The acquisition of the English voice contrast by native speakers of vernacular Belgian Dutch[1]*

A comparison between East- and West-Flemish speakers

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The present paper discusses the laryngeal phonology of Dutch Learner English. Because the laryngeal specifications of obstruents are different in Dutch and English, native speakers of Dutch learning English as a foreign language have to acquire a new laryngeal system. By analysing the presence or absence of aspirations and voice assimilations in spontaneous Dutch and English conversations between native speakers of Dutch, the paper aims to shed light on the laryngeal specifications of obstruents in Dutch Learner English and the implications for L1 Dutch and English.

1. Aim

The laryngeal specifications of Dutch and English obstruents are considerably different. This means that native speakers of Dutch learning English as a foreign language, have to acquire a new laryngeal system. Kager et al. state the following:

> 'To acquire the laryngeal phonology of a language amounts to identifying the relevant contrasts, building up a representation of laryngeal features, and learning to produce these contrasts in an adult-like fashion' (Kager et al., submitted).

As the present study deals with the second language acquisition of a laryngeal system, this means that speakers have already acquired the laryngeal system of their mother tongue and L2 learners thus have to learn to produce the new contrasts in a *native-like* (rather than *adult-like*) fashion. This paper addresses two main research questions. First, it will be investigated how native

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speakers of vernacular (Belgian) Dutch acquire the voice contrast of stops in English. The analysis will be based mainly on the production of aspirations and voice assimilations. Secondly, the study discusses whether speakers from East-Flanders follow a different path in the acquisition of the English voice contrast compared to speakers from West-Flanders. The phonological systems of East- and West-Flemish are considerable different. One way in which they differ from each other which is relevant to this study is in their treatment of fricative + sonorant consonant clusters across word-boundaries. In West-Flemish, word-final fricatives undergo regressive voice assimilation (henceforth: RVA) when followed by a sonorant consonant. RVA does not occur in this type of cluster in East-Flemish or in Standard Dutch.

2. Data and methodology

2.1. The informants

The analysis is based on recordings of sixteen spontaneous Dutch and English dialogues between dyads of second-year students of English at Ghent University, aged between 19 and 22. The informants were asked to talk to each other for forty minutes about any subject they liked, once in Dutch and once in English. All informants had Dutch as their mother tongue. The Dutch spoken in the conversations can be situated somewhere on the continuum between Standard Dutch and dialect. As the informants are second year students of English at university level, their proficiency in English was predictably high. No third person was present during the recordings, which were made in a sound-attenuated room.

Each informant was also asked to read a number of Dutch and English sentences aloud. These sentences were composed with the purpose of containing specific possible assimilation sites. An example of an English sentence is the following:

(1) It would be good if my sister could leave the room.

In this sentence six consonants occur in word-final position. The phrases *it would* and *if my* will be checked on the presence or absence of RVA. In the phrases *would be, good if, could leave* and *leave the,* the word-final consonant is a voiced obstruent (followed by, respectively, a voiced stop, a vowel, a lateral and a voiced fricative). These phrases will be analysed on the presence or absence of final laryngeal neutralization (a typical phenomenon in L1 Dutch, which is absent in L1 English).

2.2. The transcriptions

All Dutch and Dutch Learner English (henceforth DLE) conversations were orthographically transcribed in Praat (Boersma & Weenink, version 4.1.12). All voiceless stops which occurred in a stressed syllable in word-initial position were coded for presence or absence of aspiration. All clusters containing a word-final, underlying voiceless obstruent followed by an obstruent or a sonorant were coded for presence or absence of assimilation. All data were gathered in a database, which contains about 9700 tokens. The codings are based on perception. All clusters which were difficult to code because of, for instance, background noise, high speech rate, laughter, low volume, etc., were rejected.

3. The laryngeal representations of stops in DLE

3.1. Iverson & Salmons (2003) on stops

Iverson & Salmons (2003) adopt Dimensional Theory (proposed by Avery & Idsardi, 2001) to account for the different laryngeal representations in English and Dutch. Avery & Idsardi assume that the laryngeal node is divided into three dimensions: Glottal Width (GW), Glottal Tension (GT) and Larynx Height. Each dimension is linked to two mutually exclusive gestures, respectively, [spread] and [constricted], [stiff] and [slack], and [raised] and [lowered]. Larynx Height will not be discussed in this paper, as it is not contrastive in Dutch or English.

The laryngeal specifications of Dutch and English stops are assumed to be as presented in the following table (Iverson & Salmons, 2003).

	voiceless stop	voiced stop
Dutch	ø	GT
English	GW	ø

Figure 1. Laryngeal representations of Dutch and English stops

Whereas voiceless stops in Dutch are unmarked, they are marked for GW in English. This accounts for the presence of aspiration of voiceless stops in English, but not in Dutch.

Voiced stops, on the other hand, are unmarked in English and marked for GT in Dutch. This is related to the fact that voiced stops in English are often phonetically voiceless, whereas they are prevoiced in Dutch. In Dutch, there is a phonological rule which spreads the GT specification leftwards to the preceding obstruent, so that regressive voice assimilation occurs. In English, voiced stops are unmarked and are thus unable to trigger regressive voicing assimilation.

3.2. Predictions

If native speakers of Dutch transfer the Dutch laryngeal contrast to English, the following two predictions can be made: (1) there will be a lack of aspiration of voiceless stops in Dutch Learner English and (2) voiced stops will be prevoiced in DLE, which may lead to the production of regressive voice assimilation. Two things need to be considered here:

First, it should be noted that learning to aspirate voiceless stops means learning an extra specification, namely learning to specify voiceless stops for GW. In contrast, voiced stops are marked for GT in Dutch and native speakers of Dutch thus need to lose a specification.

Secondly, Kager et al. (submitted) note that children acquiring English as their mother tongue acquire the laryngeal contrast of their language earlier than children learning Dutch as their mother tongue. They argue that this can probably be explained by the greater acoustic salience of aspiration in contrast to prevoicing.

3.3. Aspiration in voiceless stops

The following graph presents the aspirations produced by the individual informants in word-initial voiceless plosives occurring in stressed syllables.

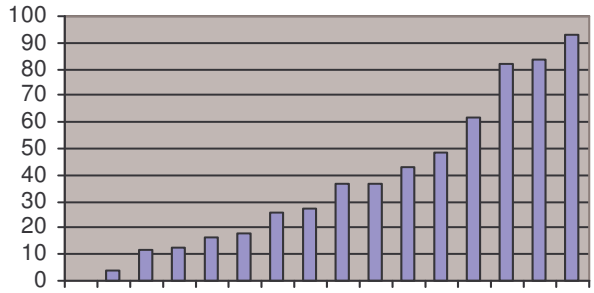

Figure 2. Aspiration of word-initial plosives in the DLE conversations (%)

The graph shows the production of aspirations by all sixteen informants (presented on the X-axis) in percentages (indicated along the Y-axis).

It was predicted that there would be a lack of aspirations in the DLE of the informants. This prediction cannot be verified, as there are large individual differences between the informants. Although all informants produce some aspirations, they do this to very different degrees: one informant did not produce any aspirations, one informant produced aspirations in 93% of the tokens and all the other informants' values are evenly spread between these two extremes. One explanation could be that the informants have acquired the laryngeal specification of voiceless stops in English, but do not all have the

correct phonetic implementation. This explanation is based on the idea that, if the informants had not acquired the correct phonological representation, they would not produce any aspirations at all.

A question which also needs to be asked is to what extent native speakers of English aspirate word-initial voiceless stops. Docherty (1992) measured VOT's in words read aloud by five native speakers of Southern British English, aged between 18 and 21. (The words were read in three environments: in isolation, in a carrier phrase where they occurred between voiced segments and in a carrier phrase where they occurred between voiceless segments.) He concluded that the VOT's for voiceless stops ranged from 18 ms up to 127 ms and that there thus is 'a large amount of within-category variability' (Docherty, 1992:127). Since my data were coded on the basis of perception rather than on VOT measurements and since they consist of spontaneous speech rather than of read words, it is hard to compare my results with Docherty's. However, Docherty refers to Stevens & Klatt (1974) and Pisoni (1977) and argues that 'in order for a displacement in voice onset with respect to stop release to become audible, (…) an interval of approximately 20 ms is required between onset of voicing and the release of the stop' (1992:12). This means that in the overwhelming majority of voiceless stops produced by Docherty's informants, namely in all those with VOT's ranging between 20 ms and 127 ms, a VOT delay is audible. This does not necessarily mean that all these stops would be classified as aspirated on the basis of perception, but it is clear that nearly all informants in my study severely underaspirate voiceless stops in English, since in most tokens with an initial voiceless stop, no delay in VOT was audible at all.

3.4. Prevoicing and regressive voice assimilation

In order to investigate the informants' acquisition of voiced stops in English, one would have to look at the occurrence of prevoicing of stops in the Dutch conversations and see whether the informants tranfer prevoicing into English. Van Alphen (2004) asked ten native speakers of Dutch to read out aloud isolated Dutch words starting with a voiced plosive. The test items consisted of both existing words, such as *deur* ('door'), *duin* ('dune'), *dwars* ('diagonally') and nonwords, such as *baag, bleep, bluim*. She concluded:

> 'Five out of 10 subjects prevoiced very consistently, with more than 90% of all their voiced tokens produced with prevoicing. The other five subjects produced prevoicing less frequently, but the proportion of prevoiced tokens varied considerably between those five less frequent prevoicers' (Van Alphen, 2004:45).

In total, 25% of all word-initial voiced plosives investigated by Van Alphen (2004) lacked prevoicing. Whether a similar percentage of voiced stops would be prevoiced in spontaneous speech still remains to be investigated. A complicating factor which should be taken into account is that there are some reports on the production of prevoicing in native English. Lisker & Abramson

(1964), for instance, investigated VOT's of stops in isolated English words produced by four speakers of American English. One of these informants produced 41 of 42 initial voiced plosives (/b, d, g/) with prevoicing. This means that not all (possible) occurrences of prevoicing in DLE could automatically be explained as cases of tranfer. Since there are - to my knowledge - no thorough studies on the production of voiced stops in British English[2], it is possible that the production of prevoicing is typical of American English. So far, no acoustic measurements on prevoicing of voiced stops in spontaneous Dutch conversations have yet been done. My research will include a study along these lines in the future.

Since RVA is only possible in clusters in which the second, word-initial voiced stop is specified for GT, the occurrence of RVA is an indication of the laryngeal specification of the stops. The following graph shows the production of RVA in clusters in which the first, word-final consonant is a voiceless obstruent and the second, word-initial consonant a voiced plosive, which is the environment in which we expect RVA in Dutch. In this graph I have pooled the data of all informants, because not enough tokens were present to reflect each informant's performance. In total, there were 140 voiceless obstruent + voiced stop clusters across word-boundaries in the English conversations which were coded for the presence or absence of aspiration. 83 out of these 140 clusters were produced with RVA (i.e. 59.3%). In the Dutch conversations, 332 clusters were coded. Of these 332 clusters, as many as 304 were realized with RVA (i.e. 91.6%).

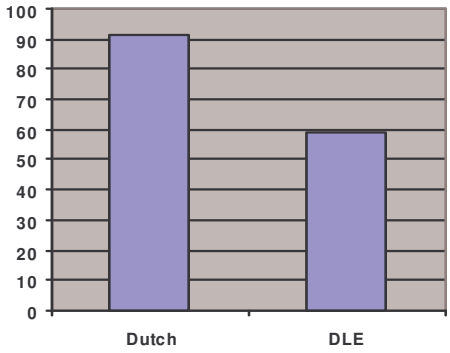

Figure 3. RVA's in [voiceless obstruent + voiced stop] clusters

[2] Docherty (1992) refers to Suomi (1980) as an exception. Suomi found hardly any cases of prevoicing in his data (Docherty, 1992:31).

The graph shows that in this type of clusters, RVA is extremely frequent in the Dutch conversations; more than 90% of the clusters underwent RVA. In the DLE conversations, RVA was produced in almost 60% of the clusters.

The following examples are taken from the conversations:

Dutch:

(2) afwas doen s [d → z
washing-up do-INF
'to do the washing-up'

(3) groep Duitse p [d → b
group German-ADJ
'group German'

(4)of drie f [d → v
or three
'or three'

DLE:

(5) difference between s [b → z
(6) different bar t [b → d
(7) it's good ts [g → dz

The high percentage of RVA in DLE seems to indicate that the informants transfer the voice specification of voiced stops from Dutch into English and the second prediction is thus confirmed by the data.

4. The laryngeal representation of fricatives in DLE

4.1. Iverson & Salmons (2003) on fricatives

English fricatives are specified in the same way as stops: voiceless fricatives are marked for GW, voiced fricatives are unmarked. In Dutch, the situation for fricatives is much more complicated than for stops. Iverson & Salmons argue that Dutch voiceless fricatives are marked for GW, whereas voiced fricatives are marked for GT. The laryngeal system in Dutch would thus be a mixed system, in which voiceless fricatives are marked for GW (which is typically the case in Germanic languages) but in which, under the influence of contact with Romance languages, voiced stops and voiced fricatives have taken on a GT-specification. The laryngeal specifications of fricatives in Iverson & Salmons' model (2003) are thus as presented in the following table:

	voiceless fricative	voiced fricative
Dutch	GW	GT
English	GW	ø

Figure 4. The laryngeal representations of Dutch and English fricatives.

In Dutch, word-initial voiced fricatives are subject to progressive voice assimililation (henceforth PVA) when preceded by a word-final voiceless obstruent. Examples are given in (8) and (9).

(8) 't is veel s] v → f
it-CLITIC is much
'it's much'

(9) de kat zien t] z → s
the cat see-INF
'to see the cat'

In order to account for PVA of voiced fricatives in Dutch, Iverson & Salmons formulate a rule of Post-obstruent fricative neutralization, which says that the Glottal Tension specification is delinked from fricatives when these are preceded by an obstruent. The fricatives are then laryngeally unspecified, but become specified for Glottal Width as a result of Vaux's Law. On the basis of evidence from a number of languages, Vaux argues that the default, unmarked state of unspecified fricatives is in fact [spread glottis] (Vaux 1998). Iverson and Salmons (2003:11) cast Vaux's statement in Dimensional Theory terms:

> 'Vaux's Law: Laryngeally unspecified fricatives in a Glottal Tension system → Glottal Width (in systems contrasting fricatives without reference to [GW]).'

Discussing the validity of this mixed system of laryngeal representations of Dutch fricatives lies outside the scope of this paper. However, a brief discussion of the laryngeal representations of fricatives was necessary, because the following sections deal with the presence or absence of RVA in fricative + sonorant consonant clusters.

4.2. [Fricative + sonorant consonant]-clusters in East- and West-Flemish

It should be noted that eight out of sixteen informants are from West-Flanders; the other eight informants are from East-Flanders. These two dialect areas (which to a large extent coalesce with the two provinces) are adjacent and are situated in the western part of the country (cf. figure 5.)

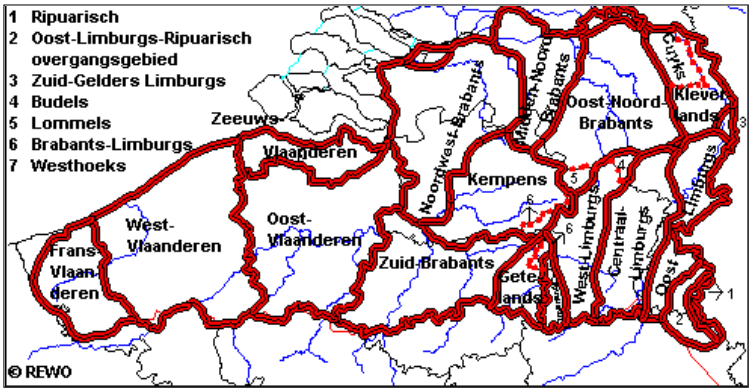

Figure 5. Dialect map of the Southern Dutch dialects (Belgium and the southern part of the Netherlands). The Dutch words for East-Flanders and West-Flanders are *Oost-Vlaanderen* en *West-Vlaanderen*. Source: REWO, http://fuzzy.arts.kuleuven.ac.be/rewo.

The reason why informants from these two areas were selected is that the regiolects spoken in these two areas differ with respect to the realization of word-final fricatives followed by sonorant consonants.

The normal state of the glottis during the production of sonorants is such that spontaneous voicing occurs (cf. e.g. Chomsky & Halle, 1968:302). As voice is not contrastive for sonorants, it is assumed by some linguists that sonorants are unspecified for [voice] (cf. e.g. Kiparsky, 1985). If we take on this assumption, this means that sonorants should not be able to trigger voice assimilation in a preceding consonant. As far as sonorant consonants (nasals, liquids and glides) are concerned, this is in line with most descriptions of Standard Dutch, which do not assume a process of RVA before sonorant consonants. De Schutter & Taeldeman (1986:111), however, report on the basis of the RND ('Reeks Nederlandse Dialectatlassen', a series of Dutch dialect atlases) that in West-Flemish word-final fricatives become voiced preceding sonorant consonants. The process is also mentioned by Weijnen (1991:176). This type of assimilation does not occur in East-Flemish or in Standard Dutch. The following examples are mentioned in De Schutter & Taeldeman (1986)

(10) zes jaar s [j → [z]
six year-SG
'six years'

(11) afjakkeren f [j → [v]
exhaust-INF
'to exhaust; to tire out'

(12) aflopen f [l → [v]
finish-INF
'to finish'

Stops do not get voiced before sonorant consonants, except in West-Flemish, where an underlying /d/ usually remains voiced when preceding a sonorant consonant. In the southeast of West-Flanders and in East-Flanders and Standard Dutch, all word-final stops are voiceless when followed by a sonorant consonant (De Schutter & Taeldeman, 1986:112-113).[3] However, in this paper only clusters in which the word-final consonant is underlying voiceless are discussed and this type of 'assimilation' thus lies outside the scope of the paper (cf. 2.2). In the voiceless stop + sonorant consonant clusters in the Dutch conversations, the word-final stop remained voiceless in 98% of the tokens (cf. examples 13 and 14). Only ten out of 369 stop + sonorant clusters were realized with a voiced stop. This very low number indicates that RVA in voiceless stop + sonorant consonant clusters is indeed highly atypical in Dutch and it will therefore not be discussed further.

(13) elk woord k [w → k
each word
'each word'
(14) stop maar p [m → p
stop PRAGM. MARKER
'stop it'

The following graph presents the RVA's in fricative + sonorant consonant clusters in the Dutch and the DLE conversations of the East-and West-Flemish groups.

[3] In my data, five items occurred in which a word-final /t/ which was an underlying /d/ became voiced before a sonorant consonant. One item was uttered by an East-Flemish informant; the other three by West-Flemish informants. Examples are 'eind maart' (*the end of March)* and 'maand naar' *(month to)*, in which the word-final stop did not undergo final laryngeal neutralization and was realized as [d].

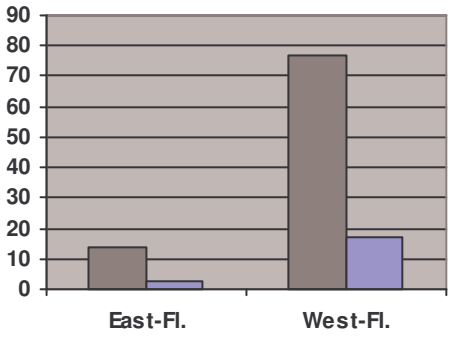

Figure 6. RVA's in voiceless fricative + sonorant consonant.

As far as the Dutch conversations are concerned, we see that all East-Flemish informants together produced RVA in only 14% of the tokens. The West-Flemish informants, on the other hand, produced it in as much as 77% of all tokens containing a voiceless fricative followed by a sonorant consonant. There is thus a very significant difference between the two groups of informants as far as the production of RVA's before sonorant consonants in Dutch is concerned.

The blue bars indicate the production of RVA's before sonorant consonants in the English conversations. The East-Flemish group produced hardly any RVA's at all in the DLE conversations; the West-Flemish group produced RVA in 17% of all tokens. Though this is not a negligible percentage, it is significantly less than the number of RVA's produced by this group in the Dutch conversations. Transfer is thus much less considerable than in clusters of a voiceless obstruent followed by a voiced stop. Some examples of RVA's before sonorant consonants taken from the conversations are given below:

Dutch

(15) zes maanden s [m → z
six months
'six months'

(16) was niemand s [n → z
was nobody
'was nobody'

(17) jezelf niet f [n → v
yourself not
'not yourself'

DLE

(18) choice you s [j → z
(19) nice man s [m → z
(20) if necessary f [n → v

On spectrograms the RVA in West-Flemish is clearly visible. Next to recording spontaneous conversations, I also asked the informants to read aloud a number of Dutch and English sentences. The following spectrogram shows the production of *geef Lien* 'give Lien' by a West-Flemish informant. The complete sentence was: *Geef Lien dat boek nu terug, want ik heb geen geduld meer* 'Give the book back to Lien now, because I've run out of patience'. The spectrogram (figure 7) shows that there is a voice bar during the production of the [v] and that the horizontal pitch line is not interrupted. This means that the vocal folds kept vibrating during the whole production of the fricative.

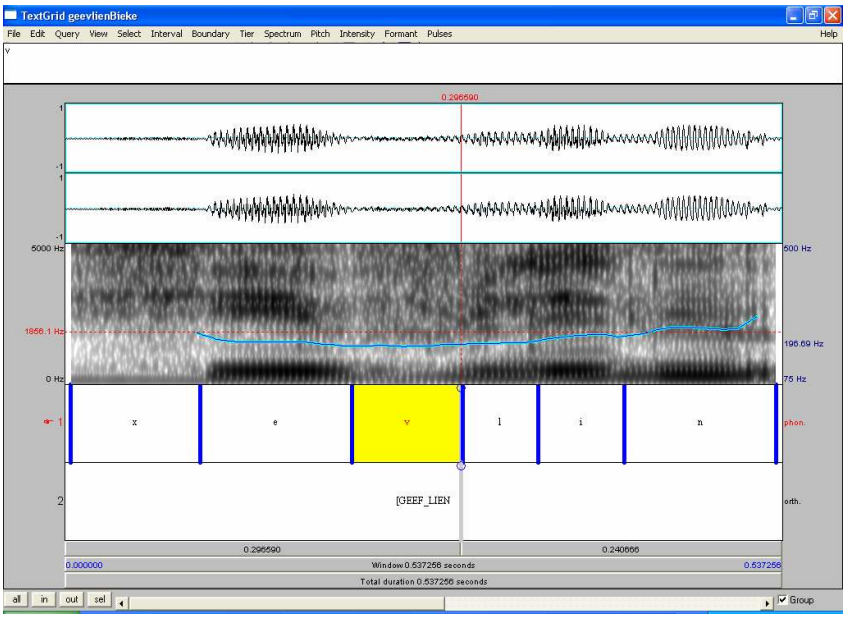

Figure 7. Spectrogram showing the production of geef Lien 'give Lien' by a West-Flemish informant. (The coloured part represents the fricative [v].)

The spectrogram in figure 8 shows the production of *geef Lien* 'give Lien' by an East-Flemish informant. On this spectrogram the voice bar and the pitch line are clearly interrupted, which means that the vocal folds were not vibrating during the production of the fricative.

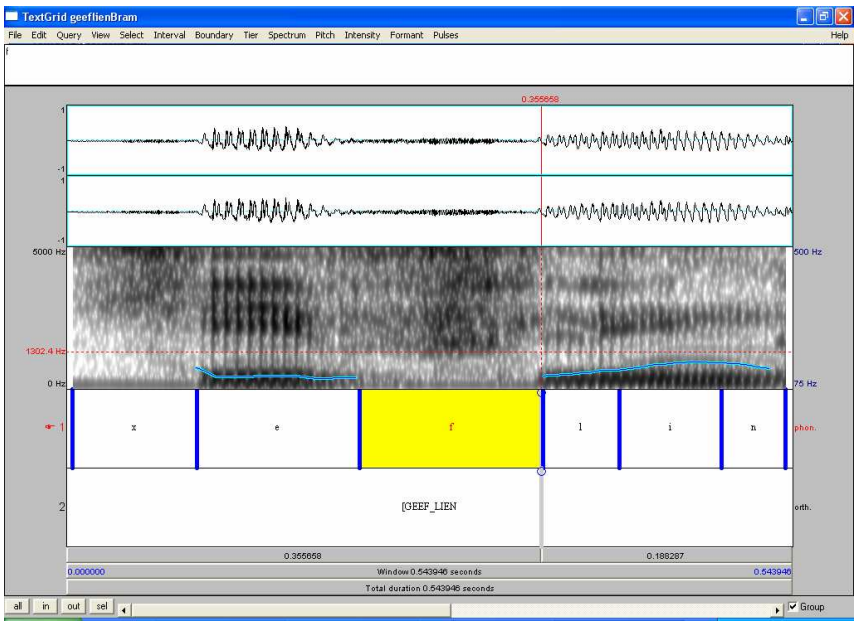

Figure 8. Spectrogram showing the production of *geef Lien* 'give Lien' by an East-Flemish informant. (The coloured part represents the fricative [f].)

The difference in realization of fricative + sonorant consonant clusters in East- and West-Flemish is thus clearly audible and visible.

Two new questions now arise:

(1) Is there a phonological rule in West-Flemish which is responsible for this type of assimilation in the Dutch conversations between the West-Flemish informants or is it the result of phonetic spill-over of voice?

(2) Why do the informants transfer this type of assimilation to a much lesser extent than regressive voice assimilation before voiced stops?

The first question will be dealt with in sections 4.3. to 4.5, in which three different approaches will be discussed. The second question will be dealt with in section 4.6.

4.3. A purely phonetic account

Jansen (2004) discusses a phonetic, articulatory-based approach to RVA in obstruent + sonorant clusters. Jansen argues that voicing assimilation before sonorant consonants only occurs in languages or language varieties in which word-final obstruents are subject to laryngeal neutralization. He mentions Krakow Polish, Catalan and Frisian as examples. According to Jansen,

sonorants are passively voiced sounds, which means that no extra articulatory gestures have to be added in order to maintain voicing. As sonorants are passively voiced sounds, this means that voice can spill over from the sonorant to the preceding neutralized consonant, as neutralized obstruents do not have voicing targets. By means of acoustic measurements, Jansen shows that in Dutch, obstruents are more voiced before sonorants than before voiceless obstruents). He argues that

> '[i]t could well be this increased amount of voicing (relative to utterance-final and _[+tense] contexts) that is interpreted by linguists as voicing assimilation. It could also become a source of confusion to listeners, who might reanalyse all presonorant obstruents (along with obstruents preceding a lax obstruent) as [-tense] on the surface, at least in theory (which would in turn lead to pronunciations that are likely to be interpreted as assimilation by linguists)' (Jansen, 2004:119).

However, if the increased amount of voicing before sonorant consonants in West-Flemish is purely phonetic, there is no reason why there wouldn't be increased voicing in East-Flemish or why the increased voicing would be interpreted as voicing assimilation in West-Flemish but not in East-Flemish.

It should be noted that when we compare Catalan, Krakow Polish, Frisian and West-Flemish, it appears that these languages differ with respect to the segments which undergo RVA before sonorant consonants. Whereas in some varieties of Polish and in Catalan both fricatives and stops become voiced before sonorant consonants (cf. Lew, 2002 for Polish; Wheeler, 1986 and Cuartero Torres, 2001 for Catalan), only fricatives become voiced in West-Flemish. (As was mentioned in section 4.2, an underlying /d/ can remain voiced before a sonorant consonant in West-Flemish. Underlying voiceless stops do not become voiced before a sonorant consonant, cf. De Schutter & Taeldeman, 1986:113). In Frisian, RVA in stop + sonorant clusters is not very frequent 'and only to be found in the speech of rather sloppily articulating speakers' (Van der Meer & De Graaf, 1986:310). RVA before sonorant consonants thus seems to be subject to a fair amount of variation.

Another way to arrive at an explanation for the voice assimilation in West-Flemish could be to investigate whether all four language varieties which have RVA before sonorant consonants (West-Flemish, Catalan, Krakow Polish and Frisian) have something in common, which other varieties are lacking. From the literature, it appears that all four language varieties discussed here, in which RVA occurs before sonorant consonants, also have RVA before voiced stops. (Cuartero Torres, 2001 refers to Carbonell, 1992 who found that native speakers of Catalan transfer regressive voice assimilations from Catalan into English). Since RVA before voiced stops only occurs in languages in which stops are marked for GT, it means that all these language varieties belong to the 'voicing language' type. It is therefore possible that there is an implicational universal which says that if a language has RVA before sonorant consonants, it also has RVA before voiced stops. However, since East-Flemish and Standard Dutch have RVA before voiced stops, but not before sonorant consonants, it is

thus not the case that if a language has RVA before voiced stops it also has RVA before sonorant consonants. Since both East- and West-Flemish are voicing languages, an explanation along these lines does not offer an explanation for the difference in realization of fricative + sonorant clusters in the two Flemish regiolects.

4.4. The sonorant scenario

Another way to explain the occurrence of RVA before sonorant consonants in West-Flemish is to assume that there is a phonological rule in West-Flemish which spreads voice from the sonorant consonant to the preceding fricative. This implies that sonorant consonants must be specified for [GT] in West-Flemish, for otherwise they would not be able to spread voice to a preceding fricative. If it were true that sonorant consonants are specified for [GT] in West-Flemish and unspecified in East-Flemish, this difference should crop up in other positions as well.

It is well know that in English, sonorant consonants get devoiced when following a word-initial plosive, as in *play* [p̥leɪ], *cry* [k̥raɪ] and *twice* [t̥waɪs]. Devoicing also occurs - though to a lesser extent - after fricatives, as in *snack* [s̥næk] and fly [f̥laɪ] (Collins & Mees, 1999:169). If sonorant consonants in West-Flemish are specified for [GT], this would mean that they lose voice less easily than East-Flemish or Standard Dutch sonorant consonants. In the English conversations of all informants together, 49 words containing an initial /pl/-clusters were cut out. On the basis of the sound files and the spectrograms, the clusters were classified on the presence or absence of devoicing of the /l/. The words and spectrograms were inspected by myself and one other person. Six clusters were rejected, because it was too difficult to make a judgement on the voice character of the sonorant. Of the remaining 43 clusters (of which 24 were produced by West-Flemish and 19 by East-Flemish informants) only eleven were produced with devoicing of the sonorant. Five of these occurred in the speech of West-Flemish informants, the other six in the speech of East-Flemish informants. There thus does not seem to be any significant difference between East-and West-Flemish informants as far as the realizations of English word-initial obstruent + sonorant consonant clusters are concerned. Because sonorant consonants do not usually become devoiced after obstruents in Dutch, /pl/ clusters in the DLE rather than in the Dutch conversations were analysed. Although it is theoretically possible that an acoustic analysis of sonorants in the Dutch conversations would reveal differences between the East- and West-Flemish informants' realizations of sonorants, it is unlikely that the informants would not transfer the laryngeal specifications of sonorants from Dutch into English. At this point, the explanation that sonorants have a different laryngeal representation in East- and West-Flemish does not seem to hold. The explanation thus needs to be looked for elsewhere.

4.5. The fricative scenario

Another possible explanation is that there is a difference between the East-and West-Flemish fricatives which is responsible for regressive voice assimilation before sonorant consonants in West-Flemish and its absence in East-Flemish (and Standard Dutch). Only voiceless fricatives and not underlying voiceless stops undergo RVA before sonorant consonants in West-Flemish, as is shown in the following examples:

West-Flemish

(21) glas water s[w → z
glass water
'glass of water'

(22) vat water t [w → t (and not *[d])
barrel water
'barrel of water'

It could be that the target segments of the assimilation (the fricatives) rather than the trigger segments (the sonorants) are responsible for the difference between East- and West-Flemish. According to Iverson & Salmons Dutch voiceless fricatives are marked for GW. One could speculate that West-Flemish voiceless fricatives are unmarked, which would explain why fricatives in West-Flemish are more susceptible to phonetic spill-over of voice from the following sonorant consonant. Again, if voiceless fricatives in East- and West-Flemish have a different laryngeal specification, this difference should surface in other contexts as well.

On the basis of a sentence-reading task, Kissine, Van de Velde and Van Hout (2003) found out that the fricative [v] is slightly less devoiced and has a higher pitch (measured in the form of periodicity of the signal) in West-Flemish than in East-Flemish. However, a slightly reverse trend can be seen for the fricative [z]. Further, Vercoullie (1885) mentions a number of words in which a Standard-Dutch initial [s] is realized as [z] in West-Flemish, namely *sikkel* 'sickle', *sintel* 'cinder', *sok* 'sock', *sop* 'soapsuds' and *sap* 'juice'. In another series of words, however, Standard Dutch [v] is realized as [f] in West-Flemish (e.g. *vorm* 'form', *vijg* 'fig', *vlag* 'flag', etc.). Rather than being evidence for a substantial difference in the voice specifications of East- and West-Flemish fricatives, these lists indicate that certain old West-Flemish dialect words have evolved differently from the Standard Dutch words (by undergoing or not undergoing certain sound changes).

A thorough analysis of East-and West-Flemish obstruents is needed to validate the assumption that fricatives have a different laryngeal specification in East- and West-Flemish. Literature on this subject seems to be largely lacking.

4.6. The role of transfer

We now turn to the second sub-question, which is why RVA before voiced stops is transferred to Dutch Learner English much more than RVA before sonorant consonants. In order to answer this question, it is useful to look at another, but similar process in Dutch. Whereas fricatives do not get voiced before sonorant consonants in Standard Dutch, they frequently get voiced when occurring between sonorants and vowels (see, for instance Booij, 1995 and Collins and Mees, 1999). Intervocalic voicing of fricatives occurs in Standard Dutch as well as in the East- and West-Flemish regiolects. The following graph presents the production of RVA in this type of cluster in the Dutch and the DLE conversations of the East- and West-Flemish informants.

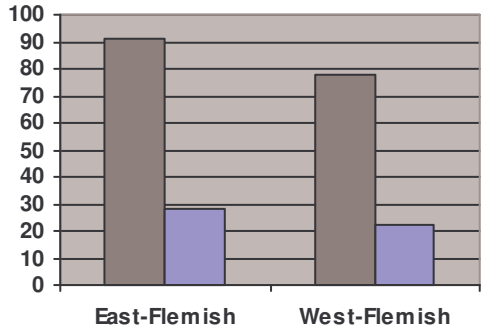

Figure 9. Voice assimilations in voiceless fricative + vowel clusters

As figure 9 shows, voicing of fricatives preceding vowels is very frequent in the Dutch conversations of the East- and West-Flemish informants. It is considerably less frequent in the DLE conversations of both groups. Examples from the conversations are the following:

Dutch

(23) 'k was echt s [ɛ→ z
I-CLITIC was really
'I was really'

(24) zes uur s [y → z
six hour-SG
'six hours'

(25) tof als f [ɑ → v
cool if
'cool if'

DLE

(26) glass of [z] s [ɒ → z

(27) yes indeed [z] s [ɪ → z

(28) if everything [v] f [e → v

The following table summarizes the assimilation patterns of (from left to right) Standard Dutch, East-Flemish, West-Flemish and Standard English. The last column indicates to what extent the informants (East- and West-Flemish informants taken together, except in the second row) produced RVA's in the different types of clusters in proportion to the number of possible assimilation sites (expressed in percentages).

RVA	St.D.	E-F	W-F	St.Eng.	DLE
vcl. obstr. + vcd. stop	+	+	+	-	(64.7%)
vcl. fric. + son. C.	-	-	+	-	(E-F: 2.4%) (W-F: 16.9%)
vcl. fric. + V	+	+	+	-	(24.1%)

Figure 10. Summary of RVA patterns

As far as voiceless obstruent + voiced stop clusters and voiceless fricative + vowel clusters are concerned, we see that English is the odd one out, being the only variety in which RVA does not occur in these clusters. As far as voiceless fricative + sonorant consonant clusters are concerned, Standard Dutch, East-Flemish and Standard English pattern together. West-Flemish is the only variety discussed in which fricatives get voiced before sonorant consonants.

When we compare the graphs representing RVA in clusters of voiceless obstruent + voiced stop (figure 3), clusters of voiceless fricative + sonorant (figure 6) and voiceless fricative + vowel (figure 9), or when we look at the percentages in the last column in figure 10, we see that RVA before voiced stops differs from the other two processes, in that the informants transfer this type of assimilation into English to a much greater extent than the other two types of assimilation. An explanation for the more frequent production of assimilations in voiceless obstruent + voiced stop clusters in the DLE conversations in comparison to the other two types of clusters could be that the former type of assimilation is a phonological rule in Dutch, whereas both regressive voice assimilation before sonorant consonants in West-Flemish and intervocalic voicing assimilation in East- and West-Flemish (as well as in Standard Dutch) are examples of phonetic assimilation, in which voice spills over from the surrounding segments. In intervocalic voicing assimilation as well as in voicing before sonorant consonants, the targets are fricatives. Since fricatives in Dutch have a more instable voice-voiceless distinction than stops (cf. e.g. Ernestus, 2000; Van de Velde, Gerritsen & Van Hout, 1995), it can be argued that they are more susceptible to phonetic spill-over of voice from the

following segment. Stops, on the other hand, are less susceptible to phonetic spill-over of voice and voiceless stops in Dutch only become voiced as the result of a phonological rule.

It would be interesting to investigate whether and if so to what extent, the informants transfer PVA in voiceless obstruent + voiced stop clusters from Dutch into English (cf. 4.1). Progressive devoicing is in a way similar to RVA before sonorants, since in both processes, the triggers (sonorants in RVA and voiceless stops in PVA) are supposed to be unspecified and the targets are fricatives. It could therefore be predicted that PVA would be transferred by the informants to the same extent as RVA before sonorants.

4.7. A note of word-internal fricative + sonorant consonant clusters

Both English and Dutch have a number of loanwords in which a word-internal fricative is followed by a sonorant consonant. Examples are the English words *islam, moslem, Oslo, cosmos,* and *Israel* and their Dutch equivalents *islam, moslim, Oslo, kosmos* and *Israël.* In the English pronunciation dictionaries by Wells (2000) and Jones (2003) all these words are transcribed with a voiced fricative [z], except for the words *islam* and *Oslo,* in which transcriptions with [s] and [z] are given. In all these words, except for the word *islam,* the stress always falls on the first syllable. In the word *islam,* stress can fall on the first or on the second syllable, but the fricative can be [s] or [z] irrespective of which syllable is stressed (Jones, 2003). In the original pronunciation of these loanwords, the fricative was probably voiceless, but became voiced when the words were adapted to English phonology. This seems to indicate that in English, sonorant consonants are able to spill-over voice to a preceding fricative if the boundary between the fricative and the sonorant is a syllable-boundary. If the fricative and the sonorant consonant are separated by a word-boundary, no phonetic spill-over occurs.

The Dutch pronunciation dictionary by Heemskerk & Zonneveld (2000) transcribes all these words with a voiceless fricative [s] and *De Nederlandse Taalunie* ('The Dutch Language Union'), an official organization which gives advice about the Dutch language (cf. http://taalunieversum.org), recommends a voiceless pronunciation in all of the above mentioned words (personal email correspondence, 4/11/2004). The following table summarizes the pronunciation of a number of words containing an obstruent + sonorant cluster according to three pronunciation dictionaries.

English	Dutch
Wells (2000), Jones (2003)	Heemskerk & Zonneveld (2000)
moslem: [z]	moslim: [s]
Oslo: [z]	Oslo: [s]
cosmos: [z]	kosmos: [s]
islam: [z] or [s]	islam: [s]
Israel: [z] or [s]	Israel: [s]

Figure 11. The realization of English and Dutch word-internal obstruent + sonorant clusters according to pronunciation dictionaries

However, in some parts of Flanders (and maybe in parts of the Netherlands too), the realization of these words with a voiced fricative is also very frequent. Trommelen (1984) discusses the syllabification of words such as *Oslo* and *islam* and argues that the syllable boundary falls in the middle of the two sonorants.

Some varieties of Dutch thus allow RVA before sonorant consonants across syllable-boundaries, but not across word-boundaries. West-Flemish might therefore be different from other varieties of Dutch only in the domain in which sonorants spread voice to preceding fricatives. Whereas in West-Flemish, sonorants spill over voice to a preceding fricative even if the sonorant and the fricative are separated by a word-boundary, many varieties of Dutch (e.g. East-Flemish) only allow phonetic spill-over across syllable-boundaries. In yet other varieties of Dutch (apparently the ones on which Heemskerk & Zonneveld, 2000, based their transcriptions) fricatives never get voiced before sonorant consonants, no matter what the depth of the boundary between the fricative and the sonorant is.

5. Conclusions

The following conclusions can be made about the acquisition of the laryngeal stop system by the Dutch-speaking informants:

First, the production of aspirations in the DLE conversations seem to suggest that the informants have acquired the laryngeal specification of voiceless stops in English, but that they differ on their 'ability' to phonetically implement this specification in the form of aspiration.

Secondly, the large number of regressive voice assimilations in the DLE conversations indicates that the informants transfer the laryngeal specification of voiced stops in Dutch (which are marked for Glottal Tension) into English.

As to the second research question, it was shown that regressive voice assimilation before sonorant consonants was produced very frequently in the Dutch conversations between the West-Flemish informants, but not in those between the East-Flemish informants. As a purely phonetic account of this type of assimilation is not able to explain the difference between the two language varieties, I assume that there is a phonological difference between the two

varieties which leads to RVA before sonorant consonants in West- but not in East-Flemish. However, as it is assumed that sonorants are not specified for [voice], they cannot be the trigger for voicing assimilation in West-Flemish. One could therefore speculate that the fricatives rather than the sonorants are responsible for the difference between East- and West-Flemish. Kissine, Van de Velde and Van Hout (2003) have shown that the fricative /v/ has a higher pitch and is slightly shorter in West- than in East-Flemish, which indicates that there is less devoicing in West- than in East-Flemish. It could therefore be speculated that fricatives in East-Flemish are marked for GW (and thus have the same laryngeal specification as the fricatives of Standard Dutch in Iverson & Salmons' account), but are unmarked in West-Flemish. If this is true, it would explain why fricatives in West-Flemish are more susceptible to phonetic spill-over of voice from the following sonorant consonant. However, this is only a suggestion, which needs to be investigated more thoroughly in future research.

It was also shown that the informants transferred RVA before voiced stops to a much greater extent than RVA before sonorant consonants or vowels. An explanation could be that RVA before voiced stops is a phonological rule in Dutch, which is transferred by the informants into English, together with the GT-specification of the voiced stops. RVA before sonorants (both consonants and vowels) would then be a case of phonetic assimilation, in which word-final fricatives, which have a more instable voice-voiceless distinction than stops, are susceptible to spill-over of voice from the following segment. In further research I will investigate to what extent the informants transfer progressive voicing assimilation (PVA) in voiceless obstruent + voiced stop clusters from Dutch into English.

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