Perception Training for All!?

MA Thesis "English Language and Culture: Education and Communication"

Utrecht University

August 2012

Hanneke Andringa, 3015084

Supervisor: dr. M.E.H. Schouten

Second reader: dr. W.Z. van den Doel

Acknowledgements

There are many people I would like to thank for helping me with this thesis.

My supervisors, initially Rias van den Doel, who has steered me in the right direction, and later Bert Schouten, who has guided me through every step of the way, thank you very much for keeping a close watch. It has helped me greatly to stay on the right track and to keep on going.

I am grateful to Theo Veenker, who has designed the computer programme for the experiment, and to Jan Doeschot, the system administrator at Leidsche Rijn College for putting a lot of effort into helping me get the programme running correctly on the school computers. I cannot image what the experiment would have been like without you.

Many thanks go to Carolyn, Michael, Annamieke, Chloe and Max for providing the native speaker samples. I would also like to thank the pupils from classes 1A and 1B at Leidsche Rijn College and their tutors, Janneke, Anne, Demian and Frederike, and their English teacher, Steven, for offering up lessons for my experiment. I am also very grateful to Mieke and Jamal for lending me space, figuratively and literally, to conduct my experiment at school. And thanks to all my colleagues, particularly Fatima and Anette, for their support.

Last, but certainly not least, I would like to thank Mathijs, Sjoerd, Vera and Wouter for their unwavering love and support from beginning to end. Special thanks to my dad for helping me arrange the raw data in such a way that it became interpretable; to my brother for teaching me the basics of statistical analysis and to Mathijs for running the last mile with me. And thank you all for pre-reading and sharing your expertise and ideas!

I owe you.

Contents

Introduction

Recent studies have established that there is a need for specific training in the perception and production of English speech sounds in Dutch secondary schools. The majority of teachers claim that training is useful and necessary, and that existing methods pay no or too little attention to phonetics (Van Hattum, 2010; Krooshof and Andringa, 2011). In addition, pupils express a desire to minimize their mother tongue accent (Lantaff et al., 2011). Furthermore, Van den Doel (2006) recommends that English pronunciation training should be implemented in the standard curriculum in secondary schools to help learners communicate more effectively with native and non-native speakers alike. Apart from the comprehensibility argument, there are sociolinguistic reasons, since there is evidence that learners with foreign accents are subject to negative evaluation by their native speaker interlocutors. This effect can be reduced by learning a more native-like accent, although a completely native accent is unrealistic for most second language (L2) learners. Nonetheless, success is possible if the following three factors are combined: "high motivation, continued access to massive L2 input, and intensive training in the perception and production of L2 speech sounds" (Bongaerts, 1999, p. 155). These findings have later been confirmed by Birdsong (2007). Because of the apparent importance of the three factors combined, motivation, exposure and training are assessed with regard to their relevance to Dutch secondary school pupils. Training can be given to all pupils, but the levels of motivation and exposure are not easily regulated. Hence, the implementation of training in the standard curriculum would only be worthwhile, if the factors of motivation and exposure played a subordinate role in the development of phonetic competence. Only then would training lead to constantly positive results for all of the pupils, instead of results as varying as the levels of motivation and exposure of the individual learners.

It has been shown that phonetic and perceptual training leads to improved performance in the discrimination and identification of L2 speech sounds on the part of L2 learners by, among others, Flege (1989); Iverson and Evans (2007); Iverson, Hazan and Bannister (2005); Lambacher et al. (2005); Lively, Logan and Pisoni (1993); Logan Lively and Pisoni (1991); Logan and Pruitt (1995) and Pisoni and Lively (1995) (Aliaga-García and Mora, 2009). However, in most of these studies, both phonemes that are difficult and phonemes that are easy to acquire were trained and tested, so that effectiveness was to be expected. Studies that focus on the most difficult L2 phones alone are more interesting, because they are less likely to be perceived and produced correctly without training. Furthermore, research shows that improvement in perception due to training leads to improvement in production (Rochet, 1995 and Bradlow et al., 1997). Because accurate perception is a logical precondition for accurate production, the emphasis in this thesis is on perception.

Aliaga-García and Mora (2009) conducted an experiment with Catalan/Spanish learners of English who received six two-hour training sessions on four English sound contrasts that are known to be difficult to master for speakers of their native language. The participants were tested on their perceptive and productive competence before and after training. The discrimination scores had increased significantly for three of the four sound contrasts. This shows that a fairly short course in the perception of difficult L2 sounds can indeed be effective for perceptive competence. However, the participants were all undergraduate students of English Philology at the University of Barcelona who took part in the experiment voluntarily. Arguably, it is expected that a majority was highly motivated and exposed to English more often than Dutch secondary school pupils are. It is uncertain whether an experiment with participants who have more varying levels of motivation and exposure, would have a similarly positive outcome.

Main Question

The main question that is addressed in this thesis is whether perception training at Dutch secondary schools would be beneficial for all of the pupils in a class. To answer this question, the groups that are most likely and least likely to be successful are tested. According to Bongaerts (1999) and Birdsong (2007), highly motivated pupils, who are exposed to the L2 a lot and who receive training, are expected to improve their phonetic proficiency greatly. If pupils with low motivation and little exposure demonstrate a similar improvement in phonetic proficiency, or at least significantly more improvement than groups who do not take part in training, this can be interpreted as evidence to support Van den Doel's recommendation to implement training in the standard curriculum for English in Dutch secondary schools. If this low motivation, little exposure group fails to improve significantly, it might be better to offer training to a select group of pupils. In view of that, the following research question was formulated:

To what extent do the variables of motivation and exposure to the target language influence the effectiveness of perception training in difficult English speech sounds for Dutch secondary school pupils?

The participants are pupils in the first year of secondary school, because research has shown that most perceptual learning takes place early in the L2 learning process. Therefore, it is desirable to actively train perceptive skills "early in acquiring a language, before the lexicon and higher-order linguistic structures (morphology, syntax) are well-established" (Best and Tyler, 2007, p. 21).

Motivation

Motivation has many faces and is very dynamic for each individual learner. Consequently, it is impossible to find a group of learners who are equally motivated. The challenge here is to find out how the motivation of the participants to learn English is composed and what elements have an influence on it. Rod Ellis (2008) identified eight key motivational constructs, of which there are four that are relevant to Dutch secondary school pupils. These four will be evaluated and operationalized in an instrument that can measure the participants' levels of motivation, by means of statements that address the different elements of the motivational constructs directly (see Appendix 1).

Integrative motivation involves interest in or attitude towards foreign languages in general and the target language specifically, the desire to master the language and the effort the learner is willing to put into it. Furthermore, attitudes towards the teacher and the course, or in this case the school subject, and the materials that are used, are a part of integrative motivation. Attitudes towards the L2 community are also involved, but it is expected that this plays a minor role in motivation for Dutch pupils. The primary reason for learning English is to use it as a tool in international communication. It gives people the opportunity to communicate with people with different language backgrounds, usually other non-native speakers (Jenkins, 2007). It would therefore be more relevant to enquire about participants' attitudes towards the international community. Statements one to eleven address the participants' integrative motivation.

Instrumental motivation "derives from a perception of the concrete benefits that learning the L2 might bring about" (Ellis, 2008, p. 682). These benefits can refer to the practical use and value of being able to speak the target language, for example because it is necessary for the envisioned career that learners have in mind or as a tool in international communication, as described above. It can also refer to incentives such as money or, as is more relevant for the target group, grades. This encompasses the desire to earn good grades as well as to avoid punishments in the form of a fail (Dörnyei, 1994). Statements twelve to seventeen address the participants' instrumental motivation.

Linguistic self-confidence has proven to be an important contributor to success in learning foreign languages in educational settings, even when learners had little contact with the L2 outside of the classroom and no direct contact with members of the L2 community (cf. Ellis, 2008 and Dörnyei, 1994). Self-confidence is defined as "the belief that one has the ability to produce results, accomplish goals or perform tasks competently" (Dörnyei, 2008, p. 277), and is strongly connected to self-efficacy, which refers to "an individual's judgement of his or her ability to perform a specific action" (Dörnyei, 2008, p. 277). Statements eighteen to twenty-two are designed to learn about the participants' past accomplishments; how they view these results themselves; how they think their teacher and parents evaluate their abilities; how they view their language proficiency in comparison to their peers and how much they are influenced by encouragements and criticism.

Attributions, “explanations learners give for their progress in learning an L2” (Ellis, 2008, p. 684), play a key role, next to self-confidence, in a vicious or virtuous circle, that can predict the level of motivation and achievement for L2 learners. The most important factors of attribution are ability and effort. Generally, low motivation can restrain people from effective learning. This leads to low achievement, which can lead to lower motivation and self-confidence, especially if learners attribute their failure to factors they cannot influence. Conversely, high motivation stimulates learning and this can lead to success and higher motivation. The last two statements address attributions.

Exposure

The only type of exposure that is relevant is naturalistic exposure: spoken English produced by a native speaker. Only with this type can the listener hear the authentic sounds of the target language, although it is important to realize that, given the wide range of different accents and the variability in individual speakers, the quality of the phonemes that pupils are exposed to may vary greatly. Furthermore, pupils are probably exposed to spoken English through different mediums, for example, television, games, the internet, music and possibly contact with native speakers in their social environment or on holiday. In any case, they will hear English in the classroom. Although not all teachers are native speakers, pupils will be exposed to native spoken English by means of samples used in watching/listening exercises and possibly by other means as well. This classroom exposure, however, can be disregarded, as all pupils are exposed equally in this manner. What is important is to find out in what ways and how much the participants are exposed to the target language in native spoken form in non-educational settings. This forms the naturalistic exposure on the basis of which, in addition to motivation, the participants are divided into groups.

Although exposure is necessary for language learning, there is no general consensus on the nature of the needed exposure and the role it plays (Saville-Troike, 2006). Some theories, for example Long’s Interaction Hypothesis, Swain’s Comprehensible Output Hypothesis and Schmidt’s Noticing Hypothesis, claim that learners need to pay conscious attention to the input in order to benefit from it, whereas others, for example the Frequency Hypothesis and Krashen’s Input Hypothesis, ignore or even reject the role of consciousness (Ellis, 2008).

Others discuss the role of interaction. Mackey and Goo (2007) analyzed 28 interaction studies and found that interaction is “highly effective in facilitating L2 acquisition” (Ellis, 2008). This does not mean that it is a causative force, as Saville-Troike (2008) points out:

> 1. Some individuals are able to achieve a relatively advanced level of L2 proficiency without the benefit of any interpersonal communication or opportunity to negotiate meaning in the language with others.
>
> 2. Some individuals engage in extensive interaction with speakers of another language without learning that language to any significant degree. (p. 116)

Because there is so little agreement on which elements of exposure to the target language exactly aid acquisition, none will be excluded from the instrument with which the participants' levels of motivation and exposure are measured. However, as the perception of L2 sounds is investigated, only speech produced by native speakers can be taken into account.

Categorical Perception

The colour spectrum is a physical continuum. However, we perceive colours as separate categories. To the eye, at a certain point, red becomes orange, then yellow, then green and so forth. Even though a smooth transition is visible with colours, there is a point at which you stop seeing the shade as yellow and start seeing it as green. This is called the perceptual or categorical boundary and it can differ slightly from person to person (cf. Harnad, 1987). With speech sounds, the perceptual boundaries are much more abrupt and they differ from language to language. In a continuum of acoustic sound variation, on one side of the boundary, sounds are perceived as one phoneme and the sounds on the other side as a different phoneme. The within-category distinctions are very difficult to hear, but acoustically small differences between two sounds on either side of the boundary are very clear. For example, within a continuum of voice-onset time (VOT) for the bilabial plosive, aspirated /p/ gradually becomes the voiced consonant /b/ going through unaspirated /p/, slightly voiced /p/ and devoiced /b/. The point at which the consonant stops being perceived as /p/ and at which it starts being perceived as /b/ is different for Dutch and English. Slightly voiced /p/ may sound like a /p/ to a Dutch listener, but like a /b/ to an English listener (Kager, 2009), similarly to how the colour turquois is seen as a shade of blue by one person and as a shade of green by the next.

When young infants acquire their first language (L1), they learn to distinguish the phonetic categories. Flege (1987) suggests that, as they mature, infants become able to identify a wider range of phonetic realizations as belonging to the same category through 'equivalence classification'. Gradually, they rely less on acoustic information and more on perceived information in making categorical decisions. Similarly, Jusczyck (1992) proposes that, with L1 learning, infants 'filter' the stream of sounds from their linguistic environment. The starting point is a continuous mode, but over time they learn which sound variations are considered allophones in their L1, and through this method they categorize the meaningful entities and regulate their speech perception. Taking up this assumption, Werker & Logan propose that “it may become increasingly difficult for L2 learners to note the phonetic (but not auditory) difference between ‘similar’ phones in L1 and L2” (qtd. in Flege, 1987, p. 50), since they assign an L1 category to L2 phones that sound similar to L1 phonemes. However, there are usually phones in the L2 that have no counterpart in the L1, the ‘new’ phones that can be allocated to a new category for the L2 and therefore should not be involved in any interference of the L1 in the learning process. An example of such a ‘new’ vowel is French /y/ to native speakers of English (Flege, 1997, p. 17). ‘Similar’ phones, on the other hand, pose difficulty, as the mechanism of equivalence classification precludes the learner from distinguishing a separate category for the L2 sound. “This may ultimately prevent them from producing similar but not new phones authentically” (Flege, 1987, p. 62). Best (1995) elaborates on this notion and proposes a Perceptual Assimilation Model (PAM) that predicts learners’ perceptual assimilation of L2 phones to L1 categories based on spatial proximity of place and manner of articulation. According to this model, it is expected, in non-native contrast distinctions, that discrimination between two non-native sounds that are assimilated to the same native category and that are both equally deviant, or equally similar in Flege’s terminology, should be very poor. This type of ‘Single-Category Assimilation’ can account for the difficulties native Dutch speakers have with the distinction between English /e/ (dress) and /æ/ (trap), both of which are generally interpreted as Dutch /ɛ/ (zet) (Gussenhoven and Broeders, 1997). Furthermore, PAM predicts that discrimination between sounds of non-native contrasts that are assimilated with different native categories or that fall outside the native categories or are not even recognized as speech sounds at all, because of articulatory divergences or spatial remoteness, should be fairly easy (Best, 1995). The latter two are comparable with Flege’s classification of ‘new’ phones. In his Speech Learning Model (SLM), Flege (1995) postulates that “the mechanisms and processes used in learning the L1 sound system, including category formation, remain intact over the life span, and can be applied to L2 learning” (p. 239).

On the basis of all of the above, it can be predicted that the greater the perceived dissimilarity between an L2 phone and the closest L1 category is, the easier it is to establish a new category. Likewise, learning to distinguish between the ‘similar’ phones of Dutch and English should be most difficult for pupils. As it is unlikely that the learners have already established phonetic categories for these more difficult L2 sounds, the ‘similar’ phones are selected for the experiment.

Phonetic Contrasts for Perception Training

To determine which of the English speech sounds are suitable for testing and training the perceptive competence of Dutch pupils in the first year of secondary school, several sources have been consulted. *The Phonetics of English and Dutch* (*PED*) by Collins and Mees (2003) comes with a 'hierarchy of error in pronunciation'. Although this might differ from an error hierarchy for perception, it does give insight into the most difficult English sounds for Dutch learners. Moreover, most English phonemes are compared with Dutch and contrasted with possible counterparts, or it is explicitly stated that there is no similar sound in Dutch. For example, number five on the list of most significant persistent errors, confusion of the /v – w/ contrast, is explained to pose "a major problem for most Netherlands Dutch speakers […] both in terms of articulation and in confusion of the [English] /w – v/ contrast" (p. 175), because English /w/ is typically confused with Dutch /ʋ/ which is actually more like English /v/. In other words, among inexperienced Dutch learners, English /w/ is perceived in terms of the L1 category and therefore pronounced accordingly.

Similar to *PED*, *English Pronunciation for Student Teachers* (*EPST*) by Gussenhoven and Broeders (1997) also focusses mainly on production rather than on perception. However, *EPST* compares similar Dutch and English phonemes more thoroughly and provides better insight into how the English sounds are initially perceived and produced. It also stresses the importance of phoneme discrimination exercises and of using metacognitive strategies to obtain a clear idea of how a phoneme is realized. Once a student has achieved this, it should be fairly easy to pronounce in isolated words: "The progress you make in the production of English sounds will go hand in hand with improvements in your perception of them" (p. 74). Additionally, *EPST* also comes with a list of learner priorities, indicating specific vowels and consonants and more general points that teachers should concentrate on in pronunciation lessons for secondary school pupils.

Based on a literature review, with Van den Doel (2006) and Van Hattum (2010) as main sources, and a needs-and-context analysis among Dutch secondary school teachers of English, a selection of pronunciation priorities for Dutch pupils was made by Krooshof and Andringa (2011). Among this selection there were a few phoneme contrasts that could be classified as 'difficult' for Dutch learners as the English phones have a 'similar' counterpart in Dutch:

- /æ-e/ (trap-dress)
- /ʊ-u:/ (foot-goose)

PED describes the contrast of /æ-e/ as "a notoriously persistent learners' error" (Collins and Mees, 2003, p. 94). Because the contrast causes differences in meaning between many commonly used words, it is clearly an important contrast to master. In addition, despite the difficulty learners usually have distinguishing between the sounds, the spelling is very reliable. It can roughly be said that /æ/ is spelled as a, and /e/ as e (p. 124). *EPST* has very few vowels on its priority list, but the /æ-e/ contrast is seen as important enough. As mentioned earlier, both sounds are perceived as and replaced with Dutch /ɛ/ (zet).

As with the /æ-e/ contrast, 'Single-Category Assimilation' occurs with the /ʊ-u:/ contrast. *PED* claims that "all Dutch-speaking students confuse E[nglish] /ʊ/ and E /u:/, hearing both in terms of their D[utch] /u/, as in 'moe'" (Collins and Mees, 2003, p.97). Although *EPST* does not suggest this contrast as one of the most important ones a Dutch student of English has to learn, it does note the same confusion as *PED* and points out that the differences within the word pairs Luke-look, fool-full and pool-pull are often lost (Gussenhoven and Broeders, 1997).

Although final fortis/lenis contrasts, in particular /t-d/, also appeared on all priority lists and could be considered 'difficult', there is thus far no reason to believe that this is due to perceptual problems. Dutch is a language with the 'Laryngeal Constraint', which licenses the aspect [+voice] in a consonant only if it immediately precedes a sonorant segment in the same syllable (Lombardi, 1995). For this reason, final voicing does not occur in Dutch, and words such as 'hard' and 'hart' are homophones. English, on the other hand, does not have this constraint, so voiced consonants can occur in any position. Arguably, Dutch listeners perceive English final voicing in terms of the L1 constraint, i.e. devoiced, but research by Van Bennekum and Andringa (2010) did not lead to such findings. Instead, Dutch listeners seemed to be confused by the notion of [+voice] and [-voice] variation for plosives in final position in English, so they chose their answers on the forced choice test randomly, rather than according to the predictions. Furthermore, both *PED* and *EPST* focus solely on the aspects of production by Dutch learners of fortis/lenis contrasts in final position. Accurate production of both phonemes is correlated with the length of the preceding vowel and preglottalisation, making realization of these phonemes dependent on the adjoining sounds, and making it impossible to isolate them for analysis. Taking all of the above into consideration, final fortis/lenis seemed a contrast-type too complicated to include in the present experiment. The vowel contrasts that have been chosen, on the other hand, are much easier to isolate, and therefore more suitable for testing and training.

Method

For this experiment a pretest – training – posttest design was used with an identification task. The pre- and posttest were identical. Furthermore, the voice of the test speaker was not used in the training sessions to avoid improved results due to familiarization with the stimuli, and to force the participants "to abstract from individual speaker differences during learning" (Heeren and Schouten, 2008, p. 2294).

Stimuli

Five different speakers were asked to produce the stimuli, two men and three women, whose ages varied from 12 to 50 years. Speech from one of the speakers was recorded in a sound-proofed studio at Leidsche Rijn College in Utrecht and speech from four of the speakers was recorded in a quiet room in their own home. They were presented with a list of eighty-eight words and non-words (see Appendix 2) and asked to read each word out loud twice, pronounced with high pitch and low pitch. Normally, if a person reads a list of words, the pitch will change towards the end of the list. With the method used here, the pitch changed with each word, which made it possible to select only the high pitched ones, as they were usually produced most clearly.

The list of words and non-words was compiled by combining each English consonant that can occur in initial position with the endings -ʊt, -u:t, -æt and -et. This way, different contexts were created to allow the vowels to differ slightly, as they would in normal speech, to make the stimuli as close to natural speech as possible.

One of the female speakers was selected as the test speaker. The other two female speakers and one of the male speakers were selected as the training speakers. The other male speaker's stimuli were excluded from the experiment, because the quality of the stimuli was too deviant compared to those from the other speakers, as it contained a poorer signal to noise ratio in comparison with the other recordings.

The stimuli were cut from the recordings using the programme 'Praat' (Boersma and Weenink 2012). Then the best variants were chosen for each speaker, and their quality was downsized using the programme 'Audacity' (Audacity team 2012). The sampling frequency needed to be reduced from 96 kHz to 48 kHz in order for the stimuli to be played in 'Zep' (Veenker 2012), the programme that was used for the experiment.

Participants

There were 57 participants, 34 boys and 23 girls, with a mean age of 13.2 years, varying from 12.3 to 14.2 years. They have diverse language backgrounds and are all in year one, class 1A or 1B, of the secondary school Leidsche Rijn College in Utrecht. Before taking the tests, they were asked to fill out a survey regarding their motivation and exposure (see Appendix 1). The statements were presented in such a way that the higher the level of motivation of the participants is, the more they would agree with the statements. The level of exposure was measured by letting the participants indicate the average number of hours per week they listen to native English, for each plausible medium. The 15 pupils with the lowest scores on both motivation and exposure formed test group L (low), and the 15 pupils with the highest scores on the variables formed test group H (high). These were the groups that received training. The 27 "in-betweeners" formed group C, the control group.

Procedure

The survey was completed on 25 April with class 1B and on 26 April with class 1A. The pretest with 1A took place on 10 May and with 1B on 11 May. The training sessions of 1A were on 15, 22 and 24 May, followed by the posttest on 29 May. The training sessions of 1B were on 16, 23 and 30 May, followed by the posttest on 1 June. Both tests and the training sessions were run in computer classrooms at Leidsche Rijn College in Utrecht. The participants completed all parts of the experiment on individual computers with ear- or headphones, to minimize interference from other participants.

Participants received a written introduction (see Appendix 3a) about how the vowels pairs /ʊ-u:/ and /æ-e/ differ. As examples, the minimal pairs /sʊt-su:t/ and /bæt-bet/ were used. In addition to the introduction, participants received short instructions (see Appendix 3b) on how to complete the test. It was explained that they would be presented with a series of words and non-words and that they had to pay special attention to the vowels in these words. For each word, they were expected to indicate whether it rhymed with foot, boot, cat or net, by clicking on the corresponding image. At the end of the instructions, they heard the rhyme words, spoken by the test speaker, while seeing the corresponding images. This was followed by eight example trials with the words soot, suit, bat and bet, for which they received immediate feedback in the form of a green tick or a red cross. These words, the rhyme words and their counterparts /fu:t/, /bʊt/, /ket/ and næt/ were excluded from the test stimuli, leaving a list of seventy-six stimuli. The test contained 380 trials: five repetitions of each stimulus in randomized order. Each trial lasted approximately 3100 milliseconds: approximately 600 ms for the stimulus and at most 2500 ms of response time after the offset of the stimulus. This limitation on response time was employed to restrict the duration of the tests and training sessions, because they had to be completed within the time frame of a normal lesson. As soon as a choice had been made, there was an inter-trial interval of 1000 ms and then the test continued with the next stimulus. After every 95 trials, there was a short break in which the rhyme words were repeated. The pretest lasted between 21 and 36 minutes and the posttest lasted between 18 and 25 minutes.

The training sessions contained 1368 trails in total (three speakers x seventy-six stimuli x six repetitions) divided over three training sessions of 456 trials each. Each training session had the same set-up as the test, with the introduction, instructions, 1000 ms inter-trial intervals and a short break after every 114 trials with repeated instructions. However, the examples and rhyme words were spoken by the three training speakers instead of the test speaker. In addition, the test groups were given individual trial-by-trial feedback on the correctness of their responses. During each break the percentage of correct responses so far was shown, and at the end of each training session, the mean score was shown. In the training sessions, each trial lasted approximately 3600 milliseconds; approximately 600 ms for the stimulus, at most 2500 ms of response time and 500 ms for the feedback. As soon as a choice was made, the participant received feedback and then the test continued with the next stimulus. Each training session lasted between 24 and 37 minutes.

Analysis

During the pretest it was clear that not all participants were taking part in the experiment seriously, clicking randomly or waiting for it to be concluded without clicking at all. Inspection of the data after the posttest showed that another three pupils had not done what was asked of them, clicking mainly on ‘foot’ and ‘cat’ or mainly on ‘boot’ and ‘cat’, instead of giving earnest answers. As a result, it was decided to discard the data from participants who had an average score of less than 25% correct or who scored less than 5% correct for one or more of the vowels. All in all, the data from thirteen participants were left out of the analysis; six from group L, two from group H and five from group C, leaving 22 trained listeners (9 from group L, 13 from group H) and 22 controls. In the analyses of the usable data, the answers that were ‘false’, because the participant was too late or did not answer (rt=-9999), were omitted, because it is unclear whether the participant truly perceived them incorrectly.

Results

To begin with, planned comparisons, by means of T-tests, were made between the pretest and posttest results of each group. Average scores of each individual participant (see Appendix 4) showed that most pupils in groups L and H, with the exception of two, had higher scores in the posttest than in the pretest, with a significant average improvement of 18.79% (SD=9.00, p<0.001) for pupils of group L and 21.17% (SD=11.81, p<0.001) for pupils of group H. In group C, 15 pupils out of 22 showed an increase in their average results and the other 7 showed a decrease. The average improvement of this group was 3.05% (SD=9.47, p=0.155), which is not statistically significant. The correct-response group averages of pre- and posttest for each vowel are shown in Tables 1 and 2.

group	FOOT	BOOT	CAT	NET	Total
L	50.21%	58.02%	65.37%	53.32%	56.89%
H	58.35%	67.56%	71.83%	52.23%	62.39%
C	49.80%	58.79%	66.34%	52.63%	56.95%

Table 1. Pretest results, group averages.

group	FOOT	BOOT	CAT	NET	Total
L	83.07%	86.02%	78.36%	55.24%	75.75%
H	84.91%	89.83%	86.87%	71.81%	83.36%
C	54.43%	61.29%	69.52%	54.59%	59.98%

Table 2. Posttest results, group averages.

Table 1 shows that, initially, the scores of the groups are close to each other, with the biggest difference between groups L and H of 5.5%. Table 2 shows that, in the posttest, the difference between groups L and C is 15.77%, and the difference between groups H and C is 23.38%. Clearly, the trained groups performed considerably better in the posttest than the control group. The difference between groups L and H, based on the average posttest results alone, is 7.61%. The average scores for each group and their improvement from pretest to posttest are illustrated in Figure 1.

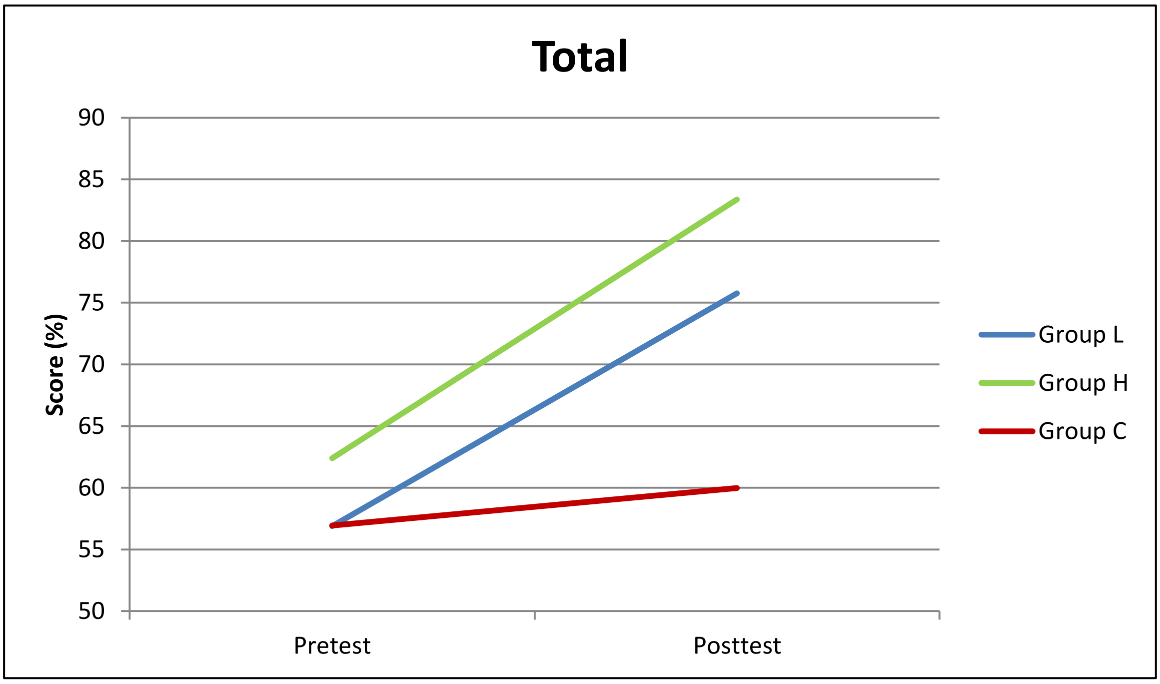


Figure 1. Group averages.

Furthermore, a General Linear Model analysis of variance was run with the effects of ‘group’ (L, H and C), ‘test’ (pre and post) and ‘vowel’ (‘ʊ’, ‘u:’, ‘æ’ and ‘e’) as fixed variables and ‘score’ (percentage of correct responses if rt>0) as a dependent variable. It showed that these three main effects were highly significant ($p<0.001$ for all). The most important effect was found in pretest and posttest scores [$F(1,328)=50.939$], followed by group scores [$F(2,328)=22.179$], and the least important of the main effects were the separate vowels [$F(3,328)=13.138$]. Also, the group*test interaction was highly significant [$F(2,328)=10.388$, $p<0.001$], which shows that the degree to which each group improved their scores from pretest to posttest, was significantly different in comparison with the other groups. The group*vowel interaction, on the other hand, showed no significant effect [$F(6,328)=1.211$, $p=0.300$], which means that none of the groups had a significantly better perception of any of the vowels compared to the other groups. The test*vowel interaction was marginally significant [$F(3,328)=2.448$, $p=0.064$]. Figures 2, 3, 4 and 5 illustrate the improvement for each vowel separately. As these charts show, the trained groups had more trouble perceiving ‘e’ correctly, compared to perceiving the other three vowels. The scores from group L deviate most, as the average improvement of this group resembles the average improvement of group C more than the average improvement of group H, with a difference of 17.26% between groups L and H for this vowel. For the other three vowels, the average improvement scores of groups L and H differ less from each other: 5.10% for ‘ʊ’, 5.33% for ‘u:’ and 2.75% for ‘æ’. This shows that the levels of motivation and exposure of the participants were relevant for the effectiveness of training in the perception of ‘e’, but not of ‘ʊ’, ‘u:’ and ‘æ’.

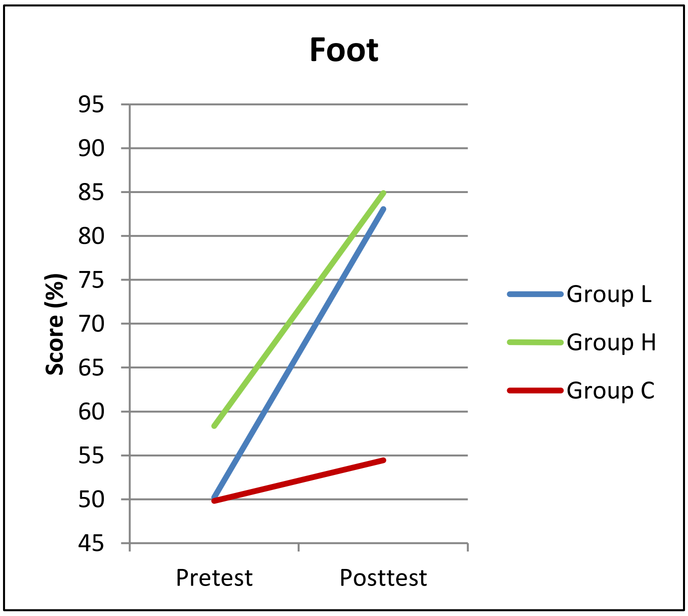


Figure 2. Group averages for ‘ʊ’.

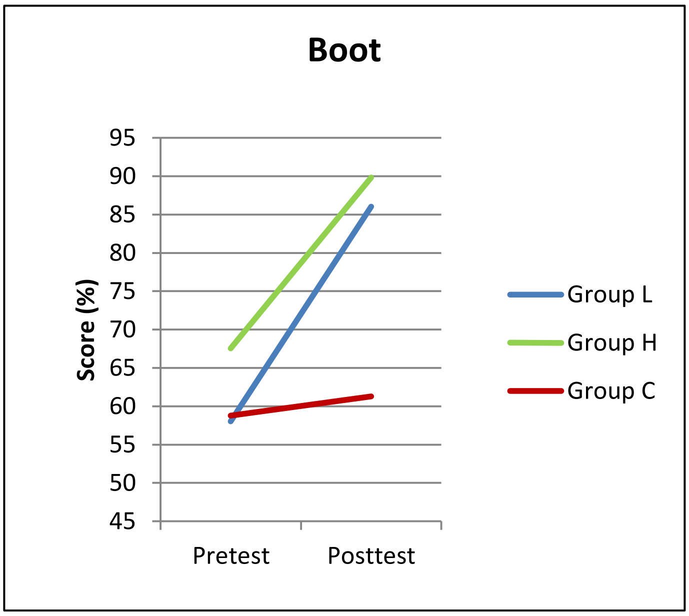


Figure 3. Group averages for ‘u:’.

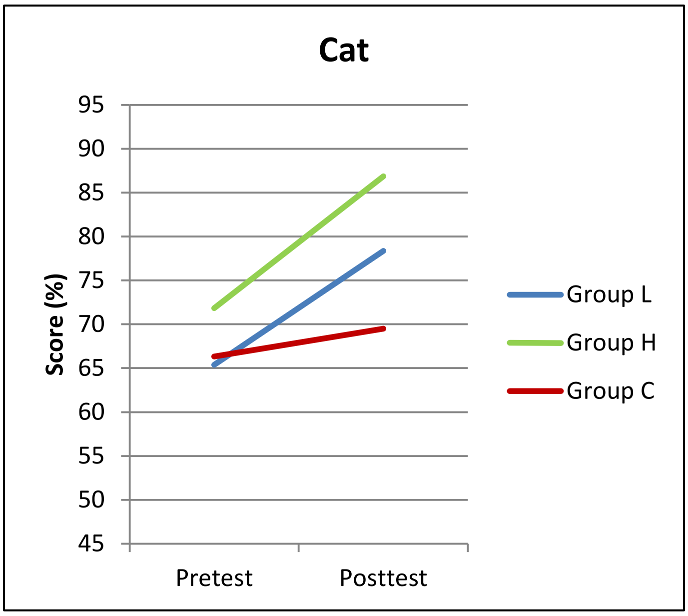


Figure 4. Group averages for ‘æ’.

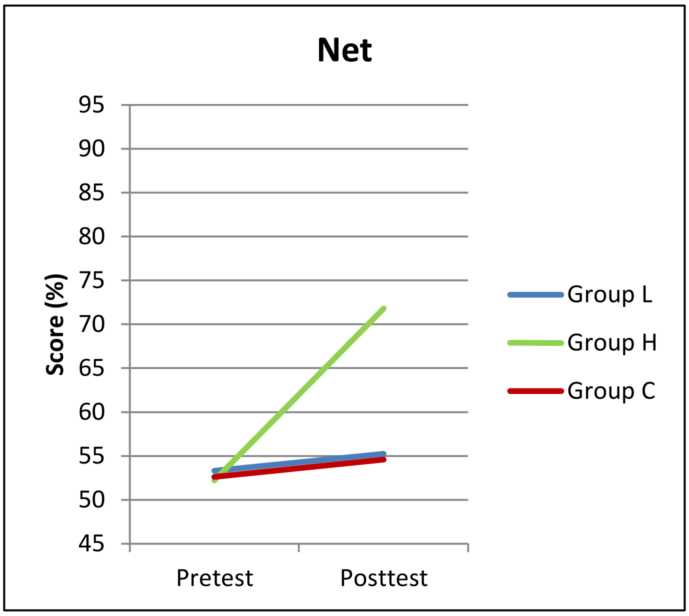


Figure 5. Group averages for ‘e’.

Lastly, a “Scheffe” Post Hoc test showed that there were significant differences in overall performance between groups L and C ($p=0.006$) and between groups H and C ($p<0.001$).The difference between groups L and H was only marginally significant ($p=0.063$).

Discussion and Conclusion

The experiment was designed to find out whether perception training in the first year of secondary school would be more effective for highly motivated pupils who have received a lot of exposure to the target language, compared to pupils with low motivation and little exposure. It was assumed that if both these groups significantly improved their perception of difficult English speech sounds after training, compared to their 'in-between' classmates who did not receive training, it would be likely that all of the pupils in a class would profit from such training, because in that case, the factors of motivation and exposure would be subordinate to the factor of training in the development of perception of L2 speech sounds.

Results showed that, the average posttest scores were higher than the average pretest scores for all of the groups, but the difference proved to be statistically significant only for the trained groups. This shows that training has a significant effect on perceptive proficiency and that familiarization with the test alone does not lead to significantly improved results. The percentages with which the trained groups had improved their scores were 18.79% ($p<0.001$) for group L and 21.17% ($p<0.001$) for group H, compared to 3.05% ($p=0.155$) for the control group.

Post hoc analyses showed that the average results, pretest and posttest together, only differed significantly between the control group and both of the trained groups. However, the fact that the average scores from group L were only marginally lower ($p=0.063$) than the average scores from group H, demonstrates that, for the participants, the levels of motivation and exposure were not relevant for their perceptive proficiency of L2 speech sounds in general.

The main effect of 'vowel' was significant, indicating that some vowels were easier to perceive than others. It appeared that the /ʊ-u:/ contrast was easier to learn for both of the trained groups than the /æ-e/ contrast. Calculations with the results of the separate vowels showed that the trained groups improved comparably on the perception of 'ʊ', 'u:' and 'æ', but that the improvement on the perception of 'e' was 17.26% higher for group H than for group L. A possible explanation for this is that, in terms of PAM's spatial proximity of place and manner of articulation (Best, 1995), 'e' is closer to Dutch /ɛ/ than 'æ' is. Likewise, 'e' is closer to its 'similar' counterpart than both 'ʊ' and 'u:' are to Dutch /u/. Therefore, the perception of 'e' is more difficult than the perception of the other vowels and this resulted in a difference in the effectiveness of the training. Only the group of pupils with the highest levels of motivation and exposure profited from training and improved their perceptive competence in the most difficult vowel, whereas the group with low levels of motivation and exposure had results that were similar to the results of the control group. Apparently, the factors of motivation and exposure do influence the effectiveness of training of the most difficult vowel. For future research, it might be interesting to find out if there are more English speech sounds that are more difficult to perceive correctly, even after training, for pupils with lower levels of motivation and exposure, and how, if at all, improved perception of these most difficult sounds can be reached for all of the pupils in a class.

Despite the findings for 'e', the marginally significant test*vowel interaction showed that, even though there was some difference, it is not safe to say that the improvement of the perception of one or more of the four vowels differed significantly from the others. Hence, the differences in improvement of the separate vowels did not distort the results of the overall improvement of the three groups taken together. Moreover, the absence of significance in the group*vowel interaction confirmed that the average scores for each vowel did not significantly deviate for any of the groups. The lack of significance indicates that the difference in improvement between groups L and H for 'e' does not carry implications for the effectiveness of training on the whole. This implies that the variables of motivation and exposure, in the end, do not influence the effectiveness of perception training to such a significant degree as to render it generally ineffective for some of the pupils. Accordingly, we can state that training for Dutch pupils in the first year of secondary school is expected to be beneficial for all of the pupils in a class. For that reason, this research provides evidence to support Van den Doel's recommendation to implement guided training in the standard curriculum for English in Dutch secondary schools.

It must be noted that 13 out of 57 pupils did not complete the test(s) seriously. Eight of them had lower than average scores on motivation in the survey. Reasons why they did not cooperate could be that the test was too boring, which was a complaint from many of the participants, or that these 13 pupils were not interested in cooperating or that they simply did not understand what they were supposed to do. In a normal classroom situation this can also occur, but a teacher would have the ability to explain things more thoroughly and could try to make speech perception more interesting, provided perception training were given in a different form. In earlier research by Krooshof and Andringa (2010), enquiries were made among teachers on how they envisioned a course in perception and production of English speech sounds for pupils in the first year of Dutch secondary schools. These findings, combined with a literature study, led to the recommendations to offer many different types of exercises with authentic audio samples, preferably from 'role model' speakers.

Since none of these features were incorporated in this experiment, it would be interesting to research how pupils would respond to tests and training sessions that were formed in accordance with the recommendations, i.e. towards a natural and preferred classroom situation, and if the effectiveness of such training sessions would be comparable to the findings of this thesis.

Works Cited

Aliaga-García, Christina and Joan C. Mora. (2009) “Assessing the Effects of Phonetic Training on L2 Sound Perception and Production.” Michael A. Watkins, Andreia S. Rauber and Barbara O. Baptista (eds.), *Recent Research in Second Language Phonetics/Phonology: Perception and Production.* Newcastle upon Tyne: Cambridge Scholars Publishing. 2-31.

Audacity team. (2012) “Audacity” version 2.0.0. (Unicode) (computer software). Available from <http://audacity.sourceforge.net/>.

Best, Catherine T. (1995) “A Direct Realist View of Cross-Language Speech Perception” Winifred Strange (ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research.* Timonium: York Press. 171-206.

Best, Catherine T. and Michael D. Tyler. (2007) “Nonnative and Second-Language Speech Perception: Commonalities and Complementarities.” Ocke-Schwen Bohn and Murray J. Munro (eds.) *Language Experience in Second Language Speech Learning: In Honor of James Emil Flege.* Amsterdam: John Benjamins Publishing Company. 13-34.

Birdsong, David. (2007) “Nativelike Pronunciation among Late Learners of French as a Second Language.” Ocke-Schwen Bohn and Murray J. Munro (eds.) *Language Experience in Second Language Speech Learning: In Honor of James Emil Flege.* Amsterdam: John Benjamins Publishing Company. 99-116.

Boersma, Paul and David Weenink. (2012) “Praat: Doing Phonetics by Computer” version 5.3.12 (computer software). Available from <www.praat.org>.

Bongaerts, T. (1999) “Ultimate attainment in L2 pronunciation: the case of very advanced late L2 learners.” D. Birdsong (ed.), *Second Language Acquisition and the Critical Period Hypothesis*. London: Lawrence Erlbaum. 133-159.

Bradlow, Ann R. et al. (1997) “Training Japanese Listeners to Identify English /r/ and /l/: IV. Some Effects of Perceptual Learning on Speech Production.” *Journal of the Acoustical Society of America* 101: 2299-2310.

Collins, B. en Inger M. Mees. (2003) *The Phonetics of English and Dutch*. 5th ed. Leiden: Brill.

Dörnyei, Zoltán. (1994) “Motivation and Motivating in the Foreign Language Classroom.” *The Modern Language Journal* 78.3: 273-284.

Ellis, Rod. (2008) *The Study of Second Language Acquisition.* 2nd ed. Oxford: Oxford University Press.

Flege, J.E. (1987) “The production of "new" and "similar" phones in a foreign language: Evidence for the effect of equivalence classification” *Journal of Phonetics* 15: 47-65.

-- (1995) “Second Language Speech Learning: Theory, Findings and Problems.” Winifred Strange (ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research.* Timonium: York Press. 233-277.

-- (1997) “English Vowel Production by Dutch Talkers: More Evidence for the ‘Similar’ vs ‘New’ Distinction.” Allan James and Jonathan Leather (eds.) *Second Language Speech: Structure and Process*. Berlin: Mouton de Gruyter. 11-52.

Gussenhoven, C. and A. Broeders. (1997) *English Pronunciation for Student Teachers.* 2nd ed. Groningen: Wolters-Noordhoff.

Harnad, Stevan. (1987) *Categorical Perception: the Groundwork of Cognition.* Cambridge: CUP.

Heeren, W.F.L. and M.E.H. Schouten. (2008) "Perceptual Development of Phoneme Contrasts: How Sensitivity Changes along Acoustic Dimensions that Contrast Phoneme Categories." *Journal of the Acoustical Society of America* 124.4: 2291-2302.

Jenkins, Jennifer. (2007) *English as a Lingua Franca: Attitude and Identity.* Oxford: Oxford University Press.

Jusczyk, P.W. (1992) "Developing phonological categories from the speech signal." C.A. Ferguson, L. Menn, & C. Stoel-Gammon (eds.), *Phonological Development: Models, Research, Implications*. Maryland: Timonium. 17-64.

Kager, René. Class lecture on Perception and Production in L2 Acquisition. Utrecht University. 26 Nov. 2009.

Krooshof, Kim and Hanneke Andringa. (2011) "Ai Ken Spiek Inglisj!" Praktijkgericht Onderzoek, Centrum voor Onderwijs en Leren – Universiteit Utrecht. 14 juni.

Lantaff, Robert-Jan, Marjolein Leppink en Michiel Verspaandonk. (2011) *Mai tietsjur ses ai hef toe sount Inglisj!: Hoe belangrijk is een native-like Engels uitspraak?* Presentation of applied research, COL-UU. 23 May.

Lombardi, Linda (1995)"Laryngeal Neutralization and Syllable Wellformedness." *Natural Language and Linguistic Theory*, 13.1: 39-74.

Rochet, Berard L. (1995) "Perception and Production of Second-Language Speech Sounds by Adults.' Winifred Strange (ed.), *Speech Perception and Linguistic Experience: Issues in Cross-Language Research.* Timonium: York Press. 379-410.

Saville-Troike, Muriel. (2006) *Introducing Second Language Acquisition.* Cambridge: CUP.

Van den Doel, W.Z. (2006) *How Friendly are the Natives?: An Evaluation of Native-speaker Judgements of Foreign-accented British and American English.* Utrecht: LOT

Van Hattum, Johan. (2010) "Yes, uh, I wanna zenk Collin, voor ze greet welkum" Article for the occasion of the symposium "Uitgesproken Engels".

Van Bennekum, Annemiek and Hanneke Andringa. (2010) "Perception of English Voiced Plosive Word Endings: An Experiment with Dutch Learners." Unpublished paper.

Veenker, T.J.G. (2012) "The Zep Experiment Control Application" version 0.18 (computer software) Utrecht Institute of Linguistics OTS, Utrecht University. Available from <http://www.hum.uu.nl/uilots/lab/zep/>.

Appendices

Appendix 1

Geboortedatum: j/m

Code (eerste drie letters voornaam vader + eerste drie letters voornaam moeder):

Deze taal/talen spreek ik thuis:

Ik leer Engels sinds:

	helemaal oneens	oneens	neutraal	eens	helmaal eens
Ik vind het leuk om een andere taal te leren.	o	o	o	o	o
Ik vind andere talen interessant.	o	o	o	o	o
Ik vind de Engelse taal leuk.	o	o	o	o	o
Ik zou Engels graag goed willen beheersen.	o	o	o	o	o
Ik ben bereid veel moeite te doen voor het leren van Engels.	o	o	o	o	o
Ik vind het leuk om Engels te kunnen praten met mensen die een andere taal spreken.	o	o	o	o	o
Ik vind het belangrijk om in het Engels met anderstaligen te kunnen spreken.	o	o	o	o	o
Ik wil graag bij een internationale, engelstalige gemeenschap horen.	o	o	o	o	o
Ik vind het schoolvak Engels leuk.	o	o	o	o	o
Ik vind mijn docent Engels aardig.	o	o	o	o	o
De boeken en andere materialen die we bij Engels gebruiken maken het vak leuker.	o	o	o	o	o
Ik doe met plezier mee in de lessen Engels.	o	o	o	o	o
Ik vind het geen probleem om buiten schooltijd voor het schoolvak Engels bezig te zijn.	o	o	o	o	o
Het is handig om Engels goed te beheersen.	o	o	o	o	o
Ik vind het belangrijk om Engels goed te beheersen voor mijn toekomst.	o	o	o	o	o

	helemaal oneens	oneens	neutraal	eens	helmaal eens
Ik haal graag goede cijfers voor Engels.	o	o	o	o	o
Ik vind het belangrijk om geen onvoldoendes te halen voor Engels.	o	o	o	o	o
Ik ben tevreden over mijn leerprestaties bij Engels.	o	o	o	o	o
Ik denk dat mijn docent tevreden is over mijn leerprestaties bij Engels.	o	o	o	o	o
Thuis is men tevreden over mijn leerprestaties bij Engels.	o	o	o	o	o
Vergeleken met mijn klasgenoten doe ik het best goed bij Engels.	o	o	o	o	o
Als ik complimenten krijg over mijn Engels, presteer ik beter.	o	o	o	o	o
Als ik slecht heb gepresteerd, komt dat meestal doordat ik mijn best niet deed.	o	o	o	o	o
Als ik goed heb gepresteerd, dan was de toets toevallig makkelijk/de normering soepel.	o	o	o	o	o

Voor het volgende onderdeel is het de bedoeling om het gemiddelde aantal uren per week in te vullen dat je Engels **hoort**, **gesproken** door een moedertaalspreker. Sprekers die Engels op latere leeftijd hebben geleerd tellen dus niet mee en geschreven teksten ook niet.

	0 - 5 uur	5 - 10 uur	10 - 15 uur	meer dan 15 uur
Via televisie:	o	o	o	o
Via radio:	o	o	o	o
Via internet:	o	o	o	o
Via games:	o	o	o	o
Via muziek:	o	o	o	o
Via films:	o	o	o	o
Via contact met mensen in mijn sociale omgeving:	o	o	o	o

Nog anders, namelijk...:

Appendix 2

Stimuli used in the identification task:

/pʊt/	/pu:t/	/pæt/	/pet/
/bʊt/	/bu:t/	/bæt/	/bet/
/tʊt/	/tu:t/	/tæt/	/tet/
/dʊt/	/du:t/	/dæt/	/det/
/kʊt/	/ku:t/	/kæt/	/ket/
/gʊt/	/gu:t/	/gæt/	/get/
/ʧʊt/	/ʧu:t/	/ʧæt/	/ʧet/
/ʤʊt/	/ʤu:t/	/ʤæt/	/ʤet/
/fʊt/	/fu:t/	/fæt/	/fet/
/vʊt/	/vu:t/	/væt/	/vet/
/θʊt/	/θu:t/	/θæt/	/θet/
/ðʊt/	/ðu:t/	/ðæt/	/ðet/
/sʊt/	/su:t/	/sæt/	/set/
/zʊt/	/zu:t/	/zæt/	/zet/
/ʃʊt/	/ʃu:t/	/ʃæt/	/ʃet/
/hʊt/	/hu:t/	/hæt/	/het/
/mʊt/	/mu:t/	/mæt/	/met/
/nʊt/	/nu:t/	/næt/	/net/
/lʊt/	/lu:t/	/læt/	/let/
/rʊt/	/ru:t/	/ræt/	/ret/
/wʊt/	/wu:t/	/wæt/	/wet/
/jʊt/	/ju:t/	/jæt/	/jet/

Appendix 3a

Introduction to the test

In het Engels komen veel dezelfde **klanken**, klinkers en medeklinkers, voor als in het Nederlands, maar ook een aantal nieuwe. In dit experiment houden we ons steeds bezig met twee sets Engelse klinkers, waarvoor er in het Nederlands maar een bestaat.

De Engelse woorden '**soot**', =roet, en '**suit**', =pak, lijken erg op elkaar. **Alleen de klinkers zijn anders**, maar ze lijken allebei op de Nederlandse 'oe' zoals in het woord 'zoet'.

Naast de oe-achtige klinkers, richten we ons op e-achtige klinkers. Deze maken het verschil tussen de woorden '**bat**', =vleermuis, en '**bet**', =weddenschap, en ze lijken op de Nederlandse 'e' zoals in 'zet'.

Om te weten welke van de Engelse woorden bedoeld wordt in **gesproken** taal, moet je **goed luisteren** naar de klinker.

Met schrijftaal is het vaak makkelijker, omdat je het dan aan de spelling kan zien.

Om die reden werken we in dit experiment alleen met **geluidsfragmentjes** en **plaatjes** om je te dwingen goed te **luisteren** naar de klinkers.

Appendix 3b

Test instructions

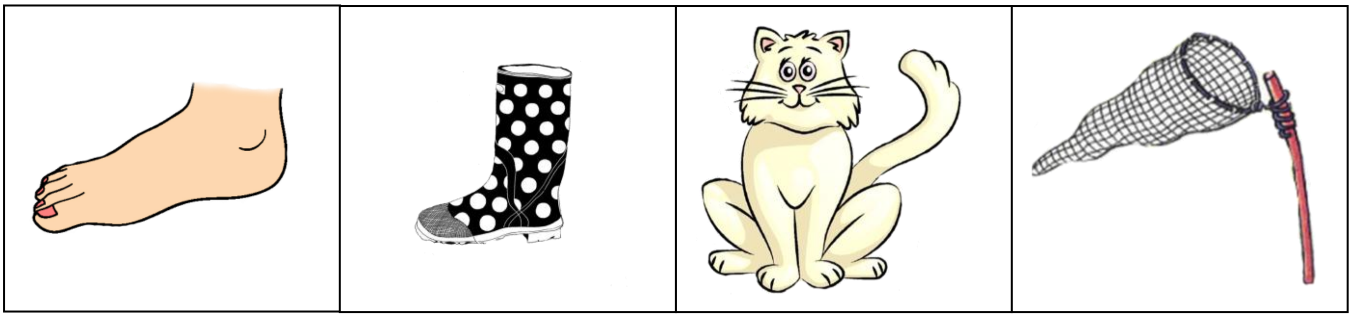
Je gaat straks luisteren naar 76 verschillende **bestaande en niet-bestaande woorden**. Daarbij moet je vooral **luisteren naar de klinker** in elk woord. De medeklinkers zijn niet belangrijk.

Ieder woord **rijmt** op een van de vier Engelse woorden die de vertalingen zijn van ‘voet’, ‘laars’, ‘kat’ en ‘net’.

Bedenk steeds waar het woord dat je hoort op rijmt, maar doe het snel! Je hebt steeds twee seconden de tijd om op het bijbehorende plaatje te klikken.

Alle woorden komen 5 keer voorbij, verdeeld over 4 blokken, in willekeurige volgorde.

Luister nu naar de rijmwoorden terwijl je kijkt naar de plaatjes[1] die erbij horen. Let op de klinker!



Na de pauzes tussendoor hoor je de rijmwoorden nog een keer.

Nu kun je een paar keer oefenen waarbij je ziet of je het goed doet.

Luister naar de klank en klik op het bijbehorende plaatje.

[1] Sources of the pictures: ‘foot’ http://www.carmenlu.com/first/vocabulary/health1/body1_1/body1_1.htm; ‘boot’ http://www.etsy.com/listing/49404539/whimsical-drawing-my-favorite-wellie; ‘cat’ http://tlc.howstuffworks.com/family/how-to-draw-a-cat.htm; ‘net’ http://natuur.ariena.com/onderzoekkoolwitje.php

Appendix 4

Group	ParticipantID	Pre/post	Total	FOOT	BOOT	CAT	NET
L	Basdia	posttest	97,5741	93,4783	98,9362	100	97,8261
L	Basdia	pretest	69,3452	69,7368	70,1149	77,6471	60,2273
L	Edwolg	posttest	79,5756	96,8085	98,9362	91,4894	31,5789
L	Edwolg	pretest	54,878	42,2535	70,2381	63,0952	42,6966
L	Eefria	posttest	83,6111	96,7033	98,9474	70,9302	65,9091
L	Eefria	pretest	53,6741	53,7313	66,2338	64,557	33,3333
L	Gerjol	posttest	69,8895	83,908	74,4681	71,7391	49,4382
L	Gerjol	Pretest	50,4673	42,8571	56	48,8372	54,2169
L	Haysig	posttest	64,4118	61,9048	76,6667	73,8095	43,9024
L	Haysig	pretest	53,8012	54,7619	33,7209	77,2727	48,8095
L	Jondeb	posttest	69,837	83,3333	79,5699	61,7021	54,9451
L	Jondeb	pretest	51,2968	48,7805	46,4286	64,8936	43,6782
L	Kennur	posttest	87,8628	93,6842	93,6842	97,8723	66,3158
L	Kennur	pretest	67,1429	57,1429	60,9195	85,3933	64,4444
L	Micsas	posttest	48,1383	43,617	53,1915	45,2632	50,5376
L	Micsas	pretest	49,5979	34,7826	56,9892	33,6842	73,1183
L	Ottang	posttest	79,9472	92,5532	98,9474	91,5789	36,8421
L	Ottang	pretest	61,4958	50	61,7021	74,4681	58,0645

Group	ParticipantID	Pre/post	Total	FOOT	BOOT	CAT	NET
H	Ahmhab	posttest	88,9807	95,3488	98,913	93,617	68,1319
H	Ahmhab	pretest	76,2667	77,1739	95,6989	70,5263	62,1053
H	Chixua	posttest	98,4211	96,8421	96,8421	100	100
H	Chixua	pretest	67,4157	62,0253	65,9341	83,871	56,9892
H	Colin	posttest	97,3684	95,7895	98,9474	97,8947	96,8421
H	Colin	pretest	55,5556	45,3488	68,4783	73,0337	35,4839
H	Housfi	posttest	99,4737	98,9474	100	100	98,9474
H	Housfi	pretest	76,3473	75,3086	60,7143	88,75	80,8989
H	Leogod	posttest	77,8947	95,7895	100	70,5263	45,2632
H	Leogod	pretest	50	50	60	59,5745	30,5263
H	Mehraz	posttest	97,6316	100	98,9474	97,8947	93,6842
H	Mehraz	pretest	65,9942	84,3373	61,1111	58,8235	60,6742
H	Mohmal	posttest	69,3122	46,3158	94,6809	88,2979	48,4211
H	Mohmal	pretest	57,971	46,988	67,0588	85,8824	33,6957
H	Mohrhi	posttest	56,9482	53,8462	35,4839	80	59,1398
H	Mohrhi	pretest	43,75	10,4478	58,9041	49,0909	54,5455
H	Omanar	posttest	84,6154	95,7447	97,8947	82,9787	61,7021
H	Omanar	pretest	65,4696	45,4545	91,2088	71,4286	53,2609
H	Raymae	posttest	89,418	97,8947	100	100	59,1398
H	Raymae	pretest	76,5896	88,0435	72,1519	75,2809	69,7674

H	Remjul	posttest	77,6316	95,7895	93,6842	72,6316	48,4211
H	Remjul	pretest	51,5759	48,8636	56,9767	62,9213	37,2093
H	Robirm	posttest	96,3158	93,6842	95,7895	97,8947	97,8947
H	Robirm	pretest	66,1808	61,3636	65,4321	73,8095	64,4444
H	Tonpel	posttest	48,5333	36,5591	55,7895	46,8085	54,8387
H	Tonpel	pretest	54,2169	51,8519	50	74,3902	41,3793
Group	**ParticipantID**	**Pre/post**	**Total**	**FOOT**	**BOOT**	**CAT**	**NET**
C	Antmar	posttest	57,4124	48,3516	63,4409	75,5319	41,9355
C	Antmar	pretest	56,2682	61,4458	58,5366	62,069	43,956
C	Arjrei	posttest	68,5294	67,0886	55,2632	91,1111	58,9474
C	Arjrei	pretest	66,7647	66,6667	54,023	78,1609	68,1818
C	Bermee	posttest	88,0109	84,0909	96,7742	86,0215	84,9462
C	Bermee	pretest	72,1264	70,5882	81,6092	70,7865	65,5172
C	Erigea	posttest	58,445	63,4409	61,0526	65,9574	42,8571
C	Erigea	pretest	55,0432	48,8636	61,9048	62,9213	46,5116
C	Erimir	posttest	38,9972	21,8391	59,0909	53,7634	20,8791
C	Erimir	pretest	47,2393	25,3333	61,1765	49,3976	50,6024
C	Framar	posttest	70,4871	45,977	90,5882	80,8989	64,7727
C	Framar	pretest	61,7816	41,8605	68,9655	80,6818	55,1724
C	Hemfau	posttest	68,7117	69,5122	56,25	81,25	67,8571
C	Hemfau	pretest	58,7248	62,2951	53,2468	67,0455	51,3889
C	Herlin	posttest	52,0349	25,2874	76,0563	69,8925	40,8602
C	Herlin	pretest	40,9091	17,3333	53,9474	53,3333	39,0244
C	Lucauk	posttest	80,7065	94,6237	97,8261	68,4783	61,5385
C	Lucauk	pretest	71,5068	68,6047	88,0435	78,7234	50,5376
C	Manans	posttest	69,4006	77,027	87,1795	84,8837	27,8481
C	Manans	pretest	51,5254	55,0725	58,4416	75	19,4805
C	Markie	posttest	33,3333	39,7727	24,1758	37,7778	31,9149
C	Markie	pretest	37,7778	40,6593	34,8315	50	25,5556
C	Mimfat	posttest	29,6636	30,4878	25	45,679	17,5
C	Mimfat	pretest	44,9231	39,5062	33,3333	64,557	42,5287
C	Mohlay	posttest	49,435	52,9412	31,3953	33,3333	78,4946
C	Mohlay	pretest	50,1458	39,4737	48,2759	35,9551	74,7253
C	Monfat	posttest	56,6766	68,6747	47,7778	85,7143	28,7356
C	Monfat	pretest	56,5934	63,3333	60,2151	70,6522	31,4607
C	Patsan	posttest	58,7258	62,6506	54,9451	67,3684	50
C	Patsan	pretest	54,4236	53,8462	59,7826	60	44,2105
C	Rudbri	posttest	57,9412	56,6265	47,7273	41,6667	85,8824
C	Rudbri	pretest	50,6369	46,4789	40	59,2105	57,3171
C	Saisam	posttest	77,5758	52,9412	64,557	97,8495	86,6667
C	Saisam	pretest	61,1732	43,8202	61,1111	79,3103	60,8696
C	Tarbet	posttest	71,8157	54,9451	56,5217	91,3043	84,0426
C	Tarbet	pretest	61,5607	53,4091	41,4634	75,2941	74,7253

C	Tursen	posttest	34,8348	32,0988	30,7692	42,6966	32,9412
C	Tursen	pretest	54,6816	46,5517	44,4444	70,8333	53,012
C	Wildia	posttest	80,4878	72,5275	75,5556	89,4737	83,871
C	Wildia	pretest	76,3158	73,4177	65,8537	78,8889	85,7143
C	Yilemi	posttest	66,6667	41,791	87,6543	80	58,9041
C	Yilemi	pretest	67,3228	38,3333	78,75	73,4694	75,3846
C	Zenann	posttest	47,9412	31,0345	58,5366	61,6279	41,1765
C	Zenann	pretest	53,2895	30,6667	79,7101	64,9351	40,9639