



DEPARTAMENT DE FILOGIA ANGLESA I DE GERMANÍSTICA

**The Increasing Use of t-glottalling in Received
Pronunciation**

Treball de Fi de Grau/ BA dissertation

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Abstract

In the 20th century, t-glottalization spread across England from its epicentre in the South of the country. The glottal stop had traditionally been considered a regional feature, but research has demonstrated that it is increasingly being used by young RP speakers. As a result, this feature could be creeping into the most formal speaking registers (Fabricius, 2002, Shen, 2014). This paper aims to assess the use of t-glottalling in RP as presented in the BBC so as to determine if the glottal stop is spreading into monitored speech. To do this, a set of audio clips and podcasts from the BBC News broadcast over the 1970s and the 2015s were analysed and an examination of t-glottalling in terms of phonetic contexts, function and content words, and interspeaker variation in BBC representatives was carried out. Results indicate that the glottal stop is a feature increasingly used in certain contexts in RP, although it is more present in conversational than in scripted speech. These findings seem to support Fabricius' (2002) claim that all changes occur in conversational or Native RP before creeping into scripted or Construct RP. The conclusion drawn from the study is that the glottal stop has lost part of its stigmatization and that its status may be changing from a regional to a non-regional feature, as already suggested in Trudgill (2001) for other features such as HAPPY-tensing. However, it will probably take a few decades for the glottal stop to be systematically used in the most conservative varieties of RP.

Keywords: t-glottalling, Received Pronunciation, BBC English, regional feature, status.

1. Introduction

In the last decades, the replacement of the voiceless alveolar plosive /t/ by a glottal stop [ʔ] has been the object of research in a wide range of fields such as sociolinguistics, sociophonetics, phonetics and dialectology. In articulatory terms, the glottal stop is a consonantal, voiceless sound produced at the glottis by bringing the vocal folds tightly together and then separating them, thus completely blocking and then suddenly releasing the airstream. The pronunciation of /t/ as a glottal stop, generally described as *t-glottalization* or *t-glottalling*, has long been documented as being a Cockneyism, especially when occurring in intervocalic word-medial position (e.g. *butter* ['bʌʔə]). Hence, it has usually been considered a *regional* feature and has been “widely regarded as ugly and also a lazy sound” (Wells 1982: 35).

As a matter of fact, t-glottalling can be seen as an outcome of the *principle of least effort*, which states that there is a tendency for words and sentences to be pronounced “in a way which involves the minimum articulatory effort consistent with the need to maintain intelligibility” (Wells: 94). The loss of the oral articulation in t-glottalization may be considered to be a way to simplify articulatory gestures in speech. In fact, this sound allows us to abandon the movement of the tip of the tongue up to the alveolar ridge and away again, while simply achieving a glottal closure. Being heavily stigmatized, the glottal stop has been prevented from being used in Received Pronunciation (RP).

The term *Received Pronunciation* was coined by the philologist Alexander J. Ellis in his book *On Early English Pronunciation* (1869). According to the Concise Oxford English Dictionary, it is “the standard accent of English as spoken in the south of England.” Similarly, the Cambridge Dictionary defines it as “the standard way in which

middle-class speakers of southern British English pronounce words.” However, Fabricius (2002) points out that the term *Received Pronunciation* is often used ambiguously. For this reason, the author considers it necessary to differentiate between two types of RP: *Construct-RP* (c-RP) and *Native-RP* (n-RP). Construct-RP refers to “a codified norm (...) the normative pronunciation described in dictionaries, especially pronunciation dictionaries” (Fabricius: 118), while Native-RP denotes “an accent used by those who acquire it as native speakers” (Fabricius: 118). In other words, these terms specifically describe, on the one hand, the accent used in those contexts that require a standard and fixed pronunciation, such as English as a Foreign Language teaching or broadcasting (c-RP) and, on the other hand, a type of accent that, as any given pronunciation of English, can be an object of variation (n-RP).

In spite of the stigmatization of t-glottalling, research has found the glottal stop to be an allophone of /t/ used by some RP speakers in preconsonantal environments, i.e. preceding an obstruent (e.g. *get to* ['geʔ tʊ]) or a sonorant (e.g. *look at me* ['lʊk əʔ 'mi] Wells, 1982). In addition, in the late-20th century it was found that t-glottalling was also creeping into RP in phrase-final position (e.g. *forget about that* [fə'get ə'baʊt 'ðæʔ] Cham, 2016) as well as in intervocalic word-boundary position (e.g. *sort of* ['sɔ:ʔ əv] Wells, 1982).

The increasing presence of regional features in standard speech has received considerable critical attention from disciplines such as sociology and sociolinguistics. Foulkes and Docherty particularly focused on the underlying reasons for this sociophonetic variation in their paper *The social life of phonetics and phonology* (2006).

In their work, they explored the correlation between alternative phonetic forms—such as [t] and [ʔ]—and social factors including, among others, speaking style. These authors argue that variants such as the glottal stop can index different social categories as well as formality of speech (i.e. formal or informal styles of speech). Additionally, Foulkes and Docherty (2006:411) point out that “sociophonetic variation is gradient rather than categorical. That is, variation may be observed such that a given form is used statistically more by one social group than another, or more in one speech style than another.” Hence, this approach provides a solid explanation for the variation in t-glottalization in formal and informal registers.

Another aspect that should be closely examined is the nature of the so-called *regional features*. Since only non-regional features are claimed to be present in Received Pronunciation, this raises the interesting question of what is—and what is not—a *regional feature*. This term has traditionally been used to refer to those sounds of a language spoken in a particular geographical area. Thus, if the glottal stop was a regional feature, it should only be present in southern accents of British English, where it originated. However, research has demonstrated this feature to be used all over England (see Hughes and Trudgill, 1987). Naturally, the change from being a regional to non-regional feature does not take place overnight and usually needs decades to be completed. Hence, it is possible to observe that features such as the glottal stop will have, as the change takes place, an intermediate status (Trudgill, 2001: paragraph 10).

An illustration of this gradual change can be found in the so-called HAPPY-tensing. As Trudgill (2001: paragraph 10) defines it, “this involves the replacement through time of word-final unstressed /ɪ/ by /i:/, so that /'hæpɪ/ becomes /'hæpi:/.” As a

matter of fact, the feature was already used by southerners in the 19th century. The preference of use of /i:/ over /ɪ/ has been spreading northwards for many decades and nowadays “/ɪ/ is increasingly replaced in the speech of younger [RP] generations by a short variety of /i:/” (Gimson 1962, cited in Wells, 1982: 258). The increasing use of HAPPY-tensing in Received Pronunciation has started to cause its absence —and not its presence as it initially was— to be a regional feature (Wells: 258).

This study aims, in the first place, to assess the use of t-glottalling in RP. More precisely, it seeks to determine whether this feature is spreading into formal, scripted speech (i.e. speech that has been written in advance), taking as a reference the English spoken in the BBC, which accounts for one of the most conservative varieties of RP. This approach is motivated by the fact that previous research has observed that “some people in public life who would previously have been expected to speak with an RP accent now find it acceptable to speak with some characteristics of the London area, such as glottal stops, which would in earlier times have caused comment or disapproval” (Roach, 2009: 4). The study also seeks to carry out a comprehensive examination of t-glottalling over time by analysing its incidence in terms of 1) phonetic contexts, 2) content and function words and 3) interspeaker variation in BBC representatives, namely newsreaders, editors and correspondents.

The central hypothesis of this paper is that t-glottalling, spreading out from London English, has gradually started to become a feature used in RP, particularly in phrase-final [_##] (e.g. *white* [waɪʔ]), preconsonantal [_#C] (e.g. *cannot be* [kən' nɒʔ 'bi]) and intervocalic word-boundary position [V_#V] (e.g. *what a nice day* ['wɒʔ ə 'naɪs 'deɪ]). In order to try to prove this hypothesis, data available in the *BBC Archive* over two

time periods, the 1970s and the 2015s, will be collected, compared and analysed. The main sources of speech will be audio clips and podcasts of the BBC Nine O'clock and Six O'clock News, which will allow a close examination of the evolution of BBC English through more than forty years.

2. The status of t-glottalling in RP

2.1. Origins and most common environments

In the Introduction it was mentioned that the term *t-glottalling* refers to the phonetic realisation of /t/ as [ʔ] in certain phonetic environments. Glottalization is found in various accents of English, yet, “t-glottalling is generally recognised as having its origins in regional varieties of English, in Scotland and the south east of England, especially London” (Fabricius, 2002: 119). As previously mentioned, Cockney speakers—usually working-class Londoners—use the glottal stop as an allophone of /t/ in various positions, the most characteristic one being intervocalically [V_V].

The glottal stop was first documented as a variant of /t/ in mainstream RP—understood as the pronunciation of English heard in radio and television broadcasts as well as that spoken by many public figures (Wells, 1985: 279)—in the mid-20th century. The high stigmatization associated to it when found in intervocalic position (e.g. in *water* ['wɔ:ʔə]) prevented RP speakers from using it in that context. As Wells observes:

T-glottalling in intervocalic environments is a more recent development in Britain, as attested by its absence from accents of English elsewhere. All these developments are characteristics of popular speech in the south-east of England, but not of RP in the traditional sense (1982: 252-3).

The glottal stop in syllable-coda is an innovation, which spread into RP in two different stages. The first stage took place in the mid-20th century, when the glottalized /t/ was found to occur in the environments where it preceded an obstruent (stop, fricative or affricate) or a sonorant (nasal, lateral or glide):

(1) $_(\#) C_{[\text{obstruent}]}$: *quite good* ['kwaɪ? 'gʊd], *nights* [naɪ?s].

(2) $_(\#) C_{[\text{sonorant}]}$: *quite likely* ['kwaɪ? 'laɪkli], *quietly* ['kwaɪə?li]

(Examples taken from Wells, 1982: 260).

When the consonant following the glottalized /t/ is a syllabic lateral (e.g. *bottle* ['bɒ?l]), the use of the glottal stop is considered to denote a Cockney accent and it usually receives the same degree of stigmatization as in intervocalic position. By contrast, the use of a glottal stop preceding a syllabic nasal (e.g. *button* ['bʌ?ŋ]) is extremely widespread and it is not negatively evaluated by RP speakers (Wells, 1985: 326).

In the second stage, chronologically dating back to the late 20th century, t-glottalling was found to occur in RP in phrase-final position, i.e. when preceding a pause [$_##$] e.g. *Quite!* [kwaɪ?] and in intervocalic word-boundary position [$V_#V$], e.g. *quite easy* ['kwaɪ? 'i:zi] (Fabricius, 2002: 119).

2.2. The spreading of t-glottalling across urban England

Research on t-glottalling has demonstrated that “it is one of the most dramatic, widespread and rapid changes to have occurred in British English in recent times” (Trudgill 1999, cited in Smith and Holmes-Elliott, 2017: 1). In fact, t-glottalling seems to have gradually spread across the nine regions of England —i.e. South East, London,

North West, East of England, West Midlands, South West, Yorkshire and the Humber, East Midlands and North East— while its use has also been attested in Wales and Scotland (Smith and Holmes-Elliott, 2017: 2).

In this section, we are going to analyse how t-glottalling has spread northwards from one of its sources which, as mentioned, is London English. In order to do this, we will follow the description of English accents in different cities provided by Hughes and Trudgill in their book *English Accents and Dialects: An Introduction to Social and Regional Varieties of British English* (1987: 59-72).

Hughes and Trudgill propose a division of England into North and South (see Figure 1). Since t-glottalling originated in the South, we will refer first to southern regions. The first subdivision to be dealt with is, naturally, London. As mentioned in the previous section, in Cockney t-glottalling is a very common feature. It occurs in all the environments in which it is found in RP as well as intervocally and accompanying /p/ and /k/ between vowels (preglottalization), as in *paper* ['peɪʔpə].



Figure 1. Map of the regions of England divided into North and South.

From London, t-glottalling spread to one of the border regions, East of England, the largest city of which is Norwich. The glottal stop is also a common feature in this region, where it is used intervocalically and accompanying /p/, /t/, /k/ particularly between vowels, as in *bottom* ['bɒʔtɒm]. The last region of the South of England described by Hughes and Trudgill is South West. In its largest city, Bristol, the glottal stop is also an allophone of /t/ and it mostly occurs in phrase-final position (e.g. *Pete* [pi:ʔ]).

After the initial spread of t-glottalling across the southern regions of England, the feature started creeping into the pronunciation of the northern regions of the country. A few glottal stops have been documented in the speech of the West Midlands, the North East and the North West, the largest cities of which are Birmingham, Newcastle-upon-Tyne and Liverpool respectively. In addition, t-glottalling is known to regularly occur in phrase-final position in Yorkshire and the Humber, taking Bradford's accent as our main reference.

2.3. The covert prestige of working-class speech

The spreading of t-glottalling across urban England has caused its status to gradually change, up to the point that it could be claimed to be transitioning from a regional feature into a non-regional feature (Trudgill, 2001). Typically associated with working-class speech, its use in RP had traditionally been highly stigmatized. Nevertheless, this seems to be changing, as the feature has been documented to be increasingly used in conversational RP (see Fabricius, 2002; Shen, 2014 below). This tendency for RP speakers to modify their pronunciation towards working-class speech had already been observed by Hughes and Trudgill:

It is sometimes said that nowadays there is not the same pressure as there once was to modify one's speech in the direction of RP. Reference is made to the fact that announcers with non-RP accents are now to be heard on the BBC, that important posts in industry and the civil service are held by non-RP speakers, and that some younger RP speakers have adopted, more or less deliberately, features of regional pronunciation (1987: 7).

It is widely acknowledged that, in England, RP enjoys *overt prestige*. That is, it is agreed to be the standard pronunciation, the one to be imitated. As a result, speakers of regional accents tend, consciously or unconsciously, to modify their accent towards RP.

However, we have seen that t-glottalling has spread from a lower to a higher social class' speech. A plausible explanation for this situation is the *covert prestige* attached to working-class pronunciation. This term refers to the relatively high value placed on the non-standard accent as a result of RP speakers wanting to gain recognition, acceptance, or solidarity with working-class men and women. For this reason, RP speakers have gradually started to incorporate features of this lower social class' speech into their own pronunciation. As Wells (1982: 106) puts it: "Mainstream RP is now the subject of imminent invasion by trends spreading from working-class urban speech, particularly that of London." The fact that t-glottalling has been attested in working-class speakers and RP speakers all over the country has led scholars to propose that this feature "may have started as a stereotype of urban speech, but such is its ubiquity that it is fast becoming a stereotype of British speech more generally" (Smith and Holmes-Elliott, 2017: 2).

2.4. T-glottalling in conversational speech

There is a relatively small body of studies concerned with the introduction of t-glottalling into RP, since the appearance of this southern feature in formal speaking

contexts was not documented until a few decades ago. One of the most relevant studies on this topic is the one carried out by Anne Fabricius at Cambridge University between 1997 and 1998, the results of which are examined in her paper *Ongoing change in modern RP: Evidence for the disappearing stigma of t-glottalling* (2002). In her study, she analysed the use of glottal stops by young mainstream RP speakers in both conversational and read speech.

Twenty-four subjects participated in her research (12 men and 12 women). Participants were first interviewed for 45-50 minutes on average and then, they were asked to read a passage from *A room with a view* (1908) by E.M. Forster, as well as some additional short sentences. Fabricius subsequently analysed the variation in their pronunciation of /t/ in five phonetic environments: 1) phrase-final, 2) intervocalic at word-boundary and preconsonantal, followed by 3) a stop, 4) a fricative or 5) a liquid/semivowel. Finally, participants were asked to take part in a judgement task aiming to determine their level of acceptability of glottalization in monitored speech — that is, in those speaking styles which are not spontaneous, such as reading.

The results of the study indicated that the home residence of participants (London, the Home Counties or the rest of England), the phonetic environment and the speaking style influenced the production and perception of t-glottalling. First, it was found that the most glottal stops were produced by Londoners and that there was a tendency for this feature to spread outwards in interview style. In addition, the judgement task suggested that the least acceptable phonetic environment for t-glottalling was intervocalically, while phrase-finally ranked second and pre-consonantally was the most acceptable context. Finally, the analysis of the candidates' recorded speech revealed that t-glottalling mostly

occurred pre-consonantly in both speaking styles, although it was more common in conversational speech. On the other hand, phrase-final and pre-vocalic glottalization were rarely found in formal speech. Nevertheless, Fabricius (2002: 134) suggests that if glottalization in these two environments continues to increase in informal registers, it could gain acceptability in monitored speech in the future.

T-glottalling seems thus to be a feature currently used in pre-consonantal, phrase-final and intervocalic word-boundary environments in conversational RP. Additionally, recent research has claimed that young RP speakers also use the glottal stop in the most stigmatized context for its appearance, i.e. in intervocalic word-medial position.

Shen's study *Phonological variation and change: A case study of intervocalic /t/-glottalling in Cambridge RP* (2014) aimed to determine whether young Cambridge RP speakers used intervocalic t-glottalling in casual and formal speech. The materials used for the study were twelve speech samples of young middle-class speakers, which were selected from the *International Variation in English* (IViE) corpus. The recordings analysed contained five different tasks, but only three of them were suitable for the purpose of the research. The first one consisted of reading a passage of the fairy tale *Cinderella* (1697) and subsequently retelling that passage. The second one required participants to describe a map and the third one was a conversation in pairs about a given topic.

All recordings were auditorily analysed and instances of allophones of /t/ in intervocalic at word-medial [V_V] and word-boundary [V_#V] positions were transcribed and classified into two groups: [t] —including pre-glottalized, ejective, aspirated, affricated, tapped and voiced /t/, as well as the plain alveolar stop— and [ʔ].

The results of the study indicated that t-glottalling was present among young Cambridge RP speakers, although in a larger proportion in casual rather than in formal speech and in intervocalic word-boundary environments than in word-medial position. Shen (2014: 8) explained the differences in glottalization between speaking styles by claiming that t-glottalling was consciously avoided in formal situations (i.e. when reading), since speakers showed a tendency to accommodate their pronunciation to the standard.

So far, we have seen how t-glottalling, originally a regional feature characteristic of Cockney English, progressively spread across urban England, possibly due to the covert prestige of the speech of working-class Londoners. It has also been pointed out that young RP speakers have incorporated this feature into their conversational speech in certain phonetic environments. Nevertheless, the glottal stop has not lost all its stigmatization just yet, since recent research has observed this feature to be consciously avoided in the most conservative varieties of RP (Cham, 2016). In the next section, we will turn to review a study on the use of the glottal stop in the BBC which seems to support this claim.

2.5. Variation in RP in broadcasting

The study by Cham (2016), titled *Sixty years of speech: A study of language change in adulthood*, provides a deeper insight into the current status of t-glottalling in mainstream RP —i.e. as used in broadcasting. His research examines the speech of a BBC broadcaster, David Attenborough, throughout his 60-year-long career. The aim of his study was to assess the changes that took place in the speech of such a BBC representative throughout a period of time when the prestigious RP accent was known to have

experienced several modifications. For this reason, the paper focused on two different *regional* features, namely t-glottalling and the TRAP/STRUT vowel distinction and how they were used by Attenborough in his narration of nature-related documentaries in the 1960s, 1980s and 2000s.

After analysing nine different documentary episodes, Cham found that even if the glottal stop was a variant available to the broadcaster, it was never highly prevalent in his speech (it ranged between 8% and 11%). The explanation provided for the low presence of t-glottalling in the data matches the one given by the researchers mentioned in the previous section. That is, since the use of a non-standard feature would be unsuitable for broadcasting, it is consciously avoided by Attenborough. However, Cham (2016: 24) also claims that it is possible that he uses glottalization in less formal registers.

To date, several studies have suggested that t-glottalling is an allophone of /t/ which has lost part of its stigmatization (Fabricius 2002, Shen 2014). It has also been observed that the glottal stop is frequently used in conversational speech not only by working-class speakers, but also by middle-class RP speakers. By contrast, the use of this feature in monitored speech e.g. in the English of the BBC News, although presumably avoided, has not been conclusively assessed yet. Our study aims to shed some light into this issue.

2.6. Research hypotheses

In the next section, we will turn to examine the evolution of t-glottalling use in Received Pronunciation in the last forty years. However, our research hypotheses should be summarized first.

As stated in the Introduction, our main hypothesis is that the use of t-glottalization has increased over the last forty years. To test the hypothesis, a comparison of BBC News over two time periods, the 1970s and the 2015s, will be carried out. The analysed data will also allow us to test the following hypotheses:

(1) As reported in the literature, the use of t-glottalling seems to be more common before a consonant and phrase-finally than intervocalically. To test this hypothesis, we will examine the occurrence of glottal stops in the different phonetic contexts.

(2) The use of glottal stops appears to be associated with word frequency. To test this hypothesis, we will compare the occurrence of glottal stops in function words—with a high frequency of occurrence—and content words.

(3) There is a correlation between the use of glottal stops and the formality of speech. This hypothesis will be tested by comparing the occurrence of glottal stops in the speech of newsreaders, who use scripted speech, as opposed to editors and correspondents, who use a less formal language.

3. Analysis of BBC audio clips and podcasts

The present study aimed, on the one hand, to confirm that t-glottalling was not present in Received Pronunciation forty years ago and, on the other hand, to examine if glottalization is creeping into RP speakers' reading style, reflecting a trend that has been documented in spontaneous or conversational speech.

The data analysed consisted of a set of audio clips and podcasts from the BBC Nine O'clock and Six O'clock News available in the *BBC Archive*, which were broadcast over two different time periods, the 1970s and the 2015s. The study focused, therefore, on a close examination of the evolution of t-glottalization in BBC English over the last forty years. A total of 48 minutes and 05 seconds were examined, from which 8.23 minutes were taken from 1972, 1973 and 1981 episodes and the remaining 39.42 minutes from 2015, 2016 and 2017 podcasts.

The difference in the length of the material analysed was due to the difficulty of finding audio news episodes from the 1970s, since just a small number of clips were available to the public. By contrast, a significantly larger number of podcasts from the 2000s could be accessed. The recordings of the 2015-2017 period were chosen to be of similar topics to the ones in the 1970s recordings so that the nature of the news was comparable in the two time periods. These contained news related to the British embassy in Dublin and Iraq, two different royal weddings, several memorial services, riots in prison and the funeral of IRA members (for further details see Appendix A).

While the lack of t-glottalling in conservative RP as represented in the BBC broadcasts of the 1970s is well-established, the use of t-glottalling in recent years has not been quantitatively assessed. The speech corpora for the 2015-2017 period was gathered from five BBC Radio 4 podcasts which, in total, had a duration of 135 minutes and 16 seconds (2 hours and 15 minutes). Notwithstanding, the study focused on the 39.42 minutes in which BBC representatives —defined as newsreaders, correspondents and political, business and economy editors— were found, since listening to tens of minutes of speakers other than BBC representatives could bias our results (see section 4.1 below).

Although the study focused on finding t-glottalling instances, the 39.42 minutes analysed contained the speech of different BBC representatives, some of whom glottalized while others did not.

The analysis of the data followed a standard procedure. All audio clips and podcasts were listened to and the instances of glottal stops produced by BBC representatives—who predominantly use scripted rather than spontaneous speech and supposedly comply with the BBC pronunciation norms—were identified and transcribed in the context in which they occurred. Following Shen (2014), instances of /t/ were auditorily classified into two categories: [t]—including preglottalized and aspirated /t/ as well as the plain alveolar stop—and [ʔ]. When the occurrence of a glottal stop instead of a [t] was not clear by auditory analysis, another judge listened to the recording and both judges had to agree for a glottalized /t/ to be counted as such. Still, on some occasions this task proved to be challenging. In order to check glottal stops in auditorily disputed words, acoustic analysis using Praat was utilized (see Figures 2 and 3).

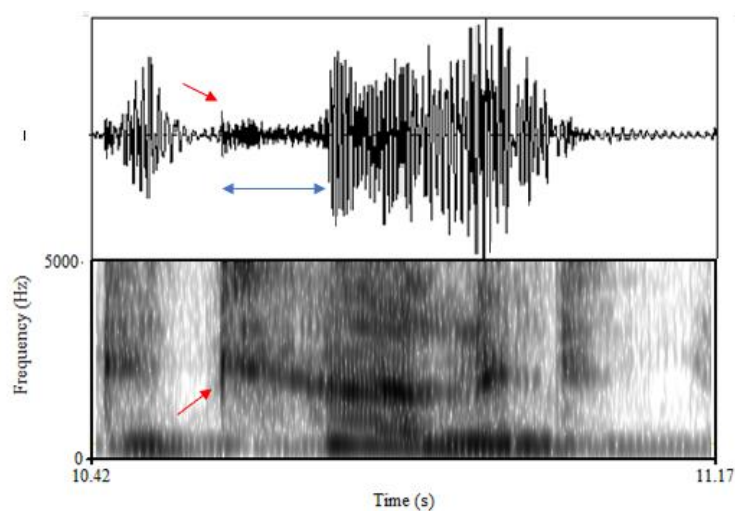


Figure 2. Waveform and spectrogram of the token *determined* produced by an editor showing an aspirated alveolar stop.

Figure 2 shows the waveform and spectrogram for the token *determined* /dɪ'ts:mɪnd/, where /t/ is articulated as an aspirated alveolar oral stop [t^h]. The cues for the stop release and subsequent aspiration are clear. The release transient is clearly identifiable both in the spectrogram and in the waveform (indicated by a red arrow in the figure) and the high frequency energy following it in the spectrogram marks aspiration (see the blue arrow in the waveform). The falling F2 transition visible in the spectrogram right after the release is characteristic of alveolar closures. As for the stop closure phase, it immediately precedes the release transient. The end of the vowel, and thus the onset of the stop closure, is identified at the end of the formants in the preceding vowel.

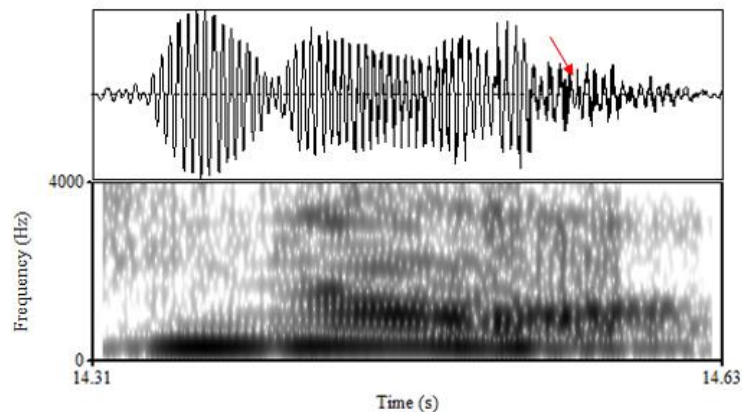


Figure 3. Waveform and spectrogram of the token *not* produced by an editor showing a glottalized stop.

Figure 3 shows the waveform and spectrogram for the token *not* [nɒʔ], where /t/ is articulated as a glottal stop [ʔ]. As shown in the figure—and as has been observed in most languages—the glottal stop does not have a complete closure (Ladefoged and Maddieson 1996: 75). Instead of a complete closure, creaky voice is superimposed on the vowel. This can be seen in the waveform, which shows a significant drop in the amplitude of the signal at the end of the vowel [ɒ] as well as irregular vibrations characteristic of creak (indicated by the arrow). The spectrogram also shows this drop in

the amplitude of the signal, which is reflected in the reduced intensity of the shading throughout the glottal stop articulation. Moreover, the vertical striations are more spread out during the glottal stop than in other portions of the spectrogram, reflecting again laryngealisation or creaky voice. Because glottal stops are produced by obstructing the airflow at the glottis, the position or the movement of the articulators is not affected. Therefore, there is no particular formant transition associated with these consonantal sounds.

Following the identification of t-glottalling, its occurrence was calculated in seven phonetic environments. That is, in 1) phrase-final, preconsonantal —preceding a 2) stop, 3) fricative, 4) nasal, 5) lateral or 6) glide— and 7) intervocalic across word-boundary positions (see Table 1).

4. Results

In this section, we will analyse the results of the examination of the audio clips and podcasts mentioned. First, we will present the occurrences of t-glottalling in the two time periods analysed. Second, we will turn to examine t-glottalling in terms of phonetic contexts to test the hypothesis that t-glottalization is more common in pre-consonantal and phrase-final environments than intervocalically. Third, an analysis of t-glottalling in function and content words will be carried out to test if the glottal stop is more likely to occur in frequently used words. Finally, we will examine interspeaker variation in BBC representatives to test if there is a correlation between the use of glottal stops and the formality of speech.

4.1. T-glottalling in Received Pronunciation

The result of the count of occurrences of t-glottalization by context in the two time periods analysed is shown in Table 1. Overall, the data seems to suggest that the use of t-glottalling increased in the last forty years, as its occurrence rose from a total of 3 in the 1970s to 57 in the 2015s. However, the difference in the length of the clips and podcasts analysed is an aspect that should be carefully examined before making any generalisations about t-glottalling in RP. As already mentioned, the clips from the 1970s only accounted for 8.23 minutes of the 48.05 minutes analysed. Therefore, it could be claimed that if the duration of the material had been the same for both time periods, the figures for t-glottalling in the 1970s could have increased to match those for the 2015s.

Time period	Total	_##	_stop	_fricative	_nasal	_lateral	_glide	_#V	V_V
1970s	3	0	1	0	0	0	2	0	0
2015s	57	3	21	13	5	5	6	2	2

Table 1. Number of cases of t-glottalling in the 1970s and 2015s by context.

The impossibility to listen to a larger number of clips from the first time period prevented us from comparing the same amount of time in the two periods. Nevertheless, not wanting to base the study on results that were not comparable, the percentage of t-glottalling produced in both time periods was calculated to normalize differences in absolute values (see Table 2). In order to do this, the five clips from the 1970s were transcribed and potential sites of t-glottalling were identified (108 sites). This analysis is presented in Appendix B.

The identification of the potential sites of t-glottalling allowed us to calculate the percentage of t-glottalling actually encountered in our 1970s data, which finally stood at 2.8% (3 occurrences/108 potential sites = 2.8%). Then, these results allowed us to extrapolate the figures for potential t-glottalling sites in the 2015s recordings, and subsequently, to calculate the percentage of t-glottalling found in the second time period (see Table 2). Only potential glottal stops in the three phonetic environments included in our hypothesis ($_##$, $_C$, $V_#V$) were considered in this second part of the analysis. Hence, although 57 instances of t-glottalling were found in the 2015s recordings, the two instances that occurred in intervocalic word-medial position were left out when calculating the percentages.

	1970s	Percentage (%)	2015s	Percentage (%)
Potential t-glottalling	108	100	527	100
Glottal stops	3	2.8	55	10.4

Table 2. Percentage of t-glottalling production in relation to all potential sites in the 1970s and the 2015s.

Table 2 shows the percentage of t-glottalling produced in relation to the total of potential sites in both time periods. If 108 potential sites were found in 8 minutes, it was extrapolated that in 39 minutes, 527 potential glottal stops could be found. The total of 3 glottal stops found in the 1970s recordings accounted for 2.8% of all potential sites, while the 55 instances found in the 2015s recordings accounted for 10.4% of all potential sites. The proportion of t-glottalling in the two time periods is shown in Figure 4.

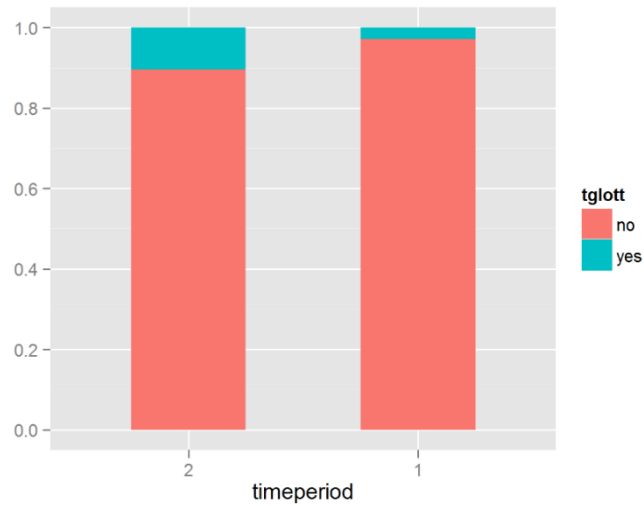


Figure 4. Proportion of t-glottalling by time period (1= 1970s, 2= 2015s).

In order to examine whether the rate of t-glottalling differed statistically across the two time periods, a chi-squared test of homogeneity was performed on the data shown in the contingency table (Table 3). Since the contingency table is 2x2 (two rows, two columns), the degrees of freedom of the chi-squared distribution is 1.

	1970s	2015s
Yes	3	55
No	105	472

Table 3. Contingency table displaying the occurrences of t-glottalling (yes vs. no) in two time periods (1970s and 2015s).

The value of the test statistic of the contingency table is [$\chi^2(1) = 6.33$], which has a p-value of 0.011871, lower than the significance level, which typically stands at 5% ($p < 0.05$). This result allows us to reject the null hypothesis and, therefore, shows that t-glottalling is significantly associated to time period. Specifically, the recordings of the

2015s show more cases of t-glottalling than those of the 1970s (10.4% vs 2.8%). All the details about the chi-squared test are presented in Appendix C.

The findings of the study indicate that the use of t-glottalling in Received Pronunciation has actually increased in the last forty years. At this point, a generalisation could be made. Some decades ago, the use of the glottal stop in formal registers was consciously avoided, since it was associated with Cockney, the speech of working-class Londoners and, therefore, highly stigmatized. The significant increase of t-glottalling in the second time period allows us to suggest that glottalization is creeping into RP, although it may take a few decades before it is systematically used in the most formal registers.

4.2. T-glottalling in different phonetic environments

In terms of phonetic environments, the data in Table 1 suggests that the most favourable environment for t-glottalization to occur is pre-consonantly ($_ \# C$), especially before a stop or a fricative, as 21 (37 %) and 13 (23%) glottal stops respectively were found in these positions for the 2015s recordings. Similarly, the small number of glottal stops produced in the 1970s occurred word-finally before a consonant (a stop or glide, 1 (33%) and 2 (67%), respectively).

In addition, t-glottalling was also found to occur in phrase-final ($_ \#\#$) and intervocalic word-boundary ($V _ \# V$) contexts in the 2015s. However, the figures in these positions were much lower and accounted for just 3 (5%) and 2 (3.5%) of all glottal stops in the 2015s, compared to none in the 1970s. Finally, two instances (3.5%) of t-glottalling were found in intervocalic word-medial position ($V _ V$) in the 2015s podcasts.

The instances of t-glottalization in intervocalic position found in the present study—both word-internally and at word-boundary—were uttered by an Australian correspondent and a Scottish editor. Thus, the presence of t-glottalling in this phonetic environment, which is unusual in RP speakers’ monitored speech, could be explained by the fact that these speakers, although being BBC representatives, show features which reflect their regional dialect.

On the basis of these results, it is possible to conclude that t-glottalling is mostly found pre-consonantly, especially before a stop, a fricative or a glide. Additionally, t-glottalization can also occur in phrase-final and intervocalic word-boundary contexts, although speakers of the most formal registers are less likely to utter glottal stops in these phonetic environments.

4.3. T-glottalling in content and function words

As mentioned in the previous section, t-glottalling was found to appear in different phonetic environments. In addition, the present data allows us to observe a differential use of t-glottalization in function and content words. The results in Table 4 show that the glottal stop is a variant of /t/ found in function and content words, but the vast majority of instances were uttered in function words (for the full inventory see Appendix A).

Period	Function words	Percentage (%)	Content words	Percentage (%)
1970s	3	100	0	0
2015s	38	67	19	33

Table 4. Distribution of glottal stops by function and content words in the 1970s and 2015s.

The majority of glottal stops were found in the negative particle *not* (N= 11), while the demonstrative pronoun *that* and the pronoun *it* ranked second (N=9). In terms of content words, the verbs *get* (N=4) and *put* (N=3) were the most frequently glottalized words in our data. The finding that t-glottalization occurs more often in function words, with a high frequency of occurrence, than in content words, with a lower text frequency (and differences within content words related to frequency are also found) provides support for the hypothesis that frequently used words are more likely to show t-glottalization.

4.4. Interspeaker variation in t-glottalling in BBC representatives

Once confirmed that t-glottalling is actually creeping into RP, the distribution of t-glottalization for different BBC representatives was examined. It was mentioned above that regional dialects may be at the basis of differences in the use of t-glottalization (cf. Australian, Scottish speakers), and it was also observed in the Introduction that there is a correlation between the use of glottal stops and the formality of speech — i.e. the degree of monitoring and scripted vs unscripted speech. By dividing the speakers into three categories —newsreaders, editors and correspondents— rates of t-glottalling could be related to the degree of formality of their speech in Received Pronunciation. The results of the analysis are presented in Table 5.

Speaker	t-glottalling 1970s	t-glottalling 2015s
Newsreaders	2	3
Editors	0	18
Correspondents	1	36
Total	3	57

Table 5. Number of glottal stops produced by newsreaders, editors and correspondents in the 1970s and 2015s.

Newsreaders are known to be representatives of the so-called *Mainstream RP* (Wells, 1982), *Standard Southern British* (Deterding, 1997) or even *BBC English* (in late editions of Daniel Jones' *English Pronouncing Dictionary* (1924)). This accent is typically associated with middle-class professionals and, therefore, taken as a model of what standard British English should sound like. In addition, newsreaders read scripted speech and have a high degree of self-monitoring. Taking this into account, the low figures for news presenters' t-glottalling in both time periods shown in Table 5 could be explained by arguing that these professionals must avoid showing regional features in their reading style speech, as they are representatives of the most formal speaking registers.

Editors are senior reporters who cover the most important news related to a region or a section, such as politics, economy or business. Hence, they usually have a large team of correspondents working under them. Due to the importance of their role in broadcasting, editors' speech must also be formal, but the control for regional features in their pronunciation appears to be more permissive, since they typically work on the field (e.g. carrying out major interviews or covering important events, such as conferences). Their speech is not, therefore, as monitored as that of newsreaders. The data collected in

Table 5 seems to support this idea, as 18 out of the total 57 glottal stops produced in the 2015s were uttered by editors.

Glottal stops were most frequently found in the speech of correspondents in the 2015s (N= 36). These journalists also work on the field and provide on-site reports, which commonly involve rather unscripted speech. Their speech appears to be the less monitored one of the three mentioned. Hence, it is in their pronunciation where the increasing use of t-glottalling in RP can be more clearly seen. In fact, the results of the analysis suggest that, while forty years ago they carefully avoided showing regional features in their speech—just one glottal stop was found in the 1970s data—they are no longer as constrained to avoid the use of such a feature. Thus, the findings of the study indicate that t-glottalling could be starting to be considered an acceptable variant to be used in certain formal registers, matching Fabricius' (2002) observations on the fading stigma of t-glottalization.

5. Discussion of the findings

The results reported in the previous section indicate a heightened use of t-glottalling in BBC English in the last few decades, rising from 2.8% in the 1970s to 10.4% in the 2015s. These results are in accordance with the trend reported in the reviewed literature stating that there is an increasing use of t-glottalling in Received Pronunciation, as predicted by our main hypothesis.

The data in Table 1 offers support for the second hypothesis, that the occurrence of glottal stops varies depending on the context. Thus, the use of t-glottalling seems to be more common before a consonant than phrase finally or intervocalically. The third

hypothesis, that the use of glottal stops seems to be associated with word frequency, is also confirmed. The results in Table 4 show that function words, which have a higher text frequency than content words, show more cases of t-glottalization (this is also the case for highly frequent content words, e.g., *get* and *put* vs less frequent words). The results in Table 5 provide support for our fourth hypothesis, that the use of glottal stops is related to the formality of speech. Thus, newsreaders, who use scripted speech, show a lower use of t-glottalling than editors and correspondents. We will now turn to the interpretation of our findings in terms of current views.

The distinction between *Construct-RP* (c-RP) and *Native-RP* (n-RP) introduced by Fabricius (2002) and reviewed in the Introduction may help us account for the observed data. Recall that c-RP is referred to as the accent used in contexts that require a standard and fixed pronunciation, such as broadcasting, while n-RP is the accent used by those who acquire it as native speakers and, as any other accent, is subject to variation. Thus, even if both c-RP and n-RP can change over time, a change in c-RP involves an alteration in the evaluation of one or several features of the language, whereas a change in n-RP is the result of a modification of language over time. That is, c-RP is consciously modified by a community of speakers whose attitude towards a specific characteristic of standard British English changes (e.g. a regional feature changes its status and enters the most formal speaking registers). By contrast, modifications in n-RP are unconsciously generated and usually involve the spreading upwards of a feature from an accent having a lower status (e.g. the use of intrusive /r/, now widespread in RP, such as in *Victoria-r-and Albert Museum* (Trudgill, 2001)). Furthermore, Fabricius (2002: 119) also points out that the changes in n-RP usually precede and determine the ones in c-RP.

As mentioned in the literature review, many reports have provided evidence for the influence of speaking styles on speech. Previous studies evaluating glottalization in RP have noted its increasing use in interview style (n-RP), while it is present in reading style (c-RP) just marginally. An illustration of this is Shen's (2014) study, which pointed out that young Cambridge RP speakers use intervocalic t-glottalling —both word-internally and at word-boundary— in both speaking styles, even if a significantly larger proportion of the tokens was found in casual speech than in formal speech (119 and 18 respectively out of 519 tokens of variants of /t/).

Similarly, the research carried out by Fabricius (2002) —which focused on more than one phonetic environment i.e. phrase-final, intervocalic at word-boundary and preconsonantal— found higher rates of t-glottalling in conversational speech than in formal speech for all contexts, especially in phrase-final and intervocalic environments (36 and 40 glottal stops in casual speech compared to 1 and 2 in read speech). Hence, as Shen (2014: 3) puts it, “speaking style [appears] as a sociolinguistic parameter to explore its correlation with the speakers’ phonological variation in one linguistic variety.”

In this light, it seems plausible to assess the increasing use of t-glottalling in Received Pronunciation in terms of c-RP and n-RP. The results in Table 5 suggest that, while editors and correspondents seem to be gradually incorporating the glottal stop to their standard speech, this feature has not crept into newsreaders’ monitored speech just yet. Therefore, it could conceivably be hypothesised that editors and correspondents —who work on the field and do not have to stick to scripted speech as newsreaders do— display features present in their n-RP, among which we find t-glottalling. By contrast, the role of news presenters as exponents of the standard accent of English forces them to

consciously adapt their pronunciation to the norms of c-RP, which do not contemplate the use of regional features.

As mentioned in the Introduction, this sociophonetic variation has been an object of research in sociolinguistics. Foulkes and Docherty (2006) refer to the exemplar-based model of representation of phonological knowledge to explain why speakers having both [t] and [ʔ] as variants of /t/ can switch between both allophones depending on the speaking register they use. This model assumes that “knowledge of linguistic structure is built up by representing in memory the totality of linguistic experiences that an individual has” (Foulkes and Docherty: 426). That is to say, individuals keep a detailed record in their memory of all the exemplars of a word they have listened to and uttered. In addition, the model states that speakers-listeners can access the indexical information conveyed by different phonological forms (e.g. speaking style) and that adults are aware of the associations in memory between linguistic and indexical information. Thus, RP speakers would consider [t] an allophone to be used in the most formal speaking styles, while [ʔ] would be associated with less formal speech.

The results of our study suggest that RP speakers seem to have started to change their perception of the glottal stop as being a regional feature to be only used in informal speaking styles, as suggested by the fact that it is used by BBC editors and correspondents. In the Introduction it was observed that it is possible for a regional feature to evolve into a non-regional one (Trudgill, 2001), even if this transition usually takes decades to be completed. In light of these considerations, it could be claimed that t-glottalling may currently have an indeterminate status. Even though the use of this feature in certain phonetic environments has lost some of its stigmatization, it has not completed its

transition from a regional to non-regional feature just yet, for it is not systematically used by c-RP speakers (newsreaders). Its status lies, therefore, somewhere between a regional and a non-regional feature, even if it could be argued that in some decades it will be fully accepted by the normative pronunciation.

In Foulkes and Docherty's terms, it could be claimed that the social-indexical value of a linguistic form can evolve through time. According to these authors (2006: 432) "the same phonetic properties can be redeployed in the same environment with different indexical consequences." Hence, the spread of sound change—in this case, of the glottal stop— may take different paths. If the use of t-glottalling becomes widespread in n-RP, it may end up being associated to prestige speakers and then, definitively creep into c-RP. In another possible scenario, if the number of speakers using t-glottalling as a variant in c-RP was to increase dramatically, it is very likely that, for the subsequent generations, this phonological feature would have changed its indexical value and it would no longer be an indicator of regional speech, but instead denote the individuals who used it as speakers of the standard English pronunciation. This is certainly an interesting aspect to be studied in future studies on the topic.

6. Conclusions

The aim of the present research was to examine the use of t-glottalling in RP over more than forty years (1970s-2015s), paying special attention to the presence or absence of this feature in the scripted speech used in the BBC. The study also investigated the occurrence of t-glottalling in seven different phonetic contexts, in content and function

words and interspeaker variation associated to formality in the use of this feature by BBC representatives.

One of the more significant findings to emerge from this study is that the glottal stop is becoming a feature increasingly used in certain contexts in RP, as proposed in our initial hypothesis. As a matter of fact, the research found that there has been a significant growth in the overall use of this feature from the 1970s to the 2015s. The results of the study have also shown that t-glottalling is mostly used in conversational speech or Native RP (n-RP), which is present in BBC English through editors and correspondents' speech. By contrast, the use of the glottal stop in scripted speech or Construct RP (c-RP) still appears to be marginal.

Additionally, the close analysis of the audio clips and podcasts revealed that the most common environment for t-glottalling to occur is pre-consonantly (e.g. *that could mean* ['ðæ? 'kʊd 'mi:n]), while phrase-finally (e.g. *he came out to bat* [bæ?]) ranks second and intervocalically at word-boundary (e.g. *put into* ['pʊ? ɪntu]) comes third. Finally, it was also found that the glottal stop is more likely to occur in function than in content words, suggesting that frequently used items are more likely to show features of conversational speech.

Overall, this study strengthens the idea that RP, as any accent of English, is subject to variation and evolves through time. In fact, the findings of this investigation complement those of earlier studies (see Fabricius 2002, Shen, 2014) suggesting that the glottal stop is losing part of its stigmatization and is gradually changing its status from a regional to a non-regional feature.

The major limitation of this study was the difficulty of finding audio clips and podcasts from the 1970s, which made the difference in the minutes of speech analysed in the two time periods a considerable one. However, despite the relatively limited sample of the speech corpora for the first time period, this study offers valuable insights into the increase of t-glottalling over the years and suggests that in a few decades the presence of this feature in scripted speech could be much larger. The issue of t-glottalling creeping into c-RP is, hence, an intriguing one which could be usefully explored in further research.

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Appendix A: Clips and podcasts analysed

1. Title of the recording: British Embassy burns down in Dublin

Date: 02/02/1972

Duration: 1:45

Speaker	Glottal stop	Minute	Context
Newsreader	But [ɪʔ] was clear that the government was not leading but reflecting public opinion	1:37	/t/ → [ʔ]/_#C _[glide]

2. Title of the recording: London prepares for Princess Anne's wedding

Date: 13/11/1973

Duration: 02:03

Speaker	Glottal stop	Minute	Context
Correspondent	Is [ɪʔ] worth it?	1:57	/t/ → [ʔ]/_#C _[glide]

3. Title of the recording: Memorial Service for victims of IRA terrorism

Date: 07/05/1981

Duration: 01:18

Speaker	Glottal stop	Minute	Context
Newsreader	(..) to express some of [ðæʔ] bitterness	0:23	/t/ → [ʔ]/_#C _[stop]

4. Title of the recording: Second republican hunger strike in the Maze begins

Date: 02/03/1981

Duration: 01:35

5. Title of the recording: The funeral of Bobby Sands

Date: 07/05/1981

Duration: 02:22

No glottal stops were found in recordings 4 and 5.

6. Title of the recording: The London bombings remembered, a decade on

Date: 07/07/2015

Duration: 30:14

Speaker	Glottal stop	Minute	Context
Newsreader	But Downing Street said David Cameron did [nɒʔ] support (...)	13:31	/t/ → [ʔ]/_#C _[fricative]
Correspondent	(...) it ['kæmʔ] be a bad deal and there shouldn't be any more postponements.	20:05-20:27	/t/ → [ʔ]/_#C _[stop]
	[They] will [geʔ] twice as long to try to pick a deal apart if it isn't done by Thursday at the latest		/t/ → [ʔ]/_#C _[stop]
	(...) customers in the west, including [brɪʔŋ]	29:10-29:23	/t/ → [ʔ]/_C _[syllabic nasal]
	[ðæʔ] let the surveillance arrayed.		/t/ → [ʔ]/_#C _[lateral]

7. Title of the recording: British Embassy in Iran reopening

Date: 20/08/2015

Duration: 30:26

Speaker	Glottal stop	Minute	Context
Correspondent	It's taken almost four years to [geʔ] the British embassy in Teheran to open again.	01:35	/t/→ [ʔ]/_#C _[fricative]
	The embassy will be reopened and relations [pʊʔ] back on a near normal footing.	02:35	/t/→ [ʔ]/_#C _[stop]
	Negotiations between London and Teheran to [geʔ] to the reopening of the embassy have been far from smooth.	03:13	/t/→ [ʔ]/_#C _[stop]

Speaker	Glottal stop	Minute	Context
Correspondent	For three hours he went through long spells of saying “I don’t want to answer [ðæʔ] question”.	04:34	/t/ → [ʔ]/_#C _[stop]
	And the next minute, [ɪʔ] was like a [larʔ] switch.	04:55	/t/ → [ʔ]/_#C _[glide] /t/ → [ʔ]/_#C _[fricative]
	[ɪʔ] felt like a mile away.	05:04	/t/ → [ʔ]/_#C _[fricative]
	A young graduate from Damasco who’s trying to [geʔ] to Britain.	07:00	/t/ → [ʔ]/_#C _[stop]

Speaker	Glottal stop	Minute	Context
Correspondent	[ɪʔ] can pull its vast resources for the common good.	10:01	/t/ → [ʔ]/_#C _[stop]
	[He] appeared to point a finger [əʔ] both the dissident republic and criminal gang as well as members of the IRA.	13:43	/t/ → [ʔ]/_#C _[stop]
	And [ðæʔ] means spending cuts, tax rises (...)	16:53	/t/ → [ʔ]/_#C _[nasal]
	And he will argue this election is [ə'baʊʔ] bringing certainty to Greece's future.	17:20	/t/ → [ʔ]/_#C _[stop]

Speaker	Glottal stop	Minute	Context
Correspondent	Jeremy Corbyn has made [ɾ] clear he would expect Labour and Peace to support his plans if he wins.	18:43	/t/ → [ɾ]/_#C _[stop]
	(...) in [wæɾ] was seen as a reprisal attack.	21:34	/t/ → [ɾ]/_#C _[glide]
	(...) having been [pɒɾ] into [bæɾ]	26:50-27:36	/t/ → [ɾ]/_#V /t/ → [ɾ]/_##
	The [ˈbæɾəz] did apply themselves.		/t/ → [ɾ]/V_V

Speaker	Glottal stop	Minute	Context
Correspondent	He came out to [bæʔ]	26:50-27:36	/t/ → [ʔ]/_##
	[ðæʔ] should help them.		/t/ → [ʔ]/_#C _[fricative]
Newsreader	[əʔ] least three thousand migrants (...)	05:40	/t/ → [ʔ]/_#C _[lateral]
Political correspondent	And she could [nɒʔ] see him wanting to serve in her team if she wins.	18:02	/t/ → [ʔ]/_#C _[fricative]
Economy editor	[ə'pɑ:ʔ] from anything else (...)	25:07	/t/ → [ʔ]/_#C _[fricative]

8. Title of the recording: Hundreds of prisoners moved after riot

Date: 17/12/2016

Duration: 15:10

Speaker	Glottal stop	Minute	Context
Correspondent	[bʌʔ] [nɒʔ] before two were substantially damaged.	02:13	/t/→ [ʔ]/_#C _[nasal] /t/→ [ʔ]/_#C _[stop]
	[ɪʔ] means prisoners spend fewer hours doing work, training or exercise.	03:06	/t/→ [ʔ]/_#C _[nasal]
Newsreader	(...) and talked of [wæʔ] she called its aggressive actions.	07:28	/t/→ [ʔ]/_#C _[fricative]

9. Title of the recording: Meghan couldn't wait to say 'yes' after Harry proposed

Date: 27/11/2017

Duration: 29:59

Speaker	Glottal stop	Minute	Context
Correspondent	It's believed he's in hospital in a serious [bʌʔ] [nʊʔ] life-threatening condition.	17:57	/t/ → [ʔ]/_#C _[nasal] /t/ → [ʔ]/_#C _[lateral]
	People have been leaving flowers and messages for them [əʔ] the crash scene.	18:31	/t/ → [ʔ]/_#C _[fricative]
	[ðæʔ] would allow investors to bet against the currency and [ðæʔ] could mean its value would plummet as quickly as it has soared.	28:36	/t/ → [ʔ]/_#C _[glide] /t/ → [ʔ]/_#C _[stop]

Speaker	Glottal stop	Minute	Context
Business editor	They hadn't [jeʔ] determined the size of their investment.	19:54-20:08	/t/ → [ʔ]/_#C _[stop]
	Most of the economy is [nɒʔ] like that.		/t/ → [ʔ]/_#C _[lateral]
Political editor	[They] say [ðæʔ] was always the case.	21:40-21:56	/t/ → [ʔ]/_#C _[glide]
	By [nɒʔ] passing on the full document ministers could be in contempt of Parliament.		/t/ → [ʔ]/_#C _[stop]
	It's [nɒʔ] at an end.		/t/ → [ʔ]/_## ¹

¹ The editor paused between the glottal stop and the following word when pronouncing the sentence. For this reason, this particular case has been analysed as if occurring in phrase-final position.

10. Title of the recording: Political leaders and relatives of victims of the IRA remember Martin McGuinness, who has died at the age of 66

Date: 21/03/2017

Duration: 30:07

Speaker	Glottal stop	Minute	Context
Political editor	[bʌʔ] the former unionist (...)	09:15	/t/ → [ʔ]/_#C _[fricative]
	As the politicians at Stormont attempt to [pʊʔ] their collabs to power sharing coalition together again		
Scotland editor	(...) seeking the backing of the Scottish Parliament for another [vəʊʔ] on independence.	11:57	/t/ → [ʔ]/_#V

Speaker	Glottal stop	Minute	Context
Scotland editor	She says it should [nɒʔ] be for her to decide the future direction of Scotland, nor should [ɪʔ] be up to the Prime Minister.	12:08	/t/ → [ʔ]/_#C _[stop]
	Now it's [nɒʔ] the time.	12:43	/t/ → [ʔ]/_#C _[fricative]
	[ɪʔ] will almost ['sɛ:ʔənli] win this [vəʊʔ] when the [dɪ'beɪʔ] continues tomorrow. They think [ðæʔ] gave them the moral authority to demand another referendum.	13:10	/t/ → [ʔ]/V_V /t/ → [ʔ]/_#C _[glide] /t/ → [ʔ]/_#C _[stop]

Speaker	Glottal stop	Minute	Context
Scotland editor	She will [nʊʔ] discuss the timing of another vote until after the UK has left the EU.	13:23	/t/ → [ʔ]/_#C _[stop]
Correspondent	(...) but in the ['bʌdʒɪʔ] last week	17:57	t/ → [ʔ]/_#C _[nasal]
	(...) because of concerns [ə'baʊʔ] poor services.	21:17	/t/ → [ʔ]/_#C _[stop]
	It was there in a [weʔ] summer holiday in the 1970s	26:49	/t/ → [ʔ]/_#C _[fricative]
	(...) being [fʊʔ] by the provisional IRA as a spy.	29:11	/t/ → [ʔ]/_#C _[stop]

Appendix B

Potential t-glottalling in the 1970s clips including the contexts 1-7 in Table 1 (Orthographic transcription by the author)

1. British Embassy burns down in Dublin- 02/02/1972

Crowds estimated **at** some six thousand assembled **outside** the British embassy for the second **night** running. **At** first, **it** was a peaceful gathering. Then, petrol bombs were hurled **at** the building. There were warning shouts **that** someone was throwing a **gelignite** bomb. Two policemen were **slightly hurt** in the explosion, **but** amazingly, there were no other injuries.

Later today, workmen were repairing the doorway. The embassy's steel reinforced front door had been torn from its hinges in the explosion. Thomas Cook's travel agency was one of several British-owned shop premises to have windows smashed during the **night**. BEA, whose planes have been refused tunnelling facilities **at** Dublin **airport** had boards up **at** their city offices after windows were smashed. Processions of workers marched through Dublin's **streets** to mass in memory of those who died in Londonderry. Nearly all businesses and services ceased to function during this officially declared National day of mourning **throughout** the Irish republic. The president, Mr. de Valera, was among those who attended mass **at** Dublin's pro-Cathedral. The Prime Minister, Mr. Jack Lynch, went to the same service. But **[r?]** was clear **that** the government was **not** leading **but** reflecting public opinion in the republic following the events in Londonderry.

2. London prepares for Princess Anne's wedding- 13/11/1973

In the Mall and outside the palace the white wedding flags have been going up with their entwined blue initials, A and M. Outside the railings there's been a constant crowd hoping to catch a glimpse of either of the couple or members of the four foreign royal families who are staying at the palace. Some of the tourists have come to Britain specially to see the royal wedding.

Correspondent: May I ask you where you come from?

Woman: Toronto, Canada.

Correspondent: Specially for the wedding?

Woman: Specially for the wedding.

Correspondent: And from now until the great moment, are you gonna stay here outside Buckingham Palace?

Woman: Well, we may have to move around a little bit.

Correspondent: But you're gonna be here?

Woman: If we can.

At the palace and at the abbey, there's been a general tidying up in preparation for tomorrow. After their private rehearsal with the dean of Westminster here at the abbey, the bride and groom will spend a quiet evening relaxing with their friends and family before parting in company to meet here again, at eleven thirty in the morning.

Already one man has reserved his seat for the great event.

Correspondent: Can I take **it that** you've already taken up your position for the wedding?

Man: Yes, I've been here since six o'clock this morning.

Correspondent: And you're gonna stay here until the **great** moment?

Man: Until everything's cleared up and said **that**'s another royal wedding.

Correspondent: How many, in fact, have you **witnessed**?

Man: This will be number ten.

Correspondent: Dating back to?

Man: 1922.

Correspondent: So, you're here with your **blanket** around your knees. How will you be spending the **night**?

Man: Well, my daughter will be with me, my young daughter, she's nine, and my sister from America with her husband, so **that**'ll be four of us here all **night**.

Correspondent: Is **[1?]** worth **it**?

Man: You come along and ask me **that** tomorrow afternoon at half past two.

3. Memorial Service for victims of IRA terrorism- 07/05/1981

At exactly the same time as the Sands' funeral was getting on the way, more than two thousand Ulster loyalists were gathering in Belfast city centre to remember the hundreds of victims of the IRA. Resentment **at what** they see as the glorification of a

terrorist has been building up in recent days. The special service had been called by the reverend Ian Paisley to express some of [ðæ?] bitterness.

Ian Paisley: The world unjustly focused its- its attention upon the burial of an IRA convicted terrorist who took his own life in the Maze prison and committed suicide. By a deliberate choice, he chose to die, but those that we remember today had no choice.

But the emphasis was religious, and the relatives of those killed by IRA bombings and shootings preceded Mr Paisley and laid wreaths at the cenotaph before dispersing quietly, their point made.

4. Second republican hunger strike in the Maze begins 02/03/1981

For the past three years, the so-called 'dirty protest' has been the central feature of the republican prisoners' campaign for political status. It went on even after the last hunger strike ended in December. At one time more than five hundred men in the H-blocks were refusing to wash and were fouling themselves. They also refused to wear prison uniform, remaining instead on the blanket. That protest will continue, but today, quite unexpectedly, the prisoners announced that the dirty protest is over. It's a move which they calculate will profit the new hunger strike which began in the prison yesterday.

Correspondent: Both the prisoners and the government know very clearly that the dispute here at the Maze is a massive test of tactics. During the hunger strike last autumn, more prisoners actually joined the dirty protest. That didn't work. This time, they've all suddenly come off it. By so doing, they hope to put more pressure on the government to offer some gesture in return towards their demand for political status.

-**What** is the thinking behind this move to come off the no-wash protest?

Man: Well, it's to show **that** it's **not** a protest **about** prison furniture or **about** access to the toilets, **but that it** is a protest for a political status and **quite** clearly **it** now throws the honours onto the present administration.

The second hunger strike appears to have been much more carefully **thought out** by the prisoners. Today's development is one which they hope will win them some **outside support**. The Northern Ireland office said they welcomed the ending of the dirty protest and expressed the hope **that** other forms of protest in the prison **might** also soon be ended.

5. The funeral of Bobby Sands 07/05/1981

To the tens of thousands who watched his coffin to the grave, this was the burial of Bobby Sands, martyr. The full paraphernalia of an IRA military funeral. The Irish tricolour wrapped over the coffin after a funeral mass in Saint Luke's church where the priest asked the congregation to pray **not** only for Bobby Sands **but** for the two other men who died last **night**, a policeman and a terrorist bomber.

The masked **escort** in **combat** uniforms prepared to march the four miles to **Milton** cemetery. An army helicopter grinding relentlessly overhead all **but** drown the tones of the Irish pipes. And there were **shouts** from the stewards as they tried to supervise the coverage by the world's press. For this, was both funeral cortege and demonstration. Tens of thousands of people from all over Northern Ireland and from the south. A grim face demonstration of **support** for the political aims of the hunger strikers overtaking the

private grief of the Sands family. Such a procession had to be prevented from having any contact with a protestant area. And huge screams had been erected to avoid even the **sight** of the cortege provoking trouble. The security forces kept their distance as the procession passed the protestant Suffolk district.

Outside a shopping centre in Andersonstown, came the symbolic moment for the republicans. Three masked men stepped forward and obeyed orders in Irish to fire a three-volley **salute**. Illegal uniforms, illegal shooting. All grist to the mill for the convictions of republican and loyalist. Among the mourners, the vice presidents of provisional Sinn Féin, Gerry Adams and David O'Connell. There was a huge crowd **at** the entrance to the cemetery perched on crosses and headstones.

At the grave side, in the pouring rain, Sands' mother, father, sister and his **eight**-year-old son. Sands, the elected MP for Fermanagh and South Tyrone, serving fourteen years for the possession of firearms, starved himself to death and into a place in republican history.

Appendix C

The chi-squared test of homogeneity

The chi-squared test of homogeneity is a type of statistical hypothesis test. A hypothesis test is a method used to statistically decide whether to reject or not a given hypothesis. In particular, a chi-squared test of homogeneity is applied to a single categorical variable (in our study, t-glottalling occurrence (yes vs. no)) from two or more different populations (in our study, two time periods, the 1970s and the 2015s). The test is used to determine whether the frequency counts (in this case, of t-glottalling occurrence) are distributed similarly across different populations (i.e. if they are homogenous).

The test has five basic components: 1) the null hypothesis, 2) the alternative hypothesis, 3) the statistic, 4) the p value and 5) the significance level. The null hypothesis is a statement. The opposite statement is referred to as the alternative hypothesis. A statistical hypothesis test usually seeks to reject the null hypothesis, so as to validate the alternative hypothesis. The null hypothesis of our particular chi-squared test of homogeneity states that the frequency of t-glottalling in the 1970s and the 2015s is homogeneous. That is to say, the frequencies for both time periods are quite similar, there is not a large difference between them. By contrast, the alternative hypothesis states that the frequencies of t-glottalling for both time periods are very different. The chi-squared test of homogeneity allows us to find out whether this difference is statistically significant.

The third component of the test is the statistic. The statistic is a calculation to be applied to our data. In the case of a chi-squared test of homogeneity this equation is the following:

$$X^2 = \sum [(O_{r,c} - E_{r,c})^2 / E_{r,c}]$$

$O_{r,c}$ is the observed frequency count in population r (row) for level c (column) of the categorical variable, and $E_{r,c}$ is the expected frequency count under the null hypothesis in population r for level c of the categorical variable. While the observed frequency counts are displayed in the contingency table (see Table 3), the expected frequency counts have to be calculated with the following equation: $E_{r,c} = (n_r * n_c) / n$

n_r is the total number of observations in a row, n_c is the total number of observations in a column and n is the total sample size. The statistic in our study is 6.33:

$$\frac{(3 - 9.865)^2}{9.865} + \frac{(55 - 48.135)^2}{48.135} + \frac{(105 - 98.135)^2}{98.135} + \frac{(472 - 478.865)^2}{478.865} = 6.33$$

The probability density of the statistic (the likelihood that the number resulting from the statistic formula is this value) is given by a chi-squared distribution with k degrees of freedom. The data in our study are displayed in a contingency table 2x2 (t-glottalling occurrences (yes vs. no) x two time periods). In order to calculate which is the degree of freedom of our chi-squared distribution, we count the number of rows (r) and columns (c) in our contingency table and we apply the following formula: $DF = (r - 1) * (c - 1)$. In our particular study, the degree of freedom of the chi-squared distribution is 1.

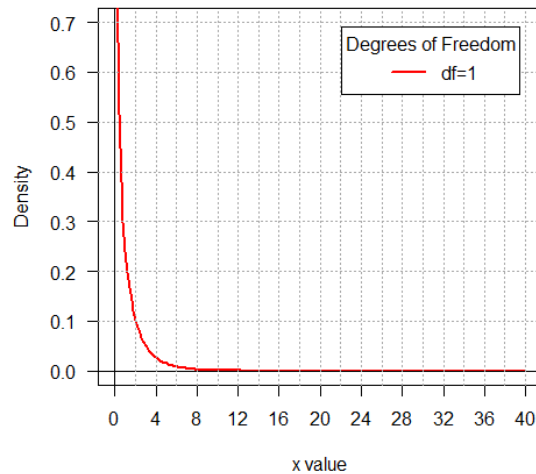


Figure 5. Chi-squared distribution with one degree of freedom.

The p value of the statistic indicates the probability that there exist other values at least as extreme as the statistic that we got with the test using our data, given that the null hypothesis was true. As mentioned, this probability is given by a chi-squared distribution. The p value of our statistic is 0.011871.

Finally, the significance level (α) is a threshold usually standing at 0.05 (5%). If $p < \alpha$, the likelihood of getting more extreme values than the statistic found with our data is very low. Since the p value of our statistic is < 0.05 , it is possible to reject the null hypothesis. The reason why this is possible is because the p-value indicates that our statistic is very extreme and, therefore, it would be very unlikely to get this exact number if the null hypothesis was true. Hence, it is possible to validate the alternative hypothesis and to conclude that the difference between the frequencies of t-glottalling for the 1970s and the 2015s is statistically significant.