat in front of the microphone with their arms rested in their lap under the table.

One of the sentences was put on the table, which the participants read, and then it was taken away and a new sentence was read. The participants read all sentences in one recording.

After the recording had finished, the participants filled in a set of background questions.

## Analysis

The first three formants were measured manually in Praat, despite the fact that the third formant is irrelevant, in case something interesting would show up. However, the final measurements showed that the third formant was in fact irrelevant, as it was in most cases found at very similar frequencies between each vowel phoneme in each pair.

R was used to create scatterplots from the documented formant frequencies. In addition, R was used to calculate mean the mean frequency of each vowel phoneme within each group of speakers, in order see if the formants were found in close frequency range within each pair. The standard deviation was also calculated in R, in order to see how the formants in each vowel phoneme would scatter. If standard deviation will be high, then the formants will scatter over a larger area on the scatter plot.

# Results

Figures 4(a)-4(d) show the results of the measurements, in Hz, when young male and female speakers from the capital region of Iceland, and from the East, read sentences containing key words with either the /œ:/ or the /ʏ:/ vowel phoneme. Furthermore, Tables 3(a)-3(d) show the mean frequency, and standard deviation, also measured in Hz.

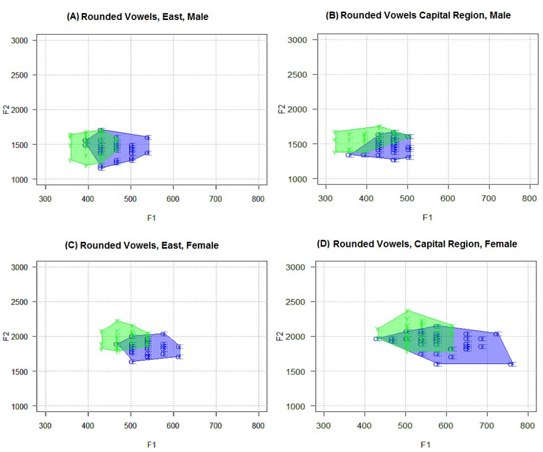


*Figure 4. A scatter plot of the first two formants in /œ:/ and /ʏ:/.*

*Table 3. The mean frequency (MF) and the standard deviation (SD) of the first two formants in /œ:/ and /ʏ:/.*

| | F1(MF) | F1(SD) | F2(MF) | F1(SD) |
|---|---|---|---|---|
| (a) Male, East | | | | |
| /œ:/ | 465.412 | 39.944 | 1439.000 | 132.717 |
| /ʏ:/ | 409.618 | 32.258 | 1531.029 | 143.115 |
| (b) Male, capital region | | | | |
| /œ:/ | 457.606 | 31.243 | 1488.667 | 108.616 |
| /ʏ:/ | 415.546 | 50.056 | 1576.970 | 101.974 |
| (c) Female, East | | | | |
| /œ:/ | 539.800 | 34.996 | 1850.857 | 91.146 |
| /ʏ:/ | 494.857 | 35.191 | 1957.800 | 99.385 |
| (d) Female, capital region | | | | |
| /œ:/ | 584.886 | 31.243 | 1915.943 | 126.020 |
| /ʏ:/ | 535.514 | 47.784 | 2029.686 | 139.659 |

Figures 4(a)-4(b), and Tables 3(a)-3(b) show that an overlap is found when the young male speakers from both regions pronounce both of the two rounded vowel phonemes. Tables 3(a)-3(b) show that the formants are found around similar frequencies for the young male speakers in the East and in the capital region. Standard deviation is relatively low in the case of both formants, which means the formants scatter over a smaller area on the scatter plot. Also, standard deviation of F2 in both rounded vowel phonemes is lower for the young male speakers in the capital region, which means that the second formant is found at a narrower frequency scale, i.e. the scatter of both rounded vowel phonemes is narrower on y-axis, than that of the young male speakers of the East.

Figures 4(c)-4(d), and Tables 3(c)-3(d) show that there is also an overlap when the young female speakers from both regions pronounce the two rounded vowel phonemes. Tables 3(c)-3(d) show that the first two formants in the rounded vowel phonemes are found at similarly close frequencies. Nevertheless, standard deviation of the first two formants in both rounded vowel phonemes is higher in the case of the young female speakers from the capital region, which means that the formants scatter over a greater area, at least in the case of F1. This allows for a greater overlap, as can be seen in Figure 4(d), compared with Figure 4(c).

Figures 5(a)-5(d) show the results of the measurements, in Hz, when young male and female speakers from the capital region of Iceland, and from the East, read sentences containing key words with either the /ɛ:/ or the /ɪ:/ vowel phoneme. Furthermore, Tables 4(a)-

4(d) show the mean frequency, and standard deviation, also measured in Hz:

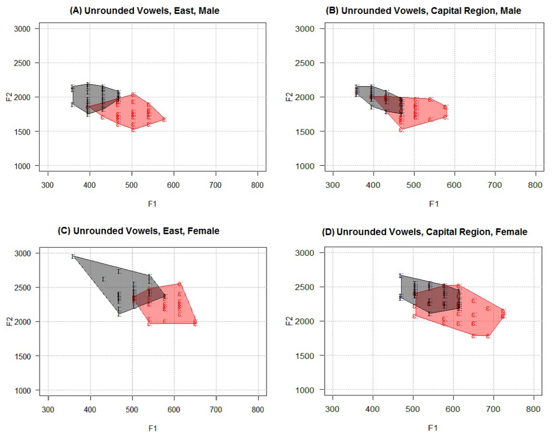


*Figure 5. A scatter plot of the first two formants in all occurrences of the /ɛ:/ and /ɪ:/ vowel phonemes.*

*Table 4. The mean frequency (MF) and the standard deviation (SD) of the first two formants in /ɛ:/ and /ɪ:/.*

| Group | F1(MF) | F1(SD) | F2(MF) | F1(SD) |
|---|---|---|---|---|
| (a) ME | | | | |
| /ɛ:/ | 495.857 | 39.638 | 1825.414 | 128.847 |
| /ɪ:/ | 415.036 | 32.191 | 1998.207 | 122.661 |
| (b) MC | | | | |
| /ɛ:/ | 493.759 | 42.935 | 1488.667 | 122.871 |
| /ɪ:/ | 413.207 | 38.598 | 1987.429 | 98.295 |
| (c) FE | | | | |
| /ɛ:/ | 579.621 | 41.546 | 1850.857 | 148.267 |
| /ɪ:/ | 494.931 | 41.596 | 2436.138 | 167.253 |
| (d) FC | | | | |
| /ɛ:/ | 624.700 | 66.404 | 2162.033 | 182.437 |
| /ɪ:/ | 539.267 | 45.546 | 2393.367 | 122.523 |

Figures 5(a)-5(d) show that the scatter fields for the /ɪ:/ vowel phoneme is of similar shape for all groups, except for the young male speakers in the East. However, despite that the scatter field for /ɪ:/ for the young female speakers in the East was of similar shape as for both groups in the capital region, the degree of scatter is nevertheless larger in that area. The scatter field for the /ɛ:/ vowel phoneme is of similar shape for the young male speakers from both regions. The scatter field for the /ɛ:/ vowel phoneme is also similar between the young female speakers in both regions. However, the degree of scatter is greater amongst the young female speakers in the capital region. This can be seen in how the field in Figure 5(d) extends over a longer frequency range, in terms of the first formant.

Figures 5(a)-5(b), and Tables 4(a)-4(b), show that an overlap was found when the young male speakers in the East, and in the capital region, were pronouncing the two unrounded vowel phonemes. Also, the first two formants are at equally close frequencies in both regions. Nevertheless, standard deviation of F1 is greater for young female speakers in the capital region, which means that the scatter of F1 in both unrounded vowel phonemes is greater than that of the young male speakers in the capital region. However, Tables 4(a)-4(b) show that standard deviation of F2 is greater for the young male speakers in the East, in both unrounded vowel phonemes

Figures 5(c)-5(d), and Tables 4(c)-4(d) show that an overlap was found when the young female speakers in the East, and in the capital region, were pronouncing the two unrounded vowel phonemes. Also, the first two formants in the unrounded vowel phonemes are found at similarly close frequencies in both regions. However, the second formant in the unrounded vowel phonemes is slightly further apart in the case of the young female speakers from the capital region. In addition, standard deviation is greater in almost all cases for the young female speakers in the capital region, except for F2 in the East. This allows for a greater overlap between the two unrounded vowel phonemes amongst the young female speakers from the capital region.

# Discussion

Several interesting points should be discussed at this point. The lack of distinction between the vowel phonemes in both pairs is slightly greater amongst the young male speakers than for the young female speakers in the capital region. This might indicate different attitudes towards the overlap of the unrounded vowel phonemes, and the unrounded vowel phonemes.

In addition, the young female speakers in both regions have a greater scatter in the case of the unrounded vowel phonemes than that of the young male speakers, while in the case of the rounded vowel phonemes, the young male speakers in both regions have a greater scatter, except in the case of the first formant in /ʏ:/. This indicates that gender might matter in the usage of the two mergers

The fact that the overlap is only apparent in some example sentences questions the fact that the flayspeech dialect feature was is in fact an example of spontaneous changes. Various consonants appeared in the following context of the rounded and the unrounded vowel phonemes, such as plosives, fricatives, and liquids. These different types of consonants might affect the young speakers in making a distinction between two vowel phonemes in different ways.

Neither of the more open vowel phonemes had completely moved to the more close vowel phonemes, nor did the opposite movement occur for the more close vowel phonemes. Thus the vowel phonemes met in the middle, forming sounds similar to /ø:/ and /e:/ respectively. This also means that for those young speakers who lack the distinction, the form of the vocal tract is less varied compared to those young speakers who do make the distinction. For both the rounded and the unrounded pair, the more open and the more close vowel phonemes have become a close mid vowel phoneme. Assumptions about tongue position are made based on formant measurements, as shown in the tables in the results, in reference to Lindblad's second and third point (2002, see Section 2.1).

As in Guðmundsson (1964), and in the RÍN research (Árnason and Pind, 2005), flayspeech was found in the same three counties in this study. This suggests that the results in Árnason and Þráinsson's study might not be entirely true (Árnason and Pind, 2005).

As Section 2.4.1 shows, the use of the flayspeech dialect feature had drastically decreased from Guðfinnsson's research in 1941-1943 until the RÍN research in the 1980s. The young speakers in the capital region had developed a new version (Árnason and Pind, 2005: 402), and the lack of distinction found amongst the speakers in this group is partly maintained in that region, and now found in the East of Iceland.

# Conclusion

The analysis of the results have now shown that the research question stated in Section 1 has been answered. Previous research has shown that Icelanders are moving towards a more general pronunciation, where the distinction between /ɛ:/ and /ɪ:/, and between /œ:/ and /ʏ:/ is maintained. The current study shows otherwise.

The fact that this merger was found in the two regions indicates that either its usage is decreasing at a slower rate than indicated by Árnason and Þráinsson's RÍN research, or the generation of speakers that the participants in this study belong to, have started to use it, on purpose or not, and might do so in the coming future. Further study in the future is needed to predict the future of this dialect feature, whether its usage is in fact coming to an end, or is regaining popularity and increasing in usage.

Despite the fact that the context the vowel phonemes appeared in was not taken into consideration in the analysis of the results of this study, it raises the question of the flayspeech dialect feature to be a free variation or context sensitive, as this dialect feature was only partly apparent. This is what will be taken up in a master's thesis, in addition to taking the differences found between individual results and general results into consideration.

Dialect features are often closely connected with social aspects, such as attitudes, and also with the context the sounds in question appear in. Flayspeech is no exception. To be precise, "flayspeech is a little more complicated than swapping out *i*/*e*, and *u*/*ö*" (Hermannsdóttir, 2015: personal communication). Even though this this study indicated that the flayspeech dialect feature is in usage at this point in time, it is not enough to fully understand its past, present, or its future. However, future studies suggested in this section will give a clearer comparison of the current situation within the age group that is tested, which will make generalizations and future predictions easier

# References


Árnason K, Pind J (2005). Hljóð. In: *Íslensk Tunga: Handbók um hljóðfræði og hljóðkerfisfræði*. Reykjavík: Almenna Bókafélagið.

Böðvarsson Á (1997). *Íslensk Orðabók*. 2d ed. Reykjavík: Mál og Menning.

Guðbjörnsson B (1964). *Mállýzkur II: Um Íslenzkan framburð*. Heimspekideild Háskóla Íslands og Bókaútgáfa Menningarsjóðs.

Hickey R (2004). Mergers, near-mergers and phonological interpretation. In Christian J Kay, Carole Hough and Irené Wotherspoon (eds.). *New Perspectives on English Historical Linguistics*. Amsterdam: John Benjamins.

Lindblad P (2002). *Grundläggande Akustisk Fonetik*. Lund: Lunds Universitet.

Lindblad P (2010). *Fonetikens Grunder*. Lund: Lunds Universitet.