Dutch L2 Perception of English Fricatives:

The Nature of L1 Transfer and

the Influence of Regional Variation

MA thesis Taal en Ontwikkeling, Universiteit Utrecht

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Preface

Since we are both interested in the sounds of the Dutch and English language and equally so in the phenomenon of second language acquisition, and, moreover, the last time we coproduced a thesis the result was very satisfying, the decision to work together again on the current thesis was virtually predictable. This thesis reports on an investigation into the effects of Dutch regional variation on the second language acquisition of English sounds. Second language acquisition is a major part of the linguistic Master programme "Taal en Ontwikkeling", at Utrecht University. The choice to investigate the languages Dutch and English (Dutch as the first language and English as the second) was an easy one, since Dutch is our first language and English is the language we were trained in during our Bachelor programme of "Engelse Taal en Cultuur". Our interest in the regional variation in Dutch is due to our backgrounds, one of us originating from the south of the Netherlands (Inge), and one from the western Randstad (Annina). Finally, our interest in the acquisition of phonology and phonemes in particular originated from the master course 'Perception and production in L2 acquisition', taught by René Kager, who later became our tutor for this thesis. All of these interests underlie this thesis.

In the process of doing research for the thesis, setting up the experiment and writing the actual thesis as it is now, we have learned many things. We learned how to manipulate speech sounds and set up a phonological experiment with the program *Praat,* and how to do statistical analysis with *SPSS*, with which we did not have much prior experience. During this learning process we have received help and advice from many people. In addition to appreciating each other for our teamwork, we would like to specifically mention a number of people. First, we want to thank René Kager, our tutor, who was there during the whole process, and Wim Zonneveld, our Bachelor thesis supervisor who now acted as our second

reader. Furthermore, we want to thank Hans van de Velde for his advice and information on the process of devoicing of fricatives in Dutch, Bert Schouten for his advice on how to record stimuli for a discrimination task and how to manipulate the phonemes in the speech samples, and Simon Cook for recording the actual stimuli. Very important to us were the two high schools (Dr. Aletta Jacobs College in Groningen and Stedelijke Humaniora in Flemish Limburg), their students and teachers, and also the native speakers of English, who were willing to participate in our experiment. Without them, conducting this experiment would not have been possible. We want to thank Frits van Brenk and Anke van Bussel, who gave us some of their time in helping us to learn how to work with *SPSS*, and Kim Peeters who helped us to put data in *Excel*. Finally, we want to express our gratitude to Willem Loo and Tineke Smit, for helping us to find participants and to get us to them.

Inge Loo and Annina Smit, August 2008.

1. Introduction

Every language has its own inventory of phonemes. Between languages, some of these phonemes might be similar to each other, but others might differ or have no counterpart in the other language at all. For example, a Dutch learner of English often has difficulties with the pronunciation of the English 'th' in a word such as 'that'. Or if a language does have a phoneme (contrast) similar to a phoneme (contrast) in another language, this might occur in an unfamiliar position in the other language. An English word such as 'have' is often pronounced with an /f/ instead of a /v/ by a native speaker of Dutch, who is not used to voiced obstruents in word-final position (due to the well known process of final devoicing of obstruents). It is not only the pronunciation (production) of sounds, however, that causes difficulties for second language (L2) learners. The perception of the phonemes of another language can do the same. Second language learners are often unable to hear the difference between two phonemes that are not present in their own language, nor recognise a familiar phoneme when heard in an unfamiliar position. For example, Dutch learners are often unable to hear the difference between the unfamiliar English vowels /ɛ/ and /æ/ in the words 'bed' and 'bad', or the difference between the familiar English consonants /s/ and /z/ in the unfamiliar final position in the words 'bus' and 'buzz'.Several studies (Broersma 2005; Cutler et al. 2004) have reported difficulties for second language learners in perceiving certain phoneme contrasts. Dutch and English are languages that contrast voiced and voiceless fricatives (and also other obstruents) such as /s-z/ and /v-f/. Unlike English, though, Dutch allows only voiceless fricatives in word-final position whereas English allows both voiced and voiceless fricatives there. Being unfamiliar with the contrast in final position, Dutch second language learners (L2 learners) of English can be expected to have difficulties in perceiving the difference between voiced and voiceless in this position.

In the present study we will focus on perception in second language acquisition (SLA), more specifically, Dutch L2 learners' perception of English. In the process of learning an L2, the first language (L1), and possibly variation within the L1, can influence the L2 acquisition of accurate perception. We will investigate the role of the L1, Dutch, in the acquisition of phonemes and features of the L2, English, from this perception perspective. In doing so, we will focus on the role of Dutch regional variation in this process. In the North of the Netherlands, the contrast between certain voiced and voiceless fricatives, for example the /f/ and /v/, is disappearing, whereas in the Dutch speaking part of Belgium, this contrast is still maintained in some specific positions. Since in English the voicing contrast in fricatives (and other obstruents) is prominently present, L2 learners of English from the North of the Netherlands may be expected to have more difficulties in L2 perception concerning the discrimination between the voicing contrast than L2 learners from the south.

The hypothesized difficulties of Dutch L2 learners of English can be phrased in terms of the concept of L1 transfer, which will be the actual main focus of this paper. L1 transfer implies that the L2 learner's knowledge of the L1 interferes with (and shows up in) the acquisition of the L2. In this thesis, several questions will be asked concerning L1 transfer. The first question of this thesis concerns the variation in the Dutch language just alluded to. Dutch is spoken not only in the Netherlands, but also in a part of Belgium[1]. A variety of dialects is spoken in the Netherlands and Belgium, and diachronic processes of language- and dialect change are taking place in the spoken language. This causes variation in the inventory of phonemes and the way they are realised across the Dutch speaking regions. This study focuses on one process in particular, namely the 'devoicing' of (initial) fricatives, implying that even in initial position the contrast between voiced and voiceless fricatives is disappearing. This process is evident especially in the northern and western parts of the

[1] Dutch is also spoken in several other parts of the world, but this is not of any importance in this paper.

Netherlands. In Flanders the devoicing process is also visible, but much less so than in the Netherlands (van de Velde, Gerritsen & van Hout, 1995). The question can be interestingly raised whether these regional differences of the first language have an influence on the perception of the second language, in this case English. A difference between English and Dutch is the occurrence of voiced fricatives in word-final position in English but not in Dutch, being less familiar with the voicing contrast in general, certainly in final but presumably also growingly so in initial position, the speakers of northern Dutch can be expected to have more difficulties in perceiving the differences between English (fricative) phonemes than the speakers of southern Dutch.

The second question that can be asked in this thesis concerns the nature of the L1 transfer: How does transfer work? In English, the voicing contrast can be found in all fricatives and in every position. This is a distinctive quality of the feature [voice]. The question arises whether this feature plays a part in the acquisition of a second language. Considering that the Dutch fricatives are also distinguished in terms of [voice], the possibility exists that L2 learners transfer this to their perception of the L2. This can be tested by focusing on the /f-v/ and /s-z/ contrasts, but the investigation becomes more interesting when an unfamiliar contrast, such as the English /θ-ð/, is added. Assuming that the southern speakers of Dutch are more familiar with the voicing contrast of fricatives than the northern speakers of Dutch, and assuming that they will perform better on the identification of voice in the contrasts /f/-/v/ and /s/-/z/, two predictions are possible. If transfer is phoneme-bound, the southern and northern group will perform equally poorly on the unfamiliar /θ/-/ð/ contrast. But if the transfer is feature-bound, the familiarity with the contrast of voiced-voiceless predicts that the southern speakers of Dutch will perform better on the unfamiliar English contrast than the northern speakers.

By conducting this investigation we hope to learn more about the nature of L1 transfer in SLA and the effects of regional variation in the L1 on L1 transfer. We formulated four hypotheses in order to do this, which will be elaborately discussed in Chapter 3. In short, these hypotheses are the following. An L1 transfer effect will be visible in the perception of fricatives by Dutch learners of English and regional differences will affect the L2 perception of the participants. The question is asked whether the nature of L1 transfer is phoneme-bound or feature-bound. Finally, the results will show confusion with other phonemes by all groups. In order to test these hypotheses, a perception experiment was constructed in *Praat* and thirty native speakers of Dutch and five native speakers of English will participate in this experiment. In the experiment participants will have to choose which of the aforementioned fricatives they hear (these six fricatives are represented by six buttons on the computer screen to be clicked on). However, before discussing the actual study and the hypotheses in chapter 3, some theoretical background will be given in the next chapter (Chapter 2). In this chapter, the topics of importance for this study will be exemplified. First, the topic of L1 transfer will be reviewed, including previous studies on the subject. The possible effects of transfer will be discussed in a subsection concerning adult versus infant perception. Second, the phonology of English and Dutch will be described and the variation in the Dutch language, caused by the process of the devoicing of fricatives, will be discussed. Third, perception of the six specific fricatives for this study will be discussed, including Dutch native perception of Dutch and English native perception of English, and non-native perception. In Chapter 3, the hypotheses and predictions will be discussed, followed by the method of testing in chapter 4 and, finally, the results and discussion in chapter 5 and 6. A general conclusion will be drawn in chapter 7, in which the previously mentioned aims will be related to our findings.

2. Theoretical Background

2.1 The interaction between L1 and L2

In this paragraph first language (L1) in interaction with second language acquisition (SLA) will be discussed. The notion of L1 transfer will be explained, including a review of certain aspects of L1 transfer and some examples, points of view of some of the authors that have written on the subject and a brief section on the problem surrounding the term 'L1 transfer'. Native speakers by definition know their mother tongue (L1) perfectly. In acquiring a second language (L2), it is well known that the knowledge of the L1 can influence the process of acquiring the second language. This is commonly referred to as L1 transfer. In this chapter we will first discuss several papers on the existence and nature of L1 transfer; after this, we turn to a number of papers which concern a specific example of L1 transfer.

Gass and Selinker (1992) do not doubt that L1 transfer exists and must be considered when looking at the process of SLA. More specifically, they claim that "it is indeed possible and not incompatible to view second language acquisition as both (1) a process of hypothesis testing in which learners create bodies of knowledge from the second language data they have available to them, while at the same time viewing it as (2) a process of utilizing first language knowledge as well as knowledge of other languages known to learners in the creation of a learner language"(6). Transfer depends on both the first language of the language learner and the language to be learned; there is a correlation between the two. Broselow (1992), in her study, claims that the different epenthesis errors of Egyptian Arabic and Iraqi Arabic learners "provided a clear case where learners of different native language backgrounds exhibited different error patterns consistent with a difference in their native language rules" (Broselow, 84). Another clear example of transfer being dependent on the specific L1 is the difficulty for a Japanese learner of English to learn the contrast between the English phonemes /l/ and /r/.

The reason for this is that in Japanese, there is only one liquid, about which Japanese L2ers of English have to learn that this one liquid phoneme cannot be used for both /r/ and /l/ in English. In Sheldon & Strange (1982), perceptual difficulties for Japanese learners of English in perceiving these English phonemes were found. In their study a perception test is done by six Japanese students at the University of Minnesota. The test consisted of test words in which the liquids were inserted in different positions of the word and in combination with several other consonants, forming clusters. These words formed minimal pairs and the participants had to choose which word they heard. For example, the word ' arrive' is presented auditorily and the participant has to choose whether he/she hears 'arrive' or 'alive'. Results showed that Japanese learners of English have significant difficulties with perceiving the differences between the two liquids (Sheldon & Strange, 1982). Compared to a Japanese learner, a Dutch learner has less or no difficulty with learning the contrast between the English /l/ and /r/, since native speakers of Dutch have both phonemes in their language. Considering the above, if certain errors in the L2 can be so clearly attributed to certain aspects of the L1, it is nearly impossible not to ascribe the errors to an L1 transfer effect.

L1 transfer has also been discussed in relation to its 'name' and definition. Corder (1992) states that both the term 'L1 transfer' and attempting to define this term, are problematic issues. Instead, he uses the term 'role for the mother tongue in language learning' and rejects the terms 'transfer' and 'interference'. One of the reasons for this is that phenomena such as "avoidance of the use of certain features of the target language"(Corder, 20) cannot be explained by transfer, since transfer means 'transferring' knowledge of the L1 to the L2 and avoidance of a feature does not exactly show transfer. For convenience we will continue to use the term 'L1 transfer', and just to be clear about our intentions, we refer to L1 transfer as the use of, or rather the interference of, L1 knowledge in acquiring the L2.

As was mentioned before, whether L1 is helpful or not in the process of SLA can

depend on several factors. One of the factors that seems to be able to have wide-ranging effects on SLA is similarity between the L1 and the L2. When looking at the influence of similarity, a second language learner can benefit from his/her knowledge of the L1 if it is very similar to the L2. Corder (1992), for example, says that when the second language is closely related to the L1, this facilitates the SLA because knowledge of the L1 can help in acquiring the L2 (Corder, 21). The grammar of the L1, for example, can support the learner when acquiring the grammar of the L2 if certain rules are similar. Looking at the acquisition of word order for instance, it is quite possible that the acquisition of the L2 is facilitated by the L1 if the native language and the L2 both have the same word order (SVO for example). However, according to some authors, similarity between L1 and L2 is not always helpful in the process of SLA. In Pallier et al. (1997) and Flege (1987), it is claimed that adults do not necessarily have difficulties with perceiving sounds that are unknown to their first language. "Discrimination may occur without acoustic experience if the contrasting phonemes cannot be subsumed by any native categories"(Pallier et al., 129), and moreover, discrimination can become more difficult if "the foreign sounds are both similar to one phoneme of the native language" (Pallier et al., 129). Flege (1987) makes a distinction between 'new' and 'similar' L2 phonemes, in his theory of 'Equivalence Classification'.[2] According to Flege (1987), new L2 phones "have no counterpart in the L1 and so, by definition, differ acoustically from phones found in L1"(48), whereas similar L2 phones "[…] differ systematically from an easily identifiable counterpart in L1"(48). Flege argues that L2 learners identify L2 phonemes according to their L1 categories and use the articulatory patterns of their L1 to realise those in the L2 (Flege, 48). The issues of L1 and L2 interaction, as already discussed above, are formulated by Flege as follows:

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[2] Note that this is a study on production rather than perception. However, it does speak of perception too.

> Unlike young children just beginning to acquire their L1, older children and adults learning an L2 have a well established inventory of phonetic categories. We must presume that L2 learners, like infants, seek constancy in the sensory information they process. If so, they are likely to judge L2 phones (even those which differ auditorily from phones in L1) as being the realization of an L1 category, for they have become accustomed to the wide range of variants used to realize a single category.
> (Flege, 50)

In Flege (1987) and Pallier et al. (1997) it is suggested that similar phonemes are more difficult to acquire than new phonemes. One problem, however, is that in Flege's theory of Equivalence Classification, it is not clear when a sound must be regarded as 'similar' and when as 'new'. An important question for our study is whether the English phonemes /θ/ and /ð/, which are unfamiliar to native speakers of Dutch, must count as new or similar. Wester et al. (2007) report on an investigation of the substitution of /θ/ and /ð/ by different sounds in the speech of Dutch learners of English, and ask a similar question. The authors of this study conclude that in the case of dental fricatives, which are both phonetically and phonologically similar to several sounds in the Dutch language, but are new to Dutch learners since they are not present in their own language as phonemes, Flege's theory needs to be developed further regarding the distinction between similar and new phones, before it can actually be applied. We adopt Wester et al.'s point of view here, and use a notion of L1 transfer, which implies that what is new for a second language learner is more difficult than that what is similar. Given this, we expect that negative transfer, which in this case is not being able to perceive voice in certain positions, will occur when the Dutch learners of English have to acquire something that is not present in Dutch. This can either show in familiar phonemes in an

unfamiliar (and new) position, or in phonemes that are unfamiliar (and new) to the L1 but present in the L2.

Our study uses adult participants. This choice was based on the assumption found in several studies that adults' experience with a certain language (their L1) might lead to difficulties in perceiving other non-native phonetic contrasts that infants can perceive (Pallier et al. 1997; Werker & Polka 1993). These authors have, to a certain extent, discussed the language acquisition course that infants go through. Pallier et al. (1997) argue that "babies start off with a universal phonetic inventory that allows them to perceive any phonetic contrast from any of the world's language so far tested"(131). As Werker and Polka (1993) put it, "infants begin life with perceptual capabilities that facilitate discrimination of phonetic contrasts. This capability is quite broad-based, and extends to phonetic distinctions that are not used in the infants' language-learning environment"(83). These authors also claim that "research with adults has shown that experience with a particular language leads to decreased perceptibility of at least some non-native phonetic contrasts, and enhanced perception of native phonetic contrasts"(83) and that "language-specific influences on non-native speech perception are evident by the end of the first year of life"(83). In other words, adults are likely to have difficulties in discriminating between phonetic contrasts that do not occur in their L1 (Werker & Polka, 85).

So far, in this chapter it was attempted to support the notion of L1 transfer, and to give some examples. These examples showed that L1 transfer can manifest itself in different ways and that very language-specific L1 information can be transferred to the L2. L1 transfer can have a negative effect on SLA, depending on several factors. In the present study, we will be looking specifically at the possible (negative) effects of L1 transfer, by investigating Dutch L2 learners' perception of English fricatives. In order to do this we selected specific phonemes for the test, namely 'familiar' and 'unfamiliar' phonemes. Moreover, in order to

properly test the effects of L1 transfer, we selected adult L2 learners. It was discussed that adults have lost the ability to discriminate between foreign phonemes, which young infants are able to do. It was also argued that adults use their own inventory of phonemes in trying to discriminate between foreign phonemes. The assumptions, then, that adults cannot perceive non-native contrasts as natives (or infants) can and that adults will probably suffer from L1 transfer are the reason we selected adult participants for our experiment. Even though these participants are not formally 'adults' yet, they are well beyond their first years of life and should, as stated above, no longer be able to perceive non-native contrasts perfectly.

2.2 Fricatives in English and Dutch: the voicing contrast

2.2.1 The fricatives of English and Standard Dutch

When fricatives are produced, the articulators come close to each other, but not to a complete closure, so that the sound is produced with narrow constriction in the oral cavity. The air stream passes though the constriction, producing audible friction. (Jongman et al. 2000). The fricatives are usually grouped together according to their place of articulation which can be found in Table 1. Besides their place of articulation, they can also be grouped according to voicing (voiced and voiceless). To understand the differences in perception between Dutch and English with respect to the voicing contrast, the relevant phonemes will be discussed in this paragraph. The main focus will be on the fricatives of Dutch and English and the positions in which they occur in the two languages. Dutch has nine fricatives in the standard

language[3], namely the /f/, /v/, /s/, /z/, /ʃ/, /ʒ/, /x/ and /γ/, and /h/. English also has nine fricatives in the standard language, namely the /f/, /v/, /θ/, /ð/, /s/, /z/, /ʃ/, /ʒ/ and /h/ (for an overview of Dutch and English fricatives and the place of articulation see Table 1). Whereas Dutch lacks English /θ/ and /ð/, English lacks Dutch /x/ and /γ/. (Collins & Mees 1981; Ernestus 2000) In this thesis we will focus on fricative phonemes in which Dutch and English overlap, namely /f/, /v/, /s/ and /z/, and ones which are unique to English, namely /θ/ and /ð/. In Dutch, the /x/ - /γ/ contrast is questionable, since /γ/ is usually realised as /x/ (Ernestus 2000); the /h/ has a very limited distribution in both Dutch and English, which gave us reason to eliminate these phonemes from our investigation. The phonemes /ʃ/ and /ʒ/ were also excluded from the investigation, since the contrast between the two is marginal even though they occur in many languages. The for both English and Dutch speaking participants familiar phonemes /f/, /v/, /s/ and /z/ and the for Dutch speaking participants unfamiliar phonemes /θ/ and /ð/ remain.

TABLE 1. Fricatives of Dutch and English: Place of Articulation

	Labio-Dental	Dental	Alveolar	Palato-Alveolar	Velar	Glottal
Dutch	/f/ /v/		/s/ /z/	/ʃ/ /ʒ/	/x/ /γ/	/h/
English	/f/ /v/	/θ/ /ð/	/s/ /z/	/ʃ/ /ʒ/		/h/

The phonemes /f/, /θ/, /s/ are produced without voice; /v/ /ð/, and /z/ are produced with voice. The voiceless fricatives are generally longer (fricative duration) and louder than voiced

[3] Dutch has many regional variations in the language and the notion of Standard Dutch is not well defined (Ernestus 2000, 45). The term will be used here to refer to the language Dutch in general and to the varieties that are generally accepted by the speakers of the language.

fricatives (Kissine et al. 2003; Collins & Mees 1981). In Ladefoged (1993) voiceless fricatives are described as having a higher frequency than voiced fricatives. The pitch of a sound, which is described in Ladefoged (1993) as "that auditory property that enables a listener to place it on a scale going from low to high, without considering its acoustic properties (186)", depends on the frequency of vibration of the vocal cords. Since frequency is higher in a voiceless fricative, pitch is also higher in a voiceless fricative than in a voiced fricative (187). Another cue distinguishing between voiced and voiceless fricatives, for English and possibly for Dutch, is preceding vowel duration (this is not relevant for fricatives in initial position). Vowels preceding voiced fricatives are longer than vowels preceding voiceless fricatives (Ladefoged, 62).

In Dutch, voiceless fricatives are allowed in initial, medial and final position (fier 'proud', tafel 'table', lief 'sweet'). Voiced fricatives (and other voiced obstruents) are, however, not allowed in word final position (vier 'four', haven 'harbor', *liev). This generalisation holds only for words that are spoken in isolation or when they occur at the end of an utterance. In assimilation, fricatives can become voiced in word final position. For example, in the sentence "Zij heeft een vaa**s**" (*She has a vase*) the 's' is pronounced voiceless, but in the sentence "Zij heeft een vaa**s** **b**eschilderd" (*She has painted a vase*), the 's' of the word 'vaas' is pronounced voiced (/z/) because of the influence of the following voiced obstruent. Fricatives in medial positions and fricatives influenced by assimilation will not be relevant to this thesis. Important for this study is that word-final fricatives of isolated words in Dutch are never pronounced voiced.

In English voiced and voiceless fricatives (and other obstruents) are allowed in word initial, medial and word final position (forest / victory, shuffle / level, brief / sleeve). English and Dutch thus have the voiced fricatives in initial and medial position in common, but not in

final position. In English voiced and voiceless fricatives in word final position can form minimal pairs. Examples of such minimal pairs are listed in (1a-c):

(1) English minimal pairs with final /f/-/v/; /s/-/z/, and /θ/-/ð/

a.				
grief	[griːf]	-	*grieve*	[griːv]
half	[hɑːf]	-	*halve*	[hɑːv]
leaf	[liːf]	-	*leave*	[liːv]
safe	[seɪf]	-	*save*	[seɪv]
b.				
fuss	[fʌs]	-	*fuzz*	[fʌz]
rice	[raɪs]	-	*rise*	[raɪz]
once	[wʌns]	-	*ones*	[wʌnz]
race	[reɪs]	-	*raise*	[reɪz]
c.				
loath	[loʊθ]	-	loathe	[loʊð]
sheath	[ʃiːθ]	-	sheathe	[ʃiːð]

Dutch lacks minimal pairs such as in (1a-c). Even though Dutch and English have the contrasts /f-v/ and /s-z/ in common in initial position, a difference between the two languages in the use of these contrasts can be found. Although the voicing contrast for fricatives in Dutch is allowed in initial position, the contrast /f/-/v/ is stronger in English than in Dutch in this position, meaning that in English there are more minimal pairs starting with these fricatives than in Dutch. In everyday speech, English has approximately fifty to sixty minimal pairs beginning with these fricatives (Higgins 2008). Examples of minimal pairs beginning with the mentioned fricatives are:

(2)	*fairy*	[feəri]	-	*vary*	[veəri]
	fan	[fæn]	-	*van*	[væn]
	fast	[fɑːst]	-	*vast*	[vɑːst]
	fault	[fɔːlt]	-	*vault*	[vɔːlt]
	fear	[fɪə]	-	*veer*	[vɪə]
	feign	[feɪn]	-	*vain*	[veɪn]
	few	[fjuː]	-	*view*	[vjuː]
	figure	[fɪgə]	-	*vigour*	[vɪgə]
	fine	[faɪn]	-	*vine*	[vaɪn]
	focal	[foʊkəl]	-	*vocal*	[voʊkəl]

Dutch has only a few minimal pairs with initial /f/ and /v/ and some of their members are barely used in every-day speech. In a study by Ernestus (2000) a list of nine of these minimal pairs with initial /v/ and /f/ was presented, the same list is presented here (see below). Several more /f/-/v/ minimal pairs can be found in the Dutch language, which are not in this list but can be found in (4), and still it is possible that there are a few more. Still, there are not so many as in the English language, in which this contrast is present more prominently and more significant for meaning than in Dutch.

(3) Dutch minimal word-pairs with initial /v/ and /f/.

faal	[fa:l]	'fail'	-	*vaal*	[va:l]	'faded'
fat	[fɑt]	'dandy'	-	*vat*	[vɑt]	'hold'
fee	[fe:]	'fairy'	-	*vee*	[ve:]	'cattle'
feil	[fɛɪl]	'failing'	-	*vijl*	[vɛɪl]	'file'
fel	[fɛl]	'fierce'	-	*vel*	[vɛl]	'skin'
fin	[fɪn]	'Finn'	-	*vin*	[vɪn]	'fin'
fier	[fi:r]	'proud'	-	*vier*	[vi:r]	'four'
fout	[fɑut]	'mistake'	-	*vouwt*	[vɑut]	'folds' (verb form)
fries	[fris]	'Frisian'	-	*vries*	[vris]	'freeze'

(Ernestus 2000, 51)

(4) Several more Dutch minimal word-pairs with initial /v/ and /f/.

frees	[fre:s]	'mill'	-	*vrees*	[vre:s]	'fear'
Fis	[fi:s]	'fi'	-	*vies*	[vi:s]	'dirty'
fa	[fa:]	'fa'	-	*va*	[va:]	'father'

The voicing contrasts of the fricatives /s-z/ and /v-f/ are disappearing in the Dutch language (Ernestus 2000; Van de Velde et al. 1995), and minimal pairs such as in this list above are becoming dependent on other cues than voice or on the context in which they are used. What can be concluded from this paragraph in general, is that native speakers of English are more familiar with the voicing contrasts of /f-v/ and /s-z/ than native speakers of Dutch, in whose language these contrasts are less frequent, less relevant for meaning, and thus less strong. Note, however, that familiarity with the aforementioned fricatives and their contrasts varies across the Dutch speaking regions; this will be discussed in 2.2.2.

2.2.2 Regional variation in Dutch

The disappearance of the /s-z/ and /v-f/ contrasts in Dutch is a process called the *devoicing of Dutch fricatives* in the literature (Van de Velde et al. 1995; Van de Velde & Van Hout 2001; Kissine et al. 2003; Verhoeven & Hageman 2007). Although it can be generally said that this process is taking place throughout the Netherlands and the Dutch speaking part of Belgium, some regional variants are influenced in smaller degree by the process than others, and therefore regional variation can be found in the Dutch spoken language.

In some parts of the Dutch speaking regions, the voicing contrasts /s-z/ and /f-v/ have almost disappeared, whereas in others, these contrasts are still maintained. This variation, however, cannot be described very easily. The pronunciation of the fricatives /f/ and /v/ in some regions is more severely affected than the pronunciation of the /s/ and /z/. For example, in the northern part of the Netherlands it seems that almost no differences between the /f/ and

/v/ can be found, and a merger into /f/ represents both sounds of the former contrast. (Kissine et al. 2003; Kissine et al. 2005). However, when looking at the general picture, "[t]he devoicing of voiced fricatives in Dutch is a known phenomenon that is generally considered one of the most important pronunciation differences between Dutch in the Netherlands, and Dutch in Flanders" (translated from Dutch, Verhoeven & Hageman 2007, 139). In this study, we will investigate the effects of regional variation on the perception of English fricatives. Participants from two regions that differ from each other concerning this process of devoicing will be used for our study.

Van de Velde et al. (1995) investigated the process of devoicing in the Dutch language, and the extent to which regions in the Netherlands and the Dutch speaking part of Belgium are affected by this process. In this study, spoken Dutch was analysed using recordings of radio-language in the period 1935-1993. One of the reasons for the use of this type of language material was that the language use of reporters represents the standard language, in this case Standard Dutch, since reporters from national broadcast companies speak to whole language communities, and must be interpretable for the people of this community (Van de Velde et al., 423). In this study a difference between the standard language of Dutch in Flanders and the standard language of Dutch in the Netherlands, the two most important varieties of Standard Dutch, was made. One of the hypotheses in this study by van de Velde et al. (1995), based on the intuition of the authors and some incidental evidence, was that in the Dutch material an expanding process of devoicing would be found, but not in the Flemish material (430). The material was scored auditorily by one transcriber, since instrumental analysis was impossible due to background noise (Van de Velde et al., 432). Results confirmed the first hypothesis only partly. Data showed that the devoicing of voiced fricatives was indeed taking place in the Netherlands, and also that the voiced fricatives were indeed pronounced more and more voiceless in the period of 1935-1993. The mean scores (in

percentages) for /v/ decreased from 87.3 in 1935 to 37.2 in 1993 in the Netherlands, and for /z/ from 90.0 to 62.4. The prediction, however, that this process would not be present in the Dutch speaking part of Belgium was not confirmed, and evidence was found that the process of the devoicing of fricatives was also taking place in Flanders, although less strongly than in the Netherlands. In Flanders, the mean scores (in percentages) for /v/ decreased from 99.1 in 1935 to 86.4 in 1993, and for /z/ from 98.1 to 84.8. Also found was a certain order in the process of devoicing of fricatives, namely (γ) > (v) > (z), for both the Netherlands and Flanders, the (γ) being realized voiceless more frequently than the /v/ and the /z/, and the /v/ realized more often voiceless than the /z/. Another observation was that the devoicing process was stronger in initial position than in medial position.

In van de Velde & van Hout (2001) this process of devoicing was investigated with more regional detail. As was discussed above, in van de Velde et al. (1995) it was concluded that the fricatives /v/ and /z/ in the Netherlands were affected by a strong devoicing process and that even in Flanders a similar effect of a devoicing process could be seen, although less strong than in the Netherlands. Participants were reporters of national broadcast companies. In van de Velde & van Hout (2001), on the other hand, the authors chose to use teachers of the Dutch language in the Netherlands and Flanders, since they, as teachers of the language, should represent the norm of Standard Dutch, but also because more pronunciation variation was expected in this group than in a group of reporters of national broadcasting who speak to larger communities than language teachers do (Van de Velde & van Hout, 220). The participants came from four different regions in the Netherlands and four different regions in Flanders. For the Netherlands these regions were the Randstad, the Middle, the North and the South. For Flanders the four regions were Brabant, East Flanders, West Flanders and Limburg (further details about these regions can be found in van de Velde & van Hout, 220). The consonants /v/, /z/ and /γ/ were investigated by means of a reading task (the /γ/ will be left out

of discussion here, since it is not relevant for our study). Participants had to pronounce the target consonant in a sentence twice, first in combination with a schwa and then separately, for example “In de vuize horen we v” (Van de Velde & van Hout, 221). Based on the previously discussed study, it was hypothesized that the fricatives would be more frequently devoiced in the Netherlands than in Flanders. Regional effects were expected in the Netherlands, but not in Flanders. Also, for the fricatives /v/ and /z/ an age effect was expected in the Netherlands: the younger group would devoice the fricatives more than the older middle aged group. In Flanders these effects were not expected. Results confirmed the hypothesis that the fricatives /v/ and /z/ would be more frequently devoiced in the Netherlands than in Flanders. Also regional effects were found in the results, but not only for the Netherlands, as was predicted, but also for Flanders, which was not expected. These regional effects were found especially for the /v/ and less so for the /z/ in both regions. In the North of the Netherlands the /v/ was strongly devoiced, but in the South (Limburg) the /z/ was strongly devoiced, although not as frequently as the /v/ in the North. In Flanders all regions still had more voiced realizations of the /v/ than voiceless realizations, and also more voiced realizations of the /z/ than voiceless realizations, although less than for the /v/ (which is devoiced very little, except for the Brabant region). In the Randstad the number of voiceless realizations of the /v/ were found to be much higher than the numbers of voiced realizations, but such a strong effect could not be seen for the /z/, which was realized a little more often voiced than voiceless. Remarkable were the results for the North of the Netherlands, which showed an even stronger effect of devoicing for the /v/ than the results for the Randstad. Only a small 10 percent was realized voiced or varied between voiced/voiceless. Ninety percent was pronounced voiceless. In the North of the Netherlands the /f-v/ contrast seems to have disappeared almost completely in initial position. The factor age did not have a significant effect.

In Kissine et al. (2003) an acoustic analysis of the /f/, /v/, /s/ and /z/ was presented with similar participants and method as in the previously discussed study by van de Velde & van Hout (2001). These similarities are, for example, that the same division was made in regions and the participants were told to utter sentences in which the target consonant was tested twice in the same environments (Kissine et al. 2003). Duration, noise, pitch and voice were included in the acoustic analysis of the fricatives. Again results confirmed the earlier findings by van de Velde & van Hout (2001). Furthermore, a strong correlation was found between voice and pitch, which, according to the authors, "confirms that pitch is the most important indicator for the identification of voiced fricatives in Dutch" (Kissine et al. 2003: 98). Results regarding the presence of voice in the /f/, /s/, /v/ and /z/, split up by region, showed significant effects of the devoicing process in the different regions. The /v/ in the North of the Netherlands was pronounced almost always devoiced. In the South of the Netherlands the /z/ was pronounced more frequently devoiced than in all other regions. In West Flanders the most voiced realizations of the /v/ were found, and in East Flanders the /z/ was pronounced less often devoiced than in other regions. It can be concluded from this study that, similar to the results in other studies, regional variation in the process of devoicing of fricatives can indeed be found in both the Netherlands and Flanders.

The results of these studies all show that there are indeed regional differences in the pronunciation of fricatives in Dutch in Flanders and in the Netherlands, and that there is a significant difference between the Netherlands and Flanders in the effect of the process of devoicing. Although in Flanders a process of devoicing of fricatives is taking place as well, it is not as advanced as it is in the Netherlands, especially compared to the northern part of the Netherlands and the Randstad. Based on the results of these studies, the two groups of participants that are used for this study are from the North of the Netherlands, namely Hoogezand in Groningen, and from Belgium, namely Dilsen in Flemish Limburg. Groningen

was chosen because data in the previously discussed studies showed that in this region the most numerous voiceless realisations were found and Flemish Limburg was chosen because compared to Groningen the voicing contrast is still present. Flemish Limburg is, however, not the region in which the voicing contrast is present to the largest degree in Flanders, which is West-Flanders, but it differed significantly enough from Groningen to be used for our goals. To illustrate this difference, some relevant numbers from one of the previously discussed studies, namely van de Velde & van Hout (2001), will be discussed briefly. These results showed that in the North of the Netherlands, /v/ was pronounced voiced in 7.5% of the cases and voiceless in 90% of the cases, whereas in Flemish Limburg the /v/ was pronounced voiced in 52.5% of the cases and voiceless in 10% of the cases. Compared to results for /v/, the results for /z/ are not as striking, however, /z/ is pronounced voiceless more often by participants from the North of the Netherlands than by those from Flemish Limburg.

2.3 The perception of fricatives

In this paragraph several studies will be discussed that focus on the perception of the sounds of their respective languages by native listeners of both Dutch and English and on the differences in this perception. We know that some cues are simply not relevant for one language, but are for the other, so differences in perception can occur. This could have an effect on L2 perception of a language, and could therefore cause difficulties for L2 learners. The question here is whether there are differences between Dutch and English in the use of cues for fricatives. First, native perception of native speakers of English and Dutch will be discussed; then non-native perception of English by Dutch natives is discussed.

2.3.1 Dutch and English native perception

When listening to speech streams listeners use certain cues to identify certain phonemes. The question here is which cues an English listener uses to discriminate between voiced and voiceless English fricatives. In a study by Flege and Hillenbrand (1986), in which the use of temporal cues to the English /s-z/ contrast in word-final position was investigated, the most important cues used by native speaker of English to determine the voicing contrast for the fricatives /s-z/ were found to be vowel duration (important for fricatives in syllable final position only) and fricative duration. Both vowel and fricative duration affected the judgement of native speakers of English when discriminating between these two fricatives. When vowel duration was increased and fricative duration decreased, an increase of /z/ judgements occurred. In Greenlee (1979), too, one of these cues, namely vowel duration, is mentioned as the most important cue for the voicing distinction of English consonants in word-final position, including fricatives. In this study CVC items were presented to child and adult native speakers of English. In the experiment vowel duration as a voicing cue was tested. Results showed that adults were indeed affected by the varying vowel duration, and an increase of voiced judgements was seen when vowel duration was lengthened in the CVC items. In Broersma (2005) vowel duration is also mentioned as one of the most important cues for a native listener of English to discriminate between voiced and voiceless fricatives. Voiced and voiceless fricatives in word-final position apparently differ from each other by 148ms. (Broersma, 3891). Also the duration of the frication noise is mentioned as a cue to identify voice (Broersma, 3891). Note that these studies do not really mention or focus on voice itself as a cue in English. However, the fact that the manipulation of vowel duration or fricative duration affected the perception of participants in the previously discussed studies, could mean that voice as a cue is overruled by the other cues in these cases.

It can be said that in English the most important cues to discriminate between voiced and voiceless fricatives are vowel duration and fricative duration. The question is whether or not these cues are also used by native listeners of Dutch. It could be that if native speakers of Dutch use different cues for perceiving the difference between voiced and voiceless fricatives than native speakers of English, that this could cause difficulties when discriminating between English voiced and voiceless fricatives. Since Dutch does not have a voicing contrast in final position, it is not comparable to English in this respect. However, Dutch does have a voicing contrast in medial position and it could be that cues that are used to discriminate or not between voiced and voiceless in medial position, can also be used by Dutch learners of English in discriminating between English voiced and voiceless fricatives in word-final position. In Slis and Van Heugten (1989), which is a production study instead of perception, speech samples of forty speakers of Dutch from different regions were analysed. Participants were presented with a reading task and were asked to utter the sentences that included the fricatives /f/, /v/, /s/, /z/, /x/ and /ɣ/. The two most important cues to discriminate between voiced and voiceless fricatives in intervocalic position in Dutch were found to be the presence and absence of voice activity and the duration of the fricatives; the latter is also mentioned as a voicing distinction cue for native listeners of Dutch in Ernestus (2000). Natives of Dutch and English thus have this cue in common. In Broersma (2005) the use of vowel duration as a cue by Dutch listeners of English was investigated. Broersma (2005) mentions that the Dutch language does have vowel duration as a potential voicing cue in medial position, but apparently this cue is not used by native listeners to discriminate between voiced and voiceless in their own language. Other cues seem to be more important. The same is said about this cue in Ernestus (2000): “this cue [acoustic duration of the preceding vowel] is not as important for the voiced/voiceless distinction in Dutch as it is in English”(153). The cues mentioned by Broersma as important for the voicing distinction in Dutch are frication

duration, the presence or absence of vocal cord vibration (also mentioned in Ernestus (2000) as a cue for the voicing distinctions for fricatives) and the intensity of frication noise. This last cue, however, plays only a small role in the voicing distinction of fricatives. The cues that Dutch and English do not have in common are the preceding vowel duration cue and the presence/absence of voice. The first cue is found to be very important in English, whereas the second cue is not mentioned in those studies at all. Contrary to English, for Dutch the vowel duration cue seems not to be very important, whereas voice is mentioned several times in the previously discussed studies. This might cause difficulties for Dutch listeners of English in hearing the differences between the voicing contrast in fricatives in final position, which, again, the Dutch native speakers do not have.

2.3.2 Non-native perception: Dutch listeners of English

2.3.2.1 The voicing contrast

In this section, the focus will be specifically on Dutch non-native listening and Dutch listeners' perception of English. Several studies on this subject will be discussed, in order to get an impression of the varying performances of non-native listeners and the effects that language experience can have. An important role in this discussion is that of using cues in non-native listening. The concept of cues was already discussed in sections 2.3.1, however, this discussion only concerned L1 cues. In several studies, authors have attempted to shed a light on which of these cues are used in L2 perception, and which are not.

Broersma (2005) discusses non-native perception and L1 influence on SLA. Note that this author, similarly to the aims of this thesis, examines the perception of English by (advanced) Dutch listeners by having them listen to natural speech and use a button press. Broersma (2005) suggests, based on earlier studies, that "the categorization of a non-native contrast which exists in the native language, but in a position where it does not occur in the

native language, seems to benefit from native-language experience with one of the phonemes of the contrast in the relevant position and from experience with relevant perceptual cues"(3891). Concerning our current topic, she adds that "Dutch has a distinction between voiced and voiceless obstruents in word-initial and –medial position, allows for voiceless obstruents in word-final position, and also provides experience with the use of vowel duration as a cue for several phoneme distinctions, […]"(3891). Thus, in Broersma's view, native listeners of Dutch should be able to learn to perceive the English voicing contrast in word-final position, where this contrast is unfamiliar in Dutch (even though the contrast is familiar to the language in other positions), using the cue of vowel duration. Note that Broersma assumes especially advanced learners to be able to learn this and the focus of her study, consequently, is on such learners (who received training in primary and secondary school) in her paper. Broersma's results show that Dutch and English listeners showed no difference in categorising the voicing contrast of fricatives in initial position (3899), meaning that the differences between Dutch and English participants were insignificant. Interestingly also, the Dutch participants categorised the English final voicing contrast with a native-like level of accuracy, however, the Dutch listeners did not use the vowel duration cue for discriminating between voiced and voiceless in final position, as opposed to the English whose judgements relied greatly upon this cue.

A study that did show a clear difference in performance on the perception of phonemes between native (English) and non-native (Dutch) listeners is Cutler et al. (2004). In this study the hypothesis was that the influence of the native repertoire on non-native phonetic decisions becomes stronger when stimuli are harder to perceive (3668). By having native speakers of American English and native speakers of Dutch listen to almost all possible CV and VC items of American English, recorded as natural speech, under several noise conditions and having them choose with a button press, these authors tested the perception abilities of

these two groups. Results showed that “the identification performance of the non-native listeners is significantly and consistently worse than that of the native listeners”(Cutler et al., 3670). This performance was not influenced by the quantities of interfering noise. Clearly this is a result very much different from that reached in Broersma (2005). Moreover, it was found that the Dutch responses in terms of voicing identification to syllable-final consonants were much worse. This result is said to show the one clear effect of native phonology on non-native listening in the paper (Cutler et al., 3671), since the lack of the voicing contrast in final position in Dutch could have caused this. The question then arises as to why there is such a large difference between the results of the studies by Broersma and Cutler et al. We will refer to this issue in Chapter 6.

A study that does not concern either the language Dutch or English, but does focus on adult L2 perception and the use of perceptual cues is Flege & Hillebrand (1986) (this study was already mentioned in section 2.3.1). The authors claim that even though it has been shown that it is possible that adults can learn to identify L2 phonemes using cues that are not part of the L1, it is not certain that adults can identify every L2 phonetic contrast of an L2, nor that L2 learners use the same perceptual cues as native speakers when they are apperently able to correctly perceive a phonetic contrast of the L2 (Flege & Hillebrand, 508). In Broersma (2005), results already showed that (advanced) Dutch L2 learners of English performed as well as English native speakers, without using the English vowel duration cue. Flege & Hillebrand (1986) illustrate, as an example, that Arabic /s/-/z/ in word-final position are distinguished by voicing, but not by duration of fricative noise or preceding vowel, whereas English perception of /s/-/z/ in word-final position is also influenced by length of fricative noise and preceding vowel duration. The aim of the study of Flege & Hillebrand (1986) was to find out whether non-native listeners process temporal cues in the way native listeners do, in which case these non-native listeners should be affected by both vowel and fricative

duration (Flege & Hillebrand, 509). The participants were native speakers of French, Finnish and Swedish. The Swedish and Finnish participants, who do not have an /s/-/z/ contrast in their language, showed no significant effect of fricative duration, whereas the effects of vowel duration were as large as in the English participants. The French participants, who do have the phonemic /s/-/z/ contrast, were less affected by lengthening of vowel duration than the English. These results suggest that listeners are more sensitive to changes in vowel duration than in fricative duration. The question whether L2 learners can learn to use the same perceptual cues as native speakers in identifying non-native contrasts is left unanswered, however, because the results did not suggest that these participants were unable to do so. The general conclusion drawn in Flege & Hillebrand (1986) is that the development of perception by adults of non-native contrasts is a slow process. This development can be influenced by many factors, such as "age, the amount and kind of L2 experience, the nature and extend of phonological differences between L1 and L2, and especially the acoustic nature of the phonetic contrast being learned" (Flege & Hillebrand, 515).

In a study by Cho & McQueen (2006), an attempt is made to further explore how perception is tuned by (first) language experience. This study is focused on Dutch and Korean participants' processing of sounds which are possible and impossible in their languages (3086). A difference between Dutch and Korean is that in Korean, when looking at isolated syllables, released coda stops occur, whereas in Dutch, these released coda stops in isolated syllables are not phonologically feasible (Cho & McQueen, 3086). In a perception test, the Dutch and Korean participants were asked to listen to consonants spoken in Dutch and in American English. The results showed that Dutch listeners overall performed better on released stops than on unreleased stops (which were, as we recall, respectively viable and non-viable in Dutch). The authors draw several conclusions from these results, of which one is that "perception of non-native and native speech is influenced by the phonological system

of the listener's native language"(Cho & McQueen, 3092). This conclusion, which suggests the existence of L1 influence on SLA, is in line with results from several other studies previously discussed (see Broersma 2005; Broselow 1992; Cutler et al. 2004; Pallier & Mehler 1997; Werker & Polka 1993). Furthermore, as Broersma (2005) also noted, Cho & McQueen (2006) conclude that phonetic details of the non-native language can be familiar to the listener because of the presence of these phonetic details in the native language, and this can influence the perception of non-native speech (3092) in that non-native sounds with familiar phonetic details are easier to perceive than non-native sounds with unfamiliar phonetic details.

In this section, we have tried to shed a light on the question how Dutch listeners of English perceive non-native phoneme contrasts. Broersma (2005) showed that Dutch L2 learners of English performed equally to the native speakers of English, yet did not use the same cue in making distinctions between the voicing contrast, namely the vowel duration cue. Cutler et al. (2004), on the other hand, showed that Dutch L2 learners of English performed much worse on the identification of phonemes (including consonants and vowels) than the native speakers of English, independently of the quality of experimental added noise. A significant L1 effect in this study was that the Dutch performed poorly on the voicing contrast in final position, probably because of the final devoicing phenomenon in Dutch. More studies were reviewed with respect to perceptual cues that might or might not be used in L2 learning and the effects an L1 can have. Since the results from these studies differ from each other still, this paper aims to gain more insight in the matter of L1 transfer in the perception of phonemes, or more specifically, in the perception of fricatives.

2.3.2.2 Phoneme confusions by Dutch listeners of English

In Cutler et al. (2004) Dutch listeners' perception of the English voicing contrast under disadvantageous voicing conditions was tested and also the confusions between the phonemes /p/, /t/, /k/, /f/, /θ/, /s/, /ʃ/, /tʃ/, /h/, /b/, /d/, /g/, /v/, /ð/, /z/, /dʒ/, /j/, /m/, /n/, /l/, /r/ and /w/ in general. These authors also elaborately discuss the confusions between phonemes that occur in the responses of their participants. Because of the design of the experiment, it could be that in our thesis, too, participants will show certain phoneme confusion other than confusion between the contrasts voiced/voiceless Similar to Cutler et al. (2004), we will thus be looking at phoneme confusions also and will therefore discuss Cutler et al's study further. Sixteen native speakers of Dutch participated in the study. CV and VC items of natural speech were auditorily presented to the participants. The test items were normalized for rms vowel amplitude and were combined with babble noise. Results showed that although the disadvantageous conditions (the babble noise) did not interact with language background, the Dutch participants did have difficulties with identifying certain phonemes and often chose a different (wrong) phoneme instead. Figures in Cutler et al. (2004) show that Dutch listeners had many difficulties with several phonemes. The relevant figures for this paper are presented (in percentages) in Tables 2 and 3, for phonemes in respectively initial and final position.

TABLE 2 – Phoneme confusions in initial position by Dutch participants.

Response → Target consonant ↓	/ð/	/θ/	/v/	/f/	/z/	/s/
/ð/	**18.8**	14.6	1.3	13.3	1.3	2.1
/θ/	7.5	**12.1**	2.9	13.3	0	0.4
/v/	7.9	5.0	**9.6**	8.8	0	0.4
/f/	4.2	7.1	5.4	**15.0**	0	0
/z/	23.8	9.6	2.5	1.3	**27.1**	3.3
/s/	7.9	24.6	3.3	12.5	14.6	**30.4**

It can be seen in Table 2 that the performance on the phonemes in initial position varied. The /s/ and /z/ were categorised best. The /s/ however, was confused quite frequent with the /θ/

and /z/ with /ð/. It is remarkable that the performance on initial /v/ was extremely poor, since this is a familiar phoneme in a familiar position in Dutch. The /θ/, /v/ and /f/ were never confused with /z/, and /f/ also never with /s/, whereas /z/ and /s/, when presented, were always to some extent confused with the other phonemes. In short, when looking at the figures, most difficulties in initial position occur for the perception of /v/, /ð/ and /θ/.

TABLE 3 – Phoneme confusions in final position by Dutch participants.

Response → Target consonant ↓	/ð/	/θ/	/v/	/f/	/z/	/s/
/ð/	**8.3**	8.3	10.0	4.2	2.9	3.3
/θ/	9.2	**17.5**	2.5	17.9	0	0.8
/v/	5.4	5.4	**15.8**	12.1	1.3	0
/f/	5.0	9.6	3.3	**22.1**	0.4	1.7
/z/	10.0	10.0	5.0	1.7	**25.8**	12.2
/s/	10.0	14.6	2.5	17.1	4.6	**37.5**

The first noteworthy result in Table 3 is that final /ð/ was treated extremely poorly, and was confused more with /v/ than it was judged as correct /ð/. Similarly, /θ/ was more often judged as /f/ than as /θ/ itself, even though it was judged rather well compared to the other dental phoneme. Remarkably, final /v/ was judged far better than initial /v/. Speakers of Dutch are not familiar with /v/ in final position in their L1, whereas they are familiar with initial /v/ in their L1, so it was this expected that they would perform better for /v/ in initial position than in final position. Final voiced /z/, for that matter, was also judged correctly on many occasions. Final /θ/ was never confused with /z/ (but it was the other way around) and final /v/ was never confused with /s/ (but it was the other way around, again). Thus, when looking at the figures, most difficulties in final position occur for the perception of /v/, /ð/ and /θ/. These are the same difficulties as in initial position.

It can be concluded from these results that voiced fricatives in final position are not by definition more difficult to perceive by Dutch listeners than voiced fricatives in initial position (as shown by the example of /v/). However, the results generally indicate serious difficulties

for Dutch learners of English to discriminate between the fricatives /f/, /v/, /θ/, /ð/, /s/ and /z/. Most difficult for the Dutch participants are the unfamiliar phonemes /θ/ and /ð/. In general the phonemes of the test are most frequently confused with either their voiced/voiceless counterpart, or another phoneme with the same voice value or both.

2.3.2.3 Phoneme confusions by English listeners of English

In our study a control group of native speakers of English was tested, to see whether their performance on the identification of voice in obstruents would be better than that of the Dutch speaking groups, as will be seen in Chapter 4. In Cutler et al. (2004) too, Dutch and American English listeners' perception of the English voicing contrast was tested. In Tables 4 and 5 the relevant numbers for this paper are presented (in percentages), in respectively initial and final position, and the most noteworthy results will be discussed briefly. Table 4 gives the average numbers of phoneme confusions in initial position by English participants.

TABLE 4 – Phoneme confusions in initial position by English participants.

Response → Target consonant ↓	/ð/	/θ/	/v/	/f/	/z/	/s/
/ð/	**30.4**	14.6	5.8	1.3	4.2	0.8
/θ/	14.6	**18.3**	3.8	13.3	0.8	0
/v/	14.6	4.2	**17.5**	5.8	0	0.8
/f/	5.8	7.5	3.8	**19.2**	0	0.4
/z/	21.3	9.2	8.3	0	**31.3**	2.5
/s/	9.6	10.0	0	9.2	8.8	**51.7**

First, the performance on the phonemes in initial position varies. Moreover, several general observations can be made about these data that are more or less the same as for the Dutch results given in paragraph 2.3.2.2. For example, fricatives categorised most correctly were /s/ and /z/. Even though the numbers differ considerately from the Dutch results, /z/ was again judged quite often as /ð/ and /s/ as /θ/. The initial /v/ was not judged as poorly as by the Dutch

speakers, yet it has the lowest percentage of all correct answers. The specific phonemes that were never confused with specific other phonemes are also quite similar to the Dutch results and where there is a difference, this difference is not very large. A difference between the performances of the groups is that performances by the American English speakers on the initial /ð/ and /s/ were better the than by the Dutch group (/ð/: 30.4 > 18.8 ; /s/:51.7 > 30.4). The other phonemes were also categorised better by the American English speakers, but the difference in percentage is not as large. Overall, the performance on phonemes in initial position by the American English speakers was better than by the Dutch. For the Americans most difficulties in initial position occur with the perception of /v/, /f/ and /θ/. Table 5 gives the average numbers of phoneme confusions in final position by English participants.

TABLE 5 – Phoneme confusions in final position by the English participants.

Response → Target consonant ↓	/ð/	/θ/	/v/	/f/	/z/	/s/
/ð/	**16.7**	4.2	17.5	1.7	5.8	2.5
/θ/	7.5	**19.2**	2.5	30.8	0	0.8
/v/	5.8	2.5	**47.5**	9.2	0.4	0
/f/	5.4	12.9	1.3	**45.0**	0	0
/z/	9.6	2.5	12.5	0	**37.1**	7.5
/s/	1.7	8.8	0	12.9	0.8	**65.4**

Again, several results in this table are found to be similar to the earlier Dutch results for phonemes in final position. First notice that the performance on the categorisation of the final /ð/ was worse than the performance on the other fricatives. Moreover, /ð/ was confused more with /v/ than it was judged as the correct /ð/ itself, as was also the case for the Dutch results. Also similar to the Dutch results is that /θ/ was judged more often to be /f/ than as /θ/. Final /θ/ was never confused with /z/ as with the Dutch (this is also other way around, unlike in the Dutch results), and final /v/ was never confused with /s/ (and this is also other way around, unlike in the Dutch results). When looking at the figures, most difficulties in final position

occur for the perception of /ð/ and /θ/, which are the same difficulties as for the Dutch speakers; for /v/, however, the American English speakers performed very well. Overall though, the results of the American group were much better than the results of the Dutch group on phonemes in final position. As for the differences between initial and final position when looking only at the American results, it is noteworthy that /v/ and /f/ were categorised far better in final position than in initial position, but the /ð/ was done better in initial position.

What we saw in this section was that Dutch L2 learners of American English can make many confusion mistakes in perceiving fricatives. Most difficulties in both initial and final position occurred in the perception of /v/, /ð/ and /θ/. Native speakers of English also made mistakes, mostly with the /v/, /f/ and /θ/ in initial position and the /ð/ and /θ/ in final position. Although the American English participants scored much better on the phonemes overall, they did show remarkably many similarities with the Dutch speakers in phoneme confusions. Overall, the performance of the American English speakers on phonemes in initial position was slightly better than that of the Dutch speakers and the results of the American English group on phonemes in final position were much better than those of the Dutch group. If we were to use these results as guides in our expectations for the present study, the English participants that are involved in the experiment of our study would probably perform better on the categorisation of phonemes than the Dutch overall, but would still confuse phonemes, though to a smaller degree than the Dutch speaking participants. In both initial and final position the English speaking participants would perform better than the Dutch speaking participants, although in final position this difference in performance would be bigger.

3. Hypotheses and predictions

In this study, we aim to answer two main questions concerning L1 transfer. First, we want to find out whether regional differences of the Dutch L2 learners of English will affect their SLA in different ways. Second, we want to know the nature of L1 transfer, by specifically looking at the performances on the 'familiar' contrasts versus the 'unfamiliar' contrast. The experiment that was used in an attempt to answer these questions was an identification experiment, in which the participants were presented with stimuli auditorily and were instructed to choose between six fricatives (the options were visible on the computer screen). The fricatives that were presented in the test were both familiar and unfamiliar fricatives for the Dutch speaking participants, for the English participants however, these fricatives were all familiar. The participants were divided into three groups, namely, one English group (Group E), one Dutch speaking group with participants from the north of the Netherlands (Group N), and one Dutch speaking group with participants from Belgium (Group S), that lies south of the Netherlands.

In Hypothesis 1, it is hypothesized that an L1 transfer effect will be visible in the identification of voice in English fricatives by Dutch listeners of English. This hypothesis is partly based on results of Cutler et al. (2004) in which results showed that Dutch L2ers of English performed worse on the identification of phonemes (including fricatives) than native speakers of English. We expect this transfer to show in several ways. First, we expect the group of English speaking participants (group E) to perform better overall than both Dutch speaking groups (Group N = North, Groningen, Group S = South, Flemish Limburg). Second, we expect the Dutch speaking groups (N & S) to perform better on the identification of voice in initial phonemes than on final phonemes since in Dutch voice is neutralised in codas and speakers of Dutch are thus not familiar with voiced fricatives in final position. Third, we

expect that since in Dutch voiced fricatives are neutralised in final position, the Dutch speaking Groups N & S to show a bias towards the voiceless option in final position when judging voiced fricatives. Fourth, we expect all groups to perform better on the labio-dental and alveolar phonemes, than on the dental phonemes, since for both the Dutch and English speaking groups the voicing contrast of the dental phonemes is less familiar than the other phonemes that are, contrary to the dental phonemes, represented by different symbols in spelling ('th'-'th' versus 'f'-'v' / 's'-'z'). However, we expect Group E to perform better on the dental phonemes than the Dutch speaking groups (N & S) since Group E is familiar with these phonemes in their native language, whereas Groups N and S are not.

Second, we hypothesize that regional differences will affect the perception of the participants. We expect that, because the Dutch speaking Group N is not as familiar with the voicing contrast in general as the Group S due to the devoicing process (as was discussed in paragraph 2.2.2) , Group N will perform worse than Group S in general and, moreover, we expect Group N to also show a bias towards the voiceless option in initial position when perceiving voiced fricatives.

The third hypothesis concerns the nature of L1 transfer. In order to know whether L1 transfer is feature or phoneme bound, we formulate this hypothesis in the shape of possible options. One prerequisite enabling an answer to this hypothesis, however, is that Group S performs better than Group N in general, as hypothesised above. The first option, then, is that L1 transfer is phoneme-bound, in which case both Groups N and S will perform more or less the same (equally worse) on the categorisation of the dental, 'unfamiliar', phonemes. This is because the transfer is bound to the phoneme, and not to a specific feature (in this case 'voice') of the phoneme. When two phonemes that differ only in voice, are unfamiliar to both Dutch speaking groups, these groups will both perform poorly on the identification of voice for these phonemes (voiced or voiceless). The second option is that L1 transfer is feature-

bound, in which case Group S will perform better on the dental phonemes than Group N. This is because in this case, transfer is bound to certain features of the phoneme. In the language of the Dutch speaking participants from Belgium (Group S), voiced fricatives are more prominently present than in the language of the Dutch speaking participants from Groningen (Group N). Since participants are more familiar with the contrast between voiced and voiceless in fricatives, it is expected that Group S will perform better than Group N in discriminating between the unfamiliar phonemes that differ only in voicing.

Fourth and finally, since the participants are not restricted in choosing between the voicing contrasts in the test, but can choose all six options given on the screen when hearing the stimulus with the target consonant, we hypothesize that the results will show confusion with other phonemes by all groups, implying that participants will not only have difficulties with discriminating between the voicing contrasts, but also between the fricatives in general. This expectation is partly based on the results found in Cutler et al. (2004) (discussed in paragraph 2.3.2.3). In general, we expect the English speaking participants to perform better on phoneme identification than the Dutch speaking participants. However, we expect both the English speaking and the Dutch speaking groups to mistake the dental phonemes most frequently for either the labio-dental phonemes with the same voice value, or their voiced/ voiceless counterparts. Moreover, we expect the alveolar phonemes to be confused with other phonemes less frequently than the other two groups of phonemes, but if they are confused, this will most often be for their voiced/ voiceless counterparts.

4. Method

4.1 Participants

The participants were divided into three groups. The first group consisted of fifteen speakers of northern Dutch from Groningen (Group N), the region in which the process of devoicing of fricatives is quite advanced. All participants in this group were third year high school students (VWO in the Dutch system). The second group (Group S) consisted of fifteen speakers of southern Dutch from Flemish Limburg, the region in which the voicing contrast in fricatives is still maintained in several positions more than in Groningen. Participants from this second group were also third year high school (VWO) students. The ages of the participants in Groups N and S varied between fourteen and fifteen years. The third group (group E) was a group consisting of five native speakers of English. To create homogenous groups, variance across the Dutch speaking participants (Group N and S) concerning experience with the L2 (English) and other languages was ruled out by administering a questionnaire about language background of these participants. Students who were found to have exceptionally more experience in English (or other languages) or did not grow up in the relevant region were excluded from the experiment, this way the participants all had comparable experience with the English language and the Dutch regional dialect.

4.2 Materials

For the test we used monosyllabic CVC English nonwords, all beginning or ending in one of the following contrastive fricatives: /f/, /v/, /s/, /z/, /θ/ or /ð/. The non-target consonant in the CVC item was always a consonant different from the six target consonants, in practice either /m/, /n/,/d/, /t/, /k/, /b/ or /p/, in order to rule out confusion with the target consonants. There were 120 items in total, divided into 3 groups, each consisting of 4 subgroups of 10 items.

The first subgroup consisted of 10 CVC items beginning with /s/, 10 CVC items beginning with /z/, 10 CVC items ending in /s/ and 10 CVC items ending in /z/. Since the /z/ and /s/ form a contrast, the stimuli were all pairs of nonwords differing only in the contrastive phoneme. This was the case in all stimuli subgroups. The second group consisted of 10 CVC items beginning with /f/, 10 CVC items beginning with /v/, 10 CVC items ending in /f/ and 10 CVC items ending in /v/. The third group consisted of 10 CVC items beginning with /θ/, 10 CVC items beginning with /ð/, 10 CVC items ending in /θ/ and 10 CVC items ending in /ð/.

The items were recorded by an adult male native speaker of British English, using a Sennheiser ME-64 microphone and a Tascam DA-40 DAT recorder. Vowel duration and pitch were manipulated in the programme *Praat* to create minimal pairs that differed only in fricatives at the beginning or end of the word. The vowel in the two nonwords of a pair was either lengthened or shortened to an average length of the two vowels together by adding or removing sound waves. This was done for all vowels in the nonwords, so that the possibility of vowel duration as a cue for voicing distinction was removed. The pitch was manipulated so that the nonwords became more monotone and intonation could not function as a cue for voicing.

4.3 Procedure

Participants were tested individually in a quiet room using headphones and a computer screen. The test was constructed in *Praat* and took the form of an identification task. The items were presented auditorily and one by one, separated by a brief interval. The stimuli were accompanied by six options on the screen to choose from, and the items were randomly presented. The pre-test instruction took place in the first language of the participants to prevent misinterpretations about the task. However, to put the Dutch speaking participants in an English language mode, the test and the instructions on the screen were in English. The

participants were unaware of the purpose of the study, when interested they were explained afterwards. As was already mentioned, different from the other four phonemes, the ‘θ’ and ‘ð’ are unfamiliar phonemes to Dutch speakers. Moreover, the difference between these two phoneme (one being voiced and one being voiceless) is not necessarily consciously known to English native speakers. Therefore, instruction on this issue was needed beforehand, which was given to all the participants as part of the overall instructions. In this instruction, it was explained what the differences are between the phonemes and examples were given. It was explained that in the test the phonemes were represented by the IPA notations ‘s’, ‘z’, ‘f’, ‘v’, ‘θ’ and ‘ð’. The participants were provided with a sheet of paper, with English examples of words containing these phonemes, so that during the test they could look when they were not sure which symbol belonged to which sound (this was especially the case for the /θ/ and /ð/, since these are the IPA notations of the sounds, whereas the rest were the symbols from both the alphabet and IPA). Participants were informed that they were going to listen to nonwords of English and were told to choose between the consonant they heard at the beginning or the end of the word, and to indicate their choice with a button press. Before they could start with the actual test, they were shown what they were going to do in a small trial version of the test. The participants were allowed to ask questions during the instruction and the trail test. After the instruction they could start with the test by clicking the screen. Six options then appeared on the screen, namely the phonemes ‘s’, ‘z’, ‘f’, ‘v’, ‘θ’ and ‘ð’, in IPA notation. The test was divided into two parts, separated by a brief break in which new instructions (whether to focus on the word-initial or the word-final consonant) were given.

5. Results

In this section the principle findings of the experiment will be discussed. This will be done separately for each hypothesis. We analysed the performances of the participants in three ways. In hypotheses 1, 2 and 3, we focussed on voicing categorisation. Responses were 'correct' when the response matched the voicing value of the target phoneme. The term 'correct' in the tables and figures of the first three hypotheses thus refers to the number of items that were answered correctly in terms of voicing. For example, when the target phoneme was a /f/ and the response was a /s/, the response was correct, since both are voiceless. When the target phoneme was, for example, /v/ and the response was /f/, this was considered incorrect. In the fourth hypothesis, we focused on phoneme identification. Results were analysed with respect to correct or incorrect categorisation of phoneme, meaning that the response was correct when the correct phoneme was chosen. For example, when the target phoneme was /f/ the only possible correct response was /f/. Finally, an extra analysis was done, in which the focus was on the places of articulation. As long as the response was within the same category of place of articulation, the answer was considered correct. For example, if the target phoneme was /f/ and the response was /v/, then this was correct. This was not part of any hypothesis, but could reveal some interesting results.

5.1 Hypothesis 1

Hypothesis 1 was that an L1 transfer effect would be visible in the identification of voice in English fricatives by Dutch listeners of English. In Table 6 and 7 the means of correct responses per fricative and per position by both groups are given together with the standard deviation.

TABLE 6 and 7 - Means of correct responses per fricative and per position and the standard deviation by the Dutch and English groups.

Dutch			
Position	Phoneme	Mean	Std. Deviation
I	/f/	8.67	1.373
	/v/	8.07	1.780
	/s/	9.20	1.215
	/z/	9.07	1.230
	/θ/	7.87	1.833
	/ð/	6.30	2.261
F	/f/	6.67	1.988
	/v/	8.80	1.669
	/s/	9.27	.980
	/z/	8.13	2.330
	/θ/	7.37	1.829
	/ð/	8.30	1.535

English			
Position	Phoneme	Mean	Std. Deviation
I	/f/	8.60	1.673
	/v/	6.40	2.702
	/s/	7.80	1.095
	/z/	8.20	1.643
	/θ/	7.20	1.095
	/ð/	4.80	1.643
F	/f/	8.40	1.817
	/v/	9.20	.837
	/s/	9.80	.447
	/z/	9.40	.894
	/θ/	7.00	2.345
	/ð/	5.80	2.588

Prediction 1.a. Our first expectation for this hypothesis was that the group of English speaking participants (Group E) would perform better than both Dutch speaking groups (Groups N & S, for North & South) in general. An analysis of variance (ANOVA) across subjects showed that there was no main effect of language. The English speaking participants, therefore, did not perform significantly better than the Dutch speaking participants.

Prediction 1.b. We expected the Dutch speaking groups (N & S) to perform better on initial phonemes than on final phonemes. An ANOVA revealed that there was no significant difference between the performance on initial versus final position by the Dutch speaking groups, as can be seen in Figure 1. The performance on initial phonemes, therefore, was not significantly better than that on final position.

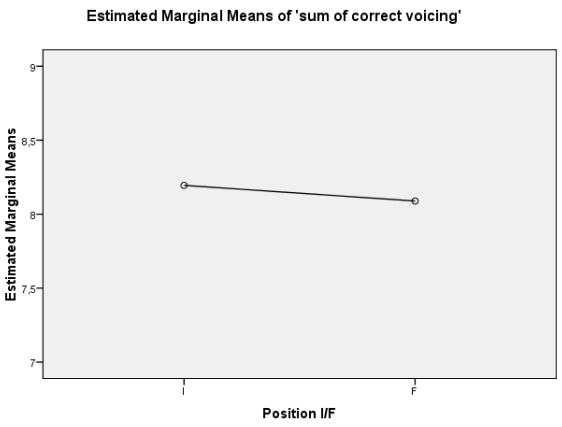

FIG 1. Means of correct categorisations of voice per position by the Dutch speaking participants. ('I'= Initial, 'F' = Final)

Prediction 1.c. We expected the Dutch speaking Groups N & S to show a bias towards the voiceless option in final position when judging voiced fricatives. This bias towards the voiceless option in final position by the Dutch speaking group was not found. However, an ANOVA showed a significant difference between means of incorrect voiced responses (mean 15.9% incorrect) and incorrect voiceless responses (mean 22.3% incorrect; $F[1,1\ 78] = 5.03$, $p < 0.03$), but this difference can be attributed to a bias towards the voiced option in final position, not the voiceless option. A bias towards the voiceless option in final position was not found for the Dutch speaking participants.

Prediction 1.d. We expected all groups to perform better on the labio-dental (L) and alveolar (A) phonemes, than on the dental (D) phonemes. However, we also expected Group E to perform better on the dental phonemes than the Dutch speaking groups (N & S). Note that *labio-dental* (L) articulation includes the phonemes /f/ and /v/, *dental* (D) includes the phonemes /θ/ and /ð/, and *alveolar* (A) includes the phonemes /s/ and /z/. Figure 2 presents the means of correct responses with respect to voicing on three groups of phonemes with different places of articulation. An ANOVA showed a clear difference in performance on the three places of articulation ($F[2,417] = 26.93$, $p < 0.001$), and a *post hoc* analysis revealed that this difference is significant between all three groups of phonemes (all comparisons $p < 0.002$).

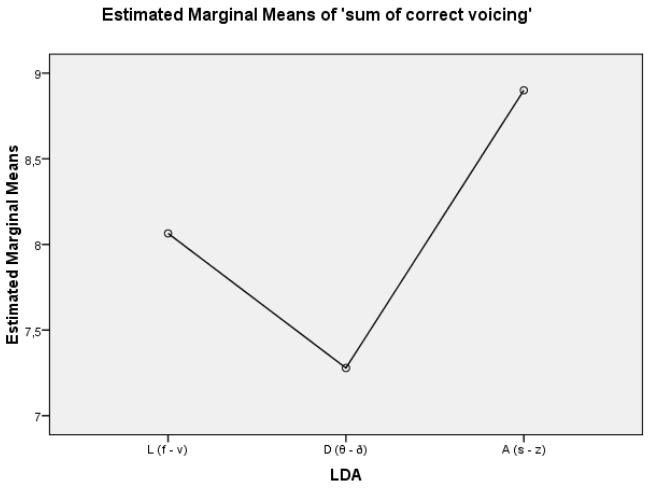

FIG 2. Means of correct categorisations of voice per place of articulation by all participants ('L' = labio-dental, 'D' = dental, 'A' = alveolar).

It was predicted that the English speaking participants would perform better on the dental phonemes than the Dutch speaking participants. An ANOVA showed that the English speaking group performed significantly worse on the voicing categorisation of the dental phonemes (mean 62% correct) than the Dutch speaking group did (mean 74.6% correct; $F[1,138] = 6.68$, $p < 0.02$), as can be seen in Figure 3. All participants, thus, performed better on the labio-dental and alveolar phonemes than on the dental phonemes, but the English speaking group did not perform better on the dental phonemes than the Dutch speaking group did.

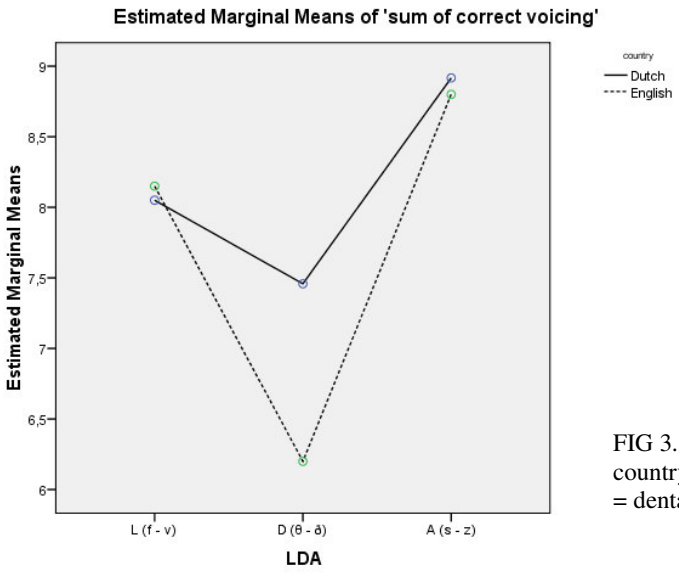

FIG 3. Means of correct categorisations of voice per country and place of articulation ('L' = labio-dental, 'D' = dental, 'A' = alveolar).

Thus, the main results for Hypothesis 1 were that there was no significant difference between the performances of the English speaking participants and the Dutch speaking participants overall and that the Dutch speaking participants did not identify voice better in initial or final position of the item; there was no significant difference to be found between the performance on target consonants in initial versus final position. Furthermore, for the Dutch speaking participants, a bias was found towards the voiced option in final position. All participants, both English and Dutch speaking, performed significantly better on the alveolar

and labio-dental phonemes than on the dental phonemes. Finally, compared to the Dutch speaking participants, the English speaking participants performed significantly worse on the identification of the voicing contrast in the dental phonemes.

5.2 Hypothesis 2

We hypothesized that regional differences would affect the participants' perception. Table 8 and 9 show the means of correct responses per fricative and position and the standard deviations by Group N and S.

TABLE 8 and 9 - Means of correct responses per fricative and position and the standard deviations by Group N and S.

Group N			
Position	Phoneme	Mean	Std. Deviation
I	/f/	7.93	1.438
	/v/	7.60	1.882
	/s/	9.13	1.060
	/z/	9.13	.990
	/θ/	7.47	1.885
	/ð/	6.87	1.807
F	/f/	7.07	2.120
	/v/	8.60	1.882
	/s/	9.20	1.014
	/z/	8.87	1.807
	/θ/	6.67	2.127
	/ð/	7.93	1.831

Group S			
Position	Phoneme	Mean	Std. Deviation
I	/f/	9.40	.828
	/v/	8.53	1.598
	/s/	9.27	1.387
	/z/	9.00	1.464
	/θ/	8.27	1.751
	/ð/	5.73	2.576
F	/f/	6.27	1.831
	/v/	9.00	1.464
	/s/	9.33	.976
	/z/	7.40	2.613
	/θ/	8.09	1.163
	/ð/	8.67	1.113

Prediction 2.a. Because the Dutch speaking Group N is not as familiar with the voicing contrast in general as the Group S due to the devoicing process discussed in Chapter 2.2.2, we expected that Group N would perform worse than Group S overall. Means of correct voicing answers between Group S and N showed that Group S performed slightly better (means 82.4% correct) than Group N (means 80.4% correct) in general. An ANOVA, however, showed that there was no significant effect of region on overall performance of voicing

categorisation. The Dutch Group N, therefore, did not perform significantly worse than Group S.

Prediction 2.b. We also expected that Group N, when perceiving voiced fricatives, would show a bias towards the voiceless option, not only in final, but also in initial position. An ANOVA showed that there was no significant difference between performance on means of incorrect voiced responses and incorrect voiceless responses, no bias was found for either the voiceless option or the voiced option.

To briefly summarise the main results for Hypothesis 2, no main effect of region was found, the regions performed almost equally on the categorisation of voice. No bias towards the voiced or voiceless option was found for the target consonants in initial position in the performance of Group N.

5.3 Hypothesis 3

The third hypothesis concerned the nature of L1 transfer. This hypothesis was formulated as possible options. The first option was that L1 transfer is phoneme-bound, in which case both Groups N and S would perform more or less the same (equally worse) on the categorisation of the dental, 'unfamiliar', phonemes. The second option was that L1 transfer is feature-bound, in which case Group S would perform better on the dental phonemes than Group N. One requirement was that Group S performed better than Group N in general. Results from Hypothesis 2 already showed that there was no significant difference between the performances of Group S and N in general. Also, a small difference was found between the performance of Group S and Group N with respect to voicing categorisation of the dental phonemes (/θ/ and /ð/), as shown in Figure 4. Group S seemed to perform slightly better (mean 76.8% correct) than Group N (mean 72.3% correct), however, an ANOVA showed that this difference was insignificant.

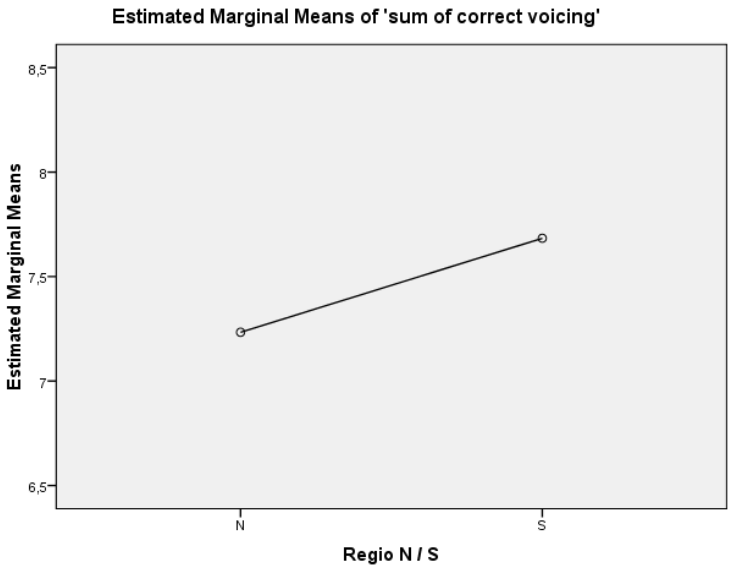

FIG 4. Means of correct categorisations of voice per region ('N' = North (Groningen), 'S' = South ('Flemish Limburg)).

5.4 Hypothesis 4

We hypothesized that confusions of phonemes with other phonemes by all groups would be seen in the results, implying that participants would not only have difficulties with discriminating between the voicing contrasts, but also between the fricatives in general.

Prediction 4.a. We expected the English speaking participants to perform better on phoneme identification than the Dutch speaking participants in general. An ANOVA showed a significant effect of language ($F[1,4198] = 4.37$, $p < 0.04$) with respect to identification of phoneme. The overall percentages of correct phoneme identification were a little higher for the English speaking participants (mean 65.8% correct) than for the Dutch speaking participants (mean 61.4% correct). The English speaking participants, therefore, performed better than the Dutch speaking participants in general.

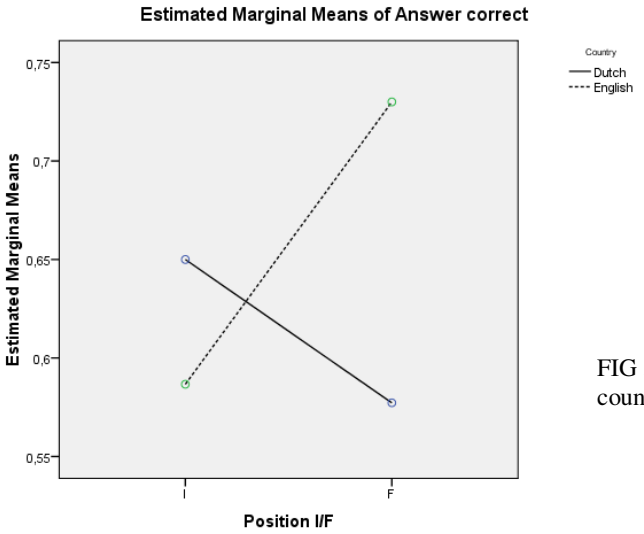

FIG 5. Means of correct phoneme identifications per country and per position ('I' = initial, 'F' = final).

An ANOVA revealed that there was a significant interaction ($F[1,4196] = 25.69$, $p < 0.001$) between the total number of correct phoneme categorisations on the one hand and language and position on the other. Figure 5 shows that the Dutch speaking participants performed significantly better on initial position (mean 65% correct), than on final position (mean 57.7% correct) and that the English speaking participants performed significantly better on final (mean 73% correct) than on initial position (mean 58.7% correct).

Prediction 4.b. We expected that, if mistakes would be made in the categorisation of phonemes, all groups would mistake the dental phonemes for either the labio-dental phonemes with the same voice value, or their voiced/ voiceless counterparts, and also that all groups would mistake labio-dental phonemes for either dental phonemes with the same voice value or their voiced/ voiceless counterparts. We also expected the alveolar phonemes to be mistaken for other phonemes less than the other two groups of phonemes, and if they were mistaken, it would mainly be for their voiced/ voiceless counterparts. Table 10 and 11 show

the phoneme categorisations and confusions of the Dutch and English speaking groups in initial and final position.

TABLE 10. Confusion matrix for initial and final fricatives by the Dutch group in percentages. (The correct responses are presented in bold)

	Initial						Final					
Response→ Target↓	/f/	/v/	/s/	/z/	/θ/	/ð/	/f/	/v/	/s/	/z/	/θ/	/ð/
/f/	**77.7**	11.7	0.3	0.3	8.7	1.3	**52.0**	32.3	1.0	0.7	13.7	9.3
/v/	8.0	**71.3**	0.3	0.3	11.0	9.0	7.3	**82.3**	1.0	0.3	3.7	5.0
/s/	2.3	1.3	**88.7**	5.3	1.0	1.3	0.7	1.0	**91.0**	4.0	1.3	2.0
/z/	-	0.7	9.0	**89.3**	0.3	0.7	0.3	0.7	17.0	**80.7**	1.0	0.7
/θ/	46.0	4.7	4.6	-	**27.3**	17.3	32.0	10.0	11.0	2.0	**30.7**	14.3
/ð/	8.3	18.0	1.0	5.0	28.0	**39.7**	6.7	63.7	1.0	6.3	9.0	**13.3**

TABLE 11. Confusion matrix for initial and final fricatives by the English group in percentages. (The correct responses are presented in bold)

	Initial						Final					
Response→ Target↓	/f/	/v/	/s/	/z/	/θ/	/ð/	/f/	/v/	/s/	/z/	/θ/	/ð/
/f/	**70.0**	-	-	-	16.0	14.0	**64.0**	4.0	-	-	20.0	12.0
/v/	8.0	**50.0**	-	-	28.0	14.0	4.0	**90.0**	-	-	4.0	2.0
/s/	2.0	-	**74.0**	16.0	2.0	6.0	-	-	**96.0**	-	2.0	2.0
/z/	-	-	18.0	**82.0**	-	-	-	2.0	6.0	**90.0**	-	2.0
/θ/	24.0	2.0	-	-	**48.0**	26.0	10.0	-	-	-	**60.0**	30.0
/ð/	-	16.0	-	4.0	52.0	**28.0**	2.0	20.0	-	-	40.0	**38.0**

As shown, the Dutch speaking participants confuse the /v/ and the /f/ mostly with each other in both initial and final position. The English speaking participants do not confuse the /f/ and /v/ with each other in initial position, and in final position the percentages are insignificantly low. However, in initial position the English speaking participants confuse respectively /f/ and /v/ with /θ/ and /ð/, and /f/ in final position also for /θ/. A further result is that the Dutch speaking participants categorise the /θ/ in both initial and final position most often as /f/. The percentage of correct categorization of the /θ/ is lower than the percentage of /θ/ being categorized as /f/. In initial position /ð/ is often categorised by the Dutch speaking participants as /θ/, and in a small percentage of cases as /v/. In final position, /ð/ is categorised more often

as /v/ than /ð/, and in a very small percentage of cases it is confused with /θ/. The English speaking participants confuse /θ/ in both initial and final position mostly with /ð/ and also with /f/. The phoneme /ð/ is most often categorised by the English speaking participants as /θ/, again even more than /ð/ itself, and also in a smaller percentage of cases as /v/. Therefore, /θ/ and /ð/ in initial and final position are confused mostly with each other, though the percentages are much higher for the confusion of /ð/. Results show that the alveolar phonemes /s/ and /z/ in initial and final position for both the English and Dutch speaking groups are confused least, and when they are confused it is mostly with their voiced or voiceless counterpart.

In general, the English speaking participants performed better on phoneme identification than the Dutch speaking participants. The English speaking participants mostly confuse the dental phonemes with their voiced/voiceless counterparts, the labio-dental phonemes with the dental phonemes, though not necessarily with the same voice value. The alveolar phonemes were categorised better than the labio-dental and dental phonemes and if they were confused with other phonemes, it was with their voiced/voiceless counterparts. The Dutch speaking participants show a slightly different pattern: the dental phonemes are mostly confused with the labio-dental phonemes with the same voice value, the labio-dental phonemes with their voiced/voiceless counterparts, and the alveolar, similarly to the English speaking participants, were confused less than the labio-dental and dental phonemes.

5.5 Additional analyses

For the following results, an analysis was done on miscategorisation of place of articulation (L, D and A). This additional analysis was not part of an hypothesis, but could reveal some interesting results regarding miscategorisations of place of articulation by the different

groups. These results will later be compared to miscategorisations in voice and phoneme. In this analysis responses were counted as incorrect when they belonged to another place of articulation than the target phoneme. For example, when the /s/ was the target phoneme, both /s/ and /z/ as response were considered correct since both are pronounced with the same place of articulation, namely alveolar. An ANOVA revealed that overall, for all results together of all participants and both positions, there was a significant effect of place of articulation ($F[2,207] = 103.07$, $p < 0.001$). Performance on the dental phonemes (mean 51% correct) was worse than performance on labio-dental (mean 80 % correct) and alveolar phonemes (mean 94.8% correct). The order of performance from best to worse was A > L > D. As can be seen in Figure 3, a similar pattern was found for voicing miscategorisations per category of place of articulation. When separated out by position, the results also show a significant effect of place of articulation ($F[2,204] = 110.26$, $p < 0.001$), as shown in Figure 6. The same pattern in order of performance (A > L > D) can be seen when looking at initial and final position separately.

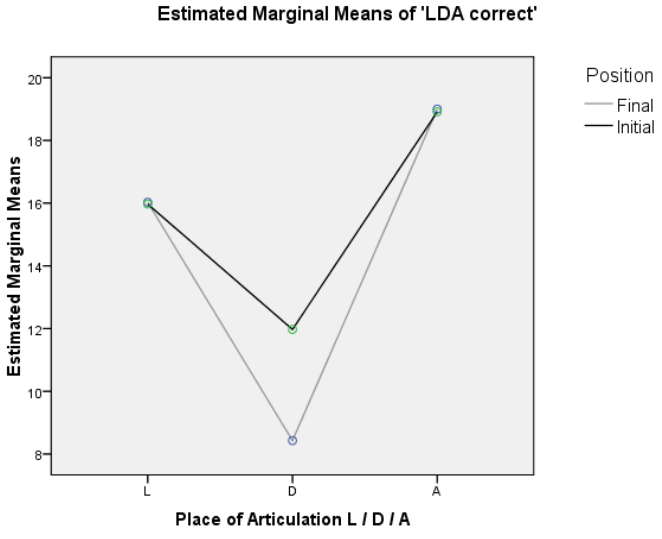

FIG 6. Means of correct categorisation of place of articulation per position and place of articulation ('L' = labio-dental, 'D' = dental, 'A' = alveolar).

However, there is also a significant interaction between place of articulation and position, in which performance on the dental phonemes in final position was significantly worse than in initial position ($F[1,68] = 10.49$, $p < 0.003$), whereas performances on L and A were almost the same in both positions.

Further analyses of variance showed a significant interaction between language and place of articulation ($F[2,198] = 17.15$, $p < 0.001$) and between language and position ($F[1,198] = 6.68$, $p < 0.02$). Figure 7 shows the results on the categorisation performances for place of articulation on both positions and by both language groups separately. Contrary to the results for voicing categorisation (see Figure 3 on page 47), the English speaking group performed better on the dental phonemes in both positions than the Dutch speaking group.

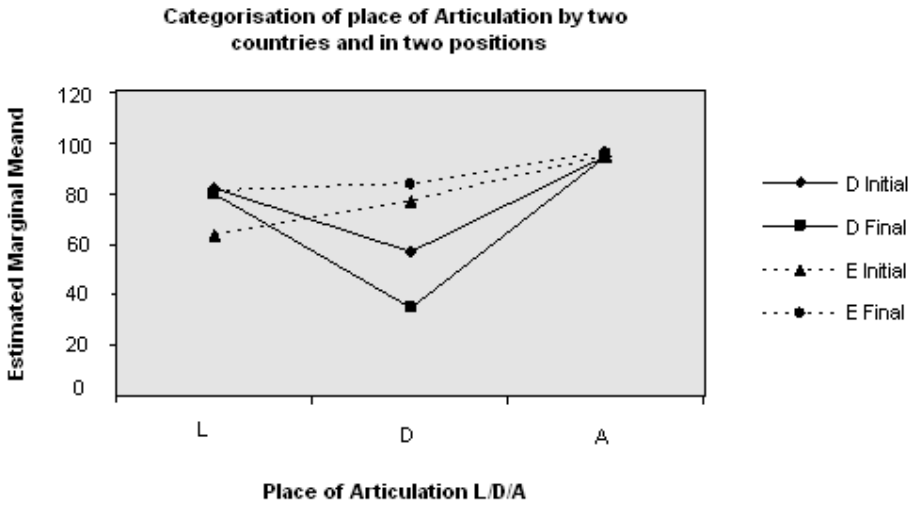

FIG 7. Means of correct categorization of place of articulation per position, per language and per place of articulation ('L' = labio-dental, 'D' = dental, 'A' = alveolar).

Moreover, the Dutch speaking participants performed worse on the dental phonemes in final position (mean 35% correct) than initial position (mean 57%), and the English speaking participants performed better in final position (mean 84% correct) than in initial position (mean 77% correct). In general, though, the English speaking participants did not perform significantly better than the Dutch speaking participants.

The performance on alveolar phonemes was still best, by both countries and both positions, and on labio-dental phonemes a little worse. The performances of the two language groups on labio-dental phonemes in final position did not differ much, with the English speaking participants just slightly better (mean 81% correct) than the Dutch speaking participants (mean 80% correct). However, the English speaking group performed much worse on the categorisation of initial labio-dental phonemes (mean 64% correct) and also worse than the Dutch speaking participants (mean 82.5% correct).

6. Discussion

In this chapter the results of the four hypotheses and the additional analysis will be discussed and the relevant findings will be summarized after each hypothesis.

6.1 Hypothesis 1

Hypothesis 1 was not confirmed: there was no significant effect of L1 transfer for the perception of fricatives by Dutch listeners of English. First, the prediction that the English speaking group would perform better on voicing categorisation than the Dutch speaking groups was not confirmed. No significant difference in performance between the two language groups, Dutch and English, was found. This result is similar to those in Broersma (2005), in which the English speaking participants also did not perform better than the Dutch participants. But at the same time it is different from Cutler et al. (2004), in which the English speaking participants did perform significantly better than the Dutch participants. Our current finding may be attributed to our manipulating the stimuli for vowel duration, by removing the vowel duration cue, which normally is an important cue for English speakers. However, the English speaking participants did not perform worse on the target consonants in final position in which this vowel duration cue is important. The Dutch speaking participants did not identify voice better in initial or final position of the item. There was no significant difference to be found between the performance on target consonants in initial versus final position. Thus, the second prediction of Hypothesis 1, that the Dutch speaking groups would perform worse on final position than on initial position, was not confirmed either. The third prediction of Hypothesis 1 was that the Dutch group would bias toward the voiceless option in final position. Although a significant difference was found between means of incorrect responses by the Dutch groups on voiced and voiceless fricatives, there was no bias towards the

voiceless option in this position. Remarkably, the bias appeared to be towards the voiced option rather than the voiceless. These results, that the Dutch speaking participants did not perform worse than the English speaking participants in discriminating between the voicing contrast and did not perform worse on final position than on initial position, somewhat resemble the results of the relevant experiment in Broersma (2005). The results contradict those of Cutler et al. (2004), in which the Dutch speaking participants performed worse than the English speaking participants. Both studies involved advanced learners of English who had received on average 7 to 8 years of English instruction in primary school and high school education, which means that this could not have caused the difference in results between the studies. A possible explanation for the resemblance to Broersma's work (2005) and the dissimilarity to Cutler et al. (2004) is that in Broersma (2005), only the fricatives /f-v/ and /s-z/ were used in the relevant experiment: this resembles the number of fricatives used in the present study. In Cutler et al. (2004) on the other hand, twenty-one phonemes were used, including stops, fricatives, nasals and liquids. What may be concluded from this comparison is that for Dutch learners of English in an experiment situation, the voicing contrast in just English fricatives is less difficult to detect than the voicing contrast in a whole range of consonants. Regarding the fourth prediction of Hypothesis 1, all participants, both English and Dutch speaking, performed significantly better on the alveolar and labio-dental phonemes than on the dental phonemes, as was expected. Against expectations, the English speaking participants, compared to the Dutch speaking participants, performed significantly worse on the voicing contrast in dental phonemes. A possible explanation for this could be that, although present in their native language, the English speakers are not aware of the voicing contrast in the dental phonemes, since these are spelled the same (namely: 'th'). For them, perhaps, this contrast was just as new as for the Dutch speaking participants. Having to make a conscious choice between the two phonemes might have been more difficult for a native

speaker of English than for a native speaker of Dutch, who is taught about the English sounds explicitly. However, the results from Hypothesis 4 and the additional analyses showed that the English speaking participants performed better than the Dutch speaking participants on the labelling of the dental phonemes.

When looking at the results for each prediction it can be concluded that Hypothesis 1 was not confirmed; a clear effect of L1 transfer was not found. In general, the Dutch speaking participants did not perform worse than the English speaking participants, nor did they bias towards the voiceless option in final position, even though the voicing contrast in final position is not present in the native language. Although in general all participants performed worse on the dental phonemes, the Dutch speaking participants did not perform worse on the dental phonemes, which are unfamiliar to them in their native language, than the English speaking participants.

6.2 Hypothesis 2

Hypothesis 2 was not confirmed: there was no significant effect of region on the perception of the voicing contrast in fricatives. The prediction that Group N would perform worse than Group S on voicing categorisation was not confirmed. Both groups (N&S) performed almost equally well on the categorisation of voice. The more advanced process of devoicing in the northern part of the Netherlands apparently did not have any influence on the ability to identify voice, compared to the southern group from Belgium, in which the process of devoicing is not as advanced. Furthermore, the expectation that for Group N a bias towards the voiceless option in initial position would be found, too, was not confirmed.
Thus, Hypothesis 2 was not confirmed. This seems to imply that the difference between the degree of the fricative devoicing process in the two regions does not affect the ability to distinguish between the voicing contrast in fricatives. However, there is a possible alternative

explanation. The lack of a difference in the performance between the two groups may be due to the fact that that in production, the difference between Groups N and S was not significant. Although there were differences in the degree of the devoicing process between Groups N and S, the region from which the participants in Group S came, was not the region in which the process of devoicing is the least advanced. Results might have been different if the participants were from the west of Belgium, in which the process of devoicing of fricatives is even less advanced than in (Eastern) Flemish Limburg.

6.3 Hypothesis 3

Hypothesis 3 implied that was that if Group S performed better than Group N overall, and also better than Group N on the dental phonemes, L1 transfer would be feature-bound. If Group S performed better than Group N overall, but equal to Group N on the dental phonemes in particular, L1 transfer would be phoneme-bound. But since the predictions from Hypothesis 1 that there would be an L1 transfer effect and Hypothesis 2 that Group S would perform better on the voicing categorisation than Group N, were both left unconfirmed, no conclusion can be drawn from the results regarding the nature of L1 transfer. Results did show that there was no significant difference in the performance between the two Dutch speaking Groups on the dental phonemes, but since Group S did not perform better than Group N overall and Group E did not perform better than both Groups N and S, it cannot be concluded from this that L1 transfer is phoneme-bound.

6.4 Hypothesis 4

Hypothesis 4 was confirmed: all groups confused phonemes most frequently with specific different phonemes. The prediction that the English speaking participants would perform

better on phoneme identification than the Dutch speaking participants was confirmed. Remarkably, the English speaking participants did not perform better than the Dutch speaking participants on voicing categorisation (predicted in Hypothesis 1), but they did on phoneme identification. The English speaking participants, therefore, seem to have more difficulties with voicing identification than with phoneme identification. The fact that the Dutch participants perform worse than the English participants on the identification of the phonemes overall might be due to the Dutch participants being less familiar with the English fricatives than the English participants are. This implies a form of L1 transfer: being less familiar with certain non-native phonemes causes difficulties in the L2 perception.

The prediction that the dental phonemes would mostly be confused with labio-dental phonemes (of the same voice value) and with each other, that the labio-dental phonemes would mostly be confused with dental phonemes (of the same voice value) and with each other, and that alveolar phonemes would mostly be confused with each other and least of all, is largely confirmed. The Dutch speaking and English speaking groups, however, show a small difference with respect to the specific confusions. The English speaking participants mostly confuse the dental phonemes with their voiced/voiceless counterparts, whereas the Dutch speaking participants mostly confuse the dental phonemes with labio-dental phonemes of the same voice value. The English speaking participants most often confuse the labio-dental phonemes with the dental phonemes, though not with the same voice value in most cases, whereas the Dutch speaking participants mostly confuse the labio-dental phonemes with their voiced/voiceless counterparts. A possible explanation for the fact that the English speaking participants also perceive dentals when presented with labio-dentals, and why the Dutch speaking participants perceive labio-dentals when presented with dentals, is familiarity with the specific phonemes. The English speaking participants are familiar with the dentals and the Dutch speaking participants are not.

Hence, Hypothesis 4 was confirmed: the English participants did perform better on the identification of the phonemes than the Dutch participants.

6.5 Additional analyses

In the fourth prediction of Hypothesis 1, we expected all groups to perform better on the labio-dental and alveolar phonemes than on the dental phonemes, and we also expected the English speaking group to perform better on the dental phonemes than the Dutch speaking groups. The first part of the prediction was confirmed, but the second part was not. In the results of the analysis in which the focus was on place of articulation instead of voicing identification, however, the order of performance from best to worse was A > L > D, similar to the voicing identification analysis of Hypothesis 1: the English speaking group, in this case, did perform better on the dental phonemes than the Dutch speaking participants. Again, it seems as if the English speaking participants have more difficulties with the voicing contrast than with the identification of place of articulation or phoneme identification (as was concluded in Hypothesis 4). Further analyses showed some small variations in the performance on consonants in initial and final position and place of articulation, though none of these results reached true significance. In summary, the English speaking participants identified the place of articulation of the dental phonemes better than the Dutch speaking participants did. This is the opposite of the results of the identification of voice in dental phonemes, as tested in Hypothesis 1. The Dutch participants performing worse on the identification of place of articulation of the dental phonemes could be due to L1 transfer: the Dutch participants were less familiar with the English fricatives than the English participants were and had therefore more difficulties with perceiving these differences between the place of articulation of the dental phonemes and the other four (labio-dental and alveolar) phonemes.

7. Conclusion

In this study, we tried to answer two main questions concerning L1 transfer. The first aim was to find out whether L1 transfer would be visible in the perception of the voicing contrast in English fricatives by Dutch listeners and whether regional differences of the Dutch L2 learners of English would affect their SLA in different ways. To answer this question a perception experiment in which native listeners of Dutch and native listeners of English had to identify voiced and voiceless fricatives was conducted. Hypothesis 1 and 2 were formulated to fit this aim. However, Hypothesis 1 and 2 were not confirmed. From the first hypothesis, in which it was claimed that there would be an L1 transfer effect visible, most predictions were not confirmed. First, the English speaking participants did not perform better than the Dutch speaking participants. Second, the performance on initial position was not significantly better than on final position by the Dutch speaking participants, even though in Dutch there is no voicing contrast in final position. Third, there was no bias towards the voiceless option in final position by the Dutch speaking participants and fourth, the English speaking participants did not perform better on the dental phonemes than the Dutch speaking participants. The only prediction that was confirmed, was that the performance of all participants on the dental phonemes was worse than on the alveolar and labio-dental phonemes. However, this prediction does not say anything about an effect of language and does not positively contribute to a conclusion about L1 transfer. It can be concluded from the results of Hypothesis 1 that there was no significant effect of L1 transfer on the perception of the voicing contrast in fricatives by Dutch L2ers of English. Although no effect of L1 transfer was found for the perception of the English voicing contrast by Dutch listeners, this does not mean that no effect of L1 transfer was found at all. Results from Hypothesis 4 and the Additional analysis showed that the English participants performed better on the

categorisation of the fricatives overall, and on the categorisation of place of articulation of the dental phonemes. The Dutch participants performing worse than the English participants on these two issues might be due to the Dutch participants being less familiar to the English phonemes than the English participants were.

The results for Hypothesis 2 showed that the northern group did not perform worse than the southern group and did not show a bias towards the voiceless option in initial position. Our expectation, thus, that the lack of experience with the voicing contrast in the North of the Netherlands would cause a negative transfer effect, was not confirmed. Thus, no main effect of region on non-native perception of fricatives was found.

Our second aim in this study was to answer a question about the nature of L1 transfer, namely, whether L1 transfer is feature of phoneme bound, by specifically looking at the performances on the 'familiar' contrasts versus the 'unfamiliar' contrast. One requirement to be able to answer this question was that the participants from Belgium would perform better than the participants from Groningen overall. This was however not the case, as became clear from the first two hypotheses. Since the first two hypotheses were not confirmed, no conclusion can be drawn for the third hypothesis. There were no significant results to confirm that L1 transfer is phoneme –or feature bound.

To conclude, in the data of this experiment no clear effect of L1 transfer on the perception of the voicing contrast in fricatives was found. Regional variation in the Dutch language did not have influence on the performance on voicing identification in English fricatives and so, no conclusion can be drawn about the nature of L1 transfer. The question then about the nature of L1 transfer remains unanswered.

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