https://doi.org/10.3176/lu.1998.3.26

MALLE A. NIEMELÄ, TAISTO MÄÄTTÄ (Oulu)

DURATIONAL PROPERTIES OF FINNISH DIPHTHONGS AS PRODUCED BY ESTONIAN LEARNERS

1. Introduction

The typological and genetic kinship of Estonian and Finnish is widely known. This leads the man in the street to regard the mutual learning of the languages as easy. However, a number of phonological and phonetic features differ, to the effect that attention and conscious effort is required of the learner, to reach a decent level of command.

A persistent source of interference lies in the production patterns of diphthong segments of the languages. The overall prominence of the second segment of certain diphthongs, e.g., is striking to a Finnish listener in the Estonian accent. The writers of the present article made cross-language perceptions of the phenomenon, which called for the empirical study. In this context, we focus our attention on the possible role of the distribution of duration over the diphthong segments.

The total durations of the Finnish primary-stressed diphthongs have been measured by K. Wiik (1965 : 125—126) and J. Lehtonen (1970 : 69). In their results, the mean durations vary from a minimum of 162 ms (diphthong /ie/; Lehtonen 1970) to an informant-specific maximum of 284 ms (informant PK; Wiik 1965). To our knowledge, the within-diphthong division of the duration has been reported by K. Wiik (1965 : 126) only. According to the total means given by him, the first segment occupies an average 52% portion of the Finnish diphthong.

The diphthongs of Estonian have been studied by H. Piir (1985), among others. Also normative rules for the production of Estonian diphthongs are given by P. Alvre (1971 : 13; 1992 : 25) and P. Palmeos (1981 : 116). The duration of Estonian diphthongs is also dealt with by H. Piir (1985 : 44—46). Her measurements show that the 1st segment of an Estonian diphthong varies 75 to 105 ms in duration, and the 2nd segment varies in the range 100 to 115 ms, on an average.

The average duration divisions between the segments shows a cross-language difference: the Estonian diphthongs tend to have a relatively longer 2nd segment than the Finnish ones. Besides, a quantity-specific differentiation is demonstrated by H. Piir's measurements: the overlong (Q3) quantity degree on the diphthong further increases the quoted proportion in favour of the 2nd segment duration in Estonian.

Notions on contrastive production problems of diphthong duration have not been presented in phonetic literature. In the present paper, we study the productions of Finnish diphthongs by two native speakers of Estonian, who have learned

Finnish under different sets of conditions and from different native dialect bases. A special focus is on the durational division of the 1st and 2nd segment of diphthongs as produced in Finnish words by the two informants. The hypothesis is given a better specified form at the end of chapter 2.

2. The diphthong systems in Estonian and Finnish

The syllable nuclei with two different vowel qualities are called diphthongs. As a rule, the two vowel elements are phonemically definable, like in Estonian and Finnish. All the nine E s t o n i a n vowel phonemes, viz. /i e æ y ö u o ɑ õ/, can stand as the 1st segment of an Estonian diphthong. The possible vowels as the second segment are /i e ɑ u o/ only. All the Estonian diphthongs occur in the primary stressed syllable, and only three of them, /ɑi ei ui/ also occur in post-stress syllables.

You can classify diphthongs in various ways. Let us characterize the Estonian diphthong paradigm by way of a few classifications. The diphthongs of today with /i / as the 2nd segment are of two origins: the 2nd segment used to be either /i/ or /y/. The diphthongs that have preserved the /i/-phoneme as the 2nd segment, show a late gradation, e.g. *heina* (Q2) : *heina* (Q3); *taime* (Q2) : (Q3) *taime* (Q3). The vowel /y/ as the 2nd segment has developed into an /i/, and diphthongs subject to late gradation have turned up: **köysi* : **köyen* > *köis* : *köie*. Many diphthongs ending on /i/ have been engendered by morpho-phonemic rules that combine a plural or past tense /i/ with a monosyllabic stem: *puid* 'trees', *maid* 'lands', *sain* 'I obtained'.

Certain late diphthongs have developed as a result of qualitative gradation. A consonant syncope has taken place in the consonantal weak grade, and the two vowels from the successive syllables come to form a single syllable nucleus, with the disappearance of the syllable boundary (e.g. *mato* + plural *-t* > *ma.ot* > *maod* 'worms'). These late diphtongs represent the quantity degree Q3.

A criterion central for the present theme is the prominence pattern of the diphthong. It may have either a falling or a rising prominence (or stress) (Piir 1985 : 8). The falling pattern involves a greater prominence on the 1st segment, and a rising pattern has a greater prominence on the 2nd segment. The phonological quantity follows this division, and Q2 represents a falling and Q3 a rising pattern, accordingly. One further criterion, presented by H. Piir (1985), is the native vs. foreign nature of diphthongs.The native diphthongs are either subject to gradation (Q2 vs. Q3), or only occur in Q3.

The eight F i n n i s h vowel phonemes, /i e æ y ö u o ɑ/, may all occur as the first segment of a diphthong. The position of the 2nd segment can be occupied by any of the eight except by /æ/ and /ɑ/. Thus, only two phonemic degrees of height, viz. high and mid, are represented in the quality of the second segments of Finnish diphthongs.

The possible permutations of the eight 1st segment vowels and six 2nd syllable vowels (a total of 48) is cut down to the 17 or 18 really occurring diphthongs in Finnish. Primarily two distributional restrictions delimit the number: (1) vowel harmony, and (2) a strong height-backness-rounding restriction of diphthongs with an /e/, /ö/, or /o/ as the 2nd segment, i.e., the diphthongs /ie/, /yö/, and /uo/ do exist, whereas /ɑo/, /ue/, /ye/, and /io/, e.g., do not occur (see Wiik 1965 : 53—54).

From the aspect of contrasting the two diphthong systems we can observe a historical deviation of Finnish and Estonian. The existence of the diphthongs /ie/, /yö/, and /uo/ in Finnish is due to a late development, and the Estonian monophthongs appear more original. In cognate words of the languages, Finnish *tie* — Estonian *tee* 'road', Finnish *työ* — Estonian *töö* 'work', and Finnish *suo* —

Estonian *soo* 'marsh', these Finnish diphthongs are represented by monophthongs in Estonian. This result of a Finnish sound change provides a learning problem to an Estonian learner, *per definitionem*, no less for the fact that the occurrence of the mentioned phoneme units in vocabulary and running speech is quite frequent (for frequencies in text, see Häkkinen 1978).

A conspicuous difference between the Estonian and Finnish diphthong systems is that the Estonian quantity differentiation also pervades the diphthong system in form of realizations of Q2 and Q3. A hypothesis concerning the transfer of the Estonian system on the production of Finnish diphthong duration could be formulated in the following way: the Estonian tendency to have a relatively long duration on the second segment of a diphthong makes the Estonian learners of Finnish apt to give surplus prominence on the 2nd segment of Finnish diphthongs in form of duration. The tendency is further strengthened by a conceived Q3 pattern in the Finnish word to be uttered. A cognate word pair to the point across the languages is Finnish *täinen* — Estonian *täine* 'lousy', which can have no other diphthongal quantity pattern than Q3 in Estonian.

3. Informants, material, and measurements

The informants were two Estonian students. Their personal and learning histories of Finnish are as follows:

Informant A: A man of 25 years, a native speaker of the north-eastern variety of Estonian. He has lived three years in Finland, and has acquired Finnish in contexts of practical language usage only, without theoretical studies of Finnish.

Informant B: A female student coming from Tallinn, age 23 years. She has studied Finnish at the University of Tartu. She had lived three years in Finland at the time of the recording.

Two students of Finnish, one male (age 23; informant C) and one female (age 19; informant D) were obtained as Finnish speaking informants for comparison. Both these Finnish informants come from Oulu.

The verbal material consists of 50 bisyllabic Finnish words with the diphthong in the first syllable. The informants uttered the words in both isolation and in the sentence frame *Mitä ... on viroksi?* 'What is ... in Estonian?'. The words uttered in the frame serve as the material for measurements in this study. Each diphthong occurs three times in the material, except the most marginal ones /iy/ and /ey/. Further, each diphthong is followed by a plosive (e.g. *pöytä* 'table'), a fricative (e.g. *köysi* 'rope'), and a resonant (e.g. *höylä* 'plane'). The recording apparatus was a high-quality casette recorder, and an unechoic chamber was used.

The measurements were made by a Macintosh-controlled speech analysis program called Signalyze. The total durations and the durations of the 1st and 2nd segment were measured. The diphthong segmentation was done by dividing the dubious between-segment glide in two, on the basis of the formant glides in the spectrogram, and then shared among the two segments. The acoustic qualities of the diphthong segments were studied by way of F1 and F2 measurements as well, but the values of the formant frequencies are not utilized in this context.

4. Results

For the presentation of the results, the Finnish diphthongs are classified according to their features with reference to the high-low dimension. All other Finnish diphthongs but /ui/, /iu/, /yi/, and /iy/ are wholly or partly differentiated by this parametre.

The results of the duration measurements are arranged with reference to four diphthong classes of Finnish:
(1) diphthongs /æi/, /æy/, /ɑi/, and /ɑu/, having the most extensive between-segment glide along the high-low dimension; a change from low to high,
(2) diphthongs /ei/, /eu/, /ey/, /ou/, /oi/, /öi/, and /öy/, having a change from mid to high,
(3) diphthongs /ie/, /uo/, and /yö/, having a change from high to mid, and
(4) diphthongs having no change along the high-low dimension: /iu/, /ui/, /iy/, and /yi/.

The duration pattern of the Finnish diphthongs, as measured from the utterances of the two (northern) Finnish informants, differs considerably from the rough 1:1-proportion obtained in K. Wiik's (1965 : 126) results. Our results show a strong dominance of the 1st segment, with an outcome of almost 2:1-proportion, the 1st segment percentage being 64%, on an average. The duration measures indicate a remarkable initial prominence in the diphthongs of the two Finnish informants. The average total durations of the two Finnish informants' diphthongs are 169 to 177 ms.

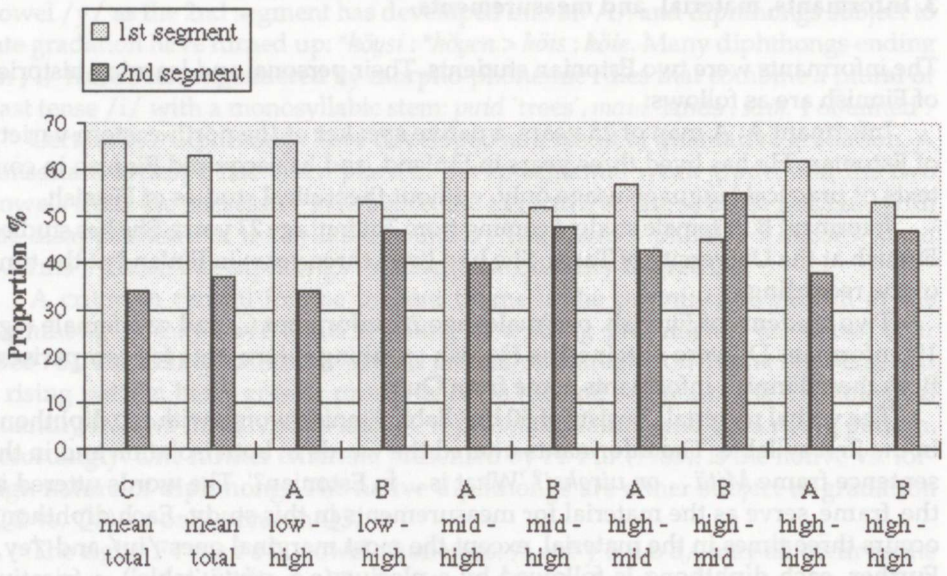

Figure 1. **Proportion (per cent) of durations of the 1st and 2nd segment of Finnish diphthongs. Diphthong classes with different extent and direction of glide: low-high (e.g. /æi/), mid-high (/ei/), high-mid (/ie/), and high-high (/iu/). Informants A, B (native Estonian speakers) and C, D (native Finnish speakers).**

Informant A, with a north-eastern variety of Estonian, produces the diphthongs with the durational prominence predominantly on the 1st segment. The 1st segment average percentages in diphthongs produced by him vary from 57 to 66% (see Figure 1). The lowest 1st segment portion (57%) is obtained from the measurements of diphthong category (3), /ie/, /uo/, and /yö/, while the highest portion (66%) results from category (1) (e.g. /æi/). The other two categories fall between the two, around 60%. On an average, informant A has a very similar durational pattern of Finnish diphthongs as the two native speakers of Finnish have. Informant A's average duration values of different diphthong classes vary in the range 205 to 229 ms (see Table 1).

Table 1.

Durations (ms) of the 1st and 2nd segment of Finnish diphthongs

	mean — total ms		low — high ms		mid — high ms		high — mid ms		high — high ms	
	C	D	A	B	A	B	A	B	A	B
1st segment	110	111	145	127	136	128	118	93	141	134
2nd segment	59	66	74	114	91	116	87	117	88	118
Total duration	169	177	219	241	227	244	205	210	229	252
N	50	50	12	12	19	18	9	8	10	10

Diphthong classes with different extent and direction of glide; explanation, see Figure 1. Informants A, B (native Estonian speakers) and C, D (native Finnish speakers).

Informant B, with a native Tallinn speaker's variety, produces her Finnish diphthongs with a much less initial prominence than informant A. The 1st segment percentage varies from 45 to 53%. The four classes of diphthongs appear to show two durational patterns in her utterances. The one is that of classes (1), (2), and (4), and the other is class (3) (diphthongs /ie/, /uo/ and /yö/). Fairly even between-segment durations are obtained from the former group of diphthongs, a possible factor to cause differences between the classes being the inherent duration of vowels (see Table 1). The other pattern differs drastically from the former one, and a 2nd segment prominence is revealed: the 1st segment occupies a portion of only 45% of the diphthong (Figure 1). The total durations of the diphthongs in informant B's utterences vary in the range 210 to 252, for different diphthong classes.

In addition to the data provided for above, a few details are of interest in the two informants' results. The initial prominence of informant A's diphthongs is not realized in a few noteworthy cases, with the drop of his 1st segment duration percentage below the even division limit 50%. They are the words *leipä* 'bread' (43%), *viulu* 'violin' (49%), and *vyötön* 'beltless' (30%). For its gradational gestalt, *leipä* represents a pattern with Q3 as the only choice, and Q3 favours the second segment prominence in Estonian. Piir's (1985: 45) duration measurments for the diphthong /iu/ show unalternate 2nd segment prominence, irrespective of the occurring Q2 vs. Q3 distinction. Again, /yö/ is a foreign and non-occurring diphthong in Estonian, and a poorly organized segment division tends to turn up. In addition to the diphthong class (3), informant B produces diphthongs with less prominence on the 1st segment quite frequently. The words *seinä* 'wall' (40%) and *leipä* (35%) are analogous with the pattern produced by informant A. Among those are also five instances of the diphthong class (1), where the inherent vowel features should increase the 1st segment duration (e.g. *laiha* 'meagre' (46%) and täyte 'filling' (46%).

5. Discussion

The two native Estonian speaking informants represent two different varieties of the language. They also have had different settings of language acquisition. Further, they are individuals as language acquirers, and personal learner properties have been found to affect the outcome strongly.

The north-eastern dialect area, where informant A comes from, has been commented to have specific quantity properties. Among those is the non-existing length differentiation under certain conditions (Must 1995 : 15). In this dialect area also the long mid vowels have been diphthongized (*sic*!) into /ie/, /uo/, and /yö/ (Must 1995 : 21). Apart from this, his acquisition of the target language has taken place in a natural language environment. His within-diphthong durational division appears

very much alike with that of the Finnish informants. His lack of academic studies of Finnish does not seem to have been an obstacle to the acquisition of the durational pattern. The perceptual impression of his diphthong prosody is, with the few exceptions dealt with above, quite satisfactory.

Informant B has a history of language acquisition under academic instruction. The durational properties of her Finnish diphthong production is much more variable than that of informant A, but her within-diphthong duration division is remarkably close, on an average, to the division obtained by K. Wiik (1965). Still, she has a strong tendency to produce a group of diphthongs with a lengthening of the latter segment. These were the ones whose cognates are met with as monophthongs in the Estonian system: /ie/, /uo/, and /yö/.

A few well-profiled details of native language transfer could be revealed in the informants' utterances. Of these, the overlong degree of length (Q3), as the sole conceived pattern, was a recurring factor to cause a relative lengthening of the latter segment of a Finnish diphthong. Another was the durational prominence of the 2nd segment in diphthongs /ie/, /uo/, and /yö/, which correspond to the cognate Estonian phoneme segments /ee/, /oo/, and /öö/, in either long or overlong degree of length. A simple — but how easily followed? — tip for a more correct Finnish diphthong pronunciation can be given: the learner should put more intensity initially on the Finnish diphthong, thus lengthening its first segment.

A shortcoming of the present study is the lack of measurements of the within-diphthong F0-contour and quality values of segments, as indices of segment prominence. Besides, a statistical analysis would have shed light on the variability of the durational features, albeit great variation is a commonplace of second language production. The details of interest, the Q2 vs. Q3 dichotomy and the durational bias in the diphthongs /ie, uo, yö/ call for a focussed study. To elicit material in accordance with the Q3-issue, Finnish words with a binding resemblance of the Q3 pattern to Estonian speakers should be selected. Certain transfer patterns seem very likely but need a study profiled against the specified issues.

REFERENCES

A l v r e, P. 1971, Soome keele õpik iseõppijaile. Teine täiendatud trükk, Tallinn.

—— 1992, Soome keele grammatika, Tallinn.

H ä k k i n e n, K. 1978, Eräistä suomen kielen äännerakenteista. — Sanajalka 19, 57—68.

L e h t o n e n, J. 1970, Aspects of Quantity in Standard Finnish. — Studia Philologica Jyväskyläensia VI, Helsinki.

M u s t, M. 1995, Kirderannikumurde tekstid, Tallinn (Eesti Teaduste Akadeemia Eesti Keele Instituut).

P a l m e o s, P. 1981, Soome keele õpik. Teine parandatud ja täiendatud trükk, Tallinn.

P i i r, H. 1985, Acoustics of the Estonian Diphthongs. — Estonian Papers in Phonetics 1982 — 1983, Tallinn, 5—103.

W i i k, K. 1965, Finnish and English Vowels. A Comparison with Special Reference to the Learning Problems Met by Native Speakers of Finnish Learning English. — Turun yliopiston julkaisuja, sarja B, osa 94, Turku.