

Estonian as a heritage language in Sweden: Acoustic and perceptual characteristics of the quantity system

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Abstract

This paper studies the Estonian three-way phonological quantity distinction by second-generation Swedish Estonians. Production of the three phonological quantities has been measured in informal interviews with four speakers, all active members of the Estonian exile community. Comparisons with native Estonians show that three of the four Swedish Estonians had retained the length difference between quantity 2 and 3 in all disyllabic word types. All four displayed native-like pitch contours while two were somewhat inconsistent. The same speakers and four additional ones were then tested for perception of the quantities with re-synthesized speech stimuli. For Estonians in Estonia the temporal cue and the pitch cue are effective in combination, while the Swedish Estonian group shows extensive variability. Some speakers only display the effect of the temporal cue, similarly to fluent Estonian L2 speakers. Others have reduced the three-way system to a binary one. In this pilot study we can thus observe either incomplete acquisition in a foreign environment or language attrition in the first Swedish-born generation.

KEYWORDS: LANGUAGE ATTRITION, PHONOLOGY ATTRITION, HERITAGE LANGUAGE, ACOUSTIC PRODUCTION, PERCEPTION, ESTONIAN IN SWEDEN

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1 Introduction

1.1 Historical and linguistic background

Minor groups of Estonians have been living on Swedish territory at least from the end of the eighteenth century. The largest group, however, has for half a century consisted of World War II refugees and their descendants. At the end of World War II, Estonia was trapped between the two main fighting forces, Nazi-Germany and the Soviet Union. When the second invasion of Soviet troops was imminent in the early autumn of 1944, many chose to flee as the horrors of the first Soviet occupation in 1940–41 were still fresh in their memories. The so-called Great Exodus started for tens of thousands of Estonians and the closest safe country was just across the Baltic Sea, Sweden.

The result of this wave of refugees was that the number of Estonian citizens who had acquired the Swedish residence permit by the end of 1945 was 22,213, excluding children under the age of 16 (Reinans, 2006:124). However, due to further migration after the war, the number of Estonian refugees diminished to about 15,500 by 1953 (Reinans, 2006:144). The Estonian refugees did not only comprise ethnic Estonians but also the Swedish minority in Estonia that was systematically evacuated. From the thirteenth century onwards, ethnic Swedes had formed a minority on the Estonian West coast, and they numbered about 6000 among the refugees (Raag, 1983:18). By World War II, many of them had become bilingual or even monolingual Estonians in their daily lives, but the Swedish authorities treated the category of ethnicity liberally during the evacuation, and included people with loose connections to the Swedish minority, as well as those who paid well (Andrae, 2004:38–40).

These two big groups of refugees from Estonia – Estonians and Estonian Swedes – have both been active in developing their cultural and community life in Sweden. Cultural activities have involved choirs, theaters, sports clubs, churches, publishing houses, newspapers, political parties and even Estonian schools and kindergartens (a comprehensive overview of these can be found in Kangro, 1976, and Raag, 2005). For a long time, it was the general hope among the refugees that they would move back home. Nevertheless, the second and third generation of Estonians in Sweden rarely belong to the core activists when it comes to ethnic sentiment. The clubs are dominated by the refugee generation.¹ This is also the group that considered fluency in Estonian highly important and valued education on Estonian topics to the extent that they took their children to special complementary schools on the weekends. The complementary schools were originally aimed at promoting children's career chances after returning to Estonia, but apparently the following generations have not been convinced of this

necessity any more. In terms of language attrition, it is important to note that the Estonian refugee community was extremely static for the first 45 years when the border to the Estonian Soviet Republic was almost hermetically closed.

As for language proficiency, the representatives of the refugee generation are as a rule highly competent speakers of Estonian and their pronunciation is virtually indistinguishable from the speakers in Estonia. This generation also put effort into preserving the language. Among the later generations of Estonians, it is very hard to evaluate language proficiency in general terms, as it varies considerably from person to person. According to a questionnaire among 98 Swedish Estonians at the beginning of the 1980s, already speakers who were infants during the flight did not use Estonian nearly as often as those who had grown up in Estonia. The difference in daily use between these two groups was about 40% (Raag, 1982:38). This is closely connected to the narrow range of functions and registers that Estonian in Sweden had been confined to, involving mainly home, ethnic clubs and national rituals (Raag and Raag, 1988:133–134). Language proficiency in the second and third generation is therefore sometimes reduced to minimal grammar and basic words (Allik, 2002). Nevertheless, many Estonian descendants who were born in Sweden after the war still speak fluent Estonian, and can talk about any subject, albeit with the help of Swedish terminology. Frequent recent contacts with Estonia after re-independence have contributed to this development.

Estonian in Sweden represents a typical language in an immigrant environment, which is susceptible to L1 attrition at both a communal and individual level (Hansen, 2001; Schmid, 2002:7). As has been shown, L1 attrition may be particularly quick during extended residence and no contact with the original language environment (de Bot, Gommans and Rossing, 1991), which was exactly the case for Swedish Estonian during the Soviet years. In addition, World War II refugees from Estonia in general adapted quickly to Swedish society, demonstrating high levels of employment soon after the war and a good knowledge of Swedish. The community was highly bilingual.

The Swedish Estonian language variety has been quite extensively studied, in particular when it comes to lexical and syntactic patterns (Raag, 1982, 1983; Allik, 2002). The phonetics and phonology of the variety have mostly amounted to observations. It has been mentioned that the quality of the stops is different: Swedish Estonians display aspiration and voicedness (Oksaar, 1961:49). The typical Swedish ‘singing’ intonation has been noticed (Raag, 1975:4), as well as the inadequate pronunciation and writing of the mid-central unrounded vowel (Raag, 1981:47; 1983:63), and the supradental pronunciation of the consonant clusters *rs rt rd rn rl* (Raag, 1991:25). A couple of instrumental studies by Krull (2007, n.d.) have specifically focused on the quantity differences in prepausal lengthening between the Estonian and Swedish varieties of Estonian and shown that while

Estonian Estonians do not lengthen the stressed syllable of second quantity words, Swedish Estonians do. That may lead to overlap between words in second and third quantity.

This study focuses on speakers of Estonian who were born and grew up in Sweden with Estonian as their L1 in monolingual families. As a complement to earlier studies it focuses exclusively on phonetics, in particular the three-way phonological quantity contrast. Earlier studies have claimed that younger speakers have reduced the quantity contrast to short and long, in accordance with the Swedish system (Raag, 1983:36, 64; 1991:28). In addition, stem gradation is not always applied in lexical borrowings. For example the loanword *bandy* 'bandy' is always pronounced in Q3 (Raag, 1982:74). In this study, no borrowed items have been included. The stimuli represent original Estonian words and a couple of names. The main question is whether and how the subtle phonological distinction has been lost in the speech and perception of second-generation immigrant speakers.

1.2 Theoretical framework

When it comes to the quality of the Estonian language of the subjects in this study there are three main possibilities. They may have acquired it perfectly or not, and third, it may have undergone attrition. Since this is a synchronic study, we can only see evidence of perfect acquisition of the phonological quantity contrast or some less perfect version of it. In the latter case we could hypothesize imperfect acquisition, which should be unlikely granted the early tuning of the phonological system (Vihman, 1996), or attrition of the system later in life.

It is not unusual for speakers of heritage languages to acquire their first language incompletely. Our subjects are typical speakers of a heritage language, defined as a language acquired by individuals raised in homes where the dominant language of the region is not spoken (Valdés, 2000). Within the research tradition on heritage languages socio-political questions and pedagogical topics have prevailed (e.g. in the online *Heritage Language Journal*) as this has been a politically controversial topic in the United States (Valdés, 2005). Practical heritage language teaching seems to be the predominant concern (Montrul, 2010) and actual testing of heritage language skills has been quite limited, centring on morphosyntax (*Heritage Language Journal*, Montrul, 2010). Montrul (2010:6) specifically underlines that heritage language pronunciation remains an understudied area, while its theoretical importance in terms of early input cannot be underestimated. Measurable non-native effects have been reported in the speech of Korean heritage language speakers (Yeni-Komshian, Flege and Liu, 2000) and in the vowel quality of Western Armenian heritage speakers (Godson, 2004). The current phonological study contributes to this line of research.

A related research paradigm, the study of language attrition deals with similar phenomena, albeit not in the heritage language context. The main difference is the initial level of L1 acquisition: subjects of attrition studies have originally lived in the complete L1 environment. However, speakers who moved in early childhood constitute a boundary case between heritage language learners and language attriters, and this is where our focus group belongs due to its specific contextual circumstances. Language attrition designates the degradation of a first or second language or a portion of that language in individuals (Gardner, 1982:24; Köpke and Schmid, 2004:5). It happens in contact situations when the speaker switches language environments, and is most spectacular when it happens before puberty (Pelc, 2001). All the subjects in this study retained their Estonian environment through puberty but were heavily influenced by Swedish from an early age at day-care and/or school. These circumstances do not automatically imply attrition and neither does the fact of emigration itself (de Bot and Clyne, 1994). First language can be preserved without noticeable attrition for longer periods of time and the attrition can be slowed down by contacts with the first language community (Hutz, 2004). The subjects of this study have had more or less active contacts with the Estonian exile community during their entire life as well as renewed contacts with the country of their parents' origin after the fall of the iron curtain. Other extralinguistic factors that have to be taken into consideration are the person's level of education, language attitudes, frequency and contexts of L1 use (Köpke and Schmid, 2004:14–15; Lubińska, 2011:33–44) as well as linguistic aptitude (Bylund, Abrahamsson and Hyltenstam, 2010). The latter can compensate other disadvantageous circumstances in the attrition process.

Similarly to heritage language studies, most work on language attrition has focused on the lexicon, syntax and morphology (Seliger and Vago, 1991; Schmid, 2002:31–36, table 39–43; 2004:330; Lubińska, 2011:27–29, 37) while phonology has attracted somewhat less interest and phonetic/phonological testing is especially rare. However, it has been indicated that losses in phonology are smaller compared to those in morphology (Hirvonen, 1998:140) while other papers have shown L2 influence on L1 phonetics. For example, the voice onset time (VOT) of better American speakers of Portuguese L2 was influenced more than that of less proficient speakers, and was also dependent on their language attitudes (Major, 1993). French allophones and final stress were used by worst speakers of Breton (Dressler, 1991). Vago (1991) has reported phonological rule simplification, reordering and loss in the Hungarian language of a speaker living in Israel.

A number of studies have shown the phonological benefits of early exposure to a language, showing advantages in relearning it later in life (Au, Knightly, Jun and Oh, 2002; Oh, Jun, Knightly and Au, 2003; Tees and Werker, 1984). On the other

hand, Korean adoptees in France have been shown to be no better able to discriminate Korean voiceless consonants than their French peers, and the effect persists even after re-exposure to Korean (Ventureyra, Pallier and Yoo, 2004). Their age of adoption was between 3 and 9. In these cases the early contact with a language has been severed later in life. In addition, the effect of age of L2 acquisition has been investigated, showing lower scores in L1 pronunciation tests for early learners of L2 and much less effect for those who started acquiring L2 after the age of 12 (Yeni-Komshian, Flege and Liu, 2000). These studies demonstrate that in the case of no contacts with L1 the basic phonological contrasts also disappear. In our case, however, the contact has been continuous for all the subjects, albeit predominantly with the exile community of speakers of Estonian.

The current study focuses on the Estonian three-way phonological quantity distinction. An important observation for this topic can be found in a study on Dutch in Indonesia, where most phonological deviations were found on the suprasegmental level (Giesbers, 1997:169). It has also been shown that preservation of contrastive features may not be the driving force of maintenance. Instead, acoustic salience may be the most influential factor (Bullock and Gerfen, 2004). The paper consists of two major parts. First, the quantity production of four speakers is closely scrutinized. Second, we will present the results of the perception tests by these four plus another four speakers with identical social background.

2 The Estonian quantity system and the research question

The Estonian quantity system has been studied relatively extensively, as more than binary length oppositions are extremely rare among the world's languages (see Prehn, 2012, for an overview). The phonetic nature of the system has turned out to be rather complex. Estonian has a three-way opposition within the disyllabic foot, which can be realized in various stressed syllable structures. The three-way opposition in initial stressed syllables can involve vowels (e.g. *sada* [sata] 'hundred' – *saada* [sa:ta] 'send!' – *saada* [sa::ta] 'you get'), consonants (e.g. *kada* [kata] 'slingshot' – *kata* [katta] 'cover!' – *katta* [kat:ta] 'to cover'), or sequences of vowels and consonants (e.g. *sade* [sate] 'fallout' – *saate* [sa:tte] 'to get' – *saate* [sa:t:te] 'broadcast'). Phonetically the quantity is manifested in the interaction of different prosodic features. The primary distinctive feature is the duration ratio of the sounds within a sequence of stressed and unstressed syllables in a word. In addition, the long (Q2) and overlong (Q3) quantity degrees are marked by different pitch patterns: in Q2 (and also in short quantity, Q1) the pitch is rather stable in the first stressed syllable and turns to fall near the syllable boundary. In contrast, in Q3 the fall starts earlier, already in the first half of the

stressed syllable (Lehiste, 1960; Lippus, Asu, Teras and Tuisk, 2013). The location of the pitch turning point (TP) has been shown to be an important cue for perceiving the distinction between Q2 and Q3 (Lippus, Pajusalu and Allik, 2009, 2011).

The aim of this study is to look at whether and how speakers of Estonian have retained the three-way quantity system when they have spent their entire lives in the mainly Swedish-speaking context. First of all – do they distinguish the three quantities perceptually as well as in their speech production? Further, since the quantity system relies on several mutually supportive features, do they use these features in ways that are similar to the Estonians living in Estonia or speakers of Estonian as a foreign language? What role do the length and pitch cues play in their quantity system? Finally, the question is whether and how the Swedish language has affected quantity distinctions. As it happens, Swedish is a quantity language in which, in disyllabic initially stressed words like the Estonian words we have studied, there is a contrast between the sequences [long vowel + short consonant] (e.g. *vägen* [vɛ:ɡen] ‘road’) and [short vowel + long consonant] (*väggen* [vɛɡ:en] ‘wall’) (see Engstrand and Krull [2004] about the duration differences). Moreover, most varieties of Swedish display a two-way pitch accent contrast (Gårding, 1977). Even though the major pitch movement contrast in Swedish is realized in second syllables in disyllabic feet, the relevance of length and pitch movement in Swedish may have supported the speakers’ sustained sensitivity to the Estonian quantity system.

3 The informants

This pilot study of phonetics is a complement to a broader project on the historical development and linguistic features of the Swedish Estonian variety (financed by the Swedish Science Foundation). The 24 extensive interviews were originally made to address a wider range of issues and only three of the interviewees happened to match the criteria for the current study. The fourth suitable interview was made by Airi Aarelaid on the topic of cultural trauma.

The four informants chosen for the production study were all born into Estonian families soon after the war. They belong to the second generation of refugees who spoke only Estonian to their highly fluent parents, and at the beginning also to their siblings, and who as a rule attended the Estonian complementary school or Estonian summer camps. They are thus sequential bilinguals with a long period of sustained exposure to the heritage language who are generally less susceptible to incomplete acquisition than simultaneous bilinguals (Montrul, 2008). In a Japanese context, it has been demonstrated that bicultural families who maintained only the minority language in the household

were able to raise bilingual, bicultural children without fail (Yamamoto, 2001). Therefore, it is highly likely that the informants of this study have acquired the Estonian language, even though in a limited number of domains. Their homes functioned in Estonian as well as community life at the numerous local clubs. All interviewees report that the social life of their parents was mainly limited to the Estonian circles. In contrast, all of the informants have predominantly worked at Swedish workplaces. Three of them are or have been married to Swedes and not all of them speak Estonian to their children. They are perfect representatives of the post-war generation of Swedish Estonians who have integrated very well into Swedish society and have not been primarily oriented towards returning to Estonia.

The youngest speaker A is a male (b. 1955) with higher education. He was an only child, and has a Swedish-speaking child of his own. He is now divorced and contemplating establishing himself in Estonia. He frequently travels back and forth between the two countries and is planning research into his Estonian genealogy. He did not partake in the activities of the Estonian community during his studies and during his professional career, but has become an avid participant during the recent years of his partial retirement.

Female speaker B (b. 1950) has taken some university courses. She has two Estonian-speaking siblings and is married to an exile Estonian from a third country. She is not planning to return to Estonia but has always been an ardent activist in the Estonian community in Sweden.

The oldest speaker C is male (b. 1946). His older brother attended the Estonian school but not the informant himself. Like all the other people in the study, he spoke only Estonian at home during his childhood. He attended Estonian confirmation and scout camps as well as the traditional summer camp but has double university degrees in Swedish. He now has a Swedish-speaking family. He has always been active in Swedish politics and cultural life, and occasionally also in the Swedish Estonian community. He has recently spent longer work periods in Estonia.

Female speaker D (b. 1951) has studied for several years at university. She has an Estonian-speaking sibling, a Swedish husband, who understands Estonian quite well, and two children to whom she still speaks Estonian. She has worked at a half-Swedish, half-Estonian workplace for all her professional life, and has recently attended a complementary course in Estonia.

These four informants were chosen for two main reasons. First, they had all taken part in a longer research interview, which was important for obtaining an adequate amount of data. The interviews were conducted with an overt ethnographic aim. Two of them were carried out by an anthropologist working on cultural conflicts, and two by linguists working on life stories and identity. The

anthropologist did not speak any Swedish but the linguists were competent in both languages. Nevertheless, language problems were made relevant in various ways by the interviewees themselves. All of them occasionally asked 'for the correct word' from the interviewer, thus treating him or her as a language expert. The interviews have an informal involved character with many argumentative segments. The recordings were made with dictophones and digitized into wav-files with the sample rate of 44,000 and 16-bit sample size. One recording was made directly to a hard disc.

Second, the speakers were chosen for the obvious Swedish Estonian character of their speech. At the same time, these speakers are fluent in Estonian and have very few problems expressing themselves, which cannot be said about all the members of this age group.

In addition to the first four subjects, four additional speakers were tested for quantity perception. Their linguistic backgrounds are very similar. Unfortunately, it was not possible to obtain production data from these additional subjects, as they were not available for the extensive interviews necessary to generate an adequate amount of spontaneously produced items.

Female subject E (b. 1945) grew up in an Estonian-speaking home and learned her Swedish at the playground. She attended the Estonian school and a Swedish university. She now teaches at the Estonian school but in Swedish. She is married to an Estonian and has two sons who speak both Estonian and Swedish to their parents.

Male subject F (b. 1953) has an identical family and educational background. Even his work situation is exactly the same, though he has also held jobs where Swedish has been used exclusively. His wife is Swedish but speaks Estonian and he himself speaks only Estonian to his two children.

Female speaker G (b. 1949) learned Swedish at school but also used it with her siblings. She has worked at Swedish schools as well as at the Estonian school in Sweden. Her husband has an Estonian background and they speak both languages. She spoke Estonian exclusively to her children when they were small but now they speak Swedish to each other.

Female speaker H (b. 1948) grew up in a small and active Estonian community but was encouraged to speak Swedish by her parents, so she spoke both languages to her siblings. She received her education in Swedish and worked in Swedish-language environments but now teaches at the Estonian school. Her husband is Swedish and their children speak only Swedish.

In the following, we will first look at the quantity production of speakers A–D and then at the perception test undertaken by all eight speakers of Swedish Estonian.

4 Quantity production

4.1 Material

The production of the phonological quantities of four Swedish Estonian speakers (A–D) was measured to test whether they still display a three-way opposition in spontaneous speech, and to show how the quantity degrees are realized in their talk.

The analysed words were extracted from spontaneous interviews from initial or middle position of the utterances in order to avoid utterance-final lengthening. Words carrying major sentence stress and compounds were excluded. All the stimuli were followed by a consonant-initial word. Vowel-initial words were eliminated when they follow a vowel-final word, with the exception of cases where the stimulus word was pronounced with an initial glottal stop. The recordings of the four speakers included 349 disyllabic tokens (see Table 1). In a combination of three quantity degrees and two word types (vocalic and consonant type) there were five contrastive word structures: CVCV (Q1), CVCCV (Q2 C) and CV:CV (Q2 V), CVC:CV (Q3 C) and CV::CV (Q3 V). The words were divided into groups by their pronunciation in Standard Estonian.

Table 1. Number of tokens per speaker.

	Q1	Q2 C	Q2 V	Q3 C	Q3 V
A	25	15	16	29	22
B	21	17	12	33	8
C	16	19	13	17	12
D	16	16	11	21	10

The acoustic analysis was carried out with Praat (Boersma and Weenink, 2007). Both the length ratio, in the form of segmental durations, and pitch movement were measured manually. The pitch measurements were taken from the beginning and the end of each syllable. Since in earlier literature the location of the pitch turning point was defined as the maximum f_0 within the first syllable (Lehiste, 1960, 1997), this additional measurement was also taken. However, the latest study on the distinction of quantities (Lippus, Asu, Teras and Tuisk, 2013) shows that in spontaneous speech (which is less controlled than laboratory speech) the absolute maximum is not relevant. Instead, the turning point (TP) should be determined as a point where the considerably stable pitch turned to fall (cf. Lippus, Asu, Teras and Tuisk, 2013). Thus in the following analysis we define TP as the pitch point that is followed by the largest fall.

4.2 Results

We will first look at the temporal pattern in words with vocalic quantity, then with consonant quantity, and finally scrutinize the pitch patterns.

In words with vocalic quantity the syllable rhymes consist of vowels (no diphthongs were included). As the syllable-initial consonants are always phonologically short and do not reveal quantity-related variation, they are usually left out of the comparison (Lehiste, 1960, 1997). The S1/S2 rhyme duration ratio (see Figure 1) was tested with ANOVA with quantity and speaker as independent factors, and the Tukey's HSD test was used for post-hoc testing.

In the case of vocalic quantity, the S1/S2 duration ratio has a significant main effect of quantity: $F(2, 170) = 232.766, p < 0.001$. The main effect of speaker was insignificant, but there was a significant interaction of quantity and speaker: $F(6, 170) 3.542, p = 0.002$. Post-hoc testing shows that for speakers A, B and C, all the three quantity degrees are different. But informant D does not display a difference between Q2 and Q3.

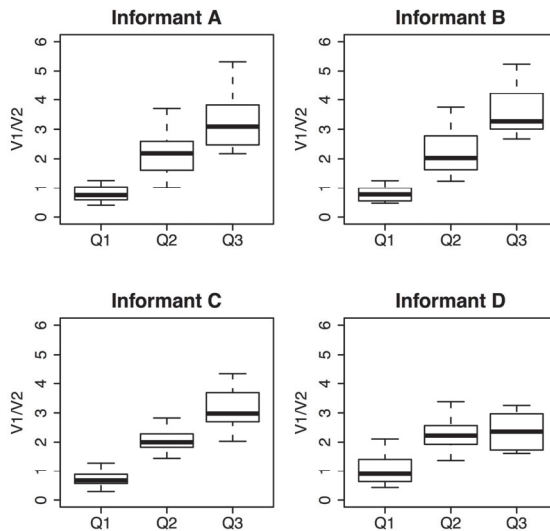


Figure 1. V1/V2 duration ratio in words with vocalic quantity for the four speakers.

In words with consonant quantity (only geminates and no consonant clusters were included), the stressed syllable rhyme has the same temporal properties as in words with vocalic quantity. In CVCV words, the medial C is the onset of the second syllable, but in CVCCV and CVC:CV words, the medial consonant is phonetically a long geminate including the coda of the first syllable and the onset of the second syllable. Of course there is no acoustic cue that would determine the

location of the syllable boundary. As the S2 onset is always a short single consonant, it is common practice to predict the syllable boundary in geminates by subtracting mean single syllable onset duration from the geminate duration (Lehiste, 1997). Instead of such speculative calculations, we here look at the ratio of whole geminate duration to the S2 rhyme, which should be generally comparable to the V1/V2 ratio in the case of vocalic quantity. C2/V2 duration ratio is presented in Figure 2.

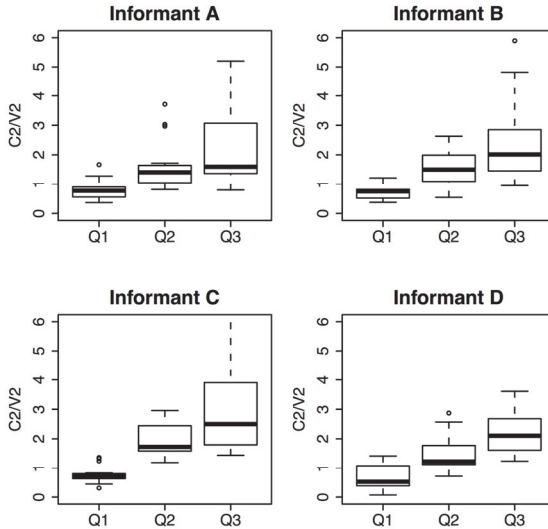


Figure 2. C2/V2 duration ratio in words with consonant quantity for the four speakers.

In the case of consonant quantity, there is a significant main effect of quantity ($F(2, 233) = 79.575, p < 0.001$) and a significant main effect of speaker ($F(3, 233) = 4.365, p = 0.005$), but there is no interaction of speaker and quantity in the ANOVA test. Post-hoc tests show that the ratio is significantly different between the three quantity degrees for all four speakers. The speaker difference is significant only between speakers C and D and probably due to the variation in ratios of Q3 words, which was the greatest for speaker C and the smallest for speaker D. However there is no clear explanation for this difference between speakers.

The characteristic pitch movement is generally described as a secondary feature in the quantity system. In normally accented words in Q1 and Q2 the pitch is usually considerably flat in S1 and the turning point, where f_0 starts falling, is located near the end of the syllable. In Q3 words, the turning point occurs already

in the first half of the S1. As the S1 duration is different in different quantity degrees, a question arises whether the peak is aligned to the same time point in all quantity degrees and whether it is independent of the quantity. Lippus, Asu, Teras and Tuisk (2013) have shown that if measured from the beginning of the vowel in absolute duration, the TP occurs at the same point in Q1 and Q3 words, but slightly later in Q2. Also, a number of perception tests have shown that the TP is a distinctive cue between Q2 and Q3, but not between Q1 and other quantities (Lehiste, 1997; Lippus, Asu, Teras and Tuisk, 2009, 2011). Thus, Q1 can be left out of the comparison. Due to different speaking rate of different speakers, we here look at the TP location in Q2 and Q3 relative to syllable boundary.

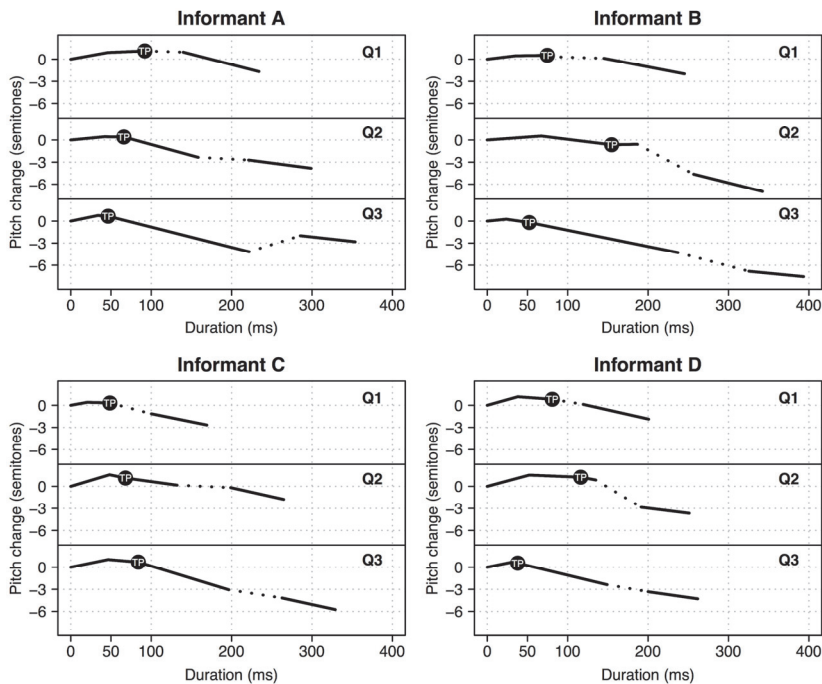


Figure 3. The pitch curves in words with vocalic quantity. (The solid line represents the pitch movement between the measured points in vowels [normalized to the beginning of V1], the S2 initial consonant is marked with dotted line. The TP is marked with a filled circle with 'TP' inside).

Figure 3 presents the pitch curves in three quantity degrees for the four speakers. In order to compare four different speakers of different sex, the pitch has been calculated to semitone scale (in relation to 50 Hz) and normalized for every sentence in relation to the V1 beginning. Previous studies have also shown that

the pitch range is not relevant in quantity distinction (Lippus, Asu, Teras and Tuisk, 2013), the range being more related to accentuation and phrasal position (Asu, Lippus, Teras and Tuisk, 2009).

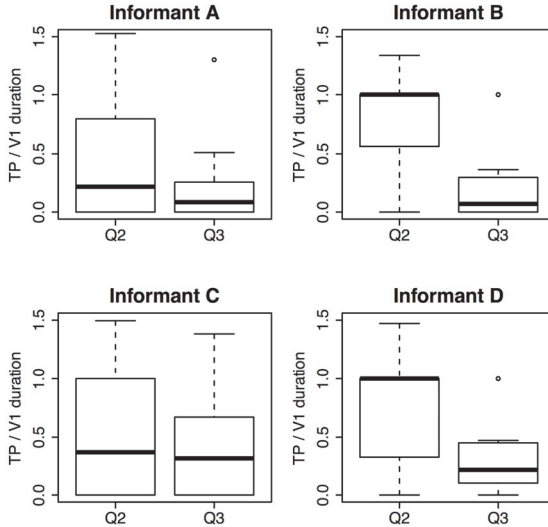


Figure 4. The location of TP in relation to the V1 duration in Q2 and Q3 words for the four speakers.

In Figure 3 we can see that in Q1, the TP is usually at the end of S1, and in Q3 it is within the first half of S1 for all four speakers, but in Q2 there is some variation between the speakers. In Q2 informants B and D have the TP in the second half of S1 as is expected for Q2 words, but informants A and C have the turning point earlier, aligned in the same time spot for all three quantities. Since the TP is not important for distinguishing between Q1 and longer quantities, only Q2 and Q3 were included in the ANOVA. The ANOVA test showed a significant effect of quantity ($F(1, 102) = 14.77, p < 0.001$), but there was no effect of the speaker nor an interaction of the speaker and the quantity, suggesting that the difference between the speakers is a random variation. Figure 4 shows the variation of the TP location in Q2 and Q3 words for the four speakers. We can see that the variation of the TP location is large for Q2 and smaller for Q3 and also that for Q2 the variation is larger for informants A and C and smaller for B and D. Thus, there might be a tendency for informant A and C not to mark the quantity distinction with the pitch pattern, whereas informants B and D do, but due to the small sample size this cannot be verified in the current study.

In summary, all four Swedish Estonian speakers show the temporal three-way contrast in consonant quantity, and speakers A, B and C also do so in vocalic quantity. The temporal pattern of the vocalic quantity for speaker D is only distinctive for short and long quantity, but not for long and overlong quantity. It is a further question, how Estonian speakers would ascribe quantities to these productions. The Swedish Estonian speakers also generally mark the long and overlong quantity distinction with the pitch movement. The persistence of this cue may have been supported by the regular deployment of contrastive pitch accents in Swedish, which in its turn may have interfered with the Estonian system in the less secure production by speakers A and C. This remains to be determined in a later study.

5 Quantity perception

5.1 Material

The perception experiment was carried out to measure whether the second-generation speakers of Swedish Estonian still auditively distinguish the three-way phonological contrast. For this, the stimuli and the test setup from Lippus and Pajusalu (2009) and Lippus, Pajusalu and Allik (2009) were used. The Swedish Estonian results were then compared to the results achieved by 10 native speakers of Estonian in Estonia and 21 fluent L2 speakers of Estonian, reported in Lippus, Pajusalu and Allik (2009).

The stimuli were generated and the test was carried out in Praat (Boersma and Weenink, 2007). For the stimuli two quantity triplets were used as base words: one for the vowel quantity where the quantity distinction is carried by V1 followed by a short consonant (*sada* [sata] ‘hundred’, *saada* [sa:ta] ‘to send, sg imperative’, *saada* [sa::ta] ‘to get’), and the other for the consonant quantity where the quantity distinction is carried by the intervocalic consonant after a short V1 (*kada* [kata] ‘slingshot’, *kata* [katta] ‘to cover, sg imperative’, *katta* [kat:ta] ‘to cover’). The words were read by a male speaker in a nonsense carrier phrase *tule ... saama* (‘come ... to get’) with the test word in a focal position preceded and followed by a disyllabic word. From each of the six words a set of nine stimuli was created in Praat by manipulating the duration of either the first vowel (V1) or the intervocalic consonant (C2), resulting in a total of 54 stimuli. They were synthesized so that for the first stimuli the syllable duration ratio (S1/S2) would be smaller than 0.7 (which is typical for Q1) and for the last larger than 2.0 (typical for Q3). The duration of only one sound in the word was changed, starting from 50 ms in nine steps of 30 ms to 290 ms. The locations of the pitch turning points remained proportionally unchanged.

A forced-choice perception experiment was carried out in Praat. The nine stimuli from each base word were arranged as one sub-test and presented to the listeners without the carrier phrase with 10 repetitions in random order (i.e. $6 \times 9 \times 10 = 540$ stimuli in total). Each sub-test was preceded by an exercise where the nine stimuli were presented without repetitions. During the test the subjects heard re-synthesized words and had to decide whether they heard a Q1, a Q2 or a Q3 word. They were instructed to think about the meaning of each word and click a button on the computer screen labelled [1], [2] and [3] accordingly. The subjects were allowed to have a short break between each sub-test. No repeated listening option was available.

5.2 Results

The results of the eight Swedish Estonian test subjects (below: SWE) show great variability. There is more within and between subject deviation than in the results of L1 Estonian listeners reported in Lippus, Pajusalu and Allik (2009) (below: EE L1). The behaviour of the Swedish Estonian listeners cannot be explained by dialectal differences, as most of their ancestors originate from areas close to Tallinn or the Western coast of Estonia, who according to Lippus and Pajusalu (2009) belong to the same 'pitch-sensitive' perception group. The Swedish Estonian results are similar to L2 Estonian listeners (below: EE L2), but within the SWE group we can see more variation.

Figure 5 shows the results of the three listener groups in the sub-tests with manipulated V1 duration. The EE L1 group judged most of the stimuli as representative of a quantity degree nearly at 100% certainty, except for the cases in sub-test 1 and 2 (Figure 5, panel a and b), when the stimuli have S1/S2 ratio > 2 (which is typical for Q3) but the F0 TP is late (typical for Q1 and Q2). Thus they base their judgments on the temporal structure, but if there is a conflict between Q2 pitch and Q3 temporal structure, they are not able to arrive at a decision. The judgment patterns of the SWE group and the EE L2 group are rather similar. Their decisions are based on temporal structure, showing no effect of the pitch cue. In the case of Q2 vs. Q3 their judgments are not entirely confident, reaching only 80%-90% level of certainty. The interquartile range (IQR) shows the middle 50% of the individual ratings, which can be taken as a measure of within-group variation. Based on IQR, there is better agreement of Q2 vs. Q3 judgments within the SWE group than in the EE L2 group, but the variation is larger compared to EE L1 group.

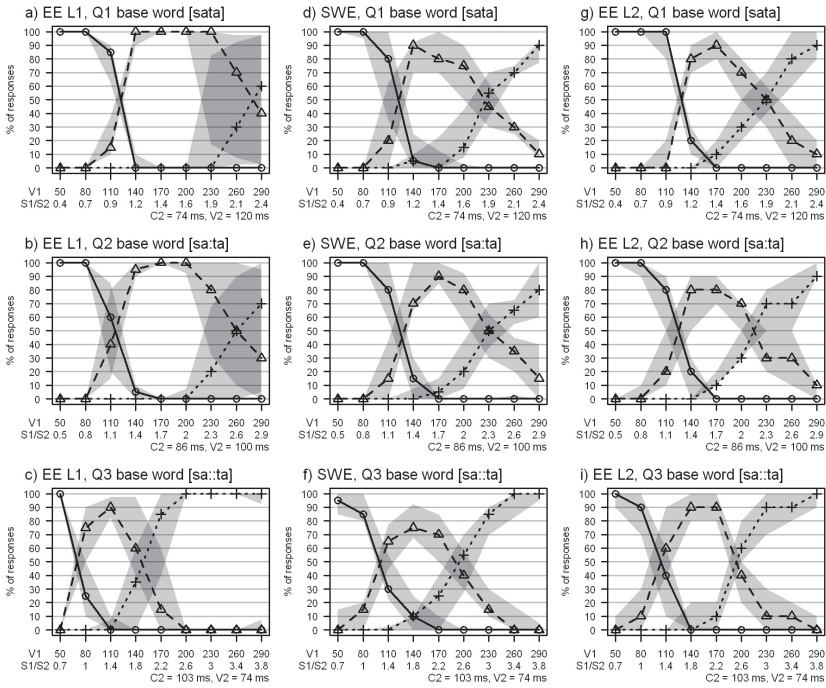


Figure 5. The results of the sub-tests with manipulated V1 duration of Estonian L1 (left column), Swedish Estonian (middle column), and Estonian L2 (right column) subject groups. (The group mean judgments are marked with circles [Q1], triangles [Q2], and crosses [Q3]. The grey background shows the interquartile range of the judgments).

The results of the sub-tests with manipulated C2 duration are presented in Figure 6. In these sub-tests there was no pitch cue available, as the length was carried by a voiceless stop, and the quantity distinction was made only by judging the temporal structure of the word. All three groups perceive the three-way distinction. Again, the EE L1 group displays the highest certainty in the judgments and the lowest group-internal variation. The mean judgments of the SWE and the EE L2 group are rather similar. The striking difference is in the sub-test with the Q3 base word (Figure 6, panel f) where in the SWE group the IQR for Q2 and Q3 ratings is extremely wide. This means that some of the SWE listeners had trouble distinguishing between Q2 and Q3, while most of the group managed the three-way distinction perfectly.

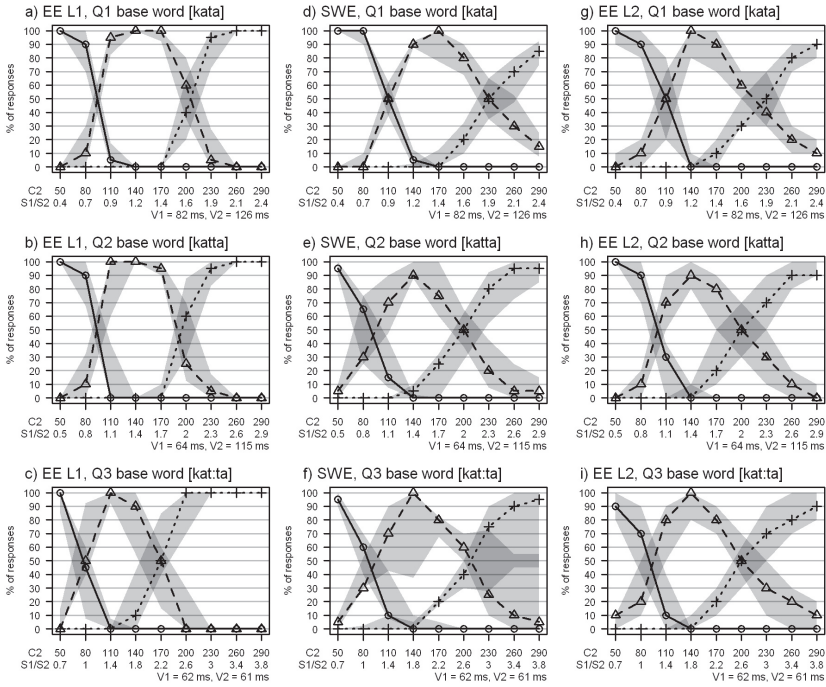


Figure 6. The results of the sub-tests with manipulated C2 duration of Estonian L1 (left column), Swedish Estonian (middle column), and Estonian L2 (right column) subject groups. (The group mean judgments are marked with circles [Q1], triangles [Q2], and crosses [Q3]. The gray background shows the interquartile range of the judgments).

The variation within the SWE group is evident in the individual results, described below on the basis of visual impressions. The latter may turn out to be relevant should the sample be expanded. Listeners A and F behaved most similarly to EE L1 listeners, as they were sensitive to both the temporal pattern and the pitch cue. However, in sub-tests 1 and 2 involving a base word with a late pitch TP, they could not identify Q3. Listeners B, C and D are instead comparable to EE L2 listeners who exclusively use the temporal structure of the stimuli to distinguish between the three quantity degrees. The pitch cue has no effect for them. Finally, listeners E, G and H tend to perceive quantity as a binary opposition between short and long, and have trouble distinguishing Q2 from Q3. This shows that growing up in a bilingual environment has caused the quantity perception of Swedish Estonians to become variably problematic, resulting in minor shifts for some individuals, reduction of the three-way system to a binary one for others, and dropping of a major cue for some.

6 Discussion and conclusion

All the speakers of Swedish Estonian in this study started their lives in monolingual Estonian refugee homes soon after the Second World War. Since then they, and their parents, have made different choices that have affected their options of practicing and developing their L1 language skills. Nevertheless, they have been able to maintain the productive ability to distinguish between the three subtle phonological quantities, with some exceptions and possible adaptation of loanwords to the Swedish patterns. In contrast, the perceptive ability to hear the same distinction reveals that many of them resemble high-proficiency L2 speakers living in Estonia rather than native speakers of Estonian in Estonia. On the one hand, this discrepancy may reflect the difference between the relaxed informal interviews used for production measurements and the unnatural experimental setting of the perception test, which many subjects commented on. It is also important to bear in mind that none of the interviewees whose production was measured had reduced their quantity system to a binary opposition in the perception test. Thus, measuring the production of the rest of the subjects might have revealed more diverging patterns. Furthermore, recruiting informants with a broader variety of backgrounds and life situations, such as even younger speakers or speakers who have no contact with the Swedish Estonian or any Estonian circles, would probably result in more variation. This could form an expansion of the current study.

As compared to earlier literature on the Swedish Estonian variety, the current study is one of the few that focuses specifically on phonetics. It targets analytically and experimentally some aspects of pronunciation that have earlier been described impressionistically or in restricted utterance-final positions, such as the vanishing difference between Q2 and Q3 (Raag, 1982, 1983; and Krull, 2007, manuscript, respectively). By choosing the generation who grew up abroad but in Estonian-speaking families, the pilot study aimed to locate the very beginning of change, if indeed there is one. Our results show only marginal effects in the second generation. Older generations who learned Swedish later clearly do not display any attrition of their mother tongue, at least when it comes to production of the phonological system. Younger descendants of the refugees are often not skilled enough to give a longer interview in Estonian and their phonology is already audibly different. Comparing these third-generation speakers with the second generation studied here would also provide interesting developmental insights into a changing language variety, especially when it comes to a rather unique phonological contrast system. However, understanding the perception test may prove to be a stumbling stone for this group. Socio-historical factors interfere strongly with the existence and fate of the variety.

Furthermore, the present-day unhindered and frequent socializing between the recent immigrants and the refugee generation substantially changes the dynamics of the Swedish Estonian variety. Indeed, some of the newcomers have already undergone startling language loss but many of them also maintain close ties to Estonia, the Estonian language and culture. The wide range of individual life choices and behaviours most probably characterizes any democratic minority group that is not authoritatively reinforcing community norms. This has repercussions on language choices as well as language abilities, which is also likely to have been the reason for the relatively incoherent results in the current study. It is not easy to control for all the social parameters simultaneously and to locate a sufficient number of speakers with sufficiently similar life stories. This is increasingly the reality in the globalizing world, but also the refugee generation demonstrated quite varied flight paths. In regard to that, it would be extremely interesting to compare the quantity systems of Estonians in Sweden to those living in some other language environment that lacks phonologically contrastive pitch accents. That would enable further conclusions about the specific effects of Swedish.

Individual variation within the group of Swedish Estonians involved in the current study, especially regarding perception, might be explained by the amount of Estonian contacts but also by the linguistic aptitude of each speaker (cf. Bylund, Abrahamsson and Hyltenstam, 2010). Interestingly, speakers A and F that are closest to EE L1 in the perception test are both talented in areas requiring sophisticated auditory perception. A is fluent in numerous languages and F is an avid amateur musician. They both have currently extensive contacts with Estonia. In terms of social factors, B, D and F use Estonian daily. In contrast, speakers E, G, and H (who displayed a binary opposition) have homes with a clear tendency towards a monolingual Swedish environment (H was even explicitly discouraged to use Estonian by her parents). Even though all three work at the Estonian school they teach in Swedish. Their motivation to maintain the language may thus be somewhat lower, which has been shown to affect proficiency (Schmid, 2002). At the same time, the objective time-gap between the flight from the country of origin and the birth of the speaker does not seem to determine the maintenance of phonological proficiency, as the two youngest speakers score closest to native speakers of L1 in Estonia. This result underlines the importance of social factors in language maintenance and attrition.

In terms of attrition, the results suggest that the phonological contrasts of bilingual speakers may become based more on primary features, such as length ratio differentiation in the quantity system of Estonian, and less on secondary features, such as pitch movement. Some Swedish Estonians (A, C) show this tendency in production and some (B, C, D) in perception. Furthermore, there is some trouble also with the length feature in distinguishing between the two longer

quantity degrees, Q2 and Q3 (D in production and E, G, H in perception). The phonological system thus gets simplified in the process of attrition. In particular, suprasegmentals have been argued to be subject to change in an immigrant environment (Giesbers, 1997). At the same time, acoustic salience has been argued to be an influential factor in language attrition (Bullock and Gerfen, 2004) and pitch movement may be less salient than the syllable ratio in the Estonian quantity system (cf. Lippus, Pajusalu and Allik, 2009). This aspect should be tested further.

Even though the study was based on a small number of informants, it fulfils a gap in heritage language and attrition studies that have focused heavily on more accessible facets of language, such as lexicon and syntax. First of all, it supports the findings in other languages that early childhood acquisition enhances the maintenance of the phonological system. On the other hand, the study shows that attrition may concern some more subtle aspects of segment length and pitch movement. It thereby complements the few studies that have already demonstrated that the phonetics of L1 is not impermeable to the influence by L2, even though the level of proficiency is high, but more so when the attitudes or interests do not support L1.

Overall, because of lack of statistically significant differences from the EE L1 group, an alternative conclusion could be that the phonological three-way quantity distinction is remarkably resistant to interference. In that case, the distinctly Swedish Estonian quality of the speech of the informants arises from other phonetic features besides the quantity contrasts. It is nevertheless more likely that some observations on differences made in this pilot study would settle as solid and significant patterns were the sample to be expanded.

More generally, the study shows that phonetic-phonological analysis can be very useful in understanding the mechanisms of the attrition process, as it reveals changes on a deep structural level of language. Even though we do not have objective access to the initial childhood level of L1 achievement of the speakers in this study, it can be assumed that at some point they were all proficient speakers of Estonian at an age-appropriate level, which included native-like production and perception abilities. They all reported being monolingual at home before entering day-care or school. Earlier studies have demonstrated that some phonetic distinctions simply do not persist through periods of massive exposure to another language (Ventureyra, Pallier and Yoo, 2004) and the pitch cue as a secondary feature in the Estonian quantity system may be one of those hardest to maintain. The comparison of quantity production and perception of speakers of Swedish Estonian further suggests that there may be a discrepancy between the closely related but different aspects of language proficiency: productive and perceptive phonetic abilities.

Notes

1. During the decades after Estonian re-independence in 1991 numerous newcomers have asserted their presence in the ethnic clubs but this group is not the focus of the current study.

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References

- Allik, M. (2002) *Lõuna-Rootsi noored eestlased: nende keel ja identiteet*. Unpublished master's thesis. Department of Estonian and Finno-Ugric Linguistics, Tartu university.
- Andrae, C. G. (2004) *Sverige och den stora flykten från Estland 1943–1944*. Acta Academiae Regiae Gustavi Adolphi 83. Uppsala: Swedish Science Press.
- Asu, E. L., Lippus, P., Teras, P. and Tuisk, T. (2009) The realization of Estonian quantity characteristics in spontaneous speech. In M. Vainio, R. Aulanko, and O. Aaltonen (eds) *Nordic prosody: Proceedings of the Xth Conference, Helsinki 2008* 49–56. Frankfurt, Berlin and New York: Peter Lang.
- Au, T. K., Knightly, L. M., Jun, S.-A. and Oh, J. S. (2002) Overhearing a language during childhood. *Psychological Science* 13(3): 238–243. <http://dx.doi.org/10.1111/1467-9280.00444>.
- Boersma, P. and Weenink, D. (2007) *Praat: Doing phonetics by computer*, Version 4.6.02 [Computer program]. Retrieved 17 May 2007 from: <http://www.praat.org>.
- Bot, K. de and Clyne, M. (1994) A 16-year longitudinal study of language attrition in Dutch immigrants in Australia. *Journal of Multilingual and Multicultural Development* 15(1): 17–28. <http://dx.doi.org/10.1080/01434632.1994.9994554>.
- Bot, K. de, Gommans, P. and Rossing, C. (1991) L1 Loss in an L2 environment: Dutch immigrants in France. In H. W. Seliger and R. M. Vago (eds) *First language attrition* 87–98. Cambridge: Cambridge University Press.
- Bullock, B. E. and Gerfen, C. (2004) Frenchville French: A case study in phonological attrition. *International Journal of Bilingualism* 8(3): 303–320. <http://dx.doi.org/10.1177/13670069040080030801>.
- Bylund, E., Abrahamsson, N. and Hyltenstam, K. (2010) The role of language aptitude in first language attrition: The case of prepubescent attriters. *Applied Linguistics* 31(3): 443–464. <http://dx.doi.org/10.1093/applin/amp059>.
- Dressler, W. U. (1991) The sociolinguistic and patholinguistic attrition of Breton phonology, morphology, and morphophonology. In H. W. Seliger and R. M. Vago (eds) *First language attrition* 99–112. Cambridge: Cambridge University Press.
- Engstrand, O. and Krull, D. (2004) Durational correlates of quantity in Swedish, Finnish and Estonian: Cross-language evidence for a theory of adaptive dispersion. *Phonetica* 51: 80–91. <http://dx.doi.org/10.1159/000261960>.
- Gårding, E. (1977). *The Scandinavian word accents*. Lund: Gleerup.
- Gardner, R. C. (1982) Social factors in language retention. In B. F. Freed and R. D. Lambert (eds) *The loss of language skills* 24–43. Rowley, MA: Newbury House.
- Giesbers, H. (1997) Dutch in Indonesia: language attrition of language contact? In J. Klatter-Folmer and S. Kroon (eds) *Dutch overseas: Studies in maintenance and loss of Dutch as an immigrant language* 163–180. Tilburg: Tilburg University Press.
- Godson, L. (2004) Vowel production in the speech of Western Armenian heritage speakers. *Heritage Language Journal* 2: 1–26.
- Hansen, L. (2001) Japanese Attrition in Contexts of Japanese Bilingualism. In M. G. Noguchi and S. Fotos (eds) *Studies in Japanese bilingualism bilingual education* 353–372. Clevedon: Multilingual Matters.

- Hirvonen, P. (1998) The Finnish-American language shift. In J. Niemi, T. Odlin and J. Heikkinen (eds) *Language contact, variation and change* 136–150. Joensuu: Faculty of Humanities.
- Hutz, M. (2004) Is there a natural process of decay? A longitudinal study of language attrition. In M. S. Schmid, B. Köpke, M. Keijzer and L. Weilemar (eds) *First language attrition: Interdisciplinary perspectives on methodological issues* 189–206. Amsterdam and Philadelphia: John Benjamins.
- Kangro, B. (1976) *Eesti Rootsis. Ülevaade sõnas ja pildis*. Lund: Eesti kirjanike kooperatiiv.
- Köpke, B. and Schmid, M. S. (2004) Language attrition: The next phase. In M. S. Schmid, B. Köpke, M. Keijzer and L. Weilemar (eds) *First language attrition: Interdisciplinary perspectives on methodological issues* 1–43. Amsterdam and Philadelphia: John Benjamins.
- Krull, D. (2007) The Influence of Swedish on prepausal lengthening in Estonian. *Proceedings of Fonetik 2007, TMH-QPSR* 50(1): 89–92.
- Krull, D. (n.d.) Prepausal lengthening in the speech of Swedish Estonians (unpublished manuscript).
- Lehiste, I. (1960) Segmental and syllabic quantity in Estonian. In T. A. Seneok (ed.) *American studies in Uralic linguistics* 21–82. Uralic and Altaic Series. Bloomington: Indiana University Publications.
- Lehiste, I. (1997) Search for phonetic correlates in Estonian prosody. In I. Lehiste and J. Ross (eds) *Estonian prosody: Papers from a Symposium* 11–35. Tallinn: Institute of Estonian Language.
- Lippus, P. and Pajusalu, K. (2009) Regional variation in the perception of Estonian quantity. In M. Vainio, R. Aulanko and O. Aaltonen (eds) *Nordic prosody: Proceedings of the Xth Conference, Helsinki 2008* 151–157. Frankfurt, Berlin and New York: Peter Lang.
- Lippus, P., Pajusalu, K. and Allik, J. (2009) The tonal component of Estonian quantity in native and non-native perception. *Journal of Phonetics* 37(4): 388–396. <http://dx.doi.org/10.1016/j.wocn.2009.07.002>.
- Lippus, P., Pajusalu, K. and Allik, J. (2011) The role of pitch cue in the perception of the Estonian long quantity. In S. Frota, G. Elordieta and P. Prieto (eds) *Prosodic categories: Production, perception and comprehension* 231–242. Dordrecht: Springer Netherlands.
- Lippus, P., Asu, E. L., Teras, P. and Tuisk, T. (2013) Quantity-related variation of duration, pitch and vowel quality in spontaneous Estonian. *Journal of Phonetics* 41(1): 17–28. <http://dx.doi.org/10.1016/j.wocn.2012.09.005>.
- Lubińska, D. (2011) *Förstaspråksattrition hos vuxna. Exemplet polsktalande i Sverige*. Dissertations in Bilingualism 21. Centrum för tvåspråkighetsforskning. Stockholms universitet.
- Major, R.C. (1993) Sociolinguistic factors in loss and acquisition of phonology. In K. Hyltenstam and A. Viberg (eds) *Progression and regression in language: Sociocultural, neuropsychological and linguistic perspectives* 463–478. Cambridge: Cambridge University Press.
- Montrul, S. (2008) *Incomplete acquisition in bilingualism: Re-examining the age factor*. Amsterdam and Philadelphia: John Benjamins. <http://dx.doi.org/10.1075/sibil.39>.

- Montrul, S. (2010) Current issues in heritage language acquisition. *Annual Review of Applied Linguistics* 30: 3–23. <http://dx.doi.org/10.1017/S0267190510000103>.
- Oh, J., Jun, S.-A., Knightly, L. and Au, T. K. (2003) Holding on to childhood language memory. *Cognition* 86: B53–B64. [http://dx.doi.org/10.1016/S0010-0277\(02\)00175-0](http://dx.doi.org/10.1016/S0010-0277(02)00175-0).
- Oksaar, E. (1961) Kaksikkeelsuse problemaatikast. *Tulimuld* 1: 47–54.
- Pelc, L. (2001) *L1 Lexical, morphological and morphosyntactic attrition in Greek-English bilinguals*. PhD dissertation, CUNY.
- Prehn, M. (2012) *Vowel quantity and the fortis-lenis distinction in North Low Saxon*. Utrecht and Amsterdam: LOT; Universiteit van Amsterdam [Host]. Retrieved from <http://dare.uva.nl/document/351231>.
- Raag, R. (1975) Kas 'bortförlarama' vöi 'öigustama'. *Välis-Eesti* 3: 4.
- Raag, R. (1981) Some aspects of Swedish Estonian. *Fenno-ugrica suecana* 4: 43–49.
- Raag, R. (1982) *Lexical characteristics in Swedish Estonian*. Acta Universitatis Upsaliensis. Studia Uralica et Altaica Upsaliensia 13. Uppsala: Almqvist & Wiksell.
- Raag, R. (1983) *Estrniskan i Sverige*. FUSKIS/FIDUS 6. Uppsala: Uppsala universitet, Finsk-ugriska institutionen.
- Raag, R. (1991) Linguistic tendencies in the Estonian Language in Sweden. *Linguistica Uralica* 27(1): 23–32.
- Raag, R. (2005) Eestlased paguluses. In A. Pajur, T. Tannberg and S. Vahre (eds) *Eesti ajalugu VI. Vabadussõjast taasiseseisvumiseni* 356–373. Tartu: Ilmamaa.
- Raag, V. and Raag, R. (1988) Språkbevarande och språkbehärskning hos esterna i Sverige. In R. Raag and H. Runblom (eds) *Estländare i Sverige. Historia, språk, kultur* 131–140. Uppsala multiethnic papers 12. Uppsala: Centre for multiethnic research.
- Reinans, A. (2006) Eesti põgenikud Rootsi statistikas. In K. Kumer-Haukanõmm, T. Rosenberg and T. Tammaru (eds) *Suur põgenemine 1944. Eestlaste lahkumine läände ning selle mõjud* 122–146. Tartu: Tartu Ülikooli Kirjastus.
- Schmid, M. S. (2002) *First language attrition, use and maintenance: The case of German Jews in anglophone countries*. Amsterdam and Philadelphia: John Benjamins. <http://dx.doi.org/10.1075/sibil.24>.
- Schmid, M. S. (2004) Language attrition research: An annotated bibliography. In M. S. Schmid, B. Köpke and M. Keijzer (eds) *First language attrition: Interdisciplinary perspectives on methodological issues* 317–347. Amsterdam and Philadelphia: John Benjamins.
- Seliger, H. W. and Vago, R. M. (eds) (1991) *First language attrition*. Cambridge: Cambridge University Press. <http://dx.doi.org/10.1017/CBO9780511620720>.
- Tees, R. C. and Werker, J. F. (1984) Perceptual flexibility: Maintenance or recovery of the ability to discriminate non-native speech sounds. *Canadian Journal of Psychology* 38(4): 579–590. <http://dx.doi.org/10.1037/h0080868>.
- Vago, R.M. (1991) Paradigmatic regularity in first language attrition. In H. W. Seliger and R. M. Vago (eds) *First language attrition* 241–251. Cambridge: Cambridge University Press.
- Valdés, G. (2000) The teaching of heritage languages: An introduction for Slavic-teaching professionals. In O. Kagan and B. Rifkin (eds) *The learning and teaching of Slavic languages and cultures* 375–403. Bloomington IN: Slavica Publishers.

- Valdés, G. (2005) Bilingualism, heritage language learners, and SLA research: Opportunities lost or seized? *The Modern Language Journal* 89(4): 410–426. <http://dx.doi.org/10.1111/j.1540-4781.2005.00314.x>.
- Ventureyra, V. A. G., Pallier, C. and Yoo, H.-Y. (2004) The loss of first language phonetic perception in adopted Koreans. *Journal of Neurolinguistics* 17(1): 79–91. [http://dx.doi.org/10.1016/S0911-6044\(03\)00053-8](http://dx.doi.org/10.1016/S0911-6044(03)00053-8).
- Vihman, M. M. (1996) *Phonological development: The origins of language in the child*. Oxford: Blackwell.
- Yamamoto, M. (2001) *Language use in interlingual families: A Japanese-English sociolinguistic study*. Clevedon: Multilingual Matters.
- Yeni-Komshian, G., Flege, J. and Liu, S. (2000) Pronunciation proficiency in the first and second languages of Korean-English bilinguals. *Bilingualism: Language and Cognition* 3(2): 131–149. <http://dx.doi.org/10.1017/S1366728900000225>.