An Exploratory Analysis of Individual Variation in Schwa Epenthesis in Flemish Dutch and Scottish English

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Abstract

Schwa epenthesis refers to the insertion of a schwa within liquid + consonant clusters. Two of the languages in which this process occurs are Dutch as it is spoken in the Netherlands and Belgium, and English as it is spoken in Ireland and Scotland. Previous studies have revealed that epenthesis is conditioned by social, regional, and linguistic factors. The aim of this study is to examine this process from a forensic phonetic perspective in terms of the potential it exhibits for speaker comparison purposes, as prior investigations have shown that sociolinguistic variables may also reveal individual speaker variability. Spontaneous speech samples for two homogeneous groups of speakers were taken from two existing Flemish and Scottish English corpora. The analysis consisted of counts of the epenthesised and schwa-less tokens observed for each speaker and chi-squared tests in the form of pair-wise comparisons between the individuals for both languages. The findings revealed that schwa epenthesis in Flemish showed higher inter-speaker variability than in Scottish English, and that for the former this variability is greater for the cluster /lf/ than for the cluster /rk/. Thus, the results suggest that while Flemish schwa insertion may potentially be suitable for use in forensic phonetic environments given its higher inter-speaker variability, this process in Scottish English is not. Moreover, any forensic examinations involving the analysis of Flemish schwa epenthesis should preferably be based on the cluster /lf/ rather than /rk/. Further research will, however, be necessary to establish the extent of the forensic potential by means of an investigation of the intra-speaker variation this process may exhibit. Moreover, considering the observations on Scottish English and the absence of epenthesis in all clusters but /rl/, a further examination of insertion in modern-day speech for this language may provide interesting insights.

Keywords: schwa epenthesis, Flemish Dutch, Scottish English, forensic phonetics, individual variation

1. Introduction

The process of schwa epenthesis consists of the insertion of said segment in certain consonant clusters. This phenomenon is particularly characteristic of Dutch, both as it is spoken in the Netherlands and in Belgium, as well as of certain regional varieties of English—more specifically those spoken in Ireland and Scotland. The inserted element is also often referred to as a *svarabhakti* vowel. In the case of Dutch, then, epenthesis has been described to occur in clusters consisting of a liquid followed by a non-homorganic consonant and can be observed in the clusters /lf, lk, lm, lp, lx/ and /rf, rk, rm, rp, rx, rn/ (Booij, 1999; Collins & Mees, 2003).[1] The process in certain varieties of English, on the other hand, has been defined as the insertion of a schwa "between two consonants, each of which is a liquid or nasal" (Wells, 1982: 435) and can, as such, be observed most often in clusters such as /rl, rm, rn/ and /lm/ (Hickey, 2007b; Kallen, 1994; Maguire, 2017; Walshe, 2009). Previous studies on schwa epenthesis have revealed that this process is influenced by an array of social, regional, and linguistic factors in both Dutch (Kloots et al., 2002; Kloots et al., 2009; Kuijpers & van Donselaar, 1998; Swerts et al., 2001; Warner et al., 2001) and Scottish, Irish, and northeast English (Beal, 2012; Hickey, 2007a; Maguire, 2017; Sell, 2012).

At the same time, studies have shown how variables which exhibit sociolinguistic variation may be of interest to the field of forensic phonetics, as these may reveal individual variability as well (de Jong et al., 2007a, 2007b; Gavaldà, 2016; Loakes, 2008; Loakes & McDougall, 2004, 2007, 2010; Moosmüller, 1997; Nolan & Oh, 1996). In this sense, the goal of the present study is to examine the process of schwa insertion in Flemish—that is, Dutch as it is spoken in Flanders, Belgium—and Scottish English in order to determine whether similar individual traits can be observed and, consequently, whether this feature holds any forensic

[1] While the second element of the cluster is often referred to as non-homorganic, other sources describe this consonant as non-coronal (Warner et al., 2001) or non-dental (Kloots et al., 2009).

potential as a result. This investigation aims to do so by means of an auditory-acoustic analysis of schwa epenthesis as it is observed in the speech of homogeneous groups of Flemish and Scottish English speakers.

Hence, the research questions of this study are as follows: firstly, whether schwa insertion exhibits individual variation once the factors which have been shown to have an influence on its occurrence are controlled for; and secondly, in the case that an affirmative result is obtained for the first research question, whether the individual variation exhibited in this variable allows for the differentiation between speakers and, therefore, whether it has forensic potential. Considering the findings of prior studies regarding the individuality that can be found in sociolinguistic variation, the hypothesis for the first research question is that the variable schwa insertion will show individual variation. In regard to the second research question, the hypothesis is that, if individual variation is found, the variable under investigation will also show forensic phonetic potential and will be observable in the form of statistical differences in the pair-wise comparisons between samples produced by different speakers.

2. Literature Review

2.1. Individual Variation and Forensic Phonetics

A core aspect to be studied in forensic phonetics is that of variation. The reason for this is that, while social factors such as age and gender result in differences between speakers, variation can still be observed even when these factors are controlled for. That is, individual variability appears "even once differences in age, socioeconomic class, region, rurality, gender and contextual style are carefully considered" (Johnstone, 1996: 16). Since this inter-speaker variation cannot be explained by social factors, it appears to rather correspond to individual preferences that a given speaker has within their speech community. While it is the case that some of these differences will be due to the anatomical characteristics such as the shape and

size of the speaker's vocal tract as well as the volume and length of their vocal chords—also referred to as the 'physical mechanism' (Nolan, 1997)—, others will embody the idiosyncratic linguistic features of the speaker. This particular way in which an individual expresses their own identity within their speech community will, in turn, constitute what is known as their 'idiolect'; that is, "the unique form of an accent/dialect typifying one given individual" (Baldwin, 1979: 231). Both the acoustic parameters and the linguistic patterns are of importance within forensic contexts, as:

> To understand the speech signal fully, and therefore to be able to exploit its potential for the identification of an individual to best effect, we need to appreciate not only its complex relation to the vocal tract which produces it, but also its determination by a linguistic system set in a social and historical context (de Jong et al., 2007b: 140).

In this sense, sociolinguistic methods—and, more particularly, those pertaining to the field of variationist sociolinguistics—could be applied to examine not only the variation that sets apart certain speech communities from others due to social factors, but also to differentiate those individuals pertaining to a single group and who, thus, share the same social characteristics. Research within the field of forensic phonetics has mainly focused on the importance of acoustic parameters such as voice onset time (Allen et al., 2003; Theodore et al., 2009), vowel formants (Hudson et al., 2007; Greisbach et al., 1995; Jessen, 1997; McDougall, 2004, 2006; McDougall & Nolan, 2007; Nolan & Grigoras, 2005), and fundamental frequency (Baldwin & French, 1990; Rose, 2002). Some studies have been conducted, however, which analysed linguistic—or, more specifically, phonological—patterns, highlighting their idiosyncratic potential and, in turn, their relevance when applied to forensic linguistic contexts. These studies include, but are not limited to: Loakes (2008), Loakes and McDougall (2010), and Nolan and Oh's (1996) research on individual linguistic variation observed in twins; Moosmüller (1997) and de Jong et al.'s (2007a, 2007b) investigations of inter-speaker variability in phonetic features undergoing processes of sound change; Loakes and McDougall's (2004, 2007) studies

on inter- and intra-speaker variability in plosive frication; and Gavaldà's (2016) examination of individual variation in allophonic processes of /t/.

In other words, this literature has shown that, if one controls for social factors, variation will still surface which can only be explained as corresponding to individual preferences, as this linguistic variability can be observed in speakers who are comparable in their social and regional characteristics. Similarly suggested by the aforementioned studies is the idea that this individual variation can, in turn, serve important purposes in forensic contexts, as they highlight the discriminatory potential of the phonetic characteristics that were analysed. In particular, a given variable will be pertinent to forensic practices if the observed inter-speaker variation is high and the intra-speaker variation is low; that is, ideally a large number of differences should be found between or across speakers and a small amount of variation should be detected within the same speaker (Nolan, 1983; Rose, 2002).

Even when a linguistic trait is found to be thusly characterised, at the same time it is worth noting that, within forensic phonetic practices, a single feature does not constitute the only variable that is analysed and should, therefore, never be the sole basis on which speaker similarity judgements are reached. Instead, they tend to involve an array of variables, of which it is not only the individual findings but rather the combined results of these analysed features which will allow for tentative conclusions to be drawn regarding the similarities and differences between individual speakers (Rose, 2003). As an analogy, one could consider each selected feature, its analysis, and its results as constituting individual pieces of a puzzle, and it is only by putting many of these pieces together that the bigger picture can be constructed and understood. Surveys on international practices are able to shed light on the features that, alongside linguistic processes, are most commonly analysed by forensic phoneticians for speaker comparison purposes (Cambier-Langeveld, 2007; French, 2017; Gold & French, 2011, 2019). These include phonetic or acoustic features such as vowel formants, fundamental

frequency, and tempo, as well as non-phonetic features such as "discourse features and/or conversational behaviours" (Gold & French, 2011: 302).

As will be outlined and argued in the following sections, the variable of interest to the present study, that of schwa epenthesis, has been documented to show sociolinguistic variation in Dutch and English. Considering, then, that sociolinguistic variables may show individual traits, it seems likely that the process of schwa insertion may also exhibit similar idiosyncratic potential. That is, it will be expected to also have the potential of showing inter-speaker variability. If these individual preferences were found they could, consequently, be of importance to the field of forensic phonetics and when carrying out forensic speech comparisons as one of the different speaker traits that are considered in such practices.

2.2. Schwa Epenthesis in Dutch

The process of schwa epenthesis in Dutch has been widely studied. Previous research has shown that this phenomenon is highly variable and conditioned by regional factors and social factors such as age and gender (Kloots et al., 2002; Kloots et al., 2009; Swerts et al., 2001), as well as by the rhythmic context in which the word appears (Kuijpers & van Donselaar, 1998), the liquid which precedes the schwa (Kloots et al., 2002) and its quality (Kloots et al., 2009), the consonant following the schwa (Kloots et al., 2002), the syllable-type of the consonant cluster (Kloots et al., 2002; Kloots et al., 2009; Kuijpers & van Donselaar, 1998; Warner et al., 2001), and the type of speech that is elicited (Kloots et al., 2009).

In terms of the regional factors, a distinction has been made between the amount of schwa epenthesis produced by speakers from the Netherlands and speakers from Flanders, the northern region of Belgium where Flemish is spoken. The study by Kloots, De Schutter, et al. (2002) reports a higher number of epenthetic vowels for the former, while a similar study by Kloots, Gillis, and Verhoeven (2009) finds the opposite is true—that is, they report a greater

number of epenthetic schwas for the Flemish informants' speech. This apparent discrepancy can be explained by the fact that the studies differed in terms of the type of speech that was analysed; while the data used in the 2002 study was controlled speech—more specifically, speech elicited from picture-naming and reading tasks—, that of the 2009 study was spontaneous speech that was part of a larger sociolinguistic interview. This finding, then, highlights style as a potentially influential factor affecting schwa insertion, the particular effects of which will be discussed in more depth later on.

Apart from the general distinctions that can be observed for both countries, a further division of the Netherlands and Flanders into different regions according to their dialects has allowed for more precise observations regarding the use of schwa insertion. In their study, Kloots et al. (2002) provide an overview of this phenomenon per region based on survey data obtained by Blancquaert and Pée (1925–1982).[2] Figure 1 and Figure 2 below illustrate their findings for Flanders and the Netherlands respectively.[3] From this survey, the authors selected four dialectal regions from each country, representing different degrees of schwa epenthesis, for their own study. For Flanders, informants were selected from the following: East Flanders, where epenthetic vowels are not used; West Flanders, which shows a sporadic—albeit leaning towards infrequent use—of the process; Brabant, comprised of the provinces Antwerp and Flemish Brabant and in which schwa insertion is common; and (Belgian) Limburg, where the process is also frequent. From the Netherlands, the selected regions were the Western region, made up of the Randstad area; the Central region, with the province Gelderland and the city of Utrecht; the Southern region, comprised of the province (Dutch) Limburg; and the Northern region, made up of the provinces Groningen and Drenthe. According to the survey data, the

[2] For a more in-depth region-based description, see Goossens (1977), van Hout et al. (1999), and Kloots (2008).
[3] These and any subsequent maps appearing in this study were created with the help of the online tool *MapChart* available at https://mapchart.net/.

former three are similar in the sense that the dialects spoken in these regions exhibit schwa insertion, while the fourth is characterised by the absence of this process.

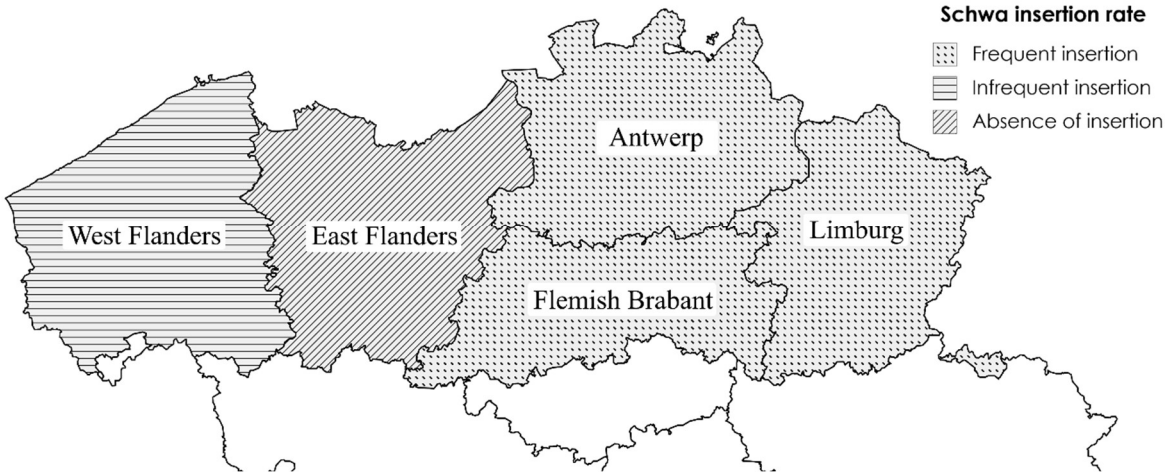

Figure 1. Map of Flanders, Belgium highlighting the different rates of epenthesis as observed by Blancquaert and Pée (1925–1982) in their survey.

Figure 2. Map of the Netherlands highlighting the different rates of epenthesis as observed by Blancquaert and Pée (1925–1982) in their survey. The named regions correspond to those selected by Kloots et al. (2002) for their study.

Bearing this classification in mind, the authors were subsequently able to observe the following: The largest amount of schwas was found in Dutch Limburg, with a total of 72% of epenthesis; the smallest amount, on the other hand, being in West and East Flanders, where a total of 17% and 19% of epenthetic vowels were recorded respectively. As the authors note, of interest is the fact that both the Randstad area and Flemish Brabant—the central regions of the Netherlands and Flanders respectively—show the same tendency, which is that of a preference for schwa-less forms; that is, in both regions only approximately 28% of clusters susceptible to schwa insertion actually involved this process, even though the dialectal data would suggest a significantly higher percentage of schwa occurrence.[4] All of the results regarding the regional differences and distribution of schwa epenthesis thus highlight the importance of these factors in terms of their effect on this process.

As for social factors, while gender in itself has not been found to have a main effect on the production of epenthetic vowels, an interaction has been shown to exist between this variable and region, as schwa insertion appears to occur more frequently in males than females in the Netherlands, while in Flanders females seem to insert more schwas than males (Kloots et al., 2002). The same results were not obtained by Kloots, Gillis, and Verhoeven (2009), however, who observed no such interaction. This difference could, again, potentially be explained by the fact that the two studies used different types of speech—spontaneous and controlled—for their respective analyses. Age, on the other hand, has been found to have an effect on this process in both studies, as schwa epenthesis is more common in older people's speech than in that of young people, regardless of region.[5] Moreover, an interaction between this variable and gender shows that, while in the case of male speakers the use of epenthetic

[4] The authors of the study suggest this may be a case of "exogeen taalgebruik" [exogenous language use] (see Sassen, 1963) or hypercorrection (Kloots et al., 2002: 118).
[5] The informants born before the year 1955 were considered to pertain to the older generation, while those constituting the younger group were born after the year 1960 (Kloots et al., 2002: 107; Kloots et al., 2009: 50).

vowels is comparable for both the younger and the older generation, young females tend to insert significantly less schwas than older females. An even further analysis of a potential interaction between age, gender, and region reveals that young Dutch women insert the fewest epenthetic schwas (Kloots et al., 2009: 57). As the authors point out, this difference may be due to the evolving pronunciation of /r/, particularly in the Netherlands, which will be discussed in more detail below. These findings provide substantial evidence that social factors—specifically age and, at least in terms of its interaction with region, gender—play an important role in the production of epenthetic vowels.

In terms of linguistic variables that have been found to affect the process of schwa insertion in Dutch, of interest is the prosodic—or, more specifically, the rhythmic—context in which a given word susceptible to schwa epenthesis appears.[6] Previous research has found that rhythmic context may cause stress patterns to vary (Kelly, 1988; Kelly & Bock, 1988). In their study, Kuijpers and van Donselaar (1998) propose that, since schwa epenthesis alters the rhythmic structure of a given word—for instance, the insertion of a schwa in monosyllabic words changes a strong foot into a trochaic foot containing a strong and a weak syllable—, rhythmic context will also influence the use of this process. The authors found that rhythmic context triggers schwa epenthesis "only if the context has a [strong-weak] alternating sequence which cooperates with the trochaic structure of the [word with epenthetic schwa]" (1998: 99). It appears, therefore, that speakers will be "inclined to maintain an established speech rhythm by inserting […] a schwa, but only if both the sentence rhythm and the [word with epenthesis] have a trochaic [strong-weak] form" (1998: 99). The following example sentences, extracted from the study in question, illustrate this point:

[6] It may be worth mentioning, albeit at the risk of oversimplifying, that Dutch can be considered a stress-timed language, similar to English (Collins & Mees, 2003: 241; Nespor, Shukla, & Mehler, 2011: 1149).

(1) *Tussen deze bloemen stond 'n hele mooie* tulp

'Amidst these flowers there was a very pretty tulip'

(2) *Ester zet de* tulp *liever op een tafel*

'Ester prefers to put the tulip on a table'

(Kuijpers & van Donselaar, 1998: 92, 96)

In both of these sentences, the first being an example of a strong-weak context preceding the target word, the second an example of a strong-weak sequence preceding the target word and a strong syllable following it, the word *tulp* [tulip] was produced more often with than without an epenthetic schwa. In other words, if the word is immediately preceded by a combination of a strong and a weak syllable—that is, a trochaic context—, the word will be produced with schwa epenthesis more often than if it were preceded by, for instance, a sequence of strong syllables (Kloots et al., 2002).

This, in turn, suggests that epenthesis will occur more frequently in the case of monosyllabic words than in that of bisyllabic words, since the standard form of the latter is by default made up of a strong-weak sequence—as is the case for the word *tulpen* [tulips]—, which does not trigger epenthesis (Kuijpers & van Donselaar, 1998; Warner et al., 2001). Moreover, a strong-weak-weak rhythmic context was also found not to favour epenthetic schwa in bisyllabic words (Kuijpers & van Donselaar, 1998). It would be more appropriate, however, to refer to the syllable-type variable in terms of its syllabicity, by means of which a distinction can be made between tauto- and heterosyllabic segments; that is, whether certain segments occur within the same syllable or whether they do not, respectively. As such, previous studies have concluded that more epenthetic schwas can be observed in tautosyllabic clusters compared to heterosyllabic clusters, although this difference is larger in the case of Flanders (Kloots et al., 2009: 54). These observations, then, establish the rhythmic context surrounding a given word as well as the syllabicity of its cluster susceptible to schwa insertion as yet another important

factor that affects this process, as the findings indicate that speakers will attempt to maintain the rhythmic structure of a given sentence by means of epenthesis.

Another linguistic variable which has been proven to affect the production of epenthetic vowels is that of the liquid which makes up the first segment of the consonant cluster; that is, /r/ or /l/. Overall, the chances of schwa epenthesis have been found to be higher when following /r/ than /l/ (Kloots et al., 2002). This finding also holds when comparing the Netherlands and Flanders, as well as young and old speakers in these regions. In other words, in both regions, schwas are more frequently inserted after /r/ than after /l/, regardless of age. This difference between the two age groups is, however, larger for /l/-clusters than it is for /r/-clusters; that is, young and old speakers' behaviour is more similar in the case of /r/-clusters than in the case of /l/-clusters. As for the differences that can be observed in terms of gender for this variable, Kloots et al. (2002) highlight an interaction between region, gender, and the liquid. In /l/-clusters, Dutch males epenthesise twice as often as Dutch females, while in /r/-clusters both genders show similar behaviour to one another in this region. In Flanders, on the other hand, females produce more than twice the amount of schwas males do in the case of both /l/- and /r/-clusters.

At the same time, however, this variable is mediated to a certain extent by an evolving change in the pronunciation of liquids. Studies have shown that both /r/ and /l/ are undergoing a process of vocalisation both in the Netherlands (Stroop, 1998; van Bezooijen & Giesbers, 2003; Van de Velde, 1994, 1996; van Reenen, 1986; van Reenen & Jongkind, 2000) and, albeit to a considerably lesser degree, in Flanders (Tops, 2005; Van de Velde, 1996; Verstraeten & Van de Velde, 2001).[7] Apart from confirming the greater use of consonantal /r/s in Flanders

[7] Vocalic realisations of /r/ include, for instance, central approximants, uvular approximants, glides, flaps, or schwa-like /r/s. A vocalic realisation of /l/, on the other hand, will have a [u]-like sound (Kloots et al., 2009: 48).

compared to the Netherlands, Kloots et al. (2009) establish a connection between the presence of these non-consonantal realisations of this liquid and schwa insertion, as the former appears to drastically decrease the occurrence of the latter. In other words, schwa epenthesis is significantly more frequent when /r/ is pronounced as a fricative or trill than when it has a vocalic quality—in fact, it can be said that a non-consonantal /r/ virtually excludes schwa insertion (2009: 58). This effect was found for both regions, although the difference between insertion in clusters with consonantal /r/ and those with vocalic /r/ is much larger in the Netherlands than it is in Flanders (2009: 56). This is due to the fact that, while in the Netherlands the presence of a consonantal /r/ is almost always paired with the insertion of a schwa, in Flanders interestingly many schwa-less forms occur with this type of /r/ as well.

In order to clarify the reason for this distinction between the two regions regarding this variable, it seems opportune at this point to highlight the importance of the type of speech and the effect it has on the pronunciation of the liquid. Studies on style as a factor that influences the pronunciation of /r/ found that, when analysing controlled speech, almost no vocalic /r/s were produced (Verstraeten & Van de Velde, 2001). It is suggested, therefore, that more non-consonantal /r/s may be produced in spontaneous speech (van Reenen, 1986; van Reenen & Jongkind, 2000). Adding these findings to those of Kloots et al. (2002) as well as to their own, Kloots et al. (2009) suggest that, at least in the Netherlands, speakers produce less schwas in spontaneous speech than in controlled speech—hence the discrepancies between the two studies—because they use comparatively more vocalic /r/s in the former than in the latter (2009: 59). Moreover, gender and age play a role in this region as well, as young Dutch females have been found to produce the lowest number of consonantal /r/s (2009: 55, 57). The reason, in turn, for the high occurrence of vocalic /r/s in the speech of this particular group of people can be attributed to the idea of women as the innovators or pioneers of language change (see, for instance, Labov, 2001; Tagliamonte & D'Arcy, 2009; Tops, 2005).

Considering that non-consonantal pronunciations of /r/ are not nearly as prevalent in Flanders however, the authors propose that norm sensitivity plays an important role in this region. Prior work by Flemish phoneticians has to a large extent stigmatised the use of epenthetic vowels in the language (see Aalbrecht et al., 1998; Blancquaert, 1969; De Coninck, 1970; Demanet, 1939; Mussche, 1962; Van Haver, 1972). If one, then, considers Flemish speakers to be more norm-sensitive than speakers from the Netherlands (Kloots et al., 2002), it appears likely that in controlled speech they will make a conscious attempt to produce as few instances of epenthetic vowels as possible. In spontaneous speech, Flemish speakers will conversely be unable to exert as much control over their speech which, in turn, will lead to an increased number of epenthetic schwas (Kloots et al., 2009: 59). One potential reason, then, for the occurrence in Flanders of many schwa-less forms with consonantal /r/s while in the Netherlands a liquid of such quality is almost always paired with an epenthetic schwa may be that Flemish speakers become at times more aware of their disregard of the norm when producing spontaneous speech. Another may be that these schwa-less forms are produced by Flemish speakers who simply never use schwa epenthesis (2009: 59).

Taking account of these findings and considerations, it becomes clear that speech style significantly influences the pronunciation of liquids which, in turn, affects several others of the factors that have been outlined in this section as well, such as age and gender. In extension, the variable style also affects, albeit indirectly by mediating other factors, the process of schwa insertion.

Finally, by means of an analysis of a selection of /l/+C and /r/+C sequences in which epenthetic vowels can occur, Kloots et al. (2002) were able to assess the second segment of the consonant cluster as a potentially influential factor on schwa insertion. The consonants that were considered were /f/, /x/, /k/, and /m/, each preceded by both /l/ and /r/, thus allowing for a paired comparison. Consequently, the authors found a significant difference between the

Netherlands and Flanders in terms of how this variable affected schwa production, particularly in the case of the latter (2002: 116). While in the Netherlands the consonant following the liquid was not found to have a significant effect—that is, schwa epenthesis occurred more frequently in /r/-clusters than in /l/-clusters, regardless of the consonant following the liquid, which all behaved similarly—, in Flanders the following was observed: Epenthesis is overall also more common in /r/-clusters than in /l/-clusters, although the cluster /lx/ showed a considerably higher epenthesis ratio than the other /l/-clusters and the clusters /rf/ and /rk/, and in the /rm/ cluster schwas were inserted significantly more often than in any of the other /r/- and even /l/-clusters (2002: 116–117).

2.2.1. Dutch Epenthesis and Individual Variation

Having outlined all the different variables discussed here, one is able to observe the many factors which previous studies have found to affect schwa epenthesis in Dutch, ranging from social and regional to linguistic ones. From these findings, it appears that this process shows significant sociolinguistic variation and that it may, in turn, exhibit individual variation as well. Of particular interest to the present study, then, are Kloots et al.'s comments regarding their suggestion that a thorough analysis of inter- and intra-speaker variation could yield interesting insights—an idea which the authors propose based on observing large amounts of schwa-less clusters containing a consonantal /r/ in Flemish (2009: 59). Having a clear understanding of the different variables' roles is, therefore, crucial when exploring said variation.

2.3. Schwa Epenthesis in English

In comparison to the literature available on schwa epenthesis in Dutch, studies on this process in English have, on the whole, rather been restricted to descriptions of the process and its historical and modern-day prevalence in Irish English (Hickey, 1985, 2004, 2007a, 2007b, 2014; Kallen, 1994; Maguire, 2018; Walshe, 2009; Wells, 1982), Scottish English (Hall, 2006,

2011; Maguire, 2012, 2018), and certain varieties from England (Beal, 2012; Maguire, 2018). These studies mainly concerned themselves with providing a general overview of the type of liquid+C clusters susceptible to schwa insertion and exemplifying these, both in historical and more modern varieties of English. That is, research on the factors which may affect the process in contemporary speech has been rather scarce and, in the case of Irish English, "it was not until 2010 that […] a significant shift [took place] away from a focus on structural matters […] towards a sociolinguistic perspective that uses quantitative sociolinguistic data" (Kallen, 2013: 239–240).

2.3.1. Schwa Epenthesis in Irish English

One of such studies was carried out by Sell (2012), in which the variables age, gender, socioeconomic background, speech style, and position of the cluster within the word were analysed in terms of the effect they have on schwa insertion in Irish English as it is spoken in Galway City. The study examined the presence of schwas in the clusters /lm/ and /rm/, among others, with the word *film* being studied separately as well due to its frequency of insertion in the data. Participants' speech was elicited by means of sociolinguistic interviews consisting of a conversational component on the one hand—serving as the source of informal speech—, and a word list, text passage, and questionnaire on the other—serving as the source of more formal speech (2012: 57). Overall, schwa insertion was not found to be very frequent, as only about 12% of the tokens susceptible to the process showed epenthetic schwas (2012: 58). In terms of social factors, age was found to have a significant effect as schwa epenthesis was more likely in the speech of older people (2012: 60). Neither gender nor socioeconomic background were found to have an influence on schwa insertion, however—females and males were found to insert schwas 10.70% and 12.96% of the time, respectively (2012: 59). As for speech style, epenthetic vowels were found to be significantly more likely to be inserted in more spontaneous speech rather than in more controlled speech (2012: 60). When comparing the clusters /lm/ and

/rm/, epenthetic schwas were observed in 54% of the former, while for the latter only 5% showed evidence of this process (2012: 60). Schwa insertion appears, then, to be significantly more frequent in /lm/ clusters than in /rm/ clusters. When analysing these two clusters in coda position only, 76% of /lm/ clusters and 8% of /rm/ clusters triggered schwas. Thus, the probability of this process increases when the cluster appears in syllable-final position compared to when it is heterosyllabic (2012: 60).

Of interest, then, is the high percentage of occurrence of schwa insertion in /lm/ clusters—regardless of its position within the word—when compared to the significantly lower overall rate of epenthesis observed in general. The reason for this difference is the particularly high occurrence of schwa insertion in the word *film*, which accounts for 76.6% of instances of this process observed in the study and excluding which the total rate of epenthesis drops to 3.37% (2012: 58). Due to its status, this particular word—which, it should be noted, is the only instance of an /lm/ cluster in coda position found in the data—underwent an additional separate analysis, in which only the variable speech style was found to significantly affect the occurrence of epenthetic vowels in this word. More specifically, the probability of schwa insertion in this particular context and in a spontaneous setting was calculated to be 87.3%, "[t]he likelihood [of which] decreases to 54.8% in [a] more formal setting" (2012: 62).

Since the data only reflects epenthesis habits for speakers from Galway City, it remains unclear how these findings compare to the characteristics of other dialectal areas in Ireland. Hickey (2007a) does, however, indicate that epenthesis in Irish English is universal in /lm/ clusters, but is only observed in /r/+C clusters in rural varieties in the south of Ireland. That is, while schwa insertion in /l/+C clusters is a "supraregional" process in Irish English, in /r/+C clusters it is limited to certain vernacular varieties (2007a: 13, 307–308). This description appears to align with Sell's (2012) findings, who observed a significantly higher insertion rate in /lm/ clusters than in /rm/ clusters.

2.3.2. Schwa Epenthesis in Scottish English

As for the process of schwa insertion in Scottish English, the most in-depth study was carried out by Maguire (2017), concerning itself in particular with "the geographical distribution of epenthesis" as well as an examination of "the individual clusters in which it occurs" (2017: 156). The data used in this study originated from the *Linguistic Survey of Scotland* (LSS) conducted in the 1950s and was elicited by means of a "direct questioning method" in which one single speaker originating from each locality of interest, "typically an older, working-class member of the community", was interviewed and presented "with a list of lexical items" (2017: 160). The reported findings indicate that epenthesis occurs almost exclusively in the clusters /lm/, /rm/, /rn/ and /rl/, although it is present in the clusters /rd/, /rk/, /rt/ and /rv/ as well, albeit to a significantly lesser degree (2017: 164). More specifically, the most commonly epenthesised cluster is /rm/ with a rate of 78.86%, followed by a 77.01% rate for /lm/, 74.63% for /rn/, and 68.71% for /rl/ (2017: 165, 168, 170, 171).

The findings also provide information regarding the regional distribution of schwa insertion within Scotland. While the process is generally found across the country, there are certain regions that do not adhere to this pattern. In Aberdeenshire, for instance, epenthesis was only observed in /rl/ clusters, although its absence in the data for the other three main clusters could be a case of fieldworker isoglosses "rather than real dialectal differences" (2017: 166–167).[8] In Caithness, Sutherland, and Ross and Cromarty, insertion of schwa was recorded for /lm/ and found to be largely absent in /r/+C clusters, which the author attributes to the "predominance of approximate (usually retroflex) /r/" in these regions as opposed to the more usual trill or tap realisations (2017: 170, 177). Finally, epenthesis in /lm/ was found to be absent

[8] The data used in Maguire's (2017) study was collected and transcribed "on the spot" (2017: 161) by different fieldworkers in different regions, which means variation in transcription practices may exist and may manifest themselves as 'fieldworker isoglosses' (see also Trudgill, 1983).

in the area extending from Fife to Nithsdale in the south of Scotland, most likely due to the quality of /l/ in those locations; that is, an examination of the pronunciation of /l/ revealed that, while in those locations where /l/ is 'clear' there is almost always epenthesis, those where /l/ is 'dark' (i.e. velarised) show equal amounts presence and lack of epenthesis (2017: 167–168). It seems likely, then, that a velarised /l/ is used by speakers in this area.

2.3.3. Schwa Epenthesis in Mainland England

While schwa insertion is most commonly associated with Scottish and Irish English, evidence of this process can also be found in certain varieties spoken in current-day England. In an examination of Tyneside English—spoken in North East England—, Beal (2012) notes that in /l/+nasal clusters "an epenthetic vowel may be heard throughout the region" (2012: 42). This is most likely the case due to the fact that /l/ is 'clear' in this variety, which makes clusters consisting of such a liquid "followed immediately by /m/ or /n/ […] very difficult to produce" (Beal, 2010: 20). This observation seems to be in line with Maguire's (2017) findings on epenthesis in /lm/ in Scotland for the area from Fife to Nithsdale.

2.3.4. Factors Affecting Schwa Epenthesis in English

In the case of Irish English—or the variety spoken in Galway, at least—, the literature indicates there is an array of factors which affect schwa epenthesis. In terms of social factors, of note is age, as older people seem to use the process more often. In terms of speech style, spontaneous speech appears to elicit significantly more schwas. As indicated by the separate analysis of *film*, however, anaptyxis still has a probability of occurrence of approximately 50% in more formal settings in this word. This finding, then, seems to run counter to Wells' suggestion that the process in Irish English "is restricted to popular speech" (1982: 435). Other factors include the liquid+C cluster in question, with epenthesis in /lm/ being more common than in /rm/ and the latter seemingly only being epenthesised in certain vernacular varieties, and cluster position, as

schwa insertion is more frequent in word-final or coda-position. The latter could also be defined in terms of syllabicity, with epenthesis being more common in tautosyllabic segments than it is in heterosyllabic ones.

For Scottish English, we know that cluster type affects schwa insertion and that /rm/, /lm/, /rn/ and /rl/ are the most commonly epenthesised, in that order, and that the process can, in general, be observed throughout Scotland, although certain regional differences do exist in the form of the absence of schwas in the Northwest Highlands in /r/+C clusters, and the lack of epenthesis in /lm/ clusters in the southern area between Fife and Nithsdale. These particular regional findings may, however, be linked to other factors mediating schwa epenthesis—more specifically, the pronunciation of the liquids /r/ and /l/ in said regions, respectively. The insertion of schwa in Aberdeenshire occurring in /rl/ clusters only, on the other hand, could be attributable to differences in fieldworker practices instead. Further assumptions regarding other potentially influential factors cannot be made, as the only evidence of epenthetic vowels in Scottish English originates from controlled speech produced by older, working-class speakers, and only considered monosyllabic words in which the liquid+C clusters occurred in word-final position.[9] Moreover, considering that the overall findings are based on data collected in the mid-20th century, it remains unclear to what degree they can be extended to modern-day Scottish English speech as well.

2.3.5. English Epenthesis and Individual Variation

Similar to the case of epenthesis in Dutch, then, the findings obtained in the studies carried out on Scottish and Irish English show that this process exhibits variation caused by different factors, some of which sociolinguistic. Maguire also notes that schwa insertion is not

[9] Maguire (2017) does consider the word *morning* and observes no epenthesis in this context (2017: 174). It is worth noting, however, that this is the only word in the data with a word-internal liquid+C cluster which is, moreover, heterosyllabic in nature.

categorical—that is, that there is variation—as the use of epenthesis is below 80% "even for those clusters which have it the most" (2017: 164). It seems possible, therefore, that schwa insertion may be subject to individual variation in this language as well. At the same time, Sell also points out that while the word "*arm(-s, -ed)*" appeared ten times in the data, only six of those tokens were epenthesised and "all six schwa tokens belonged to one speaker" (2012: 59). Based on these statements, it would appear that inter-speaker variation may exist. More evidence would be necessary, however, to ascertain the extent to which the findings by Sell (2012) are more widely applicable and whether they extend to other varieties of English as well.

3. Methodology

3.1. Corpus of Study

The recordings that were used in this study originated from two different corpora. In the case of Flemish, the samples were obtained from the *Corpus Gesproken Nederlands* [Spoken Dutch Corpus] (CGN), while the Scottish English recordings originated from the *Scottish Corpus of Texts & Speech* (SCOTS). The Flemish recordings consisted of spontaneous telephone dialogues between two people who were either friends or family of one another and were recorded via a switchboard setup. The Scottish English data, on the other hand, consisted of spontaneous face-to-face conversations or interviews. In terms of the length of the samples, these ranged from 30 to 60 minutes for both languages.

When using the term 'spontaneous' to refer to the type of speech used in this study, it is considered the way it is defined by Labov (1989). The importance of this type of speech in sociolinguistic research is due to the fact that it resembles the 'vernacular', which is "the style in which the minimum attention is given to the monitoring of speech" (Labov, 1972a: 208). Obtaining spontaneous speech can be achieved by means of the sociolinguistic interview, which was designed to overcome the inherent barrier created by the apparent inability to "observe how

people speak when they are not being observed", also known as the Observer's Paradox (Labov, 1972b: 113). Within the body of such an interview, different speech styles can be elicited from the subjects. Two of these are 'casual' speech, considered as "the everyday speech used in informal situations, where no attention is directed to language" (Labov, 1972a: 86), and 'careful' speech, which corresponds to "the type of speech that normally occurs when the subject is answering questions which are formally recognized as 'part of the interview'" (1972a: 79). The latter has also been termed 'spontaneous' speech and defined as "the counterpart of casual speech which does occur in formal contexts, not in response to the formal situation, but in spite of it" (1972a: 86). As such, Labov considers that this type of speech and 'casual' speech "can be studied together" (1972a: 87) and described under the umbrella term known as 'spontaneous speech' (Labov, 1989: 11).

Thus, the present study considers spontaneous speech as it is defined by Labov in 1989. In terms of the reason for the use of this particular type of speech, it is precisely because it is that style in which the subjects pay the least amount of attention to—or are the least aware of—the speech they produce. This makes it the preferred kind of data to be investigated and used for analysis in forensic phonetic studies, as it also most closely resembles the type of speech found and dealt with in forensic contexts such as speaker comparison practices.

The selected Flemish speakers were all females born in the central region of Flanders—that is, the provinces of Antwerp and Flemish Brabant—and were between the ages of 26 and 31, except for one speaker who was 36 years old. The Scottish English speakers, on the other hand, while also all female, originated from a wider geographic area comprised of the Glasgow, Ayrshire, and Lanarkshire regions. While less concentrated than the selected Flemish region, previous literature has described epenthesis to be present to the same degree—and in the same consonant clusters—in all of these areas (Maguire, 2017). The Scottish speakers were between

17 and 43 years old, with two people falling out of that range at 56-68 years of age.[10] Figures 3 and 4 show maps of the selected regions in both countries, and Table 1 provides a summary of the selected speakers' characteristics. In other words, a homogeneous—or an as homogeneous as possible, to the extent in which the corpora would allow so—group of speakers was selected, in order to make sure that any differences that could be observed between the speakers in terms of their use of schwa insertion would correspond to individual preferences.

	Speaker	**Gender**	**Age**	**Region**
Flemish speakers	Speaker 1	Female	26	Flemish Brabant
	Speaker 2	Female	26	Antwerp
	Speaker 3	Female	31	Antwerp
	Speaker 4	Female	28	Antwerp
	Speaker 5	Female	36	Antwerp
Scottish English speakers	Speaker 1	Female	59-68	Lanarkshire
	Speaker 2	Female	17-26	Ayrshire
	Speaker 3	Female	34-43	Ayrshire
	Speaker 4	Female	56-65	Ayrshire
	Speaker 5	Female	17-26	Glasgow

Table 1. Information of the Flemish and Scottish speakers whose recordings were used for this study. For the Scottish English speakers, the potential age range is given based on the decade of birth.

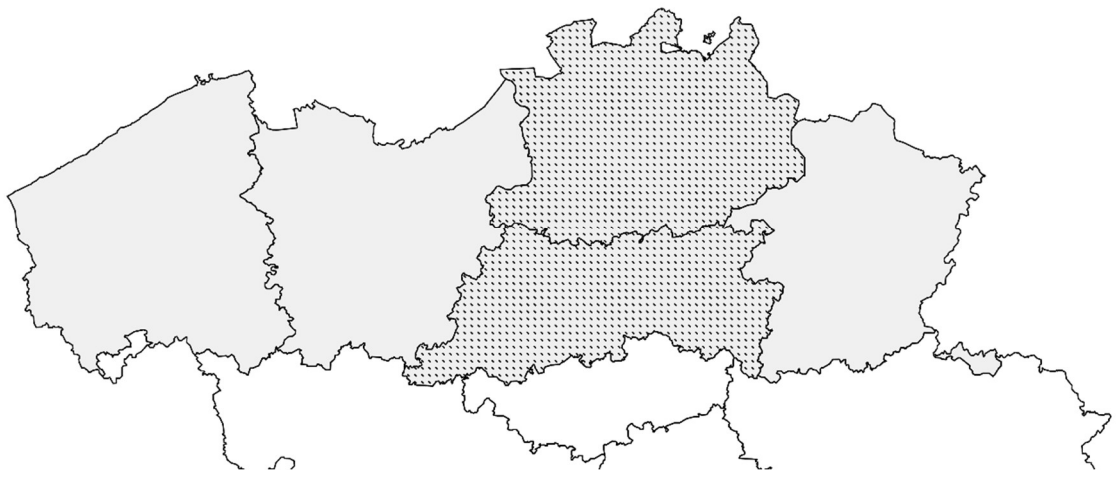

Figure 3. Map of Flanders, Belgium highlighting the provinces of Antwerp (top) and Flemish Brabant (bottom), from which the speakers in this study originated.

[10] The values reported here reflect the range of potential ages the speakers may have, as only information regarding the decade of birth was available rather than the exact years of birth.

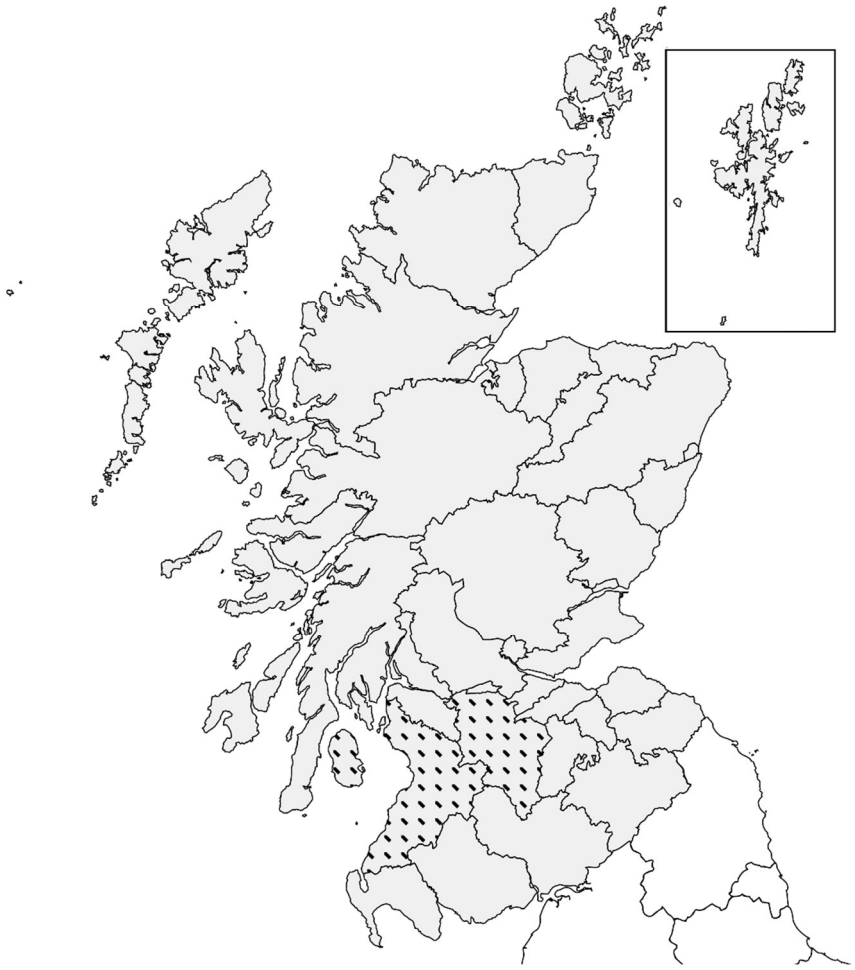

Figure 4. Map of Scotland highlighting the area from which the speakers in this study originated (patterned), comprised of the Glasgow, Ayrshire, and Lanarkshire regions.

3.2. Analysis of the Variables

When analysing phonological variables, an important first step is defining the variable of interest and its variants and distribution. Phonological variation can be said to be either discrete or continuous. The former makes reference to those variables which result in the presence or absence of a given sound, as is the case of schwa insertion, and the latter to those for which the boundaries between the variants are not as clearly defined and exist, instead, on a continuum. Then, it is necessary to define the scope of variability, which refers to "the contexts in which the [variants] may apply"; that is, "where the variation might possibly operate" (Gordon, 2007: 20). While it is possible for the phoneme itself to be the scope of the variable for those cases in

which the variation occurs “in all contexts containing that phoneme”, the scope is frequently more restricted and the variable conditioned by the context(s) in which it appears (2007: 20).

Once the variable has been clearly defined along with its contexts of occurrence, the second step in variationist analyses is measuring the variation and coding the variable. This is generally done auditorily, instrumentally, or by means of a combination of the two. While the former consists of auditory judgements, the latter involves an acoustic analysis of the data by using the spectrogram as a tool to visually interpret the speech signal. During the auditory and/or instrumental measuring, the variable is coded in terms of which variant is produced, which is done by marking the productions of the variants according to what was produced (Gordon, 2007: 21–22).

Bearing in mind the different steps to be taken when analysing phonological variation, once the speakers and their recordings had been selected for this study, a search was performed on their transcripts for those consonant clusters which may present epenthesis in their respective languages; that is, the scope of the variable was defined and, in turn, explored. In the case of the Flemish recordings, this scope included the r+C clusters /rf, rx, rk, rm, rp, rn, rv/ and the l+C clusters /lf, lx, lk, lm, lp, lv/, whereas for the Scottish English samples these were /rl, rm, rn, rv/ and /lm/. The words containing these clusters were located within the corresponding audio files and were subsequently segmented and labelled by means of the computer software *Praat*. This was done by creating TextGrids for each of the recordings.

The labelling of the tokens—that is, the coding of the variable—was carried out in such a way that said labels contained information regarding the word in question, the cluster of interest, and whether epenthesis was observed or not. As for the latter, the presence or absence of schwa insertion was determined by an auditory as well as an acoustic analysis of the clusters in question. That is, a schwa was considered to have been inserted in the r+C and l+C clusters if such an element was both heard and seen on the spectrogram, taking the form of a vowel—

or vowel-like segment—with a formant structure. Figure 5 below illustrates what an epenthetic schwa may look like on the spectrogram. Considering that the first element of the consonant clusters was either /r/ or /l/ which both have formant structures themselves, when determining the presence or absence of a schwa for those cases in which the schwa was particularly difficult to discern on the spectrogram, the auditory perception of such a segment was, at times, relied on to a larger degree than its acoustic appearance.

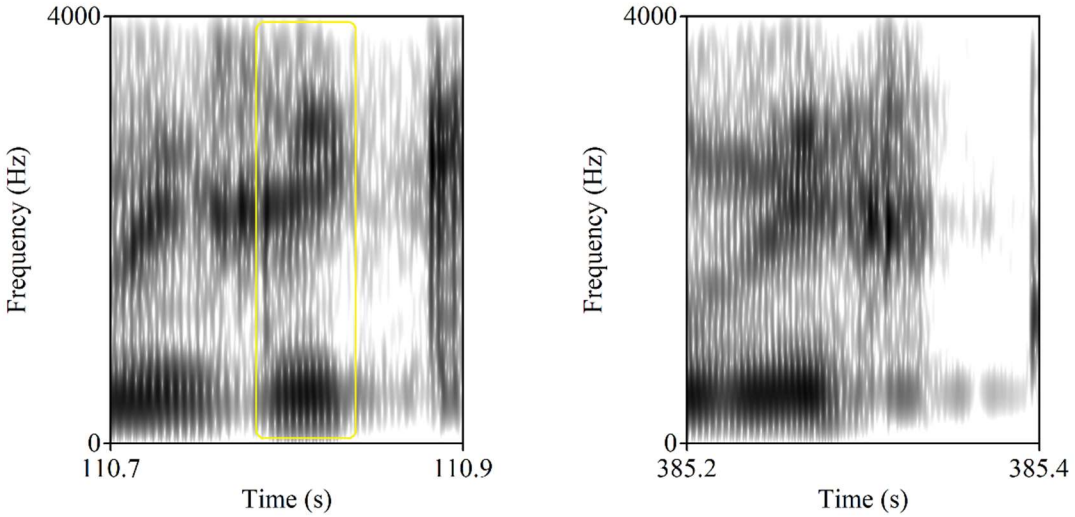

Figure 5. Spectrograms of the Flemish word '*werk*' with epenthetic schwa (left) and without epenthetic schwa (right). Both tokens were produced by the same speaker. The epenthetic schwa (left) has been marked for identification.

By including and marking the tokens in which an epenthetic schwa was present as well as those in which it was found to be absent, the principle of accountability was followed, according to which every variant of the linguistic variable under investigation has to be accounted for and included in the analysis, "whether the variants are realised or unrealised"; that is, the contexts in which the variant form appears must be studied equally to those in which this form "would have been possible" (Tagliamonte, 2006: 13). Once these steps had been performed, a script was run to extract and compile the labelled segments from the TextGrids. While the initial extraction included both tautosyllabic and heterosyllabic clusters, for the subsequent analyses

only the former were considered due to the findings of prior studies, which observed different epenthesis rates for both types of clusters in Dutch (Kloots et al., 2009).

A count was then performed of the total number of tokens which may show epenthesis for each speaker in both languages, those in which schwa insertion was observed, and those in which the process was found to be absent. This data in turn allowed for the individual speakers' overall insertion rates to be determined. This process was repeated for some of the individual clusters, consisting of an analysis of the most frequently observed consonant clusters in the collected material. For Flemish these were the clusters /lf/ and /rk/, and for Scottish English the cluster /rl/. In the case of the latter, as well as being the most common, it was also the only cluster to exhibit epenthesis in the language.

Apart from analysing the percentage of schwa insertion, additional statistical tests were carried out in order to determine whether the differences in epenthesis observed between the individual speakers in the aforementioned clusters could be considered to have statistical significance. To this end, chi-squared tests were employed in the form of pair-wise comparisons between two speakers at a time. This type of statistical test has been used in previous studies involving forensic phonetic analyses (Chaski, 2001; Dreher & Young, 1969; Smith, 1994; Svartvik, 1968). The particular tests that were performed are the $N - 1$ chi-squared tests, which are an alternative to K. Pearson's statistic initially proposed by E. Pearson (1947) and recommended by Campbell (2007). As the name suggests, this test consists of replacing N in K. Pearson's chi-squared statistic with $N - 1$; in other words, it differs from said test by the factor $(N - 1) / N$. This version of the chi-squared test is of particular interest when working with 2×2 contingency tables and smaller sets of data—as is the case for the present study—, and the p-values obtained from these have been shown to be more accurate than those provided by K. Pearson's statistic (Busing et al., 2016; Campbell, 2007).

While Yates' correction for continuity is often employed alongside K. Pearson's test in order to compensate for its reduced accuracy when any of the expected frequencies are below 5, this alteration may lead to an overcorrection of the results and, thus, overly conservative *p*-values (Camilli & Hopkins, 1978; Campbell, 2007). Conversely, $N - 1$ chi-square tests can be used on smaller sets of data, and its accuracy only decreases when any of the expected values fall below 1. In those particular cases where this occurs, as per Campbell's (2007) recommendations, the Fisher-Irwin test should be—and was—used instead. While the output of the latter consists of a *p*-value which can be interpreted as is, that of the chi-squared tests—that is, the $N - 1$ χ^2 value—serves as the input for obtaining the corresponding *p*-value. For this purpose, the degrees of freedom were calculated which, considering the statistical data in this study consisted of 2 × 2 contingency tables, was always 1. Subsequently, an online calculator was used to determine the probability values although, alternatively, a chi-square distribution table could have been consulted to the same—albeit slightly less exact—end.[11]

4. Results

Once all the data had been collected and coded, the total number of realisations of consonant clusters susceptible to schwa insertion was obtained for each speaker in both languages, and out of these the number of clusters in which epenthesis was and was not produced. Based on these counts, the individual percentages of insertion were calculated, as can be observed in Table 2 below. Overall, the Flemish speakers epenthesise more frequently than the Scottish English speakers, with mean rates of 79.92% and 21.05% respectively. In terms of the individual insertion rates, the highest can be observed for the Flemish speakers, with speaker 1 showing the most evidence of the process with 96% insertion. The lowest insertion rate, on the

[11] While different options exist, the particular online tool that was used in this study to calculate the *p*-values based on the χ^2 values can be found at https://www.graphpad.com/quickcalcs/pvalue1.cfm/.

other hand, belongs to the Scottish English speaker 3, with 7.14% epenthesis. Thus, both within and across languages, the use of epenthetic schwas is considerably lower for Scottish English than it is for Flemish.

Speaker		**Schwa**		**Total (*N*)**
		n	%	
Flemish	Speaker 1	48	96%	50
	Speaker 2	35	70%	50
	Speaker 3	34	77.27%	44
	Speaker 4	18	56.25%	32
	Speaker 5	60	88.24%	68
Mean		*39*	*79.92%*	*48.8*
Scottish English	Speaker 1	6	40%	15
	Speaker 2	2	18.18%	11
	Speaker 3	2	7.14%	28
	Speaker 4	4	12.90%	31
	Speaker 5	6	60%	10
Mean		*4*	*21.05%*	*19*

Table 2. The overall schwa insertion rate for all consonant clusters combined, per speaker and language. The individual numbers of epenthesised tokens (*n*) are also given, as well as the total of clusters susceptible to epenthesis (*N*) and the mean insertion rates across speakers for both languages.

Of more particular interest, however, are the number of tokens and the amount of epenthesis found in specific clusters, considering that prior studies found this factor to have an influence on the process. For this purpose, token and insertion counts were performed on the clusters /lf/ and /rk/ in the case of the Flemish speakers, and on the cluster /rl/ in the case of the Scottish English speakers. These were selected since they were the most frequently observed clusters in their respective languages. Moreover, for the Scottish English speech, the /rl/ cluster was found to be the only one in which speakers inserted schwas. Table 3 and Table 4 show these counts for each individual Flemish speaker for the clusters /lf/ and /rk/ respectively, while Table 5 does so for the cluster /rl/ for the Scottish English speakers.

For the cluster /lf/, the highest epenthesis rates belong to speakers 1 and 5, who produced schwas 94.44% and 100% of the time, respectively. The lowest observed rate, on the other hand, is that of speaker 3, who inserted a schwa in 58.82% of the clusters. For the cluster /rk/,

speaker 1 was once again found to have the highest insertion rate at 100% along with speaker 2, while the lowest rate at 25% belongs to speaker 4. As for the Scottish English cluster /rl/, speaker 1 and speaker 5 both produced schwas 85.71% of the time, while speaker 4 only used the process in 23.53% of the clusters.

Speaker	**Schwa**		**Total (*N*)**
	n	%	
Speaker 1	17	94.44%	18
Speaker 2	25	65.79%	38
Speaker 3	10	58.82%	17
Speaker 4	8	66.67%	12
Speaker 5	19	100%	19
Mean	*15.8*	*75.96%*	*20.8*

Table 3. The individual insertion rates for the Flemish cluster /lf/. The total number of consonant clusters (*N*) and those that were epenthesised (*n*) are also given for each speaker.

Speaker	**Schwa**		**Total (*N*)**
	n	%	
Speaker 1	11	100%	11
Speaker 2	5	100%	5
Speaker 3	20	86.96%	23
Speaker 4	2	25%	8
Speaker 5	20	83.33%	24
Mean	*11.6*	*81.69%*	*14.2*

Table 4. The individual insertion rates for the Flemish cluster /rk/. The total number of consonant clusters (*N*) and those that were epenthesised (*n*) are also given for each speaker.

Speaker	**Schwa**		**Total (*N*)**
	n	%	
Speaker 1	6	85.71%	7
Speaker 2	2	40%	5
Speaker 3	2	50%	4
Speaker 4	4	23.53%	17
Speaker 5	6	85.71%	7
Mean	*4*	*50%*	*8*

Table 5. The individual insertion rates for the Scottish English cluster /rl/. The total number of consonant clusters (*N*) and those that were epenthesised (*n*) are also given for each speaker.

In order to assess whether the epenthesis rates obtained for the different speakers were of any statistical significance, $N - 1$ chi-squared tests were carried out. For each cluster, pair-wise

comparisons were performed between two individuals at a time. The results of these analyses can be observed in Table 6, Table 7, and Table 8 below.

	Speaker comparisons – Flemish /lf/ cluster				
	1 vs 2	**1 vs 3**	**1 vs 4**	**1 vs 5***	**2 vs 3**
χ^2	5.25	6.11	3.87	N/A	0.24
p	.02	.01	.05	.49	.62
	2 vs 4	**2 vs 5**	**3 vs 4**	**3 vs 5**	**4 vs 5**
χ^2	0.003	8.27	0.18	9.44	7.04
p	.96	.004	.67	.002	.008

Table 6. The chi-squared (χ^2) and *p*-values obtained from the pair-wise $N - 1$ chi-squared tests for the Flemish /lf/ cluster. The level of significance is $p < .05$. The statistically significant values have been marked in grey.
*Due to some of the expected values falling below 1, the $N - 1$ chi-squared test for this comparison was substituted by Fisher's exact test to improve the accuracy of the obtained *p*-value.

	Speaker comparisons – Flemish /rk/ cluster				
	1 vs 2*	**1 vs 3***	**1 vs 4**	**1 vs 5**	**2 vs 3***
χ^2	N/A	N/A	11.42	2.01	N/A
p	1	.53	.001	.16	1
	2 vs 4	**2 vs 5***	**3 vs 4**	**3 vs 5**	**4 vs 5**
χ^2	6.43	N/A	10.7	0.12	9.21
p	.01	1	.001	.73	.002

Table 7. The chi-squared (χ^2) and *p*-values obtained from the pair-wise $N - 1$ chi-squared tests for the Flemish /rk/ cluster. The level of significance is $p < .05$. The statistically significant values have been marked in grey.
*Due to one or more of the expected values falling below 1, the $N - 1$ chi-squared tests for these comparisons were substituted by Fisher's exact tests to improve the accuracy of the obtained *p*-values.

	Speaker comparisons – Scottish English /rl/ cluster				
	1 vs 2	**1 vs 3**	**1 vs 4**	**1 vs 5**	**2 vs 3**
χ^2	2.51	1.49	7.56	0	0.08
p	.11	.22	.006	1	.78
	2 vs 4	**2 vs 5**	**3 vs 4**	**3 vs 5**	**4 vs 5**
χ^2	0.50	2.51	1.06	1.49	7.56
p	.48	.11	.30	.22	.006

Table 8. The chi-squared (χ^2) and *p*-values obtained from the pair-wise $N - 1$ chi-squared tests for the Scottish English /rl/ cluster. The level of significance is $p < .05$. The statistically significant values have been marked in grey.

The paired comparisons for the Flemish cluster /lf/ yielded six statistically significant results—that is, significant differences were found between the observed and the expected values six

times—, two of which are so at a $p \leq .05$ level and four of which are significant at a $p \leq .01$ level. The same comparisons for the cluster /rk/ show four statistically significant differences in total. Two of these are significant at $p \leq .01$ and the remaining two could be considered highly significant at a $p \leq .001$ level. As for the pair-wise comparisons for the Scottish English cluster /rl/, two statistically significant results were obtained at a $p < .01$ level—in fact, both values are $p = .006$. In other words, while for the Flemish clusters /lf/ and /rk/ 60% and 40%, respectively, of the chi-squared speaker comparisons were found to be statistically significant, for the Scottish English cluster /rl/ 20% of the comparisons could be considered as such.

5. Discussion

In this study, the variable schwa insertion as it manifests itself in Flemish and Scottish English was analysed so as to be able to ascertain whether, apart from the numerous (socio)linguistic factors which have been shown to affect this process, it would exhibit individual variation as well. To this end, an analysis of schwa epenthesis in both languages and in particular contexts of insertion for a homogeneous group of speakers was performed in order to shed light on the variation that could potentially be observed between individuals.

As can be observed in Tables 3 and 4, counts of the individual speakers' production of /r/+C and /l/+C clusters revealed that the Flemish subjects inserted schwas between 58.82% and 100% of the time in the cluster /lf/, making for a mean insertion rate of 75.96%, and epenthesised between 25% and 100% of the /rk/ clusters, with an average epenthesis rate of 81.69%. These results appear to be in line with Kloots et al.'s observed tendency for increased insertion rates in the Flemish cluster /lf/ compared to those for the cluster /rk/ (2002: 117). In terms of the obtained percentages, however, a significant difference can be observed as Kloots et al. report comparatively lower rates of 10.70% and 23.56% for the Flemish clusters /lf/ and /rk/ respectively (2002:117). This contrast is most likely due to the fact that the authors did not

account for influential factors such as age or gender in their analysis of the individual clusters apart from distinguishing between the Netherlands and Flanders. The values in Table 5, on the other hand, reflect the result of the counts of the Scottish English speakers' productions, revealing that they epenthesised the cluster /rl/ between 23.53% and 85.71% of the time, with a mean insertion rate of 50%. The latter thus constitutes a slight deviation from Maguire's observations regarding this cluster, which was reported to be 68.71% (2017: 170). Although, once again, the latter was obtained without controlling for factors such as age, gender, or region.

The findings obtained from the $N - 1$ chi-squared tests, by means of which the different speakers were paired up and compared to one another in terms of their use of epenthetic schwas, further highlight the individual variation and inter-speaker variability that occurs for this variable. For the Flemish speakers, six out of the ten comparisons were found to be statistically significant for the /lf/ cluster. In the case of the /rk/ context, this number was reduced to four out of ten. As for the Scottish English speakers, for whom the selected context of occurrence was the cluster /rk/, only two out of the ten speaker comparisons yielded statistically significant differences. These findings seem to indicate that, overall, individual variation for this process is considerably higher in Flemish than it is in Scottish English. The analysis of two different consonant clusters in Flemish seemingly highlights, moreover, that within this language varying degrees of individual variation can be observed depending on the linguistic context. In this sense, the findings point to a higher degree of inter-speaker variation in the case of the cluster /lf/ compared to the cluster /rk/. Thus, this study's hypotheses that schwa insertion will show individual variation as well as inter-speaker variability appear to be validated, the degree to which seemingly being dependent on the language and context of occurrence.

From these findings, it appears that in a forensic phonetic context it would be more suitable to analyse this process when working with Flemish speech rather than when dealing with Scottish English speech. That is, while the hypothesis that schwa epenthesis will exhibit

forensic phonetic potential seems to be validated, due to the higher inter-speaker variation exhibited by this process in Flemish its potential is greater than that of the process in Scottish English. Furthermore, within the analysis of Flemish speech, the context of occurrence appears to play an important role. The cluster /lf/ was found to show more individual variation than the cluster /rk/ which suggests, therefore, that the latter would be more suitable for analysis in forensic phonetic environments. Thus, if multiple consonant clusters are examined, they should be duly coded and separated when performing any analyses, so as to not neutralise any potential differences between the linguistic contexts.

The low speaker identification potential of schwa insertion in Scottish English is not only due to the low inter-speaker it exhibits, but is also reflected in its more limited scope of variation—particularly when compared to that of the same process in Flemish. Due to the more restricted contexts of occurrence, the number of tokens that can be observed and collected will, in turn, also be considerably smaller. As can be inferred from Table 5, this was the case in the present study; while an average of 8 tokens were obtained for the Scottish English cluster /rl/, an average of 20.8 and 14.2 tokens were found for the Flemish clusters /lf/ and /rk/ respectively. Thus, in order to overcome this limitation and mitigate its effects, more or longer recordings would be necessary so as to be able to obtain a more robust sample. While doing so would allow the analyses to produce more reliable results, in forensic phonetic practices larger speech samples are, in reality, not always available. These observations, thus, further highlight the relative inadequacy of analysing Scottish English schwa insertion for forensic speaker comparison ends.

Regardless of the more limited linguistic contexts in which epenthesis can occur, however, out of the different Scottish English consonant clusters that were analysed speakers only appeared to use the process in the /rl/ context. So, even though the findings obtained in this study seem to indicate that schwa insertion does not show a large amount of forensic

potential, the data does appear to shed light on some of the tendencies of modern Scottish English speech—at least for the particular demographic selected for this study—in terms of the linguistic contexts in which the process occurs. Maguire (2017) provided the most in-depth study on schwa insertion in Scottish English and highlights the clusters /rm/, /lm/, /rn/ and /rl/ as being the most commonly epenthesised based on data which was obtained in the mid-20th century. The findings observed in the present study seem to suggest, therefore, that Maguire's (2017) descriptions cannot be extended to modern-day speech. Thus, a wider dialectal study on contemporary Scottish English speech would most likely yield interesting results in terms of whether the absence of schwa insertion all clusters except for /rl/—or at least an abundant presence of the process in said cluster compared to the other linguistic contexts in which epenthesis may occur—can be generalised to the broader population.

While schwa anaptyxis appears to show forensic potential in Flemish, at the same time it is worth bearing in mind that, within forensic phonetic practices, the analysis of a single feature does not—and should not—constitute the entire foundation of any subsequent speaker (dis)similarity judgements that are made. Rather, the latter are based on the findings obtained by analysing acoustic traits, linguistic features, or a combination of both. Thus, while the observations outlined in this study regarding the process of schwa insertion in Flemish are indicative of its adequacy—to a greater or lesser extent, depending on the context of occurrence—for forensic practices, if it is analysed in such frameworks it should similarly be complemented by other examinations.

6. Conclusions

The aim of the present study was to investigate the process of schwa insertion—also commonly referred to as *svarabhakti* vowels—as it occurs in Flemish and Scottish English speech from a forensic phonetic perspective. Previous literature on the topic of schwa epenthesis has revealed

that it presents itself in varying degrees as it is conditioned by regional, social, and linguistic factors. Considering that variables which exhibit sociolinguistic variation have been found to be of interest in forensic phonetic contexts, as they may allow for individual preferences to be identified (de Jong et al., 2007a, 2007b; Gavaldà, 2016; Loakes, 2008; Loakes & McDougall, 2004, 2007, 2010; Moosmüller, 1997; Nolan & Oh, 1996), for this study schwa insertion was examined from this perspective. By means of an analysis of two homogeneous groups of Flemish and Scottish English speakers and three consonant clusters—two for Flemish and one for Scottish English—in which epenthetic schwas may be produced, certain observations regarding the individual differences between speakers could be made.

In terms of the research questions and hypotheses this study wished to explore, the speaker comparisons involving the Flemish cluster /lf/ yielded a total of six statistically significant results out of ten, whereas those for the cluster /rk/ in the same language generated four such outcomes. For the Scottish English cluster /rl/, on the other hand, only two out of the ten comparisons generated a statistically significant result. The analysis of the Flemish cluster /lf/ exhibited, therefore, higher inter-speaker variation than the cluster /rk/, and the Scottish English cluster /rl/ exhibited considerably lower inter-speaker variation. In other words, while the speakers selected for this study appear to show individual preferences in terms of their use of the variable schwa insertion, the findings do not seem to allow for a generalisable conclusion to be drawn regarding the application of its analysis in forensic phonetic environments. Rather, a more precise observation would be that schwa epenthesis appears to be a suitable forensic variable as long as the language of the speech samples is Flemish Dutch and the different linguistic contexts of occurrence are duly separated and analysed as such, considering the different results obtained for the two consonant clusters. Moreover, it appears advisable for any evaluations involving this process to preferably be based on an analysis of the cluster /lf/ rather

than the cluster /rk/ given the slightly higher inter-speaker variation the former shows compared to the latter.

Bearing in mind that a speaker comparison involves an array of analyses rather than the examination of a single variable, the findings obtained in this study seem to indicate that, at least in the case of Flemish speech—and even more particularly so in the case of the Flemish cluster /lf/—, exploring schwa insertion behaviour could be one of these and may, thus, provide useful when speaker similarity judgements have to be made. However, while high inter-speaker variation constitutes one part of the process of determining the forensic potential of a particular variable, examining whether it exhibits low intra-speaker variation—that is, a low degree of variability within the same speaker—would be the following analysis to be carried out. Due to certain limitations relating to the corpora used, this aspect was not within the scope of this study. In this sense, future studies could involve an exploration of individual speakers' behaviour across time, different tasks or styles with the aim to further aid in establishing the discriminatory potential of schwa insertion to which the findings obtained in this investigation can be considered an initial contribution.

Additionally, it is worth noting that the observations that were made apply to the particular speaker demographic that was chosen for this investigation which, due to the limitations imposed by the relatively small size of the corpus that was analysed—as well as the restrictions inherent to the rather time-consuming task of analysing spontaneous speech—, consisted only of one gender, age group, and region for each language. Thus, the potential future studies which could derive from the present investigation may involve a larger and more expanded corpus consisting of, for instance, males and females as well as speakers of different ages and originating from different regions. Considering, moreover, that only tautosyllabic clusters were considered in this study and rhythmic context was not controlled for—as the latter would have limited the sample size to such an extent that reliable measurements and statistics

would have been difficult to attain—, such explorations may yield additional results as well which could potentially provide complementary insights and expand the knowledge regarding the forensic potential this variable possesses.

As for anaptyxis in Scottish English in particular, a smaller number of susceptible tokens were found, due to which the statistical tests carried out were likely not as reliable as they were for the Flemish data, for which comparatively more tokens were collected. Therefore, these results should be understood within the limitations of the study and rather taken as being exploratory in nature. The more limited amount of data is, to a certain extent, inherent to the language however, due to the fact that the linguistic contexts and, thus, the scope of variation of schwa insertion are more restricted in Scottish English than in Flemish. While a potential solution to overcome this hurdle would be to analyse longer recordings or elicit words containing consonant clusters that can be epenthesised, this may not always be a realistic solution in actual forensic phonetic practices. The elicitation of certain tokens would, moreover, lead to the analysis of controlled rather than spontaneous speech, while the latter is considered more suited to the analysis of linguistic traits from forensic perspectives.

Notwithstanding the observed relative inadequacy of schwa insertion in speaker comparison practices involving Scottish English, the study suggests a tendency in terms of the clusters in which epenthetic schwas are inserted. Considering that Maguire (2017) reports that epenthesis can be observed in the clusters /rl, rm, rn, rv/ and /lm/, the findings of the present study indicate that insertion of schwa only occurs in the cluster /rl/ and cannot be observed in any of the other contexts which traditionally involve this process. A more extensive study on speakers' behaviour and use of the variable in modern-day speech would, therefore, certainly reveal interesting tendencies and provide insight into the contemporary use of schwa epenthesis in Scottish English. In this sense, the present study could be considered a small contribution to

research on the process of schwa insertion and its prevalence in modern-day Scottish English speech as well.

References

Aalbrecht, J., Peinen, W., & Sas, P. (1998). *Als je veel moet praten deel 2: Uitspraakvademecum* (3rd ed.). Leuven: Garant.

Allen, J. S., Miller, J. L., & DeSteno, D. (2003). Individual talker differences in voice-onset-time. *The Journal of the Acoustical Society of America, 113*(1), 544–552.

Baldwin, J. R. (1979). Phonetics and speaker identification. *Medicine, Science and the Law, 19*(4), 231–232.

Baldwin, J. R., & French, P. (1990). *Forensic phonetics*. London: Pinter Publishers.

Beal, J. C. (2010). *An introduction to regional Englishes: Dialect variation in England*. Edinburgh: Edinburgh University Press.

Beal, J. C., Burbano-Elizondo, L., & Llamas, C. (2012). *Urban north-eastern English: Tyneside to Teeside*. Edinburgh: Edinburgh University Press.

Blancquaert, E. (1969). *Praktische uitspraakleer van de Nederlandse taal* (8th ed.). Antwerp: De Sikkel.

Blancquaert, E., & Pée, W. (1925–1982). *Reeks Nederlandse dialectatlassen*. Antwerp: De Sikkel.

Boersma, P., & Weenink, D. (2020). *Praat: Doing phonetics by computer* (Version 6.1.15) [Computer software]. Available from https://www.praat.org/

Booij, G. (1999). *The phonology of Dutch*. Oxford: Oxford University Press.

Busing, F. M. T. A., Weaver, B., & Dubois, S. (2016). 2 × 2 tables: A note on Campbell's recommendation. *Statistics in Medicine, 35*(8), 1354–1358.

Cambier-Langeveld, T. (2007). Current methods in forensic speaker identification: Results of a collaborative exercise. *International Journal of Speech Language and the Law, 14*(2), 223–243.

Camilli, G., & Hopkins, K. D. (1978). Applicability of chi-square to 2 × 2 contingency tables with small expected cell frequencies. *Psychological Bulletin, 85*(1), 163–167.

Campbell, I. (2007). Chi-squared and Fisher–Irwin tests of two-by-two tables with small sample recommendations. *Statistics in Medicine, 26*(19), 3661–3675.

Chaski, C. E. (2001). Empirical evaluations of language-based author identification techniques. *Forensic Linguistics, 8*(1), 1–65.

Collins, B., & Mees, I. M. (2003). *The phonetics of English and Dutch* (5th ed.). Leiden: Brill.

Corpus Gesproken Nederlands - CGN (Version 2.0.3) (2014) [Data set]. Available at the Dutch Language Institute: http://hdl.handle.net/10032/tm-a2-k6/

De Coninck, R. (1970). *Groot uitspraakwoordenboek van de Nederlandse taal*. Antwerp: De Nederlandsche Boekhandel.

de Jong, G., McDougall, K., & Nolan, F. (2007a). The speaker-discriminating power of sounds undergoing historical change: A formant-based study. In J. Trouvain & W. Barry (Eds.), *Proceedings of the 16th International Congress of Phonetic Sciencies* (pp. 1813–1816). Saarbrücken: Universität des Saarlandes.

de Jong, G., McDougall, K., & Nolan, F. (2007b). Sound change and speaker identity: An acoustic study. In C. Müller (Ed.), *Speaker Classification II: Selected Papers* (pp. 130–141). Berlin: Springer.

Demanet, F. (1939). *Zuiver spreken. Een handboek voor onderwijzers, een leerboek voor normaal en middelbaar onderwijs*. Lier: Van In & Co.

Dreher, J. J., & Young, E. L. (1969). Chinese author identification by segment distribution. In L. Doležel & R. W. Bailey (Eds.), *Mathematical linguistics and automatic processing 6: Statistics and style* (pp. 147–169). New York, NY: Elsevier.

French, P. (2017). A developmental history of forensic speaker comparison. *English Phonetics, 21*, 271–286.

Gavaldà, N. (2016). Individual variation in allophonic processes of /t/ in Standard Southern British English. *International Journal of Speech Language and the Law, 23*(1), 43–69.

Gold, E., & French, P. (2011). International practices in forensic speaker comparison. *International Journal of Speech Language and the Law, 18*(2), 293–307.

Gold, E., & French, P. (2019). International practices in forensic speaker comparisons: Second survey. *International Journal of Speech Language and the Law, 26*(1), 1–20.

Goossens, J. (1977). *Inleiding tot de Nederlandse dialectologie*. Groningen: Wolters-Noordhoff.

Gordon, M. (2007). Techniques of analysis. Phonological variation. In C. Llamas, L. Mullany, & P. Stockwell (Eds.), *The Routledge companion to sociolinguistics* (pp. 19–27). Oxon: Routledge.

Greisbach, R., Esser, O., & Weinstock, C. (1995). Speaker identification by formant contours. *Beiträge zur Phonetik und Linguistik, 64*, 49–55.

Hall, N. (2006). Cross-linguistic patterns of vowel intrusion. *Phonology, 23*(3), 387–429.

Hall, N. (2011). Vowel epenthesis. In M. van Oostendorp, C. J. Ewen, E. Hume, & K. Rice (Eds.), *The Blackwell companion to phonology* (pp. 1576–1596). Oxford: Wiley.

Hickey, R. (1985). The interrelationship of epenthesis and syncope: Evidence from Dutch and Irish. *Lingua, 65*(3), 229–249.

Hickey, R. (2004). *A sound atlas of Irish English*. Berlin: Mouton de Gruyter.

Hickey, R. (2007a). *Irish English. History and present-day forms*. Cambridge: Cambridge University Press.

Hickey, R. (2007b). Southern Irish English. In D. Britain (Ed.), *Language in the British Isles* (pp. 135–151). Cambridge: Cambridge University Press.

Hickey, R. (2014). *The sound structure of Modern Irish*. Berlin: De Gruyter Mouton.

Hudson, T., de Jong, G., McDougall, K., Harrison, P., & Nolan, F. (2007). F0 statistics for 100 young male speakers of Standard Southern British English. In J. Trouvain & W. Barry (Eds.), *Proceedings of the 16th International Congress of Phonetic Sciences* (pp. 1809–1812). Saarbrücken, Universität des Saarlandes.

Jessen, M. (1997). Speaker-specific information in voice quality parameters. *International Journal of Speech Language and the Law, 4*(1), 84–103.

Johnstone, B. (1996). *The linguistic individual: Self-expression in language and linguistics*. New York, NY: Oxford University Press.

Kallen, J. L. (1994). English in Ireland. In R. Burchfield (Ed.), *The Cambridge history of the English language, vol. V: English in Britain and Overseas: Origins and Development* (pp. 148–196). Cambridge: Cambridge University Press.

Kallen, J. L. (2013). *Irish English volume 2: The Republic of Ireland*. Berlin: De Gruyter Mouton.

Kelly, M. H. (1988). Rhythmic alternation and lexical stress differences in English. *Cognition, 30*(2), 107–137.

Kelly, M. H., & Bock, J. K. (1988). Stress in time. *Journal of Experimental Psychology: Human Perception and Performance, 14*(3), 389–403.

Kloots, H. (2008). *Vocaalreductie in het Standaardnederlands in Vlaanderen en Nederland*. Delft: Eburon.

Kloots, H., De Schutter, G., Gillis, S., & Swerts, M. (2002). Sjwa-insertie in eindclusters: Variatiepatronen in het Standaardnederlands. *Nederlandse Taalkunde, 7*(2), 97–126.

Kloots, H., Gillis, S., & Verhoeven, J. (2009). Merk toch hoe sterk: Sjwa-insertie in spontaan gesproken Standaardnederlands. *Nederlandse Taalkunde, 14*(1), 45–65.

Kuijpers, C., & van Donselaar, W. (1998). The influence of rhythmic context on schwa epenthesis and schwa deletion in Dutch. *Language & Speech, 41*(1), 87–113.

Labov, W. (1972a). *Sociolinguistic patterns*. Philadelphia, PA: University of Pennsylvania Press.

Labov, W. (1972b). Some principles of linguistic methodology. *Language in Society, 1*(1), 97–120.

Labov, W. (1989). The exact description of a speech community: Short *a* in Philadelphia. In R. W. Fasold & D. Schiffrin (Eds.), *Language change and variation* (pp. 1–58). Amsterdam: John Benjamins.

Labov, W. (2001). *Principles of linguistic change, volume 2: Social factors*. Oxford: Blackwell.

Loakes, D. (2008). A forensic phonetic investigation into the speech patterns of identical and non-identical twins. *International Journal of Speech Language and the Law, 15*(1), 97–100.

Loakes, D., & McDougall, K. (2004). Frication of /k/ and /p/ in Australian English: Inter- and intra-speaker variation. In S. C. Cassidy (Ed.), *Proceedings of the 10th Australian International Conference on Speech Science and Technology* (pp. 171–176). Sydney: Australian Speech Science and Technology Association.

Loakes, D., & McDougall, K. (2007). Frication of Australian English /p t k/: Group tendencies and individual differences. In J. Trouvain & W. Barry (Eds.), *Proceedings of the 16th International Congress of Phonetic Sciences* (pp. 1445–1448). Saarbrücken: Universität des Saarlandes.

Loakes, D., & McDougall, K. (2010). Individual variation in the frication of voiceless plosives in Australian English: A study of twins' speech. *Australian Journal of Linguistics, 30*(2), 155–181.

Maguire, W. (2012). English and Scots in Scotland. In R. Hickey (Ed.), *Areal features of the Anglophone world* (pp. 53–78). Berlin: De Gruyter Mouton.

Maguire, W. (2017). Epenthesis in liquid+consonant clusters in Scots. In J. Cruickshank & R. M. Millar (Eds.), *Before the storm: Papers from the forum for research on the languages of Scotland and Ulster triennial meeting, Ayr 2015* (pp. 156–183). Aberdeen: Publications of the Forum for Research on the Languages of Scotland and Ulster.

Maguire, W. (2018). The origins of epenthesis in liquid+sonorant clusters in Mid-Ulster English. *Transactions of the Philological Society, 116*(3), 484–508.

McDougall, K. (2004). Speaker-specific formant dynamics: An experiment on Australian English /aɪ/. *International Journal of Speech Language and the Law, 11*(1), 103–130.

McDougall, K. (2006). Dynamic features of speech and the characterization of speakers: Toward a new approach using formant frequencies. *International Journal of Speech Language and the Law, 13*(1), 89–126.

McDougall, K., & Nolan, F. (2007). Discrimination of speakers using the formant dynamics of /u:/ in British English. In J. Trouvain & W. Barry (Eds.), *Proceedings of the 16th International Congress of Phonetic Sciences* (pp. 1825–1828). Saarbrücken: Universität des Saarlandes.

Moosmüller, S. (1997). Phonological variation in speaker identification. *Forensic Linguistics, 4*(1), 29–47.

Mussche, A. (1962). *Handleiding voor de praktijk van het Algemeen Beschaafd. Voor normaal en middelbaar onderwijs*. Brussels: A. De Boeck.

Nespor, M., Shukla, M., & Mehler, J. (2011). Stress-timed vs. syllable-timed languages. In M. van Oostendorp, C. J. Ewen, E. Hume, & K. Rice (Eds.), *The Blackwell companion to phonology* (pp. 1147–1159). Oxford: Wiley.

Nolan, F. (1983). *The phonetic bases of speaker recognition*. Cambridge: Cambridge University Press.

Nolan, F. (1997). Speaker Recognition and Forensic Phonetics. In W. J. Hardcastle & J. Laver (Eds.), *The handbook of phonetic sciences* (pp. 744–767). Oxford: Blackwell.

Nolan, F., & Grigoras, C. (2005). A case of formant analysis in forensic speaker identification. *International Journal of Speech Language and the Law, 12*(2), 143–173.

Nolan, F., & Oh, T. (1996). Identical twins, different voices. *Forensic Linguistics, 3*(1), 39–49.

Pearson, E. S. (1947). The choice of statistical tests illustrated on the interpretation of data classed in a 2 × 2 table. *Biometrika, 34*(1/2), 139–167.

Rose, P. (2002). *Forensic speaker identification*. London: Taylor & Francis.

Rose, P. (2003). The technical comparison of forensic voice samples. In I. Freckelton & H. Selby (Eds.), *Expert Evidence* (Chapter 99). Sydney: Thomson Lawbook Co.

Sassen, A. (1963). Endogeen en exogeen taalgebruik. *De Nieuwe Taalgids, 56*, 10–21.

Scottish Corpus of Texts and Speech - SCOTS (Version 17) (2013) [Data set]. Available at: https://scottishcorpus.ac.uk/

Sell, K. (2012). [ˈfiləm] and [ˈfarəm]? Sociolinguistic findings on schwa epenthesis in Galway English. In B. Migge & M. Ní Chiosáin (Eds.), *New perspectives on Irish English* (pp. 47–66). Amsterdam: John Benjamins.

Smith, W. (1994). Computers, statistics and disputed authorship. In J. Gibbons (Ed.), *Language and the law* (pp. 374–413). London: Longman.

Stroop, J. (1998). *Poldernederlands. Waardoor het ABN verdwijnt*. Amsterdam: Bert Bakker.

Svartvik, J. (1968). *The Evans statements: A case for forensic linguistics*. Stockholm: Almqvist & Wiksell.

Swerts, M., Kloots, H., Gillis, S., & De Schutter, G. (2001). Factors affecting schwa-insertion in final consonant clusters in Standard Dutch. In *Proceedings of the 7th European Conference on Speech Communication and Technology* (pp. 75–78). Aalborg, Denmark.

Tagliamonte, S. A. (2006). *Analysing sociolinguistic variation*. Cambridge: Cambridge University Press.

Tagliamonte, S. A., & D'Arcy, A. (2009). Peaks beyond phonology: Adolescence, incrementation, and language change. *Language, 85*(1), 58–108.

Theodore, R. M., Miller, J. L., & DeSteno, D. (2009). Individual talker differences in voice-onset-time: Contextual influences. *The Journal of the Acoustical Society of America, 125*(6), 3974–3982.

Tops, E. (2005). *Variatie en verandering van de /r/ in Vlaanderen*. Brussels: VUBPRESS.

Trudgill, P. (1983). *On dialect: Social and geographical perspectives*. Oxford: Blackwell.

van Bezooijen, R., & Giesbers, C. (2003). Breekt ie echt dooj? De verspreiding van de Gooise r in het Standaardnederlands. In J. Stroop (Ed.), *Waar gaat het Nederlands naartoe?* (pp. 204–214). Amsterdam: Bert Bakker.

Van de Velde, H. (1994). Zestig jaar (r)evolutie in het Standaard-Nederlands. In G. De Schutter, J. Taeldeman, & A. Weijnen (Eds.), *R: Zes visies op een kameleon. Taal en Tongval, themanummer 7* (pp. 22–42). Ghent: Taal en Tongval.

Van de Velde, H. (1996). *Variatie en verandering in het gesproken Standaard-Nederlands (1935–1993)* [Doctoral dissertation]. Nijmegen: Katholieke Universiteit Nijmegen.

Van Haver, J. (1972). *De uitspraak van het Nederlands. Een beknopte handleiding* (2nd ed.). Leuven: Acco.

van Hout, R., De Schutter, G., De Crom, E., Huinck, W., Kloots, H., & Van de Velde, H. (1999). De uitspraak van het Standaard-Nederlands: Variatie en varianten in Vlaanderen en Nederland. In E. Huls & B. Weltens (Eds.), *Artikelen van de Derde Sociolinguïstische Conferentie* (pp. 183–196). Delft: Eburon.

van Reenen, P. (1986). The vocalization of /l/ in standard Dutch, a pilot study of an ongoing change. *Linguistics in the Netherlands, 1986*, 189–198.

van Reenen, P., & Jongkind, A. (2000). De vocalisering van de /l/ in het Standaard Nederlands. *Taal en Tongval, 52*, 189–199.

Verstraeten, B., & Van de Velde, H. (2001). Socio-geographical variation of /r/ in standard Dutch. *Etudes et Travaux, 4*, 45–61.

Walshe, S. (2009). *Irish English as represented in film*. Frankfurt am Main: Peter Lang.

Warner, N., Jongman, A., Cutler, A., & Mücke, D. (2001). The phonological status of Dutch epenthetic schwa. *Phonology, 18*(3), 387–420.

Wells, J. C. (1982). *Accents of English 2. The British Isles*. Cambridge: Cambridge University Press.