

Lintunen, P., M. S. Peltola & M.-L. Varila (toim.) 2014. AFinLA-e Soveltavan kielitieteen tutkimuksia 2014 / n:o 6. 86–98.

Maija S. Peltola^{1,2}, Pekka Lintunen³ & Henna Tamminen^{1,2}

¹University of Turku, Department of Phonetics

²University of Turku, Department of Phonetics, LAB-lab

³University of Turku, Department of English

Advanced English learners benefit from explicit pronunciation teaching: an experiment with vowel duration and quality

Pronunciation skills are a key feature in overall oral communication skills. Without adequate pronunciation skills language learners might be misunderstood in communicative situations. This cross-sectional study focused on learning vowel duration and quality in L2 English. The subjects were advanced Finnish learners of English, whose production was compared to a native group before and after teaching. Our results suggest that explicit pronunciation teaching made the subjects' pronunciation of L2 vowel qualities more native-like. Both of our subject groups mastered vowel duration on a native level, which suggests that learners who are used to different degrees of vowel duration in their L1 can transfer those features into L2 even if they are used functionally differently. Our study suggests that vowel duration is easier than vowel quality for Finnish learners of English. The study also showed the positive effect of pronunciation teaching for advanced learners.

Keywords: pronunciation, learning, vowel

1 Introduction

The focus of this study was to investigate the effect of explicit teaching on the pronunciation habits of learners of English as a second language (L2). We focused on university level subjects, as there are concerns that systematic pronunciation teaching before university level is scarce (Lintunen 2004; Tergujeff 2013). The pronunciation of Finnish advanced learners of English has been studied from many perspectives, e.g. segments (Suomi 1980; Lintunen 2004), rhythm (Paananen-Porkka 2007) and intonation (Hirvonen 1970; Toivanen 2001), to name but a few larger-scale studies. In this study, we focused on the vowel system, and our aim was to find out if advanced learners improve their accuracy in vowel duration and quality through explicit pronunciation teaching.

Learning how to pronounce the target language has been a recurring theme in second language acquisition studies. Pronunciation plays a major role in overall oral communication skills. In fact, Setter and Jenkins (2005) said that they were “stating the obvious” when they commented on the tight relationship between spoken communication and pronunciation:

Pronunciation is the major contributor to successful spoken communication, and how anyone learning a language can expect to be understood with poor pronunciation skills is outside of our comprehension (Setter & Jenkins 2005: 13)

Numerous studies have shown how L2 pronunciation improves after explicit teaching and practice (e.g. Lintunen 2004; Lord 2005; Pourhosein 2012). Studies show that relatively long periods of practice involving various kinds of exercises (including production, perception and, especially for mature learners, self-analysis) facilitate learning the most. Therefore, many researchers have been surprised to notice that pronunciation is often a neglected area in language teaching (e.g. Derwing 2009), in foreign language teacher education internationally (Henderson, Frost, Tergujeff, Kautzsch, Murphy, Kirkova-Naskova, Waniek-Klimczak, Levey, Cunningham & Curnick 2012), as well as in Finland (Tergujeff 2013) and a marginalized area in applied linguistics as a whole (Derwing & Munro 2005).

Pronunciation involves both cognitive and fine-motor skills (e.g. Fraser 2001: 20), which separates pronunciation from morphology, syntax and lexis, for example. This makes pronunciation challenging to teach and learn and may also be the reason why transfer from the learner’s first language (L1) seems to be clearest in phonology (e.g. Ellis 1994: 316).¹ In the case of Finnish learners of English, the influence of orthography

¹ Naturally many other processes besides transfer are also involved in L2 pronunciation learning. See e.g. Major’s Ontogeny Model (Major 2001) that includes both transfer and developmental factors.

cannot be overlooked either, as Finnish learners are used to a transparent relationship between the spelling and pronunciation of words.

We also need to bear in mind that, in addition to linguistic factors, various psychological and social factors may affect the speaker's accent in L2 (e.g. Piske, MacKay & Flege 2001; Celce-Murcia, Brinton, Goodwin & Griner 2010). Daniels' (1995) well-known metaphor for maintaining a foreign accent in L2 is the subconscious need to avoid cutting the umbilical cord to our mother that we need when using our L1. This also describes how pronunciation is linked with speaker identities (e.g. Seidlhofer 2001; Setter & Jenkins 2005) and how there might be individual and/or social pressures for maintaining the speaker's L1 identity, which then explains some learning problems with L2 pronunciation (see also Gilbert 2008: 1).

The status of English as a target language is complex in today's world. It has changed from a foreign language, where native speaker – non-native speaker (NS-NNS) interaction is common, into an international language, where NNS-NNS interaction is more common (Setter & Jenkins 2005: 11–12). Nevertheless, research into English as an international language has also shown that pronunciation is crucial for successful communication, although the learning goals and priorities should be carefully considered in every learning situation (e.g. Jenkins 2000). The present study focused on advanced university learners of English training to become English language professionals. Therefore, their goal was to sound as native-like as possible, and we wanted to see how well they were able to approximate their learning goal. We focused on vowel duration and quality and wanted to test if there were differences between learners who had or had not yet been taught pronunciation explicitly.

2 Learning English vowels

When a learner is faced with a new sound system in an L2, it is common for the learner to look for similarities in the two systems (Ringbom 2007). Researchers, however, have usually focused on differences between the two systems (due to influence from the Contrastive Analysis tradition). Wiik (1965), for instance, said that two sound systems can have four kinds of differences: physical (L2 has a completely new sound when compared to L1), relational (L2 has a sound that might be used as an allophone in L1), distributional (L2 sound occurs in a different phonotactic environment than in L1) and segmental (sequences of sounds are segmented differently into phonemes in two languages). More recently, in Flege's (1987) Speech Learning Model (SLM) L2 sounds were categorized as New, Identical or Similar. Here the potential learning problems were the key idea: New sounds are sounds not used in L1 (cf. Wiik's physical difference), and they cause more

problems in the initial stages of language learning; Identical sounds are the same in L1 and L2 and do not cause learning problems. Similar sounds, then, have allophonic differences (cf. Wiik's relational difference), and these sounds continue to be problematic even for more advanced learners, as the differences in the phonetic qualities between L1 and L2 are more difficult to perceive. This is also related to Schmidt's (1990) noticing hypothesis: forms need to be noticed before they can be learnt.

The more recent Perceptual Assimilation Model (PAM) differs from SLM in that it focuses more directly on perception and phonological contrasts instead of individual categories (Best & Strange 1992). The model proposes four types of assimilation patterns, which describe the manner in which L1 and L2 sound contrasts are related to each other. Firstly, a sound contrast in L2 can be non-assimilable, so that neither the contrast nor its participant categories exist in L1 (cf. Flege's New or Wiik's physical difference). Secondly, two L2 sounds can be assimilated into two L1 categories (cf. Flege's Identical). The third perceptual pattern causes severe learning problems, i.e. a situation where two L2 sounds are assimilated into one L1 category equally well or equally poorly, which hinders the learner from hearing the distinction and even makes it difficult to perceive any category goodness differences. Lastly, two L2 categories can be assimilated into one L1 category, but unequally, which also causes perceptual problems, but at least it may be possible to hear a goodness distinction. The third and the fourth patterns are actually both close to Flege's Similar and Wiik's relational difference classifications. To summarize, the greatest learning problems in perception and production are to be expected, even for advanced learners, if the L1 and L2 have a relational difference when the target language category is Similar when compared to L1, and in perception there is a potential two category assimilation to an L1 sound.

Finnish and English are phonetically fairly distant languages. This causes problems for Finnish learners of English in terms of the segmental and suprasegmental features of English. However, the sound segments and vowel duration should be quite teachable and learnable (Dalton & Seidlhofer 1994) aspects of the pronunciation of English.

Vowels in Finnish and English vary between accents. In this study, we focus on learners who aimed at Standard Southern British English pronunciation, which also may be called, for example, RP (Cruttenden 2008; Wells 2008), BBC Pronunciation (Roach, Hartman & Setter 2006) or General British (Windsor Lewis 2003) depending on the source. Finnish has 8 monophthong vowel phonemes, which can all be short or long. Quantity is phonemic in Finnish (e.g. Suomi, Toivanen & Ylitalo 2008: 39–42). The RP accent is considered to have 12 monophthong vowels. These consist of 5 so-called 'long' or 'tense' vowels and 7 'short' or 'lax' vowels. Studies have shown that the tense-lax opposition is a more important distinctive feature than duration for native speakers of English with the /i:/-/ɪ/, /u:/-/ʊ/, /ɔ:/-/ɒ/ and /ɑ:/-/ʌ/ vowel pairs (the corresponding Finnish vowels

do not differ much in quality but in duration). However, duration is the distinctive feature for the /ə/-/ɜ:/ pair. In addition, RP has /e/ and /æ/ vowels (Cruttenden 2008; Morris-Wilson 2004; Raimo & Suomi 1978; Roach 2000). Acoustically speaking, vowels differ in F1 and F2 values (e.g. Deterding 1997).

The 5 tense-lax vowel pairs differ in duration in identical phonetic environments where tense vowels are longer than lax ones. However, sound duration varies substantially in English depending on, for example, stress placement and the length of the word. The greatest effect on vowel duration is caused by pre-fortis clipping, which means that vowel sounds preceding a fortis consonant in the same syllable are clipped in duration (Wells 1990). Conversely, lenis sounds make the preceding vowels longer in duration (pre-lenis lengthening). This means that, whereas in Finnish vowel length changes meanings and stays relatively constant, in English vowel duration mostly depends on the phonetic environment. Finnish learners of English are very used to different vowel durations in their L1, but the allophonic duration differences cause problems for learners in production and perception (for exact durations see Suomi 1980, 2009 or Wiik 1965). It is important to note that phonetic environment affects vowel durations in Finnish as well. Vowel duration is affected by word length and structure, for example (see, for example, Suomi, Toivanen & Ylitalo 2008: 75–110 for a thorough discussion). In our experiment we tested single-syllable words in a CVC context to minimize the possible transfer effect due to the length or structure of the word.

Finnish learners are used to many vowel qualities in their phonological system, but precise target language vowel qualities can cause many difficulties for Finnish learners of English. Especially the tense-lax opposition, which Finnish learners commonly produce with an opposition in length, can be problematic. Especially the closed front vowel pair /i:/-/ɪ/ has a high functional load (Dalton & Seidlhofer 1994) in English, and mastering this opposition phonetically would be important for the learner. The lax vowel /ɪ/ is an example of a maximal learning difficulty for Finnish learners by being a relational difference, a similar sound and a potential two category assimilation to Finnish /i/ and /e/ (see, for example, Lehtonen, Sajavaara & May 1977: 96 and Peltola 2003: 35 for a discussion on whether any L2 vowel can be called New in Flege's sense).

3 Methodology

The aim of this experiment was to see how university level explicit pronunciation training together with extensive exposure to English affect the production of non-native vowels, especially the theoretically difficult ones. For this purpose, three groups of voluntary subjects (a written consent was obtained) were selected for this cross-sectional study

in accordance with the experimental setting reported in e.g. Näätänen, Lehtokoski, Lennes, Cheour, Huotilainen, Iivonen, Vainio, Alku, Ilmoniemi, Luuk, Allik, Sinkkonen and Alho (1997), Peltola, Kujala, Tuomainen, Ek, Aaltonen and Näätänen (2003), Peltola, Tamminen, Toivonen, Kujala and Näätänen (2012) and Tamminen, Peltola, Toivonen, Kujala and Näätänen (2013). Group 1 (First-year-group) consisted of 11 native speakers of Finnish, who were all first-year students at the Department of English, University of Turku. The mean age was 20.9 years (range 18–28; 9 females). None of these subjects had participated in the pronunciation training course, which is a compulsory part of the first-year curriculum. During that course, students receive both theoretical information on the English sound system, as well as practical production training during 42 contact teaching hours in small groups. Group 2 (Second-year-group), on the other hand, consisted of 9 (mean age 21.1; range 19–23 years; 5 females) second-year students at the same Department. Consequently, these subjects had all passed the pronunciation course. The third group (Native-group) consisted of 9 native speakers of British English (mean age 40.4; range 23–66; 4 females). All subjects had lived in Finland for a considerable period of time (mean 18.8 years; range 17 months–38 years), they nevertheless considered English to be their primary language, and none of them had ever discontinued using English on a daily basis.

All subjects in all three groups reported to either speak or aim at a standard British accent of English. In addition, they were all in good health during the experiment and none was under the influence of medication that might have had an effect on voice quality. None of the student subjects had stayed in an English-speaking country for long periods (short tourist visits were acceptable); consequently, the main difference between the First-year-group and the Second-year-group lay in the amount of explicit spoken English training. The fact that all the members of the Native-group were exposed to Finnish and had lived in Finland for varied periods of time is of little consequence when testing their native production; studies have shown that the native language continues to dominate pronunciation, even on non-native production, if it is continuously used in conjunction with the L2 (Flege, Frieda & Nozawa 1997).

The stimuli were isolated English monosyllabic words, which contained 10 English vowel phonemes /i:/, /ɪ/, /e/, /æ/, /ʊ/, /u:/, /ɔ:/, /ʌ/, /ɒ/ and /ɑ:/; the neutral vowel schwa and its tense counterpart were excluded from the study since the schwa cannot occur in a stressed syllable. The vowels occurred both in a position where the following consonant was voiced (lenis) and voiceless (fortis) since, in addition to the acoustic quality, we tested whether the subjects were able to produce the voiceless-voiced dependent duration of English vowels. Phonetically the aim was to use minimal pairs, so that the articulatory environment would not affect the quality of the vowels. However, this was not always possible, and in those cases the place of articulation of the

adjacent consonants was always frontal to have comparable articulatory and acoustic loci in all stimuli. The stimuli were orthographically written words (*heed, heat, hid, hit, bed, bet, had, hat, hood, foot, who'd, hoot, board, bought, hud, hut, Todd, tot, hard, heart*), and they were presented via a PC screen using Power Point software in a sound attuned laboratory. There was a pause of 3 seconds between the stimuli, during which the subjects produced the word, and the productions were then recorded using Audacity software. A short pre-experiment training session containing three example words was always introduced first. During the test session, the subjects were presented with the same word 7 times in a pseudo-random order. There were two pauses for rest during the session, which lasted approximately 9 minutes depending on the length of the pauses. The subjects were instructed to remain calm, to stay at approximately 25 cm from the microphone (AKG C1000 S) and not to correct their productions.

From the obtained data, we analysed (using Praat) the values for the first (F1) and the second formant (F2), as well as for the duration of the vowel. The complex description of the articulatory gesture behind the individual formants is far from being simple, but it may be argued that the first formant is an indicator of the position of the tongue in the vertical axis, while the second formant relates to the horizontal axis (e.g. Fry 1979: 76–78). Consequently, these values are related to the closeness-openness of the vocal tract, as well as the frontness-backness of the constriction. The values were measured from the exact midpoint of the vowel. Duration values were obtained by segmenting the word items so that the beginning was set at the exact time of the initiation of voicing after the initial consonant /h/ and /f/, or at the point immediately after plosive explosion. The segment was considered to end at the exact time of the beginning of the occlusion. We then calculated the average value of each of these three variables for each produced exemplar (13398 measurements altogether) and then subjected these values to a Group (3) x vowel (10) x measure (3) x environment (2) Repeated Measures Analysis of Variance (ANOVA, IBM SPSS Statistics, version 19). Further post hoc tests were performed when required.

The general hypothesis of the whole data and experiment was that training and explicit phonetic knowledge would result in more native-like vowel production. However, students at the Department of English have a very high command of the target language already when they enter the curriculum, so it may tentatively also be that even First-year-students are indistinguishable from native speakers.

These predictions are valid both for vowel quality (F1 and F2) and duration. The native-like production of vowel quality is a theoretically difficult learning task since the Finnish vowel system has fewer categories than the target system. This is classified as a relational difference (Wiik 1965) or a Similar category setting (Flege 1987), which leads to underdifferentiation of distinctions, i.e. a maximal learning difficulty. However, duration

may prove to be a more demanding learning task. The fact that Finnish is a quantity language could tentatively enable a more rapid acquisition of durational cues since native speakers of a quantity language may have explicit knowledge of the system, or at least they have been accustomed to producing phonologically distinct durations. The phonological role of duration is different in the target language since it is dependent upon the consonantal context and thus it is not similarly phonemic (even though the duration of the vowel may well be a more significant cue of consonantal voicing than the actual glottal pulse). Therefore, it may be possible that durational cues are so easy to produce that even the First-year-group manages them, but it may also be that they are so demanding that even training does not provide sufficient help.

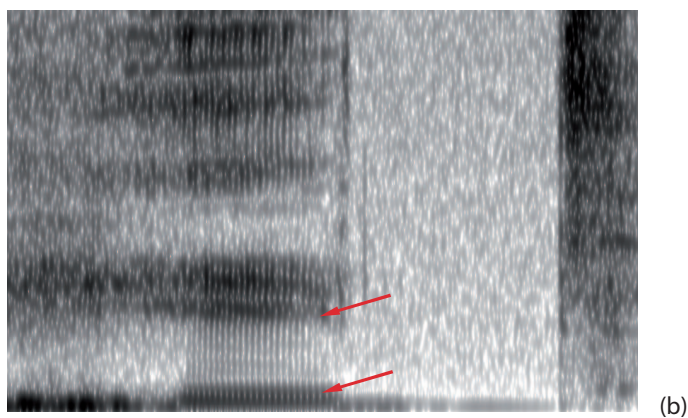
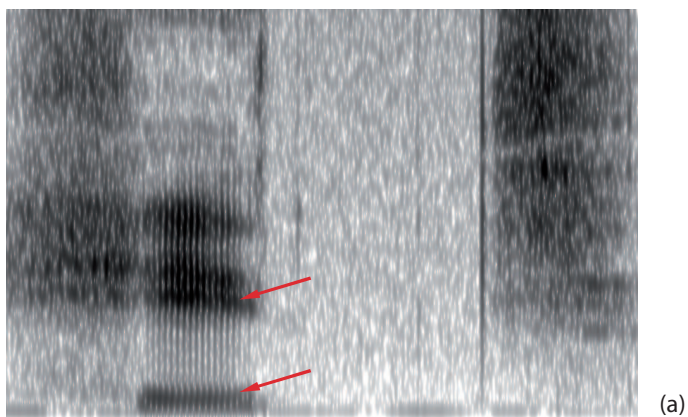
4 Results

The omnibus ANOVA (Group (3) x Vowel (10) x Measure (2) x Duration (2)) analysis revealed that, altogether, the groups differed in their production of the stimulus vowels and this was shown by the significant main effect of the Group factor ($f(2,26) = 3.389$, $p = 0.049$). A closer examination of the data (a Group (3) x Vowel (10) x Measure (2) Repeated Measures ANOVA) revealed that this difference was valid for the quality factor ($f(2,26) = 4.084$, $p = 0.029$), and not for the duration factor (n.s.). Therefore, there is no demand for further analyses on the production of non-native quantity, instead, it may be argued that the production of quantity is at a native-like level in both learner groups.

The quality data were subjected to further post hoc analyses, since the omnibus ANOVA demanded a more detailed inspection. The analysis (a Group (2) x Vowel (10) x Measure (2) Repeated Measures ANOVA) showed that there was a Group level difference between the quality of the vowel production between the First-year-Group and the Second-year-group ($f(1,18) = 4.414$, $p = 0.050$) and also between the First-year-group and the Native-group ($f(1,18) = 8.161$, $p = 0.010$). In contrast, there was no difference in quality of the vowels between Second-year-group and Native-group (n.s.). Altogether, the statistical analyses showed that the differences between groups were located in the production of quality and that the productions of the First-year-group were different from those of the other two groups.

As an example of the result shown by the statistical analyses, the theoretically maximally difficult vowel /ɪ/ may be given. Figure 1a shows the production of the word hit /hɪt/ by a first-year student. It is evident that the value for the first formant is too low for RP English (e.g. Deterding 1997), while the second formant has a high value (i.e. the learner produces this vowel as too close and front, as the quality associated with the vowel's tense counterpart). In contrast, both in Figure 1b and Figure 1c, the values

for these crucial formants are similar to each other, with F1 having a high value and F2 a low value (i.e. the vowel is less closed and less front). Therefore, it is evident that the productions of the native speaker of English and the second-year student resemble each other, while the production by the first-year student is decisively different.



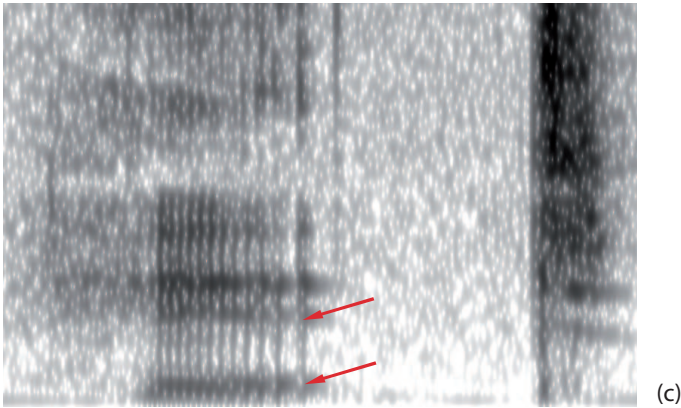


FIGURE 1. Examples of the target word /hlt/ produced by a First-year-group subject (a), a Second-year-group subject (b) and a Native-group subject (c). The arrows mark the first and second formants. The frequency scale is 0–104 Hz.

5 Discussion

According to our results, our subjects, advanced Finnish learners of English, showed a clear learning effect after a year of studies, that is, after they had attended a course in English pronunciation. The results showed that learner groups did not differ in the production of vowel duration. In fact, even Group 1 (the beginning university students) did not differ from the native control group significantly. This means that the Finnish learners, who are used to varying vowel durations in their L1, produced similar vowel durations to those produced by native speakers of English even without any university level pronunciation training. It is to be borne in mind that our experiment included both tense and lax vowels, which Finnish learners typically separate by duration only, but they all occurred in contexts where the following plosive affected their duration. This means that our results show that our subjects were able to master durations affected by the phonetic context, which they were not used to in their L1. Although the phonological role of duration differs in Finnish and English, our results suggest that Finnish learners, who are used to producing phonologically distinct durations in their L1, are able to produce accurate vowel durations at an advanced level. Changes in vowel duration, therefore, seem to be a feature that is relatively easy to learn in a foreign language if the learner is used to a similar feature in their L1, even if the phonological role of vowel duration differs.

When it comes to the benefits of explicit pronunciation teaching, our results on vowel qualities revealed a learning effect. Groups 1 and 2, that is, before and after pronunciation teaching, differed significantly from one another. Moreover, the more advanced group did not differ from the native control group, which suggests that their production of the vowel qualities of English was very similar. Therefore, our results suggest that after explicit pronunciation teaching university students are able to produce native-like vowel qualities in English, which the students who have not been taught and practised these were not able to do. It is not known how much our subjects had been taught vowel qualities during their earlier levels of education, but based on earlier studies, pronunciation teaching (and especially such that focuses on vowel qualities) is not common in Finnish schools (e.g. Tergujeff 2013). The reason may partly be the variation English accents have in their vowel qualities, which makes vowel qualities challenging to teach before very advanced levels when the learners know which accent they aim at and how accurately they want to learn the vowel qualities of their target L2 accent.

The results of this study can be further confirmed by a longitudinal study where individual learners are followed during their studies. However, in the selection of the subjects we aimed at homogenous groups who would only differ by the amount of explicit pronunciation practice they had received (following e.g. Nääänen *et al.* 1997, Peltola *et al.* 2012 and Tamminen *et al.* 2013). This experiment focused on vowels in isolated words, as well as group values and the vowel system as a whole. Our next step is to focus on individual differences in the learning process and variation in the knowledge and progress of specific vowel qualities. We would also need information on vowel durations and qualities in natural communicative situations. However, there is earlier evidence that the improvement observed in controlled settings where pronunciation is heavily focused on can be observed in less controlled communicative situations as well (e.g. Peacock 2002). Our study shows that both L2 vowel duration and quality are learnable features in the pronunciation of English. Learners are able to benefit from similar features in their L1, and explicit pronunciation teaching and practice has a positive effect on learner performance.

References

- Best, C. T. & W. Strange 1992. Effects of phonological and phonetic features on cross-language perception of approximants. *Journal of Phonetics*, 20, 305–330.
- Celce-Murcia, M., D. M. Brinton, J. M. Goodwin & B. Griner 2010. *Teaching pronunciation*. Cambridge: Cambridge University Press.
- Cruttenden, A. 2008. *Gimson's pronunciation of English*. London: Hodder Education.
- Dalton, C. & B. Seidlhofer 1994. *Pronunciation*. Oxford: Oxford University Press.

- Daniels, H. 1995. Psycholinguistic, psycho-affective and procedural factors in the acquisition of authentic L2 phonology. *Speak Out*, 15, 3–10.
- Derwing, T. 2009. Utopian goals for pronunciation teaching. In J. Levis & K. LeVelle (eds) *Proceedings of the 1st Pronunciation in Second Language Learning and Teaching Conference*. Ames: Iowa State University, 24–37.
- Derwing, T. M. & M. J. Munro 2005. Second language accent and pronunciation teaching: a research-based approach. *TESOL Quarterly*, 39 (3), 379–397.
- Deterding, D. 1997. The formants of monophthong vowels in Standard Southern British English Pronunciation. *Journal of the International Phonetic Association*, 27, 47–55.
- Ellis, R. 1994. *The Study of Second Language Acquisition*. Oxford: Oxford University Press.
- Flege, J. E. 1987. The production of “new” and “similar” phones in a foreign language: evidence of speech perception. *Journal of Phonetics*, 15, 47–65.
- Flege, J. E., E. M. Frieda & T. Nozawa 1997. Amount of native-language (L1) use affects the pronunciation of an L2. *Journal of Phonetics*, 25, 169–186.
- Fraser, H. 2001. *Teaching pronunciation: a handbook for teachers and trainers*. Canberra, Australia: Department of Education Training and Youth Affairs.
- Fry, D. B. 1979. *The physics of speech*. Cambridge: Cambridge University Press.
- Gilbert, J. 2008. *Teaching pronunciation: using the prosody pyramid*. Cambridge: Cambridge University Press.
- Henderson, A., D. Frost, E. Tergujeff, A. Kautzsch, D. Murphy, A. Kirkova-Naskova, E. Waniek-Klimczak, D. Levey, U. Cunningham & L. Curnick 2012. The English pronunciation teaching in Europe survey: selected results. *Research in Language*, 10, 5–27.
- Hirvonen, P. 1970. *Finnish and English communicative intonation*. Turku: Publications of the Phonetics Department of the University of Turku 8.
- Jenkins, J. 2000. *The phonology of English as an international language*. Oxford: Oxford University Press.
- Lehtonen, J., K. Sajavaara & A. May 1977. *Spoken English*. Jyväskylä: Gummerus.
- Lintunen, P. 2004. *Pronunciation and phonetic transcription: a study of advanced Finnish learners of English*. Anglicana Turkuensia 24. Turku: University of Turku.
- Lord, G. 2005. (How) can we teach foreign language pronunciation? On the effects of a Spanish phonetics course. *Hispania*, 88, 557–567.
- Major, R. C. 2001. *Foreign accent: the ontogeny and phylogeny of second language phonology*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Morris-Wilson, I. 2004. *English segmental phonetics for Finns*. Oulu: Oulu University Press.
- Nääätänen, R., A. Lehtokoski, M. Lennes, M. Cheour, M. Huottilainen, A. Iivonen, M. Vainio, P. Alku, R. J. Ilmoniemi, A. Luuk, J. Allik, J. Sinkkonen & K. Alho 1997. Language-specific phoneme representations revealed by electric and magnetic brain responses. *Nature*, 385, 432–434.
- Paananen-Porkka, M. 2007. *Speech rhythm in an interlanguage perspective: Finnish adolescents speaking English*. Helsinki: Department of English, University of Helsinki.
- Peacock, M. 2002. *Teaching English pronunciation at university level in Finland*. Jyväskylä: University of Jyväskylä.
- Peltola, M. S. 2003. *The attentive and preattentive perception of native and non-native vowels: the effect of second language learning*. Turku: Department of Phonetics, University of Turku.
- Peltola, M. S., T. Kujala, J. Tuomainen, M. Ek, O. Aaltonen & R. Nääätänen 2003. Native and foreign vowel discrimination as indexed by the mismatch negativity (MMN) response. *Neuroscience Letters*, 352, 25–28.
- Peltola, M. S., H. Tamminen, H. Toivonen, T. Kujala & R. Nääätänen 2012. Different kinds of bilinguals – different kinds of brains: the neural organisation of two languages in one brain. *Brain & Language*, 121, 261–266.

- Piske, T., I. R. A. MacKay & J. E. Flege 2001. Factors affecting degree of foreign accent in an L2: a review. *Journal of Phonetics*, 29, 191–215.
- Pourhoseini Gilakjani, A. 2012. The significance of pronunciation teaching in English language teaching. *English Language Teaching*, 5, 96–107.
- Raimo, I. & K. Suomi 1978. Pari kontrastiivista kuuntelukoetta. In T. Tikka (ed.) *Fonetiikan Päivät – Joensuu 1976*. Joensuu: University of Joensuu.
- Ringbom, H. 2007. *Cross-linguistic similarity in foreign language learning*. Clevedon: Multilingual Matters.
- Roach, P. 2000. *English phonetics and phonology*. Cambridge: Cambridge University Press.
- Roach, P., J. Hartman & J. Setter (eds) 2006. *English pronouncing dictionary*. Cambridge: Cambridge University Press.
- Schmidt, R. 1990. The role of consciousness in second language learning. *Applied Linguistics*, 11, 129–158.
- Seidlhofer, B. 2001. Pronunciation. In R. Carter & D. Nunan (eds) *The Cambridge guide to teaching English to speakers of other languages*. Cambridge: Cambridge University Press, 56–65.
- Setter, J. & J. Jenkins 2005. Pronunciation. *Language Teaching*, 38, 1–17.
- Suomi, K. 1980. *Voicing in English and Finnish stops*. Turku: Publications of the Department of Finnish and General Linguistics of the University of Turku, 10.
- Suomi, K. 2009. Durational elasticity for accentual purposes in Northern Finnish. *Journal of Phonetics*, 37 (4), 397–416.
- Suomi, K., J. Toivanen & R. Ylitalo 2008. *Finnish sound structure: phonetics, phonology, phonotactics and prosody*. Studia Humaniora Ouluensia 9. Oulu: University of Oulu.
- Tamminen, H., M. S. Peltola, H. Toivonen, T. Kujala & R. Näätänen 2013. Phonological processing differences in bilinguals and monolinguals. *International Journal of Psychophysiology*, 87, 8–12.
- Tergujeff, E. 2013. *English pronunciation teaching in Finland*. Jyväskylä Studies in Humanities 207. Jyväskylä: University of Jyväskylä.
- Toivanen, J. 2001. *Perspectives on intonation: English, Finnish and English spoken by Finns*. Frankfurt am Main: Peter Lang.
- Wells, J. C. 1990. Syllabification and allophony. In S. Ramsaran (ed.) *Studies in the pronunciation of English. A commemorative volume in honour of A. C. Gimson*. London: Routledge, 76–86.
- Wells, J. C. 2008. *Longman pronunciation dictionary*. Harlow: Pearson Education Limited.
- Wiik, K. 1965. *Finnish and English vowels*. Turku: University of Turku.
- Windsor Lewis, J. 2003. IPA vowel symbols for British English in dictionaries. *Journal of the International Phonetic Association*, 33 (2), 143–152.